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LEON CHAITOW

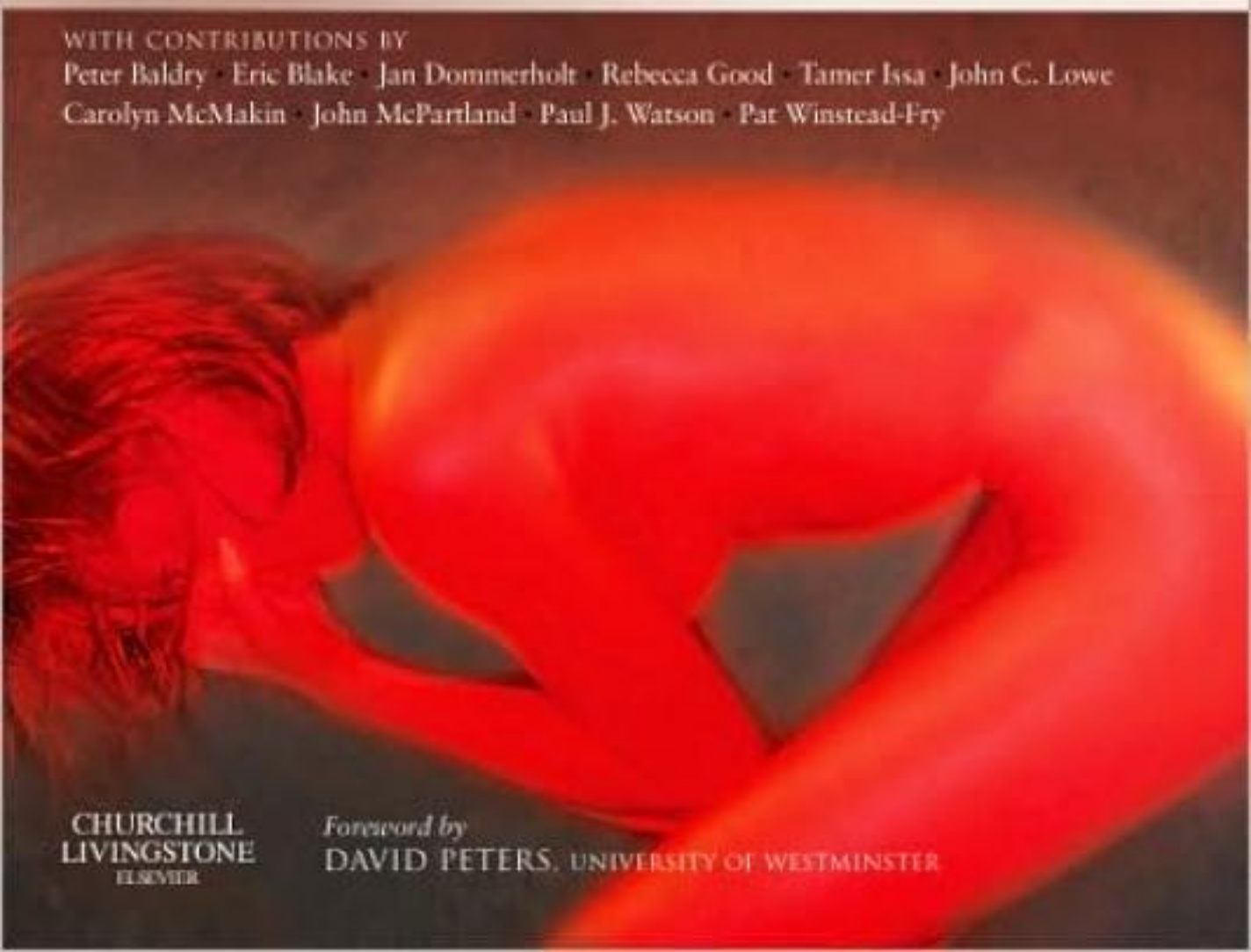
THIRD EDITION

FIBROMYALGIA SYNDROME

A Practitioner's Guide to Treatment

WITH CONTRIBUTIONS BY

Peter Baldry · Eric Blake · Jan Dommerholt · Rebecca Good · Tamer Issa · John C. Lowe
Carolyn McMakin · John McPartland · Paul J. Watson · Pat Winstead-Fry



CHURCHILL LIVINGSTONE
ELSEVIER

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CHURCHILL
LIVINGSTONE
ELSEVIER

First edition 2000
Reprinted 2000, 2001
Second edition 2003
Reprinted 2005
Third edition 2009

ISBN 978 0 443 06936 9

British Library Cataloguing in Publication Data
A catalogue record for this book is available from the British Library

Library of Congress Cataloging in Publication Data
A catalog record for this book is available from the Library of Congress

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The Publisher

Printed in China

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Foreword

Historians of medicine are fascinated by the way symptoms have been explained in former times. Before medicine acquired the scientific foundations we now take for granted, doctors – though they recognised and named certain patterns of symptoms and signs – could only speculate on their underlying causes. And of course in every period of history these explanations for people's suffering (illness) are a reliable reflection of medicine's (and the larger culture's) ideas about human nature and the causes of disease. In the Middle Ages for instance scholars based their philosophy on the four elements, and medieval physicians viewed their patients' disorders as imbalances in the four humours. Nowadays doctors can define 'real' disease according to blood tests and other objective markers of biological abnormalities. Perhaps as a consequence medicine has become less concerned with people's *subjective* experience of illness. Nevertheless some common symptoms patterns don't quite fit into the available frameworks; syndromes for which straightforward biological causes have yet to be found. But even where a clear anatomical basis for suffering *is* obvious, the underlying reasons sometimes remain partially understood until new insights help put the pieces together. For example before microbiologists discovered how Helicobacter weakened the stomach lining, doctors blamed psychological stress for duodenal ulcers. Increasingly though we realize that susceptibility to ill-health has multiple causes; that all manner of things can upset the organism's ability to self-regulate and heal itself: genetic susceptibility, nutrition, mechanical strain or injury, infection, environmental stress, psychological trauma. The list goes on. Yet like the toy gyroscope, the resilient mind-body usually rights itself unless a combination of factors pushes it too far out of balance.

And so it is with fibromyalgia syndrome. For though its underlying tissue pathology is harder to pinpoint than a duodenal ulcer's, fibromyalgia syndrome is not simply a problem 'in the heads' of those who endure it. Whatever its psychological and biochemical correlates, people who experience what we label fibromyalgia feel it in their body. Therefore the challenge is for scientists and practitioners to understand the syndrome not as some abstract 'psychosomatic' problem, nor on the other hand as the consequence of some disordered enzyme system. And this I believe, should be a leading thought for 21st century practitioners who aspire to holism; that we have to find bridges between such outdated views of single causes. Like many other complex and difficult-to-treat conditions fibromyalgia syndrome is multi-factorial, and so the holistic solutions required will surely entail not just identifying and removing trigger-factors, but also reducing susceptibility and maintaining overall wellbeing.

This book sets out courageously to comprehend the breadth of this causal and maintaining mix. The big issue is how organisms self-regulate and what dysregulates the tissues that comprise them. These are questions my colleague Leon Chaitow has long tackled with a relentless and uncompromising curiosity, guided it seems to me by Naturopathy's 'three-legged stool'. For surely it is the interweaving of our biological, mechanical and psycho-spiritual lives that determines our health; or its opposite. Feedback loops between these life-realms can build us up, or break us down, and it is the task of this book – and of the Chaitow opus in general – to help practitioners like us use science, alongside our hand-on experience and inter-personal sensitivity, to make sense of these circuits, and work to unravel them.

David Peter
London 2009

Preface

In the 6 years since the second edition of this book was published, a great deal has changed in relation to our understanding of fibromyalgia, and this is reflected in new chapters, as well as expanded old chapters in this third edition.

The majority of chapters from the second edition have either been updated or expanded, and, together with the new chapters – as listed below – this edition offers a comprehensive view of what we know, what is hypothesized, what appears to be effective therapeutically (summarized in Chapters 14 and 15) and what remains to be understood, as we grapple with this painful and debilitating condition.

Amongst the many important areas of new knowledge and investigation are the following:

- A definite connection (for some individuals) exists between use of statin drugs and fibromyalgia. Dommerholt & Issa describe the statin link in their expanded chapter on differential diagnosis – which also highlights a number of body-wide pain conditions that are commonly confused with FMS. Almost at the time of going to press, a study (Link et al 2008) has shown that the FMS–statin connection applies to genetically predisposed individuals – which means that while a small subgroup of people taking these anticholesterol drugs develop all the symptoms of fibromyalgia, others may not.
- New survey evidence (Bennett et al 2007) that cognitive behavioural therapy is of some, but limited, value in FMS, but that exercise is confirmed as a profoundly useful approach, is discussed fully in Chapter 2.
- In Chapter 3 Yunus (2007) builds a strong case for central sensitization as a key feature of FMS, while in the same chapter Van Houdenhove (2007) points to stress intolerance and pain hypersensitivity (i.e. evidence of sensitization) sometimes resulting from early childhood experiences of a violent nature. To balance Yunus's perspective, Staud (2006) argues for a peripheral sensitization model. As with so much in medicine, both views are probably valid. Buskila (2007) reports that genetic predisposition to FMS is demonstrable in many instances. The huge topic of leptin and syndrome X, and the links to widespread pain, are also outlined in Chapter 3 (Juge-Aubry et al 2005).
- Treatment options are explored, with McMakin (2004) expanding her chapter (9) on frequency specific microcurrent (FSM) usage, with much new information on this non-invasive and frequently beneficial approach.
- In his important chapter (10) on hypothyroidism and FMS, Dr John Lowe has expanded the information in this area, and makes a strong case for his protocols for normalizing thyroid hormone levels as a basic requirement for many people (Lowe & Yellin 2008).
- New topics that explore treatment options, as well as offering deeper understanding of mechanisms involved in manual, exercise and acupuncture use, are covered in Chapters 11 (Fibromyalgia and the endocannabinoid system, by John McPartland), 12 (Therapeutic Touch in the treatment of fibromyalgia, by Pat Winstead-Fry and Rebecca Good) and 13 (Naturopathic hydrotherapy in the treatment of fibromyalgia, by Eric Blake).

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Bennett R, Jones J, Turk D et al 2007 An internet survey of 2,596 people with fibromyalgia. BMC Musculoskeletal Disorders. http://www.biomedcentral.com/1471–2474/8/27.

Buskila D 2007 Genetics of chronic pain states. Best Practice and Research: Clinical Rheumatology 21(3): 535–547.

Juge-Aubry C, Henrichot E, Meier C 2005 Adipose tissue: a regulator of inflammation. Best Practice and Research: Clinical Endocrinology and Metabolism 19(4): 547–566.

Link E, Parish S, Armitage J et al 2008 SLCO1B1 variants and statin-induced myopathy – a genome-wide study. New England Journal of Medicine 359(8): 789–799.

Lowe JC, Yellin JG 2008 Inadequate thyroid hormone regulation as the main mechanism of fibromyalgia: a review of the evidence. Thyroid Science 3(6): R1–14.

McMakin C 2004 Microcurrent therapy: a novel treatment method for chronic low back myofascial pain. Journal of Bodywork and Movement Therapies 8: 143–153.

Staud R 2006 Biology and therapy of fibromyalgia: pain in fibromyalgia syndrome. Arthritis Research and Therapy 8: 208.

Van Houdenhove B 2007 Functional somatic syndromes characterized by stress intolerance and pain hypersensitivity. Tijdschrift voor Geneeskunde 63(4): 121–126.

Yunus M 2007 Fibromyalgia and overlapping disorders: the unifying concept of central sensitivity syndromes. Seminars in Arthritis and Rheumatism 36(6): 339–356.

Acknowledgements

There is no way that one person can cover the range of topics needed to provide a comprehensive overview of the management of a problem such as fibromyalgia. My sincere thanks therefore go to David Baldry, Paul Watson, Jan Dommerholt, Tamer Issa, Carolyn McMakin, John Lowe, John McPartland, Patricia Winstead-Fry, Rebecca Good and Eric Blake who contributed valuable chapters and insights for this third edition. Many thanks also to Professor David Peters, for his Foreword.

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Figs 14.1 and 16.1 from Chaitow et al (2002) Multidisciplinary Approaches to Breathing Pattern Disorders

Figs 16.4, 16.5 and A.2 from Chaitow & Fritz (2006) A Massage Therapist's Guide to Lower Back and Pelvic Pain

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Figs 16.25, 17.3, 17.4, 17.5 and 17.6 from Chaitow (2004) Maintaining Body Balance, Flexibility and Stability: A Practical Guide to the prevention and Treatment of Musculoskeletal Pain and Dysfunction.

Chapter One

1

The history and definition of fibromyalgia

CHAPTER CONTENTS

History

Historically, fibromyalgia – or conditions very like it – have been reported for hundreds of years, under many names, including the most unsatisfactory term 'fibrositis'. The fascinating history of what we now call fibromyalgia syndrome (FMS) and myofascial pain syndrome (MPS) has been catalogued by several modern clinicians working in the sphere of chronic muscle pain, from whose work the material summarized in Box 1.1 has been compiled. Thanks are due to these individuals (Peter Baldry, David Simons and Richard van Why in particular) for revealing so much about past studies into the phenomenon of chronic muscle pain. What we can learn from this information is just how long ago (well over 150 years) particular features were recognized, for example pain referral patterns and characteristics such as taut bands and 'nodules', as well as insights from many astute researchers and clinicians into the pathophysiology of these conditions.

American College of Rheumatology definition

Simply defined, fibromyalgia syndrome (FMS) can be said to be a debilitating illness, characterized primarily by musculoskeletal pain, fatigue, sleep disturbances, depression and stiffness (Yunus & Inanici 2002).

It was not until the 1980s that a redefining took place of what was by then a confused – and confusing – picture of a common condition. In 1987, the American Medical Association recognized fibromyalgia as a distinct syndrome (Starlanyl & Copeland 1996), although at that time detailed knowledge of what the syndrome comprised was not as clear as the current, generally accepted American College of Rheumatology (ACR) definition, which was produced in 1990 (see Box 1.2 and Fig. 1.1). Russell (in Mense & Simons 2001) notes that defining the condition had profound effects on the scientific and medical communities:

Box 1.1

Historical (pre-1990) research into chronic muscle pain (Baldry 1993, Simons 1988, van Why 1994)

Guillaume de Baillou (late 16th century) *Liber de Rheumatismo* (published in 1736, over 100 years after death of de Baillou).

- Used term **rheumatism** to describe muscular pain as well as acute rheumatic fever.

Thomas Sydenham (1676) *Observationes Medicae*.

- Confused the use of word **rheumatism** by using it to describe symptoms of acute rheumatic fever.

William Balfour (1815) 'Observations on the Pathology and Cure of Rheumatism.' *Edinburgh Medical and Surgical Journal* 11: 168–187

- Suggested that an inflammatory process in connective tissue was responsible for the pain of what was then called **muscular rheumatism**.

C. Scudamore (1827) *A Treatise on the Nature and Cure of Rheumatism*. Longman, London.

- Supported the concepts promoted by Balfour.

F. Valleix (1841) *Treatise on Neuralgia*. Paris.

- Noted that when certain painful points were palpated they produced shooting pain to other regions (**neuralgia**). He also reported that diet was a precipitating factor in the development of the painful aching symptoms of the back and cervical region.

Johan Mezger (mid-19th century) (W. Haberling *Johan Georg Mezger of Amsterdam. Founder of Modern Scientific Massage*. Medical Life, 1932)

- Dutch physician who developed massage techniques for treating 'nodules' and taut cord-like bands associated with this condition.

T. Inman (1858) 'Remarks on Myalgia or Muscular Pain.' *British Medical Journal*: 407–408, 866–868

- Was able clearly to state that radiating pain in these conditions (**myalgia**) was independent of nerve routes.

Uno Helleday (1876) *Nordiskt Medecinkst Arkiv* 6 & 8 (8)

- Swedish physician who described nodules as part of '**chronic myitis**'.

H. Strauss (1898) Über die sogenaunte 'rheumatische muskelschwiele'. *Klinische Wochenschrift* 35: 89–91

- German physician who distinguished between palpable nodules and 'bands'.

A. Cornelius (1903) 'Narben und Nerven.' *Deutsche Militartzlische Zeitschrift* 32: 657–673

- German physician who demonstrated the pain-influencing features of tender points and nodules, insisting that the radiating pathway was not determined by the course of nerves. He also showed that external influences, including climatic, emotional or physical exertion, could exacerbate the already hyper-reactive neural structures associated with these conditions. Cornelius also discussed these pain phenomena as being due to **reflex mechanisms**.

Sir William Gowers (1904) 'Lumbago: Its Lessons and Analogues.' *British Medical Journal* 1: 117–121

- Suggested that the word **fibrositis** be used – believing erroneously that inflammation was a key feature of 'muscular rheumatism'. (Lecture, National Hospital of Nervous Diseases, London.)

Ralph Stockman (1904) 'Causes, Pathology and Treatment of Chronic Rheumatism.' *Edinburgh Medical Journal* 15: 107–116, 223–225

- Offered support for Gowers' suggestion by reporting finding evidence of inflammation in connective tissue in such cases (never substantiated), and suggested that pain sensations emanating from nodules could be due to nerve pressure (now discounted).

Sir William Osler (1909) *Principles and Practice of Medicine*. Appleton, New York.

- Considered the painful aspects of muscular rheumatism (**myalgia**) to involve '**neuralgia of the sensory nerves** of the muscles'.

W. Telling (1911) 'Nodular Fibromyositis – an Everyday Affliction and its Identity with so-called Muscular Rheumatism.' *The Lancet* 1: 154–158

- Called the condition '**nodular fibromyositis**'.

A. Muller (1912) 'Untersuchbefund am Rheumatish Erkranten Musckel.' *Zeitschrift Klinische Medizine* 74: 34–73

- German physician who noted that to identify nodules and bands required refined palpation skills – aided, he suggested, by lubricating the skin.

L. Llewellyn (1915) *Fibrositis*. Rebman, New York.

- Broadened the use of the word **fibrositis** to include other conditions, including gout.

F. Albee (1927) 'Myofascitis – a Pathological Explanation of any Apparently Dissimilar Conditions.' *American Journal of Surgery* 3: 523–533

- Called the condition '**myofascitis**'.

G. Murray (1929) 'Myofibrositis as Simulator of other Maladies.' *The Lancet* 1: 113–116

- Called the condition '**myofibrositis**'.

Box 1.1—Cont'd

E. Clayton (1930) 'Fibrositis.' *The Lancet* 1: 1420–1423

- Called the condition '**neuro-fibrositis**'.

A. H. Rowe (1930) 'Allergic Toxemia and Migraine due to Food Allergy.' *California West Medical Journal* 33: 785

- Demonstrated that muscular pains associated with fatigue, nausea, gastrointestinal symptoms, weakness, headaches, drowsiness, mental confusion and slowness of thought, as well as irritability, despondency and widespread bodily aching, often had an allergic aetiology which he termed '**allergic toxaemia**'.

C. Hunter (1933) 'Myalgia of the Abdominal Wall.' *Canadian Medical Association Journal* 28: 157–161

- Described referred pain (**myalgia**) resulting from tender points situated in the abdominal musculature.

F. Gudzent (1935) 'Testunt und Heilbehandlung von Rheumatismus und Gicht mid Specifischen Allergen.' *Deutsche Medizinsche Wochenschrift* 61: 901

- German physician who noted that chronic '**muscular rheumatism**' may at times be allergic in origin and that removal of certain foods from the diet resulted in clinical improvement.

J. Edeiken, C. Wolferth (1936) 'Persistent Pain in the Shoulder Region Following Myocardial Infarction.' *American Journal of Medical Science* 191: 201–210

- Showed that pressure applied to tender points in scapula region muscles could reproduce shoulder pain already being experienced. This work influenced Janet Travell (see below).

Sir Thomas Lewis (1938) 'Suggestions Relating to the Study of Somatic Pain.' *British Medical Journal* 1: 321–325

- A major researcher into the phenomenon of pain in general, he charted several patterns of pain referral and suggested that Kellgren (see below), who assisted him in these studies, continue the research.

J. Kellgren (1938) 'Observations on Referred Pain Arising from Muscle.' *Clinical Science* 3: 175–190

- Identified (in patients with '**fibrositis**'/'**myalgia**') many of the features of our current understanding of the trigger point phenomenon, including consistent patterns of pain referral – to distant muscles and other structures (teeth, bone, etc.) from pain points ('spots') in muscle, ligament, tendon, joint and periosteal tissue – which could be obliterated by use of novocaine injections.

A. Reichart (1938) 'Reflexschmerzen auf Grund von Myoglosen.' *Deutsche Medizinische Wochenschrift* 64: 823–824

- Czech physician who identified and charted patterns of distribution of **reflex pain** from tender points (nodules) in particular muscles.

M. Gutstein (1938) 'Diagnosis and Treatment of Muscular Rheumatism.' *British Journal of Physical Medicine* 1: 302–321

- Refugee Polish physician working in Britain who identified that in treating **muscular rheumatism**, manual pressure applied to tender (later trigger) points produced both local and referred symptoms, and that these referral patterns were consistent in everyone, if the original point was in the same location. He deactivated these by means of injection.

A. Steindler (1940) 'The Interpretation of Sciatic Radiation and the Syndrome of Low Back Pain.' *Journal of Bone and Joint Surgery* 22: 28–34

- American orthopaedic surgeon who demonstrated that novocaine injections into tender points located in the low back and gluteal regions could relieve sciatic pain. He called these points 'trigger points'. Janet Travell (see below) was influenced by his work and popularized the term 'trigger points'.

M. Gutstein-Good (1940) (same person as M. Gutstein above) 'Idiopathic Myalgia Simulating Visceral and other Diseases.' *The Lancet* 2: 326–328

- Called the condition '**idiopathic myalgia**'.

M. Good (1941) (same person as M. Gutstein and M. Gutstein-Good above) 'Rheumatic Myalgias.' *The Practitioner* 146: 167–174

- Called the condition '**rheumatic myalgia**'.

James Cyriax (1948) 'Fibrositis.' *British Medical Journal* 2: 251–255

- Believed that chronic muscle pain derived from nerve impingement due to disc degeneration. 'It [pressure on dura mater] has misled clinicians for decades and has given rise to endless misdiagnosis; for these areas of "**fibrositis**", "trigger points", or "myalgic spots", have been regarded as the primary lesion – not the result of pressure on the dura mater' (J. Cyriax, 1962 *Text-Book of Orthopaedic Medicine*, 4th edn. Cassell, London, vol 1).

P. Ellman, D. Shaw (1950) 'The Chronic "Rheumatic" and his Pains. Psychosomatic Aspects of Chronic Non-articular Rheumatism.' *Annals of Rheumatic Disease* 9: 341–357

Continued

Box 1.1—Cont'd

- Suggested that because there were few physical manifestations to support the pain claimed by patients with chronic muscle pain, their condition was essentially psychosomatic (**psychogenic rheumatism**): 'the patient aches in his limbs because he aches in his mind'.

Theron Randolph (1951) 'Allergic Myalgia.' *Journal of Michigan State Medical Society* 50: 487

- This leading American clinical ecologist described the condition as '**allergic myalgia**' and demonstrated that widespread and severe muscle pain (particularly of the neck region) could be reproduced 'at will under experimental circumstances' following trial ingestion of allergenic foods or inhalation of house dust extract or particular hydrocarbons – with relief of symptoms often being achieved by avoidance of allergens. Randolph reported that several of his patients who achieved relief by these means had previously been diagnosed as having '**psychosomatic rheumatism**'.

James Mennell (1952) *The Science and Art of Joint Manipulation*. Churchill, London, vol 1.

- British physician who described 'sensitive areas' which referred pain. Recommended treatment was a choice between manipulation, heat, pressure and deep friction. He also emphasized the importance of diet, fluid intake, rest and the possible use of cold and procaine injections, as well as suggesting cupping, skin rolling, massage and stretching in normalization of '**fibrositic deposits**'.

Janet Travell, S. Rinzler (1952) 'The Myofascial Genesis of Pain.' *Postgraduate Medicine* 11: 425–434

- Building on previous research, and following her own detailed studies of the tissues involved, Travell coined the word 'myofascial', adding it to Steindler's term to produce 'myofascial trigger points', and finally '**myofascial pain syndrome**'.

I. Neufeld (1952) 'Pathogenetic Concepts of "Fibrositis" – Fibropathic Syndromes.' *Archives of Physical Medicine* 33: 363–369

- Suggested that the pain of '**fibrositis–fibropathic syndromes**' was due to the brain misinterpreting sensations.

F. Speer (1954) 'The Allergic–Tension–Fatigue Syndrome.' *Pediatric Clinics of North America* 1: 1029

- Called the condition the '**allergic–tension–fatigue syndrome**' and added to the pain, fatigue and general symptoms previously recognized (see Randolph above) the observation that oedema was a feature – especially involving the eyes.

R. Gutstein (1955) 'Review Of Myodysneuria (Fibrositis).' *American Practitioner* 6: 70–577

- Called the condition '**myodysneuria**'.

M. Kelly (1962) 'Local Injections for Rheumatism.' *Medical Journal of Australia* 1: 45–50

- Australian physician who carried on Kellgren's concepts from the early 1940s, diagnosing and treating pain (rheumatism) by means of identification of pain points and deactivating these using injections.

H. Moldofsky, P. Scarisbrick, R. England, H. Smythe 1975 'Musculoskeletal Symptoms and Non-REM Sleep Disturbance in Patients with Fibrositis Syndrome and Healthy Subjects.' *Psychosomatic Medicine* 371: 341–351

- Canadian physician who, together with co-workers, identified sleep disturbance as a key feature of chronic muscle pain (**fibrositis**).

M. Yunus, A. Masi, J. Calabro, K. Miller, S. Feigenbaum (1981) 'Primary Fibromyalgia (Fibrositis) Clinical Study of 50 Patients with Matched Controls.' *Seminars in Arthritis and Rheumatism* 11: 151–171

- First popularized the word **fibromyalgia**.

Janet Travell, David Simons (1983) *Myofascial Pain and Dysfunction: the Trigger Point Manual*. Williams and Wilkins, Baltimore, vol 1 (Revised 1998)

- The definitive work (with vol 2, 1992) on the subject of **myofascial pain syndrome** (MPS).

David Simons (1986) 'Fibrositis/Fibromyalgia: a Form of Myofascial Trigger Points?' *American Journal of Medicine* 81(S3A): 93–98

- American physician who collaborated with Travell in a joint study of MPS and who also conducted his own studies into the connection between **myofascial pain syndrome** and **fibromyalgia syndrome**, finding a good deal of overlap.

D. Goldenberg, D. Felson, H. Dinerman et al (1986) 'Randomized Controlled Trial of Amitriptyline and Naproxen in Treatment of Patients with FMS.' *Arthritis and Rheumatism* 29: 1371–1377

- Demonstrated that low dose tricyclic antidepressant medication improved sleep quality, reduced morning stiffness and alleviated pain in **fibromyalgia** (see Ch. 11).

Box 1.1—Cont'd

G. McCain, R. Scudds (1988) 'The Concept of Primary Fibromyalgia (Fibrositis) Clinical Value, Relation and Significance to other Chronic Musculoskeletal Pain Syndromes.' *Pain* 33: 273–287

- Showed that there was some benefit to **fibromyalgia** symptoms from cardiovascular fitness training ('aerobics') (see Ch. 11).

M. Margoles (1989) 'The Concept of Fibromyalgia.' *Pain* 36: 391

- States that most patients with **fibromyalgia** demonstrate numerous active myofascial trigger points.

R. Bennett (1990) 'Myofascial Pain Syndromes and the Fibromyalgia Syndrome'. In: R. Fricton, E. Awad (eds) *Advances in Pain Research and Therapy*. Raven Press, New York.

- Showed that many 'tender points' in **fibromyalgia** are, in reality, latent trigger points. He believes that MPS and FMS are distinctive syndromes but are 'closely related'. States that many people with MPS progress to develop fibromyalgia.

American College of Rheumatology (1990) 'Criteria for the Classification of **Fibromyalgia**.' *Arthritis and Rheumatism* 33: 160–172

- Official definition for FMS syndrome. Subsequently expanded in 1992 by the Copenhagen Declaration: Consensus Document on Fibromyalgia (Copenhagen Declaration 1992; see also p. 8).

Box 1.2

American College of Rheumatology definition of fibromyalgia syndrome

The definition of fibromyalgia syndrome (FMS) as stated by the American College of Rheumatology (ACR 1990) is as follows:

1. A history of widespread pain for at least 3 months. Pain is considered widespread when all of the following are present: pain in the left side of the body, the right side of the body, below the waist and above the waist. In addition there should be axial pain (cervical spine or anterior chest or thoracic spine or low back).
2. Pain (with the patient reporting 'pain' and not just 'tenderness') in 11 of 18 tender point sites on digital pressure involving 4 K of pressure. The sites are all bilateral and are situated:
   - at the suboccipital muscle insertions (close to where rectus capitis posterior minor inserts)
   - at the anterior aspects of the inter-transverse spaces between C5 and C7
   - at the midpoint of the upper border of upper trapezius muscle
   - at the origins of supraspinatus muscle above the scapular spines
   - at the second costochondral junctions, on the upper surface, just lateral to the junctions
   - 2 cm distal to the lateral epicondyles of the elbows
   - in the upper outer quadrants of the buttocks in the anterior fold of gluteus medius
   - posterior to the prominence of the greater trochanter (piriformis insertion)
   - on the medial aspect of the knees, on the fatty pad, proximal to the joint line.

In the wake of successful classification criteria, a surge of investigative energy in the early 1990s led to a number of important new observations. FMS was found to be universally common. It was present in approximately 2% of the adult population of the USA and exhibited a similar distribution in most other countries where valid epidemiological studies had been conducted. Adult women were affected five to seven times more commonly than were men. In children the gender distribution was about equal for boys or girls.

When psychosocial and physical/functional factors of people with FMS were compared with those six different, predominantly chronic pain syndromes (upper extremity pain, cervical pain, thoracic pain, lumbar pain, lower extremity pain and headache), it was found that the fibromyalgia group experienced the most difficulties, by a significant margin. In regard to gender distribution of these seven chronic pain conditions, it was noted that fibromyalgia (and headache) are experienced by more females than males (Porter-Mofitt et al 2006).

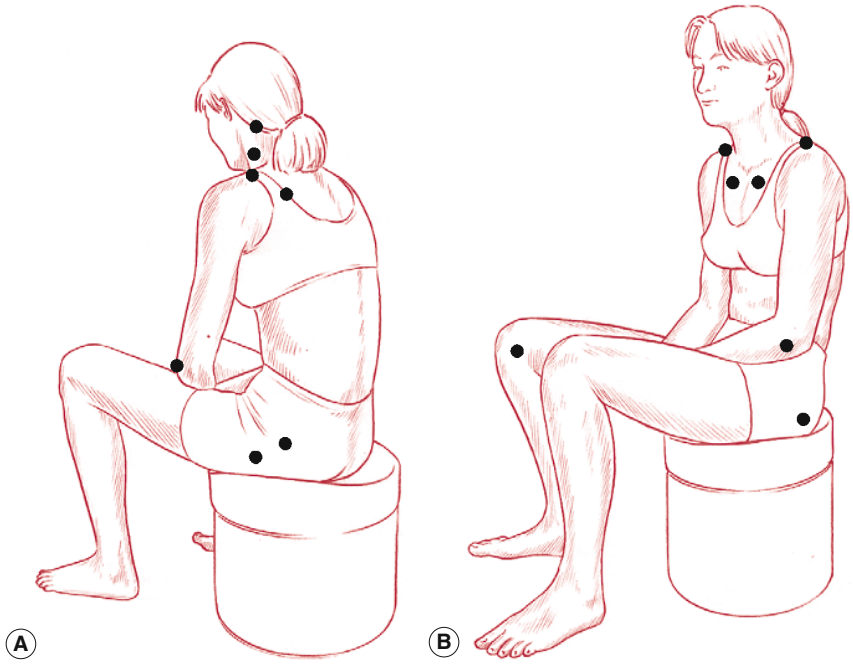


Figure 1.1 • The sites of the 18 fibromyalgia tender points as defined by the American College of Rheumatology.

What can be said with certainty about fibromyalgia syndrome is that:

- It is a non-deforming rheumatic condition, and, indeed, one of the commonest such conditions.
- It is an ancient condition, newly defined (controversially – see below) as a disease complex or syndrome.
- There is no single cause, or cure, for its widespread and persistent symptoms (however, as will become clear, there do seem to exist distinct subsets of individuals with different aetiologies to their conditions, such as thyroid imbalance and whiplash injuries).
- Its complex causation often seems to require more than one essential aetiological factor to be operating, and there are numerous theories as to what these might be (see Ch. 4).
- There has been an explosion of research into the subject over the past decade (one data search on the internet revealed over 20 000 papers which mention fibromyalgia as a key word).

Despite its earlier medical meaning, which suggested involvement of both articular and non-articular structures, the word *rheumatic* has, through common usage, come to mean 'a painful but non-deforming soft tissue musculoskeletal condition', as distinct from the word *arthritic* which suggests articular and/or deforming features (Block 1993).

The fibromyalgia controversy

For the purposes of practicality this book accepts that the current widely used ACR definition is a hypothesis that is evolving, but that it may be flawed (see below). The definition as presented in Box 1.2 allows for the categorization of individuals with chronic pain and associated symptoms into subgroups, and offers clinicians a chance to begin to decipher the confusing patterns of symptoms displayed and reported by people who have been so labelled.

However, not all experts, including many of the contributors to this text, accept the ACR definition. Nevertheless, since it forms the foundation for much of the research reported on in the book, the current definition needs to be given due consideration.

What are the arguments against the ACR definition?

Schneider et al (2006) sum up one major alternative view:

Recent data tend to support the notion that FMS is a disorder of the central nervous system pain processing pathways, and not some type of primary auto-immune disorder of the peripheral tissues. It is quite possible that the term FMS is a poor choice of words, for it implies that patients with a variable symptom complex all have the same singular disease or disorder.

As will be clear in subsequent chapters, this is precisely the message that this book will promote – that there are numerous aetiological influences relating to the symptom cluster represented by people with a diagnosis of FMS, and that within that population subgroups can be identified that demand quite distinctive therapeutic handling, compared with other subgroup cohorts.

A logical extension of this multicausal scenario is a model that offers a variety of potential therapeutic interventions, none of which would have universal applicability, and most of which would be most usefully employed in treatment of specific subgroups within the overall diagnosis of FMS.

The chapters in this book that reflect a variety of therapeutic approaches include those that evaluate and explain the use of acupuncture, endocrine issues, psychological influences, myofascial trigger points/dry needling, use of microcurrent, hydrotherapy, therapeutic touch, manipulation, massage, exercise, nutrition and various other clinical methods.

The issues surrounding FMS subsets, and of possible over(or mis-)diagnosis of FMS, are explored more fully in Chapters 3, 4 and 5.

Problems arising from the ACR definition

Useful as the defining of this condition has been, there are distinct and obvious problems with a definition as precise as that offered by the ACR:

- If pressure varies only slightly, so that on a 'good day' a patient may report sensitivity and tenderness rather than 'pain' when tender points are being tested, the patient may therefore not 'qualify'; this could have very real insurance benefit implications, as well as leaving distressed individuals still seeking a diagnosis which might help them understand their suffering.
- If all other criteria are present, and fewer than 11 of the 18 possible sites are reported as 'painful' (say only 9 or 10), what diagnosis is appropriate?
- If there are 11 painful sites but the 'widespread' nature of the pain is missing (as per the definition in Box 1.2), what diagnosis is appropriate?

Clearly, what is being observed in people with widespread pain and who also demonstrate at least 11 of the 18 test points as being painful is a situation which represents the distant end of a spectrum of dysfunction. Others who do not quite meet the required (for a diagnosis of FMS) number of tender points may well be progressing towards that unhappy state.

As reported earlier, approximately 2% of the population meet all the ACR criteria (Wolfe et al 1993). A great many more people, however, are advancing in that direction, according to both British and American research, which shows that about 20% of the population suffer 'widespread' pain that matches the ACR definition, with almost the same number, *but not necessarily the same people*, demonstrating 11 of the specified 18 tender points as being painful on appropriate testing, also in accordance with the ACR definition. Some people have the widespread pain and not enough painful points, while others have the points but their generalized pain distribution is not sufficiently widespread.

What condition do they have if it is not FMS (Croft et al 1992)?

If all the criteria are not fully met, and people with, say, 9 or 10 points (rather than the 11 needed) are offered a diagnosis of FMS (and therefore become eligible for insurance reimbursement or disability benefits, or suitable for inclusion in research projects), what of the person with only 8 painful points who meets all the other criteria?

In human terms this is all far from an academic exercise, for pain of this degree is distressing and possibly disabling, whether or not 11 (or more) points are painful. Clinically, such patients should receive the same attention, wherever they happen to be in the spectrum of disability, and whatever the tender point score, if their pain is sufficient to require professional attention.

As will become clear as examination of FMS unfolds in this and subsequent chapters, the frustration of the patient is matched in large degree by that of health care providers attempting to understand and offer treatment for the patient with FMS. This is largely because no single aetiological pattern has emerged from research efforts to date. Russell (in Mense & Simons 2001) sums it up as follows:

The cause of FMS is unknown, but growing evidence indicates that its pathogenesis involves aberrant neurochemical processing of sensory

signals in the CNS. The symptomatic result is lowering of the pain thresholds and an amplification of normal sensory signals until the patient experiences near constant pain.

As will also become clear, the components of the pathogenesis of the condition commonly include biochemical, psychological and biomechanical features. Somewhere in the combination of causal elements and unique characteristics of the individual may lie opportunities for functional improvement and the easing of the often intractable pain and other symptoms associated with FMS.

Symptoms other than pain

In 1992, at the Second World Congress on Myofascial Pain and Fibromyalgia in Copenhagen, a consensus document on fibromyalgia was produced and later published in *The Lancet* (Copenhagen Declaration 1992). This declaration accepted the ACR fibromyalgia definition as the basis for a diagnosis, and added a number of symptoms to that definition (apart from widespread pain and multiple tender points), including persistent fatigue, generalized morning stiffness and non-refreshing sleep.

The Copenhagen document recognized that people with FMS may indeed at times present with fewer than 11 painful points – which is clearly important if most of the other criteria for the diagnosis are met. In such a case, a diagnosis of 'possible FMS' is thought appropriate, with a follow-up examination suggested to reassess the condition.

There are practical implications for a cut-off point (of symptoms or tender point numbers, for example) in making such a diagnosis: these relate directly to insurance reimbursement and/or disability benefits, as well as, possibly, to differential diagnosis.

The Copenhagen document adds that FMS is seen to be a part of a larger complex which includes symptoms such as headache, irritable bladder, dysmenorrhoea, extreme sensitivity to cold, restless legs, odd patterns of numbness and tingling, intolerance to exercise, and other symptoms.

Mind issues

The Copenhagen Declaration (1992) of the symptoms associated with FMS (over and above pain, which is clearly the defining feature) also addresses the psychological patterns often related to FMS, namely anxiety and/or depression.

The possible psychological component in FMS is an area of study fraught with entrenched beliefs and defensive responses. A large body of medical opinion assigns the entire FMS phenomenon – as well as chronic fatigue syndrome (CFS) – to the arena of psychosomatic/psychosocial illness. An equally well-defined position, occupied by many health care professionals as well as most patients, holds that anxiety and depression symptoms are more commonly a result, rather than a cause, of the pain and disability being experienced in FMS (McIntyre 1993a).

A 1994 review paper analysed all British medical publications on the topic of CFS from 1980 onwards and found that 49% favoured a non-organic cause while only 31% favoured an organic cause. When the popular press was examined in the same way, between 70% (newspapers) and 80% (women's magazines) favoured an organic explanation (McClean & Wesseley 1994).

Typical of the perspective which holds to a largely 'psychological' aetiology is a multicentre study by Epstein and colleagues, which was published in 1999. It concluded: 'In this multicenter study, the persons with FMS exhibited marked functional impairment, high levels of some lifetime and current psychiatric disorders, and significant current psychological distress.' The most common disorders noted were major depression, dysthymia, panic disorder and simple phobia.

Many leading researchers into FMS who hold to an organic – biochemical – neurological explanation for the main symptoms are, however, dismissive of psychological explanations for the condition. Dr Jay Goldstein, whose detailed and important research and clinical insights into the care of patients with CFS and FMS will be outlined later in this book, uses the term 'neurosomatic' to describe what he sees as a disorder of central information processing. He makes clear his position regarding the non-organic, psychosocial school of thought (Goldstein 1996):

Many of the illnesses [CFS, FMS] treated using this model [neurosomatic] are still termed 'psychosomatic' by the medical community and are treated psychodynamically by psychiatrists, neurologists and general physicians. Social anthropologists also have their theories describing CFS as the 'neurasthenia' of the 1990s, and a 'culture bound syndrome' that

displaces the repressed conflicts of patients unable to express their emotions ('alexithymics') into a culturally acceptable viral illness or immune dysfunction. Cognitive–behavioural therapy is perhaps more appropriate, since coping with the vicissitudes of their illnesses, which wax and wane unpredictably, is a major problem for most of those afflicted. Few investigators in psychosomatic illness (except those researching panic disorders) have concerned themselves about the pathophysiology of the patients they study, seeming content to define this population in psychosocial phenomenological terms. This position becomes increasingly untenable as the mind–body duality disappears.

Goldstein says that he only refers patients for psychotherapy if they are suicidally depressed. He emphasizes the normalization (using a variety of medications) of the biochemical basis for neural network dysfunction, which he has satisfied himself is the underlying cause of these (and many other) conditions.

When is a cause not a cause?

Goldstein's methods will be examined in later chapters; however, it might prove useful at this stage to make a slight diversion in order to clarify the importance of looking beyond apparent causes to attempt to uncover their origins.

As we progress through the saga which is FMS (and CFS) we will come across a number of well-defined positions which maintain that the dominant cause is X or Y – or more usually a combination of X and Y (and possibly others). The truth is that in some important instances these 'causes' themselves have underlying causes, which might usefully be therapeutically addressed.

An example – which will emerge in more detail later – is the suggestion that many of the problems associated with FMS (and CFS) are allergy related (Tuncer 1997). This may well be so in the sense that particular foods or substances can be shown, in given cases, to provoke or exacerbate symptoms of pain and fatigue. But what produces this increased reactivity/sensitivity? Are there identifiable causes of the (usually food) intolerances (Ventura et al 2006)?

In some cases this can be shown to result from malabsorption of large molecules through the intestinal wall, possibly due to damage to the mucosal surfaces of the gut (Tagesson 1983, Zar 2005). In some cases the mucosal damage itself can be shown to have resulted from abnormal yeast or bacterial overgrowth, resulting from prior (possibly inappropriate) use of antibiotics and consequent disturbance of the normal flora, and their control over opportunistic organisms (Crissinger 1990). Or the disturbed gut mucosa may be associated with endotoxaemia involving disturbed beneficial bacteria status (McNaught et al 2005).

The layers of the onion can be peeled away one by one, revealing causes which lie ever further from the obvious. The pain is aggravated by allergy, which results from bowel mucosa damage, which results from yeast overgrowth, which results from excessive or inappropriate use of antibiotics . . . and so on. The allergy in this example is not a cause per se but an exacerbating factor, a link in a chain, and while treating it might satisfactorily reduce symptoms, it would not necessarily deal with causes. Neither would treating the bacterial or yeast overgrowth, although this too might well assist in reducing overall symptom distress.

Where does the cause lie in this particular individual's FMS? Probably in a complex array of interlocking (often historical) features, which may be impossible to untangle. Therefore, approaches such as those which direct themselves at the allergy or at the increased permeability, while possibly (in this instance) valid and helpful, are not necessarily dealing with fundamental causes.

Does this matter? In Goldstein's model of FMS and CFS aetiology we are faced with a neural network which is dysfunctional. He acknowledges that the evolution of such a state requires several interacting elements:

- a basic susceptibility which is probably genetically induced
- some developmental factors in childhood (physical, chemical or psychological abuse/trauma, for example)
- probably a degree of viral encephalopathy (influenced by 'situational perturbations of the immune response')
- increased susceptibility to environmental stressors resulting from reduction in neural plasticity.

The possibility that early developmental trauma or abuse is a feature is supported by research. For example, Weissbecker et al (2006) report that:

Adults with fibromyalgia syndrome report high rates of childhood trauma. Neuroendocrine abnormalities have also been noted in this population. . . . Findings suggest that severe traumatic experiences in childhood may be a factor of adult neuroendocrine dysregulation among fibromyalgia sufferers. Trauma history should be evaluated and psychosocial intervention may be indicated as a component of treatment for fibromyalgia.

The 'causes' within this model can be seen to be widely spread. Goldstein's (apparently successful) interventions deal with what is happening at the end of this complex sweep of events when the neural network has, as a result, become dysfunctional. By manipulating the biochemistry of that end-state, many (Goldstein says most) of his patients' symptoms apparently improve dramatically and rapidly.

Such improvement does not necessarily indicate that underlying causes have been addressed; if these are still operating, future health problems may be expected to eventually emerge. The schematic representation of a 'stairway to ill-health' (Fig. 1.2) indicates some of the possible features ongoing in complicated dysfunctional patterns such as FMS, where adaptive resources have been stretched to their limits, and the 'stage of exhaustion' in Selye's general adaptation syndrome has been reached (Selye 1952). See also the discussion of allostasis in Chapter 3, particularly Table 3.2.

Dysfunctional patterns such as CFS and FMS seem to have three overlapping aetiological features interacting with the unique inborn and subsequently acquired characteristics of individuals to determine their particular degree of vulnerability and susceptibility (Fig. 1.3):

1. *Biochemical factors*. These can include toxicity, deficiency, infectious, endocrine, allergic and other characteristics (Wood 2006).
2. *Biomechanical factors*. These might include:
   a. structural (congenital – i.e. short leg or hypermobility features – postural or traumatically induced characteristics) (Gedalia et al 1993, Goldman 1991)
   b. functional (overuse patterns, hyperventilation stresses on respiratory mechanisms, etc.)
   c. neurological (sensitization, hypersensitivity – 'wind-up') (Staud et al 2005).
3. *Psychosocial factors*. These might include depression and/or anxiety traits, poor stress coping abilities, post-traumatic stress disorders, etc. (Arguellesa et al 2006).

Let us briefly consider Dr Goldstein's model of dysfunction, which suggests neural network dysfunction as the 'cause' of FMS, itself being a result of a combination of features as outlined above (Goldstein 1996). If we utilize the clinical options suggested in Figure 1.2, we can see that it is possible to attempt to:

1. reduce the biochemical, biomechanical or psychogenic 'stress' burden to which the person is responding
2. enhance the defence, repair, immune functions of the person so that they can handle these stressors more effectively
3. palliate the symptoms, hopefully without producing any increase in adaptive demands on an already overloaded system.

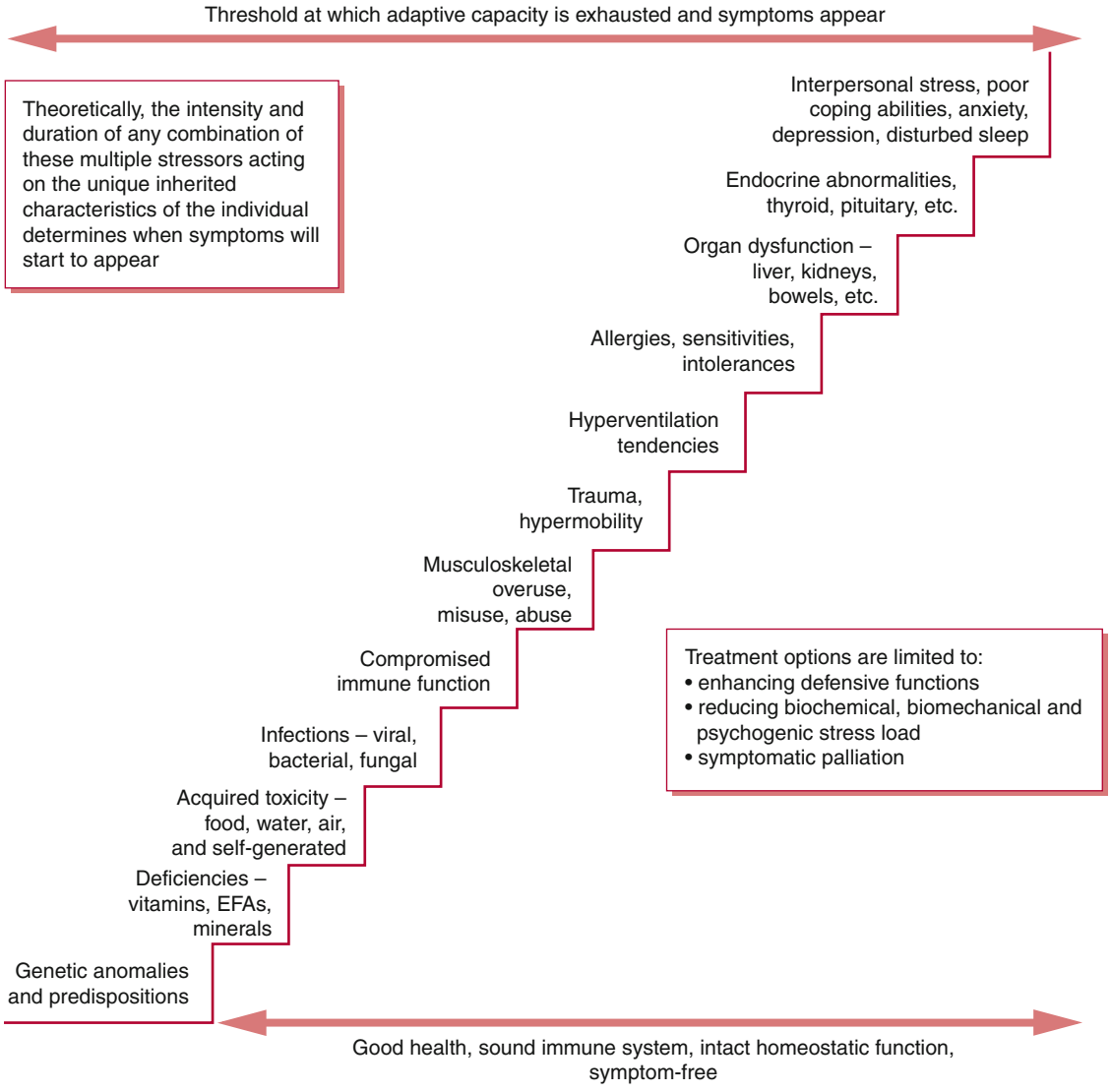
Which of these tactics are being employed in Goldstein's treatment approach in which drug-induced biochemical manipulation is being carried out, and does this address causes or symptoms, and does this matter, as long as there is overall improvement?

The particular philosophical perspective adopted by the practitioner/therapist will determine his judgement on this question. Some may see the rapid symptom relief claimed for the majority of these patients as justifying Goldstein's particular therapeutic approach. Others might see this as offering short-term benefits, not addressing underlying causes, and leaving the likelihood of a return of the original symptoms, or of others evolving, a probability. These issues will be explored in relation to this and other approaches to treatment of FMS in later chapters.

Associated conditions

A number of other complex conditions exist which have symptom patterns which mimic many of those observed in FMS, in particular:

- chronic myofascial pain syndrome (MPS) involving multiple active myofascial trigger points and their painful repercussions

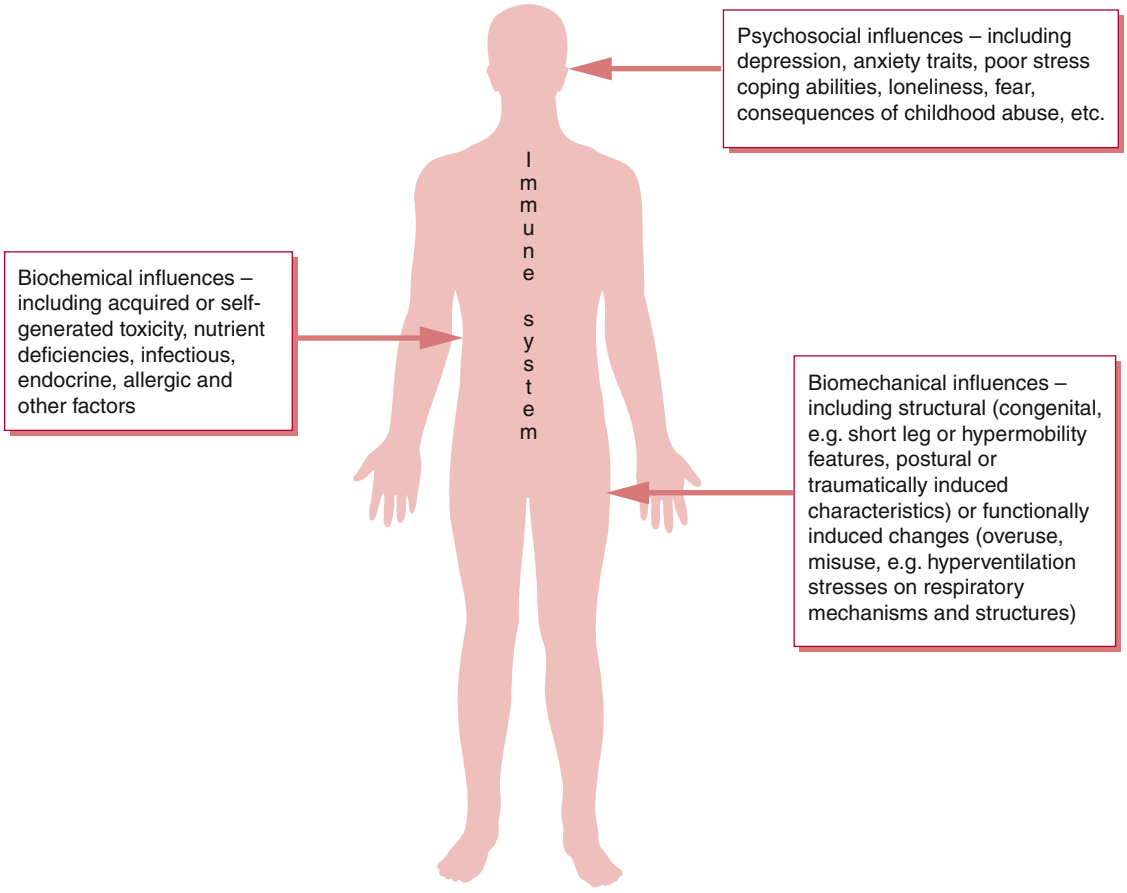


According to Selye's general adaptation syndrome, the cumulative effects of multiple stressors, each demanding adaptation on the part of the immune, defence and repair systems, eventually reaches a point where finite defence and repair resources become exhausted, at which time frank disease becomes inevitable.

The primary task of the holistic physician or therapist is to minimize the 'load' which is being carried as well as enhancing the body's defence capabilities – there are few other choices apart from offering palliative and symptom oriented attention.

Healing is the prerogative of the body itself – and this occurs when homeostasis is operating efficiently. When defence and repair functions are impaired heterostatic influences are needed – i.e. appropriate treatment – which ideally cause no further harm.

Figure 1.2 • Disease influences – fibromyalgia. EFAs, essential fatty acids.



The interacting influences of a biochemical, biomechanical and psychosocial nature do not produce single changes. For example:

- a negative emotional state (e.g. depression) produces specific biochemical changes, impairs immune function and leads to altered muscle tone.
- hyperventilation modifies blood acidity, alters neural reporting (initially hyper and then hypo), creates feelings of anxiety/apprehension and directly impacts on the structural components of the thoracic and cervical region – muscles and joints.
- altered chemistry affects mood; altered mood changes blood chemistry; altered structure (posture for example) modifies function and therefore impacts on chemistry (e.g. liver function) and potentially on mood.

Within these categories – biochemical, biomechanical and psychosocial – are to be found most major influences on health.

Figure 1.3 • Major categories of health influence.

- chronic fatigue syndrome (CFS) which has among its assortment of symptoms almost all those ascribed to FMS, with greater emphasis on the fatigue elements, rather than the pain ones
- multiple chemical sensitivity (MCS)
- post-traumatic stress disorder (PTSD).

MPS, FMS, MCS (for example, in relation to what has become known as Gulf War syndrome) and CFS – their similarities, and the sometimes great degree of overlap in their symptom presentation, as well as their differences – will be examined in later chapters. One feature of all of these conditions which has been highlighted is based on a toxic/biochemical hypothesis, involving 'elevated levels of nitric oxide and its potent oxidant product, peroxynitrite' (Pall 2001).

Other theories of causation

A variety of theories as to the causation of FMS have emerged, with many of these overlapping and some being essentially the same as others, with only slight differences in emphasis as to aetiology, cause and effect. FMS is variously thought to involve any of a combination of the following (as well as other) causative features, each of which raises questions as well as suggesting answers and therapeutic possibilities:

- FMS could be a neuroendocrine disturbance, particularly involving thyroid hormone imbalances (see Ch. 10) (Garrison & Breeding 2003, Honeyman 1997, Lowe 1997, Lowe & Honeyman-Lowe 2006) and/or hypophyseal growth hormone imbalances (possibly as a direct result of sleep disturbance – a key feature of FMS, and/or lack of physical exercise) (Moldofsky 1993). The question which then needs to be asked is, what produces the endocrine disturbance? Is it genetically determined as some believe, or is it the result of deficiency, toxicity, allergy, an autoimmune condition or infection?
- Duna & Wilke (1993) propose that disordered sleep leads to reduced serotonin production, and consequent reduction in the pain-modulating effects of endorphins and increased 'substance P' levels, combined with sympathetic nervous system changes resulting in muscle ischaemia and increased sensitivity to pain (Duna & Wilke 1993). This hypothesis starts with a symptom, sleep disturbance, and the logical question is, what produces this?
- Dysautonomia, autonomic imbalance or dysfunction, characterized by 'relentless sympathetic hyperactivity', more prominent at night (Martinez-Lavin & Hermosillo 2005), have been proposed as foundational causes in a subgroup of individuals with FMS (and CFS). Many such patients have also been labelled with Gulf War-related illness (Geisser et al 2006, Haley et al 2004, van der Borne 2004).
- Muscle microtrauma may be the cause, possibly due to genetic predisposition (and/or growth hormone dysfunction), leading to calcium leakage, and so increasing muscle contraction and reducing oxygen supply. An associated decrease in mitochondrial energy production would lead to local fatigue and an inability for excess calcium to be pumped out of the cells, resulting in local hypertonia and pain (Wolfe et al 1992). The question as to why muscle microtrauma occurs more in some people than in others, or why repair is slower, requires investigation.
- FMS may be a pain modulation disorder resulting at least in part from brain (limbic system) dysfunction and involving mistranslation of sensory signals and consequent misreporting (Goldstein 1996). Why and how the limbic system and neural networks become dysfunctional is the key to this hypothesis (promoted by Goldstein, as discussed above).
- It has been suggested that what are termed idiopathic pain disorders (IPD) – such as temporomandibular joint disorders (TMJD), fibromyalgia syndrome (FMS), irritable bowel syndrome (IBS), chronic headaches, interstitial cystitis, chronic pelvic pain, chronic tinnitus, whiplash-associated disorders and vulvar vestibulitis (VVS) – are mediated by an individual's genetic variability, as well as by exposure to environmental events. The primary pathways of vulnerability that underlie the development of such conditions are seen to involve pain amplification and psychological distress, modified by gender and ethnicity (Diatchenko et al 2006) (Fig. 1.4).
- FMS may be a congenitally acquired disorder, possibly related to inadequate thyroid regulation of gene transcription, with an autosomal dominant feature (Lowe et al 1997, Pellegrino et al 1989). As will be outlined, some research studies have found evidence of a genetically linked predisposition towards FMS. Congenital structural abnormalities, such as extreme ligamentous laxity (i.e. hypermobility (Karaaslan et al 2000)), and Chiari malformations (see further discussion of this in Ch. 3 (Kesler & Mandizabal 1999, Thimineur et al 2002)), certainly seem to predispose toward FMS. The questions this raises include: which factors exacerbate these predispositions, and can anything be done about them?
- Hudson et al (2004) have proposed that fibromyalgia is one member of a group of 14 psychiatric and medical disorders (attention-deficit/hyperactivity disorder, bulimia nervosa, dysthymic disorder, generalized anxiety disorder, major depressive disorder, obsessive-compulsive disorder, panic disorder, post-traumatic stress

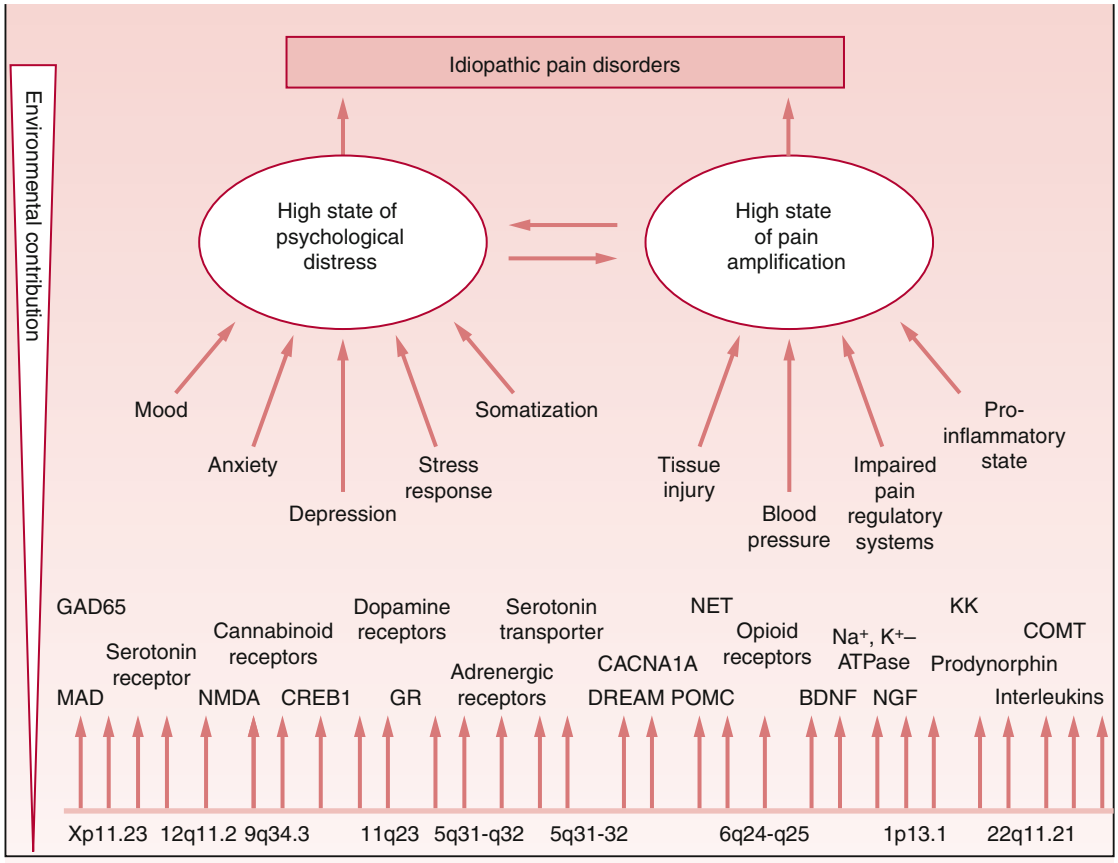


Figure 1.4 • Idiopathic pain. (Reproduced with permission from Diatchenko et al 2006.)

disorder, premenstrual dysphoric disorder and social phobia – plus four medical conditions: fibromyalgia, irritable bowel syndrome, migraine, and cataplexy), collectively termed *affective spectrum disorder* (ASD), hypothesized to share possibly heritable pathophysiological features. Following detailed analysis of data from 800 individuals with and without fibromyalgia (and the additional conditions under assessment), Hudson et al concluded that the present information added to evidence that the psychiatric and medical disorders, grouped under the term ASD, run together in families, raising the possibility that these disorders might share a heritable physiological abnormality.

- The underlying cause of FMS is seen by some to result from the (often combined) involvement of allergy, infection, toxicity and nutritional deficiency factors which themselves produce the major symptoms of FMS (and CFS), such as fatigue and pain, or which are associated with endocrine imbalances and the various consequences outlined above, such as thyroid hormone dysfunction and/or sleep disturbance (Abraham & Lubran 1981, Bland 1995, Cleveland et al 1992, Fibromyalgia Network Newsletters 1990–94, Pall 2001, Robinson 1981, Vorberg 1985). The list of possible interacting features such as these, which frequently seem to coexist in someone with FMS, offers the possibility of intervention strategies which seem to focus on causes rather than effects. For example, specific 'excitotoxins' such as monosodium glutamate (MSG) have been identified as triggering FMS symptoms (Smith et al 2001). These and other examples will be examined in later chapters.
- A central sensitization hypothesis suggests that central mechanisms of FMS pain are dependent on abnormal peripheral input(s) for development

and maintenance of the condition (Vierck 2006). A substantial literature defines peripheral–CNS–peripheral interactions that seem integral to fibromyalgia pain. The generalized hypersensitivity associated with the condition has focused interest on central (CNS) mechanisms for the disorder. These include central sensitization, central disinhibition and a dysfunctional hypothalamic–pituitary–adrenal (HPA) axis. However, it is asserted that the central effects associated with fibromyalgia can be produced by peripheral sources of pain. In this model, chronic nociceptive input induces central sensitization, magnifying pain and activating the HPA axis and the sympathetic nervous system. Chronic sympathetic activation then indirectly sensitizes peripheral nociceptors, and sets up a vicious cycle. (See also notes on facilitation later in this chapter, as well as further discussion of central and peripheral sensitization in Ch. 4.)

- Use of MRI and other scanning/imaging technology suggests that the central sensitization concept has objective evidence to support it. This subject is discussed further in Chapter 3 (see 'The polysymptomatic patient') and Chapter 4 (see 'Central sensitization hypothesis' and Fig. 3.1). Two examples of imaging evidence, relating to altered brain morphology and/or behaviour in relation to FMS, are summarized in Box 1.3.
- Within the framework of 'allergy' and 'intolerance' as triggers to FMS symptoms lies a hypothesis which remains controversial, but worthy of discussion. This relates to the concept of blood-type specific intolerances resulting from an interaction between food-derived lectins (protein molecules) and specific tissue markers related to the individual's blood type. D'Adamo (2002), who has done most to promote this concept, states (in relation to FMS sufferers who happen to be type O):

It has become obvious that those who are type O *and suffering from fibromyalgia can see quite dramatic responses if they can stick to the wheat-free component of the diet for a long enough duration. A recent study indicates that dietary lectins interacting with enterocytes (cells lining*

Box 1.3

Imaging evidence

Morphological changes

Does structure govern function, or vice versa?

Schmidte-Wilke et al (2007), having demonstrated altered brain morphology associated with fibromyalgia syndrome (FMS), using MRI imaging and voxel-based morphometry, ask: does chronic pain induce morphological change in the brain, or do these morphological changes result in chronic pain?

They note that: 'Fibromyalgia seems to be associated with an altered local brain morphology. As the most important result we describe structural changes in the striatum bilaterally, which cannot be explained by depression scores.'

So, might it be possible that central plasticity is the initial cause of chronic pain?

Thalamic region changes

Using diffusion weighted imaging (DWI) and diffusion tensor imaging (DTI), well-established MRI imaging processes, Sundgren et al (2007) investigated for the presence of cerebral abnormalities in FMS patients with normal controls.

The primary findings were that there were differences between FMS patients and controls, and that this was most pronounced in the right thalamic region. 'The magnitude of these differences in FMS patients was statistically greater in those individuals with worse clinical pain and an external locus of pain control, and nonsignificantly associated with other clinical parameters of disease severity, suggesting that these findings are clinically relevant.'

The researchers note that: 'It is not likely that the abnormalities identified in this study are due to an ongoing demyelization or even axonal injury, but instead are more likely the result of neuronal dysfunction.'

That there is a structural/morphological and functional difference between areas of the brain of FMS patients, compared with asymptomatic individuals, is clear, however, as these researchers note: 'As with any other abnormalities detected in functional imaging, the precise cause for these abnormalities is unclear.'

the intestines) and lymphocytes may facilitate the transportation of both dietary and gut-derived pathogenic antigens to peripheral tissues, which in turn causes persistent immune stimulation at the periphery of the body, such as the joints and muscles (Cordain et al 2000). This, despite the fact that many nutrition 'authorities' still question whether lectins even get into the systemic circulation! In genetically susceptible individuals, this lectin stimulation may ultimately result in the expression of disorders like rheumatoid arthritis and fibromyalgia via molecular mimicry, a process whereby foreign peptides, similar in structure to endogenous peptides, may cause antibodies or T-lymphocytes to cross-react and thereby break immunological tolerance. Thus by removing the general and type O *specific lectins from the diet, we allow for the immune system to redevelop tolerance, the inflammation begins to ebb, and healing can begin.*

- Many FMS patients demonstrate low carbon dioxide levels when resting – an indication of possible hyperventilation involvement. The symptoms of hyperventilation closely mirror those of FMS and CFS, and the pattern of upper chest breathing which it involves severely stresses the muscles of the upper body which are most affected in FMS, as well as producing major oxygen deficits in the brain and so influencing its processing of information such as messages received from pain receptors (Chaitow et al 2002, Janda 1988, King 1988, Lum 1981). When hyperventilation tendencies are present, they can be seen in some instances to be a response to elevated acid levels (because of organ dysfunction perhaps) or they can be the result of pure habit. Breathing retraining can, in some FMS patients, offer a means of modifying symptoms rapidly (Readhead 1984).
- Psychogenic (or psychosomatic) rheumatism is the name ascribed to FMS (and other non-specific chronic muscle pain problems) by those who are reluctant to see an organic origin for the syndrome. Until the 1960s it was suggested that such conditions be treated as 'psychoneurosis' (Warner 1964). In FMS, as in all chronic forms of ill-health, there are undoubtedly elements of emotional involvement, whether as a cause or as an effect. These impact directly on pain perception and immune function, and, whether causative or not, benefit from appropriate attention, assisting both in recovery and rehabilitation (Melzack & Wall 1988, Solomon 1981).
- FMS is seen by some to be an extreme of the myofascial pain syndrome (MPS), where numerous active myofascial triggers produce pain both locally and at a distance (Thompson 1990). Others see FMS and MPS as distinctive, but recognize that 'it is not uncommon for a patient with myofascial pain syndrome to progress with time to a clinical picture identical to that of FMS' (Bennett 1986a). Among the most important practical pain-relieving approaches to FMS will be the need to identify and deactivate myofascial trigger points which may be influencing the overall pain burden. A number of different approaches, ranging from electro-acupuncture to manual methods, will be detailed (see Chs 6, 8 and 9 in particular).
- Trauma (e.g. whiplash) seems to be a key feature of the onset in many cases of FMS, and especially cervical injuries, particularly those involving the suboccipital musculature (Bennett 1986b, Curatolo et al 2001, Hallgren et al 1993). Recognition of mechanical, structural factors allows for interventions which address their repercussions, as well as the psychological effects of trauma. In Chapter 9 Carolyn McMakin presents compelling evidence for the use of microcurrents in treatment of FMS of traumatic (especially of the cervical region) origin.
- There is an 'immune dysfunction' model for myalgic encephalomyelitis (ME) – that uniquely British name for what appears to be an amalgam of chronic fatigue syndrome and fibromyalgia. This proposes a viral or other (vaccination, trauma, etc.) initial trigger which may lead to persistent overactivity of the immune system (overproduction of cytokines). Associated with this there may be chemical and/or food allergies, hypothalamic disturbance, hormonal imbalance and specific areas of the brain (e.g. limbic system) 'malfunctioning'. The primary feature of this model is the overactive immune function, with many of the other features, such as endocrine imbalance and brain dysfunction, secondary to this (Macintyre 1993b). In recent research, the presence of systemic bacterial, mycoplasmal and viral coinfections in many

patients with CFS and FMS has been a feature (Nicolson et al 2002).

The musculoskeletal terrain of FMS

Current research and clinical consensus seem to indicate that FMS is not primarily a musculoskeletal problem, although it is in the tissues of this system that its major symptoms manifest: 'Fibromyalgia is a chronic, painful, musculo-skeletal condition characterised by widespread aching and points of tenderness associated with: 1) changed perception of pain, abnormal sleep patterns and reduced brain serotonin; and 2) abnormalities of microcirculation and energy metabolism in muscle' (Eisinger et al 1994).

These characteristics, involving abnormal microcirculation and energy deficits, are the prerequisites for the evolution of localized areas of myofascial distress and neural hyper-reactivity (i.e. trigger points). As indicated, one of the key questions to be answered in any given case is the degree to which the person's pain is deriving from myofascial trigger points, or other musculoskeletal sources, since these may well be more easily modified than the complex underlying imbalances which are producing, contributing to, or maintaining the primary FMS condition.

Early research

A great deal of research into FMS (under different names – see Box 1.1), and of the physiological mechanisms that increase our understanding of the FMS phenomenon, has been conducted over the past century (and earlier) and is worthy of review. Additional research in parallel with that focused on chronic muscular pain may clarify processes at work in this complex condition.

Korr's work on facilitation

Among the most important researchers in the area of musculoskeletal dysfunction and pain over the past half century has been Professor Irwin Korr, whose work in explaining the facilitation phenomenon offers important insights into some of the events occurring in FMS and, more specifically, in myofascial pain settings. Needless to say, these often overlap. As suggested above, in a clinical context it is vital to know what degree of the pain being experienced in FMS is the result of myofascial pain, since this part of the pain package can relatively easily be modified or eliminated (see Chs 8 and 9).

Neural structures can become hyper-reactive in either spinal and paraspinal tissues or almost any other soft tissue. When they are found close to the spine the phenomenon is known as segmental facilitation. When such changes occur in ligaments, tendons or periosteal tissues, they are called trigger points; if situated in muscles or in fascia they are termed 'myofascial' trigger points. In early studies by the most important researcher into facilitation, Irwin Korr (1970, 1976), he demonstrated that a feature of unilateral segmental facilitation was that one side would test as having normal skin resistance to electricity compared with the contralateral side, the facilitated area, where a marked reduction in resistance was present. When 'stress' – in the form of needling or heat – was applied elsewhere in the body, and the two areas of the spine were monitored, the area of facilitation showed a dramatic rise in electrical (i.e. neurological) activity. In one experiment volunteers had pins inserted into a calf muscle in order to gauge the effect on the paraspinal muscles, which were monitored for electrical activity. While almost no increase occurred in the normal region, the facilitated area showed greatly increased neurological activity after 60 seconds (Korr 1977) (Fig. 1.5). This and numerous similar studies have confirmed that any form of stress impacting the individual – be it climatic, toxic, emotional, physical or anything else – will produce an increase in neurological output from facilitated areas.

In Chapter 9, Carolyn McMakin describes how some forms of trauma, particularly those affecting cervical structures, can lead to chronic local facilitation, resulting in FMS-like pain. She reports that treatment utilizing microcurrent, manual modalities and nutritional support can frequently ease, or even remove, such symptoms.

Professor Michael Patterson (1976) explains the concept of segmental (spinal) facilitation as follows:

> *The concept of the facilitated segment states that because of abnormal afferent or sensory inputs to a particular area of the spinal cord, that area is kept in a state of constant increased excitation. This facilitation allows normally ineffectual or subliminal stimuli to become effective in producing efferent output from the facilitated segment, causing both skeletal and visceral organs innervated by the affected segment to be maintained in a state of*

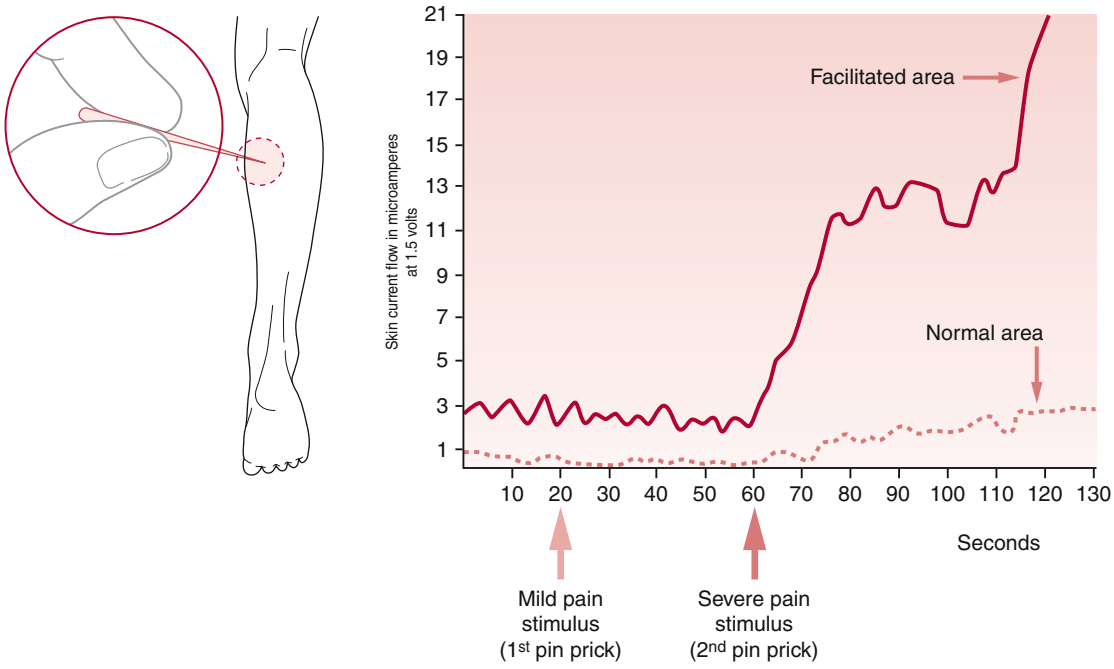


Figure 1.5 • Pain stimuli produce a marked reaction in the facilitated area and a little reaction in the normal area.

overactivity. It is probable that the somatic dysfunction with which a facilitated segment is associated, is the direct result of the abnormal segmental activity as well as being partially responsible for the facilitation.

Wind-up and facilitation

The process known as wind-up (Fig. 1.6) supports the concepts of facilitation, in different terms. Staud (2006) has described the relationship between peripheral pain impulses that lead to central sensitization as follows:

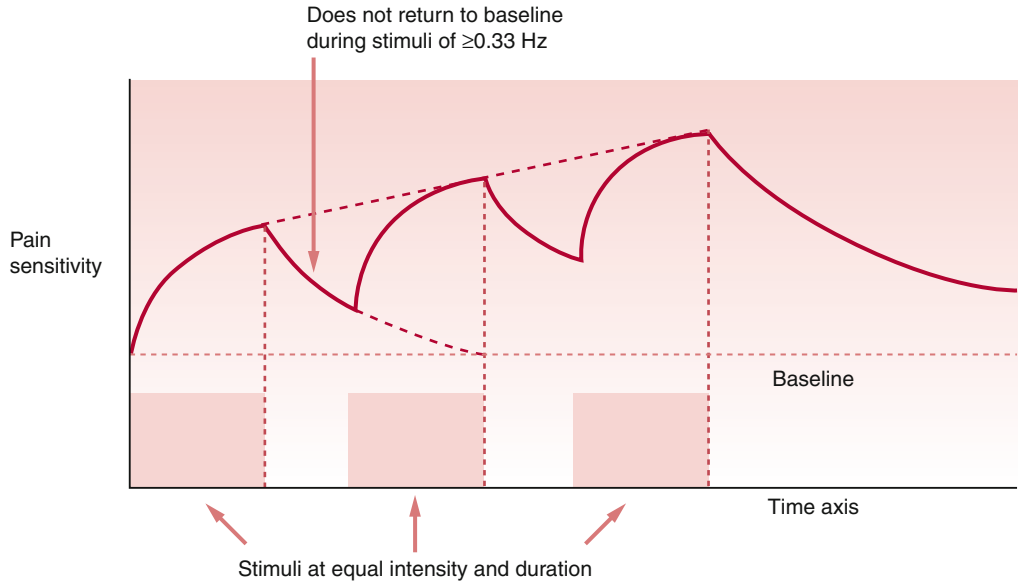
> *Increasing evidence points towards peripheral tissues as relevant contributors of painful impulse input that might either initiate or maintain central sensitization, or both. It is well known that persistent or intense nociception can lead to neuroplastic changes in the spinal cord and brain, resulting in central sensitization and pain. This mechanism represents a hallmark of FM and many other chronic pain syndromes, including irritable bowel syndrome, temporomandibular disorder, migraine, and low back pain. Importantly, after central sensitization has been established only minimal nociceptive input is required for the maintenance of the chronic pain state. Additional factors, including pain related negative affect and poor sleep have been shown to significantly contribute to clinical FM pain.*

The similarities between modern neurological observations and Korr's original work are clear.

Arousal and facilitation

Emotional arousal is also able to affect the susceptibility of neural pathways to sensitization. The increase in descending influences from the emotionally aroused subject would result in an increase in toxic excitement in the pathways and allow additional inputs to produce sensitization at lower intensities. This implies that highly emotional people, or those in a highly emotional situation, would be expected to show a higher incidence of facilitation of spinal pathways or local areas of myofascial distress (Baldry 1993).

This has a particular relevance to fibromyalgia, where heightened arousal (for a variety of possible



Temporal summation of second pain (wind-up). When identical stimuli are applied to normal subjects at frequences of >0.33 Hz, pain sensations will not return to baseline during the interstimulatory interval. Wind-up is strongly dependent on stimulus frequency and is inversely correlated with interstimulatory interval. In contrast to normal subjects, FM patients wind-up at frequencies of <0.33 Hz and require lower stimulus intensities.

Figure 1.6 • The wind-up process. (Reproduced with permission from Staud 2006.)

reasons, as will become clear), in addition to possible limbic system dysfunction, leads to major influences from the higher centres (Goldstein 1996). Since the higher brain centres do influence the tonic levels of the spinal paths, it might be expected that physical training and mental attitudes would also tend to alter the tonic excitability, reducing the person's susceptibility to sensitization from everyday stress. Thus the athlete would be expected to withstand a comparatively high level of afferent input prior to experiencing the self-perpetuating results of sensitization. This, too, has a relevance to fibromyalgia, where there exists ample evidence of beneficial influences of aerobic training programmes (McCain 1986, Richards & Scott 2002).

Selective motor unit recruitment

Researchers have shown that a small number of motor units, located in particular muscles, may display almost constant or repeated activity when influenced psychogenically. Low amplitude activity (using surface EMG) was evident even when the muscle was not being employed, if there was any degree of emotional arousal. 'A small pool of low-threshold motor units may be under considerable load for prolonged periods of time ... motor units with Type 1 [postural] fibers are predominant among these. If the subject repeatedly recruits the same motor units, the overload may result in a metabolic crisis.' (Waersted et al 1993). The implications of this research are profound for they link even low grade degrees of emotional distress with almost constant sensitization of specific myofascial structures, with the implications associated with facilitation and pain generation. This aetiology parallels the proposed evolution of myofascial trigger points, as suggested by Simons et al (1999).

Not only myelinated fibres

Research by Ronald Kramis has shown that, in chronic pain settings, non-nociceptive neurons can become sensitized to carry pain impulses (Kramis 1996).

Hypersensitization of spinal neurons may actually involve non-nociceptive neurons altering their phenotype so that they commence releasing substance P. This, it is thought, may play a significant part in FMS pain perception, as increased levels of substance P in

the cerebrospinal fluid maintain heightened amplification of what would normally be registered as benign impulses. The research suggests that impulses from associated conditions such as ongoing viral activity, 'muscular distress' or irritable bowel may be adequate to maintain the central pain perception.

Local facilitation

Apart from paraspinal tissues, where segmental facilitation, as described above, manifests, localized areas of neural facilitation can occur in almost all soft tissues: these are called myofascial trigger points.

Much of the basic research and clinical work into this aspect of facilitation has been undertaken by doctors Janet Travell and David Simons (Simons et al 1999; Travell 1957; Travell & Simons 1986, 1992; see also Chs 6 and 8). Travell and Simons are on record as stating that if a pain is severe enough to cause a patient to seek professional advice (in the absence of organic disease), it usually involves referred pain, and therefore a trigger area is probably a factor. They remind us that patterns of referred pain are constant in distribution in all people, and that only the intensity of referred symptoms/pain will vary.

The implication for the fibromyalgia patient is the possibility (according to Travell and Simons this is a veritable certainty) that their pain has as part of its make-up the involvement of myofascial trigger points, which are themselves areas of facilitation (see Ch. 8 by Dommerholt & Issa). This suggests that trigger points, and the pain (and tingling, numbness, etc.) which they produce, will be exaggerated by *all* forms of stress influencing that individual patient. Travell has confirmed that her research indicates that the following factors can all help to maintain and enhance myofascial trigger point activity:

- nutritional deficiencies (especially vitamins C and B complex, and iron)
- hormonal imbalances (low thyroid hormone production, menopausal or premenstrual dysfunction)
- infections (bacteria, viruses or yeasts)
- allergies (wheat and dairy in particular)
- low oxygenation of tissues (aggravated by tension, stress, inactivity, poor respiration) (Simons et al 1999, Travell & Simons 1986, 1992).

This list corresponds closely with factors that are key aggravating agents for many (most) people with fibromyalgia, suggesting that the connection between facilitation (trigger point activity) and FMS is close (Starlanyl & Copeland 1996). *Myofascial trigger points are, however, not the cause of fibromyalgia, and myofascial pain syndrome is not FMS*, although they may coexist in the same person at the same time. Myofascial trigger points do undoubtedly frequently contribute to the painful aspect of FMS, and as such are deserving of special attention.

As will be explained in later chapters, there are a number of ways in which deactivation or modulation of myofascial trigger points can be achieved. Some practitioners opt for approaches that deal with them manually, while others prefer microcurrents or electro-acupuncture methods or variations on these themes, with yet others suggesting that reduction in the number and intensity of stress factors – of whatever type – offers a safer approach to reducing the influence of facilitation on pain.

Following this introduction to the concept of hyper-reactive, sensitized (facilitated) neural structures, it would be justifiable to enquire as to whether or not what is happening in the brain and in the neural network, as described by Goldstein, is not simply facilitation on a grand scale. The outline of some of the leading current hypotheses as to the aetiology of FMA in Chapter 4 may shed light on this possibility.

Additional early research into FMS

Early FMS research has been presented in summary form in Box 1.1. Aspects of that research, and how some of it correlates with more recent findings, are outlined below.

R. Gutstein, a Polish physician who emigrated to the UK prior to the Second World War, was a remarkable researcher who published papers under different names (M. G. Good, for example) before, during and following the war. In them he clearly described the myofascial trigger point phenomenon, as well as what is now known as fibromyalgia, along with a great many of its predisposing and maintaining features.

Gutstein (1956) showed that conditions such as ametropia (an error in the eye's refractive power occurring in myopia, hypermetropia and astigmatism) may result from changes in the neuromuscular

component of the craniocervical area, as well as more distant conditions involving the pelvis or shoulder girdle. He stated: 'Myopia is the long-term effect of pressure of extra-ocular muscles in the convergence effort of accommodation involving spasm of the ciliary muscles, with resultant elongation of the eyeball. A sequential relationship has been shown between such a condition and muscular spasm of the neck.'

Gutstein termed reflex areas he identified 'myodysneuria' and suggested that the reference phenomena of such spots or 'triggers' would include pain, modifications of pain, itching, hypersensitivity to physiological stimuli, spasm, twitching, weakness and trembling of striated muscles, hyper- or hypotonus of smooth muscle of blood vessels and of internal organs, and/or hyper- or hyposecretion of visceral, sebaceous and sudatory glands. Somatic manifestations were also said to occur in response to visceral stimuli of corresponding spinal levels (Gutstein 1944). In all of these suggestions Gutstein seems to have been in parallel with the work of Korr.

Gutstein/Good's method of treatment involved the injection of an anaesthetic solution into the trigger area. He indicated, however, that where accessible (e.g. muscular insertions in the cervical area) the chilling of these areas combined with pressure would yield good results.

In this and much of what he reported in the 1940s and 1950s Gutstein was largely in agreement with the research findings of John Mennell (1952) as well as with Travell & Simons, as expressed in their major texts on the subject (Travell & Simons 1986, 1992). He reported that obliteration of overt and latent triggers in the occipital, cervical, interscapular, sternal and epigastric regions was accompanied by years of alleviation of premenopausal, menopausal and late menopausal symptoms (Good 1951). He quotes a number of practitioners who had achieved success in treating gastrointestinal dysfunctions by deactivating trigger areas. Some of these were treated by procainization, others by pressure techniques and massage (Cornelius 1903). He also reported the wide range of classic fibromyalgia symptoms and features, suggesting the name myodysneuria for this syndrome, which he also termed 'nonarticular rheumatism' (Gutstein 1955).

In describing myodysneuria (FMS), Gutstein demonstrated localized functional sensory and/or motor abnormalities of musculoskeletal tissues and saw the causes of such changes as multiple (Gutstein 1955). Most of these findings have been validated subsequently, in particular by the work of Travell and Simons. They include:

- acute and chronic infections, which he postulated stimulated sympathetic nerve activity via their toxins
- excessive heat or cold, changes in atmospheric pressure and draughts
- mechanical injuries, both major and repeated minor microtraumas – now validated by the recent research of Professor Philip Greenman of Michigan State University (Hallgren et al 1993)
- postural strains, unaccustomed exercise, etc., which could predispose towards future changes by lowering the threshold for future stimuli (in this he was agreeing with facilitation mechanisms as described above)
- allergic and/or endocrine factors which could cause imbalances in the autonomic nervous system
- congenital factors which make adaptation to environmental stressors difficult
- arthritic changes which could impose particular demands on the musculoskeletal system's adaptive capacity
- visceral diseases which could intensify and precipitate somatic symptoms in the distribution of their spinal and adjacent segments.

We can see from these examples of Gutstein's thinking strong echoes of the facilitation hypothesis in osteopathic medicine.

Gutstein's diagnosis of myodysneuria was made according to some of the following criteria:

- a varying degree of muscular tension and contraction is usually present, although sometimes adjacent, apparently unaffected tissue is more painful
- sensitivity to pressure or palpation of affected muscles and their adjuncts
- marked hypertonicity may require the application of deep pressure to demonstrate pain.

In 1947 Travell & Bigelow produced evidence supporting much of what Gutstein (1944) had reported. They indicated that high intensity stimuli from active trigger areas produce, by reflex, prolonged vasoconstriction with partial ischaemia in localized areas of the brain, spinal cord, or peripheral nerve structures.

A widespread pattern of dysfunction might then result, affecting almost any organ of the body. These

early research findings correlate well with modern fibromyalgia and chronic fatigue research and the hypothesis of 'neural network disorders' as described by Goldstein (1996), and in British and American research utilizing SPECT scans, which show clearly that severe circulatory deficits occur in the brainstem and in other areas of the brain of most people with CFS and FMS (Costa 1992).

Gutstein's suggested pathophysiology of fibromyalgia/fibrositis/myodysneuria

The changes which occur in tissue involved in the onset of myodysneuria/fibromyalgia, according to Gutstein, are thought to be initiated by localized sympathetic predominance, associated with changes in the hydrogen ion concentration and calcium and sodium balance in the tissue fluids (Petersen 1934). This is associated with vasoconstriction and hypoxia/ischaemia. Pain resulted, he thought, by these alterations affecting the pain sensors and proprioceptors.

Muscle spasm and hard, nodular, localized tetanic contractions of muscle bundles, together with vasomotor and musculomotor stimulation, intensified each other, creating a vicious cycle of self-perpetuating impulses (Bayer 1950). Varied and complex patterns of referred symptoms might then result from such 'trigger' areas, as well as local pain and minor disturbances. Sensations such as aching, soreness, tenderness, heaviness and tiredness may all be manifest, as may modification of muscular activity due to contraction, resulting in tightness, stiffness, swelling and so on.

It is clear from this summary of his work that Gutstein was describing fibromyalgia, and many of its possible causative features.

Chapter 2 examines what FMS is, as well as what it is not, with suggestions for differential diagnosis.

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Chapter Two

2

Fibromyalgia's symptom patterns: causes or effects?

CHAPTER CONTENTS

Prevalence of associated conditions

The overlap between fibromyalgia syndrome (FMS) and other conditions, some of which (chronic fatigue syndrome (CFS) for example) closely mimic its defining features and some which are more obviously distinctive, adds a confusing element to the understanding of this syndrome. Later chapters address similarities and differences between FMS and CFS (see Ch. 5), and similarities and differences between FMS and myofascial pain syndrome (MPS) (see Chs 6, 8 and 9). This chapter elaborates on some of the long list of other named conditions which have as a major part of their symptom picture comparable patterns to those associated with FMS. In Chapter 3 some of the major associated symptoms of FMS are evaluated, in more detail, in terms of their possible contribution to the overall aetiological progression of the syndrome.

First, considering a number of frequently associated and overlapping conditions, a comparison can be made between their presence in the general population, and their presence in patients with a diagnosis of either FMS or CFS. The list of associated conditions in Table 2.1, based on the research of Professor Daniel Clauw, shows those which are more prevalent in FMS (which is estimated to affect 2% of the population) than in the general population (or where appropriate – e.g. dysmenorrhoea – in the general female population). The conditions are listed in alphabetical order, not in any order of importance in terms of symptom severity (Clauw 1995).

Clauw (1995) states that it is his opinion that FMS/CFS represent a 'constellation' of many overlapping chronic pain disorders, many of which are difficult to treat satisfactorily:

- Many of these conditions have similar characteristics including, among others, pain and/or fatigue of a chronic nature.
- The patient population affected is predominantly female. This is one of the key defining differences between FMS and MPS, which has no gender preference; another is the fact that people with MPS have no particular predilection towards the associated conditions which are characteristic of FMS.
- These associated symptoms are seen to occur to a significantly greater degree among fibromyalgia patients than in the general population, and many of

Table 2.1 Prevalence of conditions associated with CFS/FMS

Condition	% in CFS/FMS	% in general population
Chronic headache	50%	5%
Dysmenorrhoea	60%	15%
Endometriosis	15%	2%
Interstitial cystitisa	25%	Under 1%
Irritable bladder/urethral pain[1]	15%	Under 1%
Irritable bowel syndrome	60%	10%
Mitral valve prolapse[2]	75%	15%
Multiple chemical sensitivities	40%	5%
Restless leg syndrome	30%	2%
Temporomandibular joint syndrome	25%	5%

[1]See notes in Chapter 16 on the remarkable effect on these conditions of deactivation of appropriate trigger points.
[2]This is not a life-threatening condition, usually manifesting with mild variations from normal cardiac function.

them seem to be linked to neuroendocrine disturbance.

Dr Jay Goldstein (1996) enfolds all the symptoms of FMS – and a great many more – into a model which he has called 'neurosomatic disorders' (see Ch. 4). He states that:

> *Neurosomatic disorders are the most common group of illnesses for which patients consult physicians (Yunus 1994). Fatigue, depression, anxiety, diffuse pain, cognitive dysfunction, and the other neurosomatic disorders present to different specialists in different ways and the final diagnosis often depends on the orientation and speciality of the doctor.*

The associated symptoms listed in Table 2.1, which favour females, and which are found in a large proportion of FMS/CFS patients, are not necessarily the major symptoms associated with FMS.

Symptoms as aetiological factors

Many of the conditions associated with FMS/CFS are the end result of different causal factors, whether of a biochemical/toxic, neurological or infectious (or other) nature, for example chronic headaches, restless legs or interstitial cystitis. They are unpleasant, may irritate, depress and disturb the individual, but do not themselves act as causes of further pathology or significant metabolic disturbance.

On the other hand, some symptoms do just that – they are not only major irritants but also act as the direct cause of further disturbance and imbalance. Sleep disturbance, for example, an extremely common associated symptom of FMS, which can itself result from numerous stress-related causal factors, leads to a number of direct secondary changes, including reduced protein synthesis, decreased growth hormone secretion, reduced overnight oxygen haemoglobin saturation, reduced immune activity and perturbation of the hypothalamic–pituitary–adrenal axis. The obvious effects of these changes include, among other things, symptoms such as general malaise and increased pain perception (see Fig. 3.8B, Ch. 3, for a schematic representation of the changes relative to sleep disturbance, and full citations). The less obvious effects of such changes, if they become chronic (for example disruption of serotonin status), could well be implicated in the evolution of fibromyalgia symptoms.

Irritable bowel syndrome (IBS) is a common associated symptom of FMS and may itself derive from a wide range of causal factors, including stress, food intolerance, infection, disturbed gut flora (possibly resulting from the after-effects of antibiotics), enzyme deficiencies, serotonin deficiency, and others. The obvious end result of IBS is a thoroughly disturbed digestive function which may involve irritated gut mucosa, malabsorption, dysbiosis and toxicity, as well as an increased likelihood of food intolerances – a suspected cause of both myalgia and fatigue (see Fig. 3.7, Ch. 3, for a schematic representation of the possible inter-relationship between IBS and FMS). The less obvious effects of the disruption of digestive function may involve nutritional deficiencies and stress on the organs of detoxification – liver and kidneys, for example – with further ramifications in terms of declining health levels.

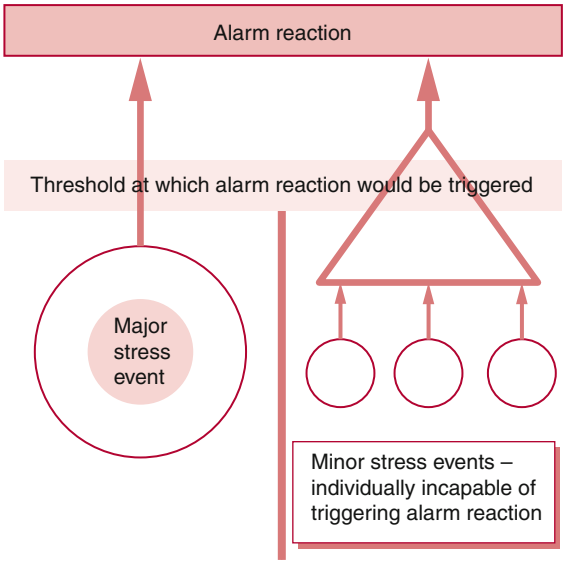
Adaptation

One of Selye's most important findings is commonly overlooked when the concurrent impact of multiple stressors on the system is being considered (Selye 1974). Shealy (1984) summarizes as follows:

> *Relative values for various stressors can only be estimated since individual responses will depend upon the level of accommodation at a given time. Selye has emphasised the fact that any systemic stress elicits an essentially generalised reaction, with release of adrenaline and glucocorticoids, in addition to any specific damage such a stressor may cause. During the stage of resistance (adaptation) a given stressor may trigger less of an alarm; however, Selye insists that adaptation to one agent is acquired at the expense of resistance to other agents. That is, as one accommodates to a given stressor, other stressors may require lower thresholds for eliciting the alarm reaction. Of considerable importance is Selye's observation that concomitant exposure to several stressors elicits an alarm reaction at stress levels which individually are sub-threshold. That is, one third the dose of histamine, one third the dose of cold, one third the dose of formaldehyde, elicit an alarm reaction equal to a full dose of any one agent.*

Consider these findings of Selye when the multiple stressors involved in the aetiology and symptomatology of FMS are considered, as symptoms themselves become stressors to add to the load being adapted to (Fig. 2.1). These observations of Selye have been further amplified, as discussed in Chapter 3 – see particularly notes on allostasis and Table 3.2.

As indicated, a number of the more important conditions associated with FMS, including IBS and sleep disturbance, will be considered in greater detail in Chapter 3, in so far as their existence seems to have a clear aetiological importance in the evolution of FMS/CFS. Some of the 'causal symptoms' which receive this more detailed attention are well researched in that their links with FMS/CFS are reasonably clear. However, the links of others to FMS/CFS, despite a great deal of anecdotal evidence, remain somewhat speculative. In this latter group can be included hyperventilation and hypoglycaemic tendencies, neither of which



A combination of minor stresses, each incapable of triggering an alarm reaction in the general adaptation syndrome can, when combined or sustained, produce sufficient adaptive demand to initiate that alarm.
In fibromyalgia a combination of major and minor biochemical, biomechanical and psychosocial stressors commonly seem to be simultaneously active.

Figure 2.1 • Alarm reaction.

appear often in mainstream research or review literature, but which feature large in unconventional assessment of causal features of both FMS and CFS. These topics will be elaborated on in Chapter 4, which summarizes the various hypotheses as to FMS causation.

Individuality

Before reviewing important evidence deriving from a survey of thousands of people with FMS, it is important to reflect on an aspect that is commonly overlooked when trying to make sense of the diversity of symptoms and reactions among apparently similar people. The factor of individuality is commonly acknowledged, but possibly not fully enough.

When patients are assessed, their individual characteristic, distinctive, idiosyncratic, inborn and acquired features and tendencies need to be considered as primary factors, not as secondary influences. While obvious anomalies may be taken into account (e.g. short leg, small hemipelvis, etc.), many

variables are less visible, not least within the mysterious and powerful realm of psychological individuality. On a more material level, anatomists have shown us that structural features such as nerves, blood vessels and even organs are not infrequently variable in their location, dimensions and orientation. Examples include individuals with duplex ureters, which sometimes merge before they reach the bladder and sometimes do not. In the field of manual therapy the example exists of the relationship between the piriformis muscle and the sciatic nerve which it overlies in about 80% of people, but is penetrated by (totally or partially) in the remainder – with potentially painful results (Travell & Simons 1992). Body type is also a feature which needs to be taken into account (endomorph, ectomorph, mesomorph, or some other categorization model) as are physiological tendencies (hypermobility for example) and individual features relative to posture and gait – comparing what we note with hypothetical norms. Subsequently, in the bodywork arena, it is common to attempt to unveil individual patterns of adaptation, and consequent joint and soft tissue changes and compensations (restricted, blocked, short, weak, etc.), as well as localized dysfunctions (trigger points, fibrosis for example). Out of all this information a picture can be built in which these findings are laid against a background of the patient's history. From this a rational plan of therapeutic or rehabilitation action should hopefully emerge.

In the wider world of health care the study of individuality has reached complex proportions, and some of the issues raised, and the methods used, can be seen to be potentially important when considering conditions such as fibromyalgia, offering ever finer grids through which the patient's history and characteristics might be sieved. Over 30 years ago Nobel prize winner Roger Williams (1976) identified biochemical individuality when he demonstrated that, in groups of students at the University of Texas, there were variations in individual requirements (to maintain optimum health) of as much as 700% for most nutrients (e.g. vitamin C). About the same time, looking at what came to be termed 'metabolic individuality', William Kelley (1974) and Henry Bieler (1978) separately observed that there appeared to be a dominance of one or other aspect of the endocrine system in most people (thyroid, pituitary, adrenal, etc.). Based on these observations they constructed protocols for health enhancement (and in Kelley's case the treatment of cancer). There were close approximations between the Kelley and Bieler classifications; for example, what Kelley called 'sympathetic-vegetarian' was very similar to Bieler's 'pituitary type', while Kelley's 'parasympathetic-carnivore' equated closely with Bieler's 'adrenal type'.

In recent years D'Adamo (2001) has constructed a framework which helps to clarify the confusion arising from such diversity, by first linking a host of variables to blood type, and then to secretor status (whether or not the individual's secretions are 'marked' by their particular blood type molecule – see Box 2.1). These concepts seem to be backed up by solid scientific observation as to the way the body works, and help to explain why the Bieler and Kelley classifications had merit. They also clearly offer additional validation for the work of Williams. Wolcott & Fahey (2000) have also gone far beyond Kelley's original work, and attempted to blend the individual's autonomic type, blood type, oxidative type, endocrine type, electrolyte balance, prostaglandin balance, acid/alkaline type, constitutional type and catabolic/anabolic balance, among other features.

Do we all have different biochemical needs because we are different metabolically/genetically, or are we different metabolically because of our diet and lifestyle habits? And, most critically, if genetics is the determining factor, is this a fixed state of affairs, or is it conceivably modifiable? Figure 2.2 provides a model of a series of 'grids' through which the individual can be viewed, each of which adds a number of variables to the complex combination which each person represents, made up of their unique genetic, biochemical, biomechanical and psychological features, together with the distinctive life experience, habits and events that characterize each of us. How much of this can be assessed and deciphered, and how much modified, is an open question. The answer will vary from person to person. Nevertheless, some elements can undoubtedly be changed, modified, modulated or eliminated, possibly even some of the predisposing features represented by our genetic make-up.

Bland, in an interview with Martin (2001), suggests that gene expression is 'not hard wired', and might be capable of being influenced by environmental factors (including diet, as in so-called 'functional medicine'). Ames and colleagues (2002) have now shown Bland to be correct. They list more than 50 genetic diseases/anomalies which have been successfully treated utilizing high doses of vitamins and

Box 2.1

Secretor status – a brief explanation

D'Adamo (2001) explains the significance of secretor status as follows:

> *The term 'secretor,' as used in blood banking, refers to secretion of ABH antigens in fluids such as saliva, sweat, tears, semen, and serum. If people are secretors, they will secrete antigens according to their blood groups. For example, group O people will secrete H antigen, group A people will secrete A and H antigens, etc. . . . To test for secretor status, an inhibition or neutralization test is done using saliva. The principle of the test is that if ABH antigens are present in a soluble form in a fluid (e.g., saliva) they will neutralize their corresponding antibodies and the antibodies will no longer be able to agglutinate red cells possessing the same antigens.*

According to the research which D'Adamo has conducted and reviewed (Agbedana et al 1996, Ben-Aryeh et al 1995, Dickey et al 1993, Ellison et al 1999, Matsushita et al 1998, Vidas et al 1999):

- A patient's blood type confers biochemical and physiological peculiarities that can predispose to specific dysfunctions.
- Secretor status is a further refinement. About 80% of humans secrete blood type antigens into mucus, saliva and other body fluids.
- Non-secretors are at greater risk of heart disease, autoimmune diseases and diabetes, have higher rates of duodenal and peptic ulcers, and have more problems with candida, *Helicobacter pylori* and other pathogens.
- D'Adamo suggests that, in his experience, 80% of individuals with fibromyalgia are non-secretors.
- Relatively inexpensive secretor test kits are readily available from many professional laboratories.
- A non-secretor status, which appears to be genetically determined, implies a need for greater vigilance regarding inappropriate food and environmental exposure to potential allergens (D'Adamo 2001).

Comment: While the concept remains speculative, a great deal of compelling anecdotal evidence supports the potential benefits of taking account of blood type and secretor status, as part of any evaluation of food choices, in conditions such as FMS.

other nutrients (Ames et al 2002). Most of these genetic conditions are rare inborn metabolic diseases involving defective enzyme function.

Practitioners of all schools should be aware of a need to update their understanding of this broad view of individuality and how it may be possible to influence gene expression via alteration of biochemistry, through diet for example. There seems to be a great deal of potential for influencing the biomechanical status of patients via their biochemistry.

An FMS patient in profile

A variety of polls and surveys have been conducted which offer profiles of the 'average' or 'typical' FMS patient. Few individuals display all the characteristics of this average patient, since almost everyone has unique characteristics which make their particular history and presentation different. Nevertheless, it is valuable to consider the most common features, predisposing factors, pre-existing and associated conditions, etc. of the person with FMS.

A basic survey was conducted on behalf of Forrest General Hospital in Mississippi, with the results being published in *Fibromyalgia Network Newsletter* (1999). A summary of the most pertinent features is given below. A total of 280 patients with FMS responded to the poll. Of these 97% were women; 93% were Caucasian, 6% African American, with the remainder Hispanic or Native American. Thirty-nine percent were smokers. The average duration of symptoms was 9.9 years, with diagnosis received at an average age of 42.7, after an average of 7.6 consultations. Seventy-one percent were employed at the onset of their illness. However, only 33% were still employed at the time of the survey, with 15% receiving disability benefits. Thirty percent reported that alcoholism was a family problem, and 24% reported other members of their family to be affected with FMS.

Who diagnosed the condition?

- 60% rheumatologist
- 19% internist
- 12% family physician
- remainder (9%) pain specialist, orthopaedist or neurologist.

Co- and pre-existing conditions/diagnoses

- 65% arthritis
- 62% depression

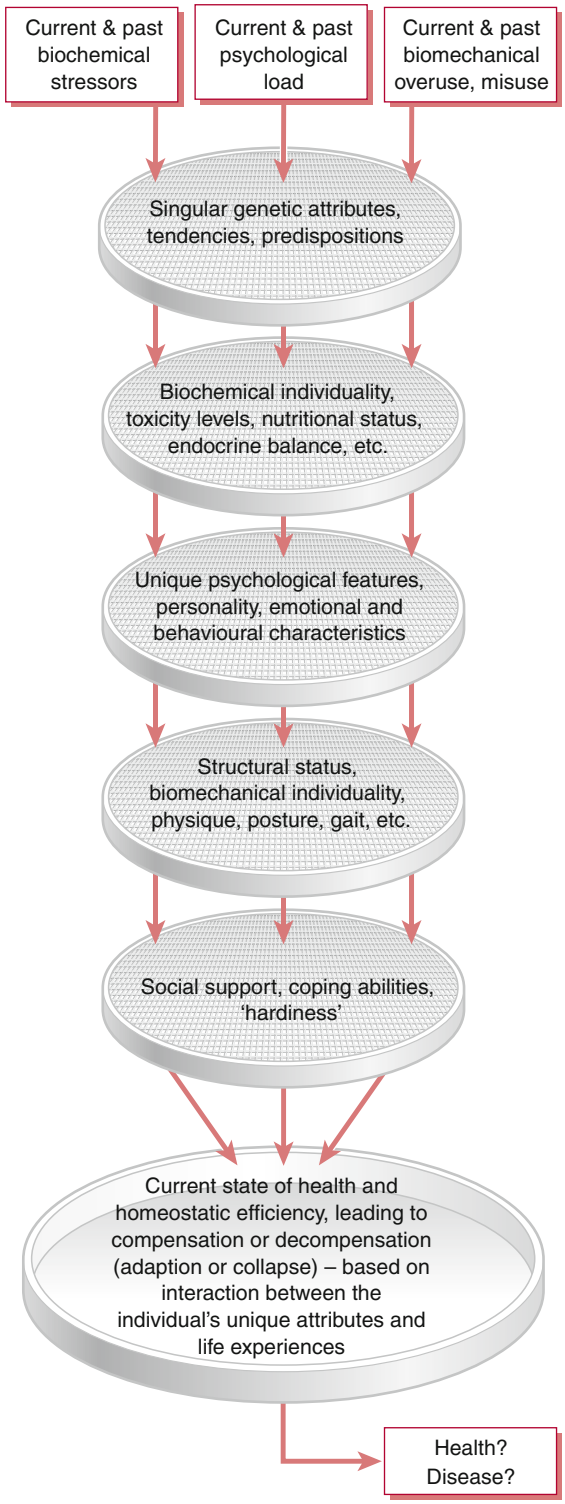


Figure 2.2 • Schematic 'life grid' representing many of the multiple interactions, acquired and genetic, involved in an individual's progression from health to ill-health.

- 52% IBS
- 41% temporomandibular joint (TMJ) disorder
- 30% carpal tunnel syndrome
- 24% hypothyroid
- 23% panic attacks
- 19% blood sugar imbalance (hyper or hypo)
- 17% mitral valve prolapse
- 9% cancer
- 7% Raynaud's syndrome
- 3% eating disorder.

Comment

There are a number of features to highlight in this list. The level of IBS is slightly lower than that of the Fibromyalgia Network survey (see below) but emphasizes the importance of gut disorders associated with FMS. This is considered further in later chapters, as is the link with underactive thyroid (see Ch. 10). The mention of panic attacks (23%) links the condition to breathing pattern disorders (e.g. hyperventilation) which is considered in Chapter 3 and in other chapters.

Predisposing features and events

- 62% reported physical and/or emotional trauma immediately before the onset of symptoms
- 46% reported an adverse drug reaction before the onset of symptoms
- 43% reported fever blisters prior to the onset of symptoms (possibly implicating viral infection in the process)
- 24% had been in close contact with toxic materials before the onset, ranging from paint to grain dust, petroleum products and radiation
- 21% reported having a feverish episode shortly before the onset of symptoms
- 20% reported a diagnosis of mononucleosis, 9% herpes, 7% hepatitis, 1% had had Lyme disease
- 6% had had a breast implant.

What are the associated symptoms, apart from pain?

- 83% are affected by cold and damp weather
- 82% have poor sleep patterns
- 81% tire easily performing normal tasks
- 81% have spinal problems

- 78% use over-the-counter pain-killing medication at least once weekly
- 68% report being sensitive to the cold
- 67% report allergies and/or drug reactions
- 65% have frequent headaches
- 61% have problems controlling their bladder
- 59% find it difficult to communicate their feelings
- 58% suffer pelvic pain, urinary urgency and/or sensations of fullness of the bladder
- 57% feel light-headed
- 56% experience PMS, with 36% reporting painful periods.

Comment

Sensitivity to cold may relate to hyperventilation (see Ch. 3) or hypothyroidism (see Chs 3 and 10); sleep disturbance is one of the commonest symptoms of FMS, as will become clear throughout the book (see in particular Ch. 3).

What has helped most with the condition?

- 67% pain medication
- 66% methods which helped sleep patterns
- 62% thermal treatment
- 61% physical exercise
- 60% antidepressant medication
- 51% hydrotherapy
- 40% physical therapy.

Comment

The responses by these FMS patients is unremarkable, and therefore useful since it offers an insight into what patients feel helps them most – anything which reduces pain, helps sleep and reduces the burden of miserable depression (most commonly a response to their troubling symptoms) is welcome. The Fibromyalgia Network survey (see below) found that what appeared to be 'most helpful' to their respondents (a far larger group than the Forrest Hospital survey) was educational material, approaches which helped them to understand their condition better.

A survey by Bennett et al (2007)

A comprehensive internet survey was conducted in 2005 by Bennett et al (2007) involving use of a questionnaire (121 questions), that was completed by 2569 people. The responses (published by BioMed Central in an open-access format) offer a snapshot of a wide range of facts, features and issues (including symptoms, functionality, perceived aggravating factors, perceived triggering events, health care utilization, management strategies and medication use) deriving from a population with FMS, mainly from the US, predominantly middle-aged caucasian females, and with 75% of respondents having a history of the condition of at least 4 years. The tables from the survey are published below, with permission from the authors (see Tables 2.2–2.7).

The information offered by the results of this survey give indications as to where further research might usefully be focused, including the prescribing habits of health care providers, the role of emotional features, the effects of obesity, the significance of low back pain, and the nature of related stiffness, in the lives of people with FMS.

Table 2.2 Demographic profile of responders

Demographic feature	Frequency
Age [years]	47.3 ± 10.68
Female	96.8%
Current weight [pounds]	179.5 ± 45.9
Weight at age 18	129.1.5 ± 26.8
Height [inches]	64.7 ± 3.2
Body mass index [BMI]	30.1 ± 7.6
Symptoms <7 months	0.6%
7–12 months	1.5%
1–2 years	3.9%
2–4 years	13.1%
>4 years	75.5%
Race/Ethnicity: Caucasian	91.5%
Afro-American	2.3%
American Indian	3.6%
Hispanic	2.6%
Asian	0.4%

Continued

Table 2.2 Demographic profile of responders—Cont'd

Demographic feature	Frequency
Marital status: Currently married	64.2%
Never married	11.2%
Divorced	17.4%
Widowed	2.5%
No children	26.5%
Number of children: 1 child	16.5%
2 children	30.5%
>3 children	20.9%
Household income: <$9000	4.9%
$10000–$19999	8.7%
$20000–$29999	8.8%
$30000–$39999	10.6%
$40000–$49999	10.4%
$50000–$59999	9.8%
$60000–$69999	7.5%
$70000–$79999	6.2%
$80000–$89999	5.2%
$90000–$99999	5.1%
$100000–$199999	7%
> $200000	1.7%

Fewer than 4% of respondents were male. Most were caucasian, middle aged (mean 47.3 ± 10.68), moderately overweight, females. Table republished from Bennett et al (2007) with permission.

Table 2.3 Frequencies of symptoms and current comorbidities

Current symptom	Frequency
Low back pain	63%
Recurrent headaches	47%
Arthritis	46%
Muscle spasm	46%
Tingling	46%
Balance problems	45%
Irritable bowel syndrome	44%
Numbness	44%
Chronic fatigue	40%
Bloating	40%
Depression	40%
Anxiety	38%
Sinus problems	37%
Tooth disorders	32%
Restless legs	32%
Tinnitus	30%
Jaw pain	29%
Bladder problems	26%
Rashes	25%

All the respondents with FMS were polysymptomatic, with symptoms and syndromes affecting a number of organ systems. The commonest symptom involved low back pain, with recurrent headaches, arthritis, muscle spasm, tingling and balance problems also prominent. Table republished from Bennett et al (2007) with permission.

Fibromyalgia Network survey

The information from the Bennett et al (2007) survey can be usefully compared with data from a number of other sources. Part of the usefulness of comparing results from these different sources, all focused on the same population group, lies in the different questions posed, as well as noting the uniformity of response when similar questions have been asked.

For example, evidence collected by one physician regarding the characteristic features of her FMS and CFS patients, both before and during their illness, is outlined in the next section (One physician's findings). In addition, there exists valuable evidence collected by the leading American patient advocacy organization for FMS, the Fibromyalgia Network (Fibromyalgia Network Newsletter 1997).

In October 1997 the newsletter of the network published raw data compiled from the more than 6000 responses they had received to a survey questionnaire. The results were as follows:

Table 2.4 Symptom intensity during the past week

Symptom	Mean ± SD
Morning stiffness	7.2 ± 2.5
Fatigue	7.1 ± 2.1
Non-restorative sleep	6.8 ± 2.7
Pain	6.4 ± 2.0
Forgetfulness	5.9 ± 2.7
Concentration	5.9 ± 2.6
Difficulty falling asleep	5.6 ± 3.3
Muscle spasms	4.8 ± 3.2
Anxiety	4.5 ± 3.1
Depression	4.4 ± 3.1
Headaches	4.3 ± 3.1
Anger	3.9 ± 2.9
Restless legs	3.6 ± 2.7
Abdominal pain	3.6 ± 2.8
Poor balance	3.5 ± 2.9
Swelling of feet and ankles	3.2 ± 3.1
Dizziness	2.9 ± 2.8
Bladder problems	2.5 ± 2.9
Skin rashes	1.9 ± 2.9

The symptoms that caused the greatest distress in the week prior to the survey were: morning stiffness, fatigue, poor sleep and pain. A variety of cognitive symptoms (particularly forgetfulness and concentration) were also reported. These were reported on a scale of 0 to 10.
Table republished from Bennett et al (2007) with permission.

Table 2.5 Factors perceived to worsen fibromyalgia symptoms

Perceived stressor	Frequency
Emotional distress	83%
Weather changes	80%
Sleeping problems	79%
Strenuous activity	70%
Mental stress	68%
Worrying	60%
Car travel	57%
Family conflicts	52%
Physical injuries	50%
Physical inactivity	50%
Infections	43%
Allergies	37%
Low to moderate physical activity	36%
Lack of emotional support	36%
Time zone changes	34%
Airplane travel	34%
Perfectionism	32%
Work-related conflicts	29%
Menses	27%
Medication side-effects	27%
Chemical exposures	27%
Sexual intercourse	17%

The most common reported exacerbating events were mental stressors, changing weather, problems with sleep and strenuous activities. Many reported a variety of factors that worsened their symptoms.
Table republished from Bennett et al (2007) with permission.

- 6240 patients responded
- 97% had a diagnosis of FMS and 28% had a diagnosis of CFS (with an overlap of a double diagnosis in fully a quarter of the respondents)
- average age was 52.6 years
- 95% were female
- duration of illness was on average 12.2 years
- 7.2 years on average was taken before a diagnosis was offered.

FMS diagnosis

Those patients with an FMS diagnosis reported the following percentage of additional diagnoses:

- IBS or irritable bladder 64%
- headaches 59%
- chemical sensitivities 26%

Table 2.6 Perceived triggering events of fibromyalgia onset

Event	Frequency
Chronic stress	41.9%
Emotional trauma	1.3%
Acute illness	26.7%
Physical injury (non-MVA)	17.1%
Surgery	16.1%
Motor vehicle accident (MVA)	16.1%
Emotional and physical abuse as an adult	12.2%
Emotional and physical abuse as a child	11.9%
Thyroid problems	10.3%
Menopause	10.1%
Sexual abuse as a child	8.7%
Childbirth	7.6%
Sexual abuse as adult	2.9%

When asked what their perception of triggers to the onset of FMS was, over 70% ascribed this to emotional trauma or 'stress'. A variety of other emotionally charged terms were also used, including emotional and physical abuse as a child, or as an adult. Stressful episodes such as acute illness and motor vehicle accidents were also prominently listed.
Table republished from Bennett et al (2007) with permission.

- osteoarthritis 20%
- thyroid disease 19%.

'Known' trigger?

When asked for known triggering events, 59% indicated they could identify the trigger and the following were listed:

- physical trauma 39% (of the 59%)
- major emotional trauma such as bereavement 27%
- infection 15%
- surgery 9%
- exposure to chemical agent or drug 5%.

Improvement or lack of it?

Asked about improvement or lack of it since their diagnosis, those with FMS offered these responses:

Table 2.7 Interventions used by the survey responders

Intervention	Frequency	Effectiveness [0–10 scale]
Resting	86%	6.3 ± 2.5
Distraction (reading, watching TV, etc.)	80%	4.7 ± 2.5
Heat modalities (warm water, hot packs)	74%	6.3 ± 2.3
Nutritional supplements	68%	3.8 ± 2.8
OTC pain medications	67%	3.8 ± 2.3
Prescription pain medications	66%	6.3 ± 2.4
Gentle walking	64%	4.6 ± 2.6
Prescription antidepressants	63%	.2 ± 2.8
Stretching	62%	5.4 ± 2.6
Prayer	57%	6.0 ± 2.9
Prescription sleep medications	52%	6.5 ± 2.7
Relaxation/meditation	47%	5.1 ± 5.5
Massage/reflexology	43%	6.1 ± 2.8
Aerobic exercise	32%	5.0 ± 3.0
Cold therapy (ice packs etc.)	30%	4.8 ± 2.8
Chiropractic manipulation	30%	5.1 ± 3.0
Counseling (psychologist, social worker, pastor)	29%	4.8 ± 3.0
Pool therapy	26%	6.0 ± 3.0
Non-aerobic exercise (stretching, yoga, Tai chi)	24%	5.1 ± 2.9
Physical therapy	24%	4.7 ± 3.1
OTC sleep medications	22%	4.0 ± 2.9
TENS unit	21%	4.3 ± 2.9
Trigger point injections	21%	5.0 ± 3.3
Support groups	19%	4.6 ± 3.0
Strength training	18%	4.3 ± 2.9

Continued

Table 2.7 Interventions used by the survey responders—Cont'd

Intervention	Frequency	Effectiveness [0–10 scale]
Pain clinic	17%	4.8 ± 3.1
Acupuncture	15%	4.5 ± 3.5
Pilates	8%	4.6 ± 3.3
Cognitive behavioural therapy	8%	4.3 ± 3.2
Energy healing (e.g. Reiki)	7%	4.0 ± 3.2
Biofeedback	6%	2.9 ± 2.9
Spinal surgery	4%	3.4 ± 3.4
Hypnosis	3%	2.5 ± 2.9

Rating the effectiveness of interventions that had been used on a 0 to 10 scale, the most effective (effectiveness rating ≥6.0), listed in descending order, were: rest, heat treatment (mainly hydrotherapy), nutritional supplements, over-the-counter (OTC) and prescribed pain medications, exercise (walking, stretching), prescribed antidepressants, prescribed sleep medications, prayer, relaxation, meditation, massage/reflexology, manipulation, counselling and pool therapy. Amongst the least rated for effectiveness were: hypnosis, spinal surgery, biofeedback, Reiki, cognitive behavioural therapy, Pilates and acupuncture.
Table republished from Bennett et al (2007) with permission.

- 0.2% had fully recovered
- 31% had improved
- 20% were unchanged
- 40% were worse
- 9% had become disabled.

Associated symptoms?

The associated symptoms reported by the FMS responders (97% of the survey) were:

- memory and concentration difficulties 86%
- major discomfort following exertion 89%
- waking tired in the morning 89%
- unable to work because of FMS 40%
- percentage of time spent in pain 76%
- percentage of body in pain 71%.

Patient satisfaction

Which health care disciplines were the most helpful and knowledgeable regarding the condition? The percentage attending each health care discipline is given in parentheses; the disciplines are listed in descending order of patient satisfaction:

- rheumatologists (51%)
- physical medicine and rehabilitation specialists (13%)
- neurologists (10%)
- chiropractors (6%)
- internists (27%)
- family physicians (46%).

What helps most?

When asked what was the most helpful on a scale of 1 to 10 (with 10 being the most helpful) the responses were that:

- drug and non-drug therapies rated 4.8
- educational material rated 7.4.

Comment

This wealth of information, added to that of the Forrest Hospital survey (earlier in this chapter) and the Bennett et al (2007) survey results, provides a profile of the complex history, symptom pattern, medical experience and current situation of a typical person with FMS, struggling with inadequate care and information about their problems.

One physician's findings

The material derived from her records by a San Francisco physician adds to this picture, because her particular interests included recording data not touched on by the various surveys outlined above, including laboratory findings with specific focus on gut dysfunction (parasites, yeast overgrowth, etc.) and nutritional imbalances (magnesium deficiency for example), and an analysis of associated conditions, in particular whether these were obvious before the onset of FMS or came on subsequently. Out of these observations and reports emerges a far more detailed set of indications, one of which is the huge number of people with FMS (in this physician's practice) whose health before the onset of FMS included digestive disorders and recurrent infections of one sort or another, most of which would normally be expected to attract antibiotic use. The implications of this will be evaluated in Chapters 3 and 15 in particular.

San Francisco physician Carol Jessop studied over 1000 people suffering from FMS or CFS who had been referred to her following diagnosis by consulting rheumatologists or neurologists (Fibromyalgia Network Newsletters 1990–94). There is no distinction in the figures offered by Dr Jessop between patients with a diagnosis of FMS and those with CFS. Nevertheless, there is much to learn from the general data regarding this mixed population (CFS and FMS) as to their current symptoms and from some of the clinical signs noted by her. Finally, and perhaps most significantly, the major symptoms existing in patients prior to the onset of their illness are listed.

Current symptoms

The commonest current symptoms reported by Jessop's patients were:

- chronic fatigue 100%
- cold extremities 100%
- impaired memory 100%
- frequent urination 95%
- depression[1] 94%
- sleep disorder 94%
- balance problems 89%
- muscle twitching 80%
- dry mouth 68%
- muscle aches 68%
- headache 68%
- sore throat 20%.

Common signs

Jessop reported the following findings among this group of patients (1324 patients, of whom 75% were female, average age 39):

- elevated temperature 10%
- normal temperature 25%
- subnormal temperature 65%
- low blood pressure 86%
- yeast infections (tongue/mouth) 87%
- tender thyroid 40%
- white spots on nails[2] 85%
- tender neck muscles 91%
- FMS tender spots 86%
- abdominal tenderness 80%
- swollen lymph nodes 18%.

Laboratory findings

Jessop reported the following summary of laboratory findings from 880 of this particular patient group:

- 82% had yeast cultured from purged stool samples
- 30% had parasites in their purged stool samples
- 38% were found to be deficient in magnesium using a 3-day loading test and two 24-hour urine samples
- 32% had low zinc levels using blood tests.

Symptoms before onset of FMS/CFS

Jessop's patients' symptoms before the onset of their CFS or FMS were:

- 89% irritable bowel symptoms
- 80% 'constant gas' or bloating
- 58% constipation
- 40% heartburn
- 89% recurrent childhood ear, nose, throat infections
- 40% recurrent sinusitis
- 30% recurrent bronchitis
- 20% recurrent bladder infections
- 90% of the females had PMS prior to CFS/FMS
- 65% reported endometriosis
- 30% dysmenorrhoea
- 22% had generalized anxiety disorders prior to their illness
- sleep problems were present in only 1% before CFS/FMS.

Analysis of this information, and comparison with the list of commonly associated FMS symptoms, helps to focus on underlying processes. For example:

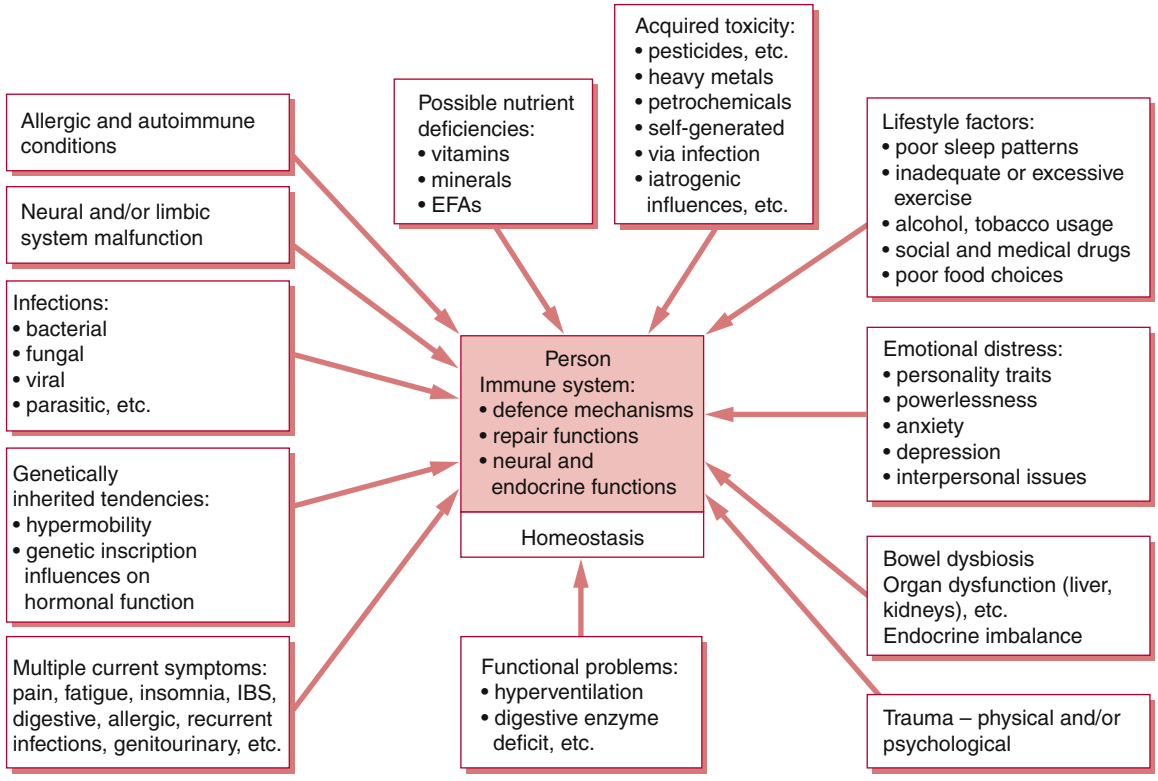
- Only 1% of Jessop's patients reported prior sleep problems whereas by the time a diagnosis of FMS or CFS was made the sleep patterns of over 90% were severely disrupted.

[1]Jessop regarded the depression noted in her patients as almost always being reactive rather than a true clinical depression. She noted that no more than 8% of her patients had required prior medical attention for depression before the onset of CFS or FMS.

[2]These white flecks are thought to relate to zinc deficiency (Davies & Stewart 1987).

- The high level of patients displaying subnormal temperatures, as well as the 'tender thyroid' observation, suggests thyroid dysfunction, something which has attracted a great deal of research (see Ch. 10).
- The high incidence of chronic genitourinary symptoms suggests additional (apart from thyroid) endocrine imbalances.
- The high levels of pre-existing ENT, sinus, respiratory, bladder and other infections suggests either a degree of immune function inefficiency or allergy involvement and, almost certainly, high usage of antibiotics with consequent bowel flora damage. The link between these elements and the elevated levels of gastrointestinal symptomatology seems obvious. How these factors link with food intolerances, malabsorption possibilities (and consequent nutrient deficiencies) and general biochemical imbalances is a field of study in itself, which is summarized in Chapter 3 (see also Fig. 2.3).

As will become evident in later chapters, these areas of possible involvement in the aetiology and/or maintenance of FMS (thyroid dysfunction, generalized endocrine imbalance, immune system deficiency, possible infection link, high use of antibiotics, bowel dysbiosis possibly involving ecological damage to the gut flora, allergy, etc.) are all possible factors in what a leading researcher into FMS, Dr Mohammed Yunus (1997), has previously called 'dysfunctional spectrum syndrome'.



When homeostatic adaptive capacity is exhausted treatment calls for:

1. Restoration of immune competence, enhancement of defence capabilities, support of repair functions
2. Reduction of as many of the multiple interacting stressors impacting the individual as possible
3. Attention to symptoms (ideally without creating new problems)

Figure 2.3 • Multiple stressors in fibromyalgia. EFAs, essential fatty acids.

Yunus (2007) later modified this term to 'central sensitivity syndrome'. This, together with other 'syndromes', such as functional somatic syndrome (Buskila 2007, van Houdenhove 2007), defined as a group of related syndromes characterized more by symptoms, suffering and disability than by structural or functional abnormality, will be outlined in Chapter 3, and explored further in Chapter 4, together with a variety of possible explanations as to the aetiology of FMS.

Some FMS protocols

The ever resourceful *Fibromyalgia Network Newsletter* invited some of America's leading FMS medical experts to report on their protocols for FMS. A summary of this material is given below, with comments regarding their differences and commonalities. For ease of comparison, the experts have been grouped into their speciality background, as reported by the Fibromyalgia Network (1999).

Rheumatologists

Robert Bennett MD, Portland, Oregon:

- medication strategies: antidepressants ('for the 30% of FMS patients who have depression'), pain and sleep enhancing medication, and L-dopa/carbidopa for restless legs (for approximately 60% of patients with FMS)
- regular stretching and low grade (non-impact) exercise
- procaine injections for trigger points (see Chs 8, 9, 16 for alternative approaches)
- cognitive behavioural therapy (see Ch. 7), plus advice to keep optimistic and 'hold onto a sense of humour'.

Paul Brown MD PhD, Seattle, Washington:

- medication strategies: opioids (such as methadone) for pain (2–3 times daily), anticonvulsant (with pain relieving and sedating effects) and sleep-enhancing medication, muscle relaxants
- acupuncture.

Daniel Clauw MD, Washington DC:

- medication strategies: drugs for sedation, muscle relaxation, pain, fatigue and to enhance mental alertness
- aerobic exercise (low impact), slowly building to 15–20 minutes daily ('I have not had an FMS patient who did this who did not benefit from it at least somewhat')
- cognitive behavioural therapy (Clauw suggests that there are only about 20 cognitive behavioural therapy programmes in the USA appropriate for FMS/CFS patients).

Thomas Romano MD PhD, Wheeling, West Virginia:

- nutritional therapy (particularly magnesium)
- medication strategies: muscle-relaxing, sleep-enhancing and pain-killing medication
- stress management
- injections for trigger point and joint pain
- insists on importance of eliminating perpetuating factors.

Daniel Wallace MD, Los Angeles, California:

- medication strategies: antidepressants, selective serotonin reuptake inhibitors (SSRIs), non-steroidal anti-inflammatory drugs (NSAIDs, e.g. COX-2), alpha-blockers, anticonvulsants (for burning nerve pain)
- topical medication for muscle relaxation effects
- local injections (e.g. Xylocaine for trigger points).

Pain specialists/physiatrists

Steve Fanto MD, Phoenix, Arizona:

- medication strategies: opioids for pain, and also medication for sleep enhancement, relaxing muscles, easing spasms and to ease neural pain
- Botox injections for trigger points.

Mark Pellegrino MD, Canton, Ohio:

- nutritional therapy, particularly magnesium and malic acid, 5-hydroxytryptophan (5-HTP) and colostrums (to enhance growth hormone) (see Chs 10, 14, 15 for more on nutrition and FMS)
- exercise, including stretching, aerobic conditioning, Theraband toning
- manual therapy, including myofascial release, massage and mobilization
- medication strategies: sleep-enhancing drugs, antidepressants
- injections for trigger points and also prolotherapy to stabilize lax tissues

- biofeedback to enhance muscle relaxation
- emphasis on education.

Internal medicine/paediatrician

Charles Lapp MD, Charlotte, North Carolina

- medication strategies: drugs to help with sleep, restless legs and pain (including long-acting opioids and amfetamines to 'reduce fatigue and improve cognition')
- vitamin B_{12} injections three times weekly to 'boost energy'
- topical medication for muscle relaxation and pain-relieving effects
- massage, craniosacral therapy
- acupuncture.

Dr Lapp finds herbal medicine, 'natural remedies' and patent medicines to be the least helpful: 'There are occasional and short-lived improvements . . . but I cannot recall a single sustained improvement.'

Family and alternative medicine

Richard Podell MD, New Providence, Rhode Island

- exercise: slowly incremental graded exercise on 3–4 days weekly
- sleep: visual imagery is taught, and various medications used, commencing with very low dosages
- massage: deep but gentle connective tissue massage (myofascial release)
- magnesium (75 mg) and malic acid (300 mg), building to between 6 and 12 tablets of each nutrient daily in divided doses (see Ch. 14 for discussion)
- medication strategies: use of medication for neural dysfunction
- general nutritional support using multivitamin/mineral supplementation, plus fish oil capsules and oil of evening primrose
- relaxation through self-hypnosis and visual imagery.

What does the evidence say?

We have seen the results of surveys indicating what people say is helping them, and what a number of medical experts think helps their patients. But what is the evidence? In some areas of the treatment of fibromyalgia we can clearly say that there is evidence, either that a particular method used helps or does not help, or that as yet the evidence is not clear one way or the other. To be sure, overall the evidence base is slim, mainly for one of two reasons:

1. much of the research that has been done is flawed (see below)
2. much of the research just has not been done.

Comment

None of these protocols seems to focus totally on causes, with some almost exclusively targeting symptoms. In a condition such as FMS, where causes and aetiological factors remain elusive in many instances, this is understandable. The fact that a number of these medical FMS experts utilize aspects of complementary health care is encouraging, ranging from nutritional support to bodywork, acupuncture and guided imagery. These and other complementary methods will be described and analysed as to efficacy in later chapters. The protocol most in line with the author is that devised by Dr Pellegrino, with his emphasis on nutrition, relaxation, manual methods, exercise, deactivation of trigger points, and education.

In the late 1990s the Cochrane Library published a systematic review designed to determine the effectiveness of multidisciplinary rehabilitation for fibromyalgia and widespread musculoskeletal pain among working age adults (Karjalainen et al 2002). The researchers selected all randomized controlled trials (RCTs) and clinical controlled trials (CCTs) recorded over the previous approximately 30 years if they involved studying the effectiveness of multidisciplinary rehabilitation for patients suffering from fibromyalgia and widespread musculoskeletal pain among working age adults.

The rehabilitation programme was required to be multidisciplinary; that is, it had to consist of a physician's consultation, plus a psychological, social or vocational intervention, or a combination of both. The report states:

> *After screening 1808 abstracts, and the references of 65 reviews, we found only seven relevant studies (1050 patients) that met our*

inclusion criteria. None of these were considered [to be] methodologically a high quality randomized controlled trial. Four of the included RCTs on fibromyalgia were graded low quality and suggest no quantifiable benefits. The three included RCTs on widespread musculoskeletal pain showed that based on limited evidence, overall, no evidence of efficacy was observed. However, behavioral treatment and stress management appear to be important components. Education combined with physical training showed some positive effects in long term follow up.

So, after reviewing almost 2000 research projects relating to one of the most commonly used methods in fibromyalgia care (multidisciplinary rehabilitation including cognitive behaviour therapy), the conclusion was reached that most of the research was flawed, but that the behavioural and stress management methods, together with educational and physical training approaches, offered benefits long term. It can therefore now be stated with some confidence that there is some merit in this form of care (see Ch. 7), but that it is not in and of itself a 'curative' approach. Arnold (2006) reports on the findings of the Cochrane report in relation to CBT, saying:

There were several important findings from this review. First, there was strong evidence that mind–body therapies were more effective for self-efficacy (a measurement of an individual's belief that she or he can cope effectively with a challenging situation) than waiting list or treatment as usual controls.

However, improvements in self-efficacy did not correspond to improvements in other clinical measures. Indeed, the results suggested that mind–body therapies were not consistently better than waiting list or treatment as usual controls in the modulation of pain or improvement in function.

Second, there was strong evidence that exercise was more effective than mind–body therapies for short-term improvement in pain intensity or tender point pain threshold and physical function. Third, patients with fibromyalgia who were also severely depressed did not respond well to mind–body therapies. Finally, mind–body therapies with cognitive restructuring and coping components were not significantly better than education or attention controls.

Perhaps this helps explain why only 8% of the respondents to Bennett's (2007) survey, as outlined in Table 2.7 above, indicated that cognitive behavioural therapy was of benefit to them.

Other Cochrane reviews will be mentioned in later chapters (particularly in relation to silicone implants and antidepressant medication), since it is only by looking at all the evidence that we can be reasonably sure of what is actually happening. Regrettably, these overviews are not yet available in all areas of FMS care, since the review process is lengthy; therapeutic methods such as exercise (Busch et al 2002), mind–body techniques, acupuncture and specific drug protocols have been, or are currently, under review.

Why muscle pain?

Why do people with FMS feel so much pain in their muscles, when the primary problem is not musculoskeletal? Much research has been undertaken in order better to understand the morphological, biochemical and physiological changes found in the soft tissues of people with FMS, as well as in the body as a whole. Fibromyalgia muscles are painful and weak, tire easily, demonstrate poor repair qualities, have multiple biochemical abnormalities, are associated with abnormal neural function, and yet, as stated previously, FMS is not principally a musculoskeletal problem. The causes lie elsewhere in the system. Research has helped towards a greater understanding of what is happening, but has failed thus far to offer a clear picture of why it is happening, apart from gathering an ever lengthening list of possible factors as being involved, ranging from the psychological to the biochemical to the structural, or any combination of these.

Park et al (2000) explain an aspect of the current perspective:

Widespread muscle pain, fatigue, and weakness are defining characteristics of patients with FMS . . . Histological muscle abnormalities of membranes, mitochondria, and fiber type have been well described at both the light microscopic and ultrastructural levels. These structural abnormalities often correlate with biochemical

abnormalities, defective energy production, and the resultant dysfunction of FMS muscles. The observed abnormalities . . . are consistent with neurological findings and disturbances in the hypothalamic–pituitary–adrenal axis. . . . Irrespective of the multifaceted causes of muscle dysfunction and pain, an in-depth understanding of the muscle defects may provide ideas for characterization of the underlying pathogenesis and development of new therapeutic approaches.

Le Goff (2006) describes some of the specific findings relating to muscle changes in FMS, which appear to be largely related to energy production:

The more serious abnormalities are demonstrated by histologic studies particularly on electron microscopy: disorganisation of Z bands and abnormalities in the number and shape of mitochondria. Biochemical studies and ^{31}P magnetic resonance spectroscopy show inconstant abnormalities of ATP and phosphocreatine levels. Mitochondrial abnormalities reduced capillary circulation and thickened capillary endothelium may result in decreased availability of oxygen and impaired oxidative phosphorylation as well as ATP synthesis. These abnormalities do not seem to be the consequences of the much-discussed deconditioning of muscles although these consequences are not well known.

However, in apparent contradiction to these findings, Staud et al (2005) note: 'Despite extensive research, no *consistent muscle abnormalities* have been demonstrated that would explain FM pain.'

Much attention is paid in research to the varying levels in different tissues of substance P, serotonin, cytokines, growth hormone and specific enzymes, and to the minutiae of the biochemistry of the tissues involved, in order to understand the mechanisms of pain in FMS. These represent the 'sharp end' of the pain picture as distinct from the broad hypothetical models that attempt to explain why these biochemical changes have occurred. Some of the most important hypothetical models are examined in Chapter 4. What they all have in common is an attempt to develop a model which draws together a collection of possible aetiological features that negatively influence neural, endocrine, immune, circulatory or other systems and functions, with an endpoint of FMS (or CFS).

In a major review article on the pathogenesis of FMS, Swedish physician Karl Henriksson (1993) stated: 'There is no single cause for a pain condition such as FMS. The pathogenesis is a chain of events. Some links are still missing, and some links are weak.' Figure 2.3 shows some of these possible interacting pathogenic factors.

A chain of events that could result in excessive pain perception ('passive pain') in the muscles has been summarized by Woolf (2000) as 'neural plasticity' (although the reasons for these events occurring remain unclear):

1. Local tissue damage occurs (for a variety of reasons), leading to the release of chemicals such as cytokines, prostaglandins and other potential pain-generating substances. In people with FMS these are often overproduced, for inappropriate lengths of time.

2. Thresholds for transmission of pain messages are lower in FMS patients, so that fairly low stimuli reaching pain receptors produce transmission of pain messages to the brain.

3. Neural structures may be modified by imbalances in calcium, sodium and potassium, so that they 'fire spontaneously', even in the absence of stimuli, to generate even more pain.

4. Neural structures (such as proprioceptors) that are not normally associated with pain transmission may be recruited to transmit pain messages and to release substance P, further exacerbating pain message input.

5. Further amplification of pain messages occurs in the cord due to excitatory amino acid and substance P activity.

6. Eventually interpretation by the brain of the flow of pain messages may lead to a form of facilitation, where normal inhibitory mechanisms of noxious signals (such as those involving serotonin, GABA and brain opioids) fail to operate.

Woolf acknowledges that having a map of the possible 'passive pain' process does not provide answers to the question as to *what causes these changes*: 'The challenge is to identify what mechanisms operate to produce an individual's pain. There may be multiple mechanisms and we need tools to target each of them so that we can return passive hypersensitivity back to normal pain sensitivity.'

What finally triggers FMS when these or other interacting stressors have loaded the 'variably genetically impaired' (Klimas 1994) homeostatic mechanisms of the body with adaptive demands for an appropriate length of time?

It seems that a viral (Albina et al 2006, Joly 1991, Oldstone 1989), bacterial (Nicolson et al 1999), traumatic (physical or emotional (Bremner 1995, Buskila 1997, Fry 1993, Waylonis 1994, Weissbecker et al 2006)) or some other factor can trigger the already compromised individual into a frank expression of dysfunction and pain. As Albina et al (2006) describe this process: 'It seems more likely that as we come to better understand and sub-classify fibromyalgia, various infections, through interaction with genetic and environmental factors, will be assigned their precise role in the syndrome's pathogenesis and etiology.'

Early stress?

One of the common pre-existing biomechanical features of many individuals who develop FMS is a tendency toward hypermobility. It is hypothesized (see Goldstein's thoughts below, and in more detail in Ch. 3) that other predisposing essentials for the development of FMS are acquired very early in life – at least for some people. As Goldstein (1996) explains: 'Those with a strong tendency to be afflicted with CFS/FMS may have had the disorder since childhood. Others may require one or more triggering stimuli such as child abuse, viral infections, surgery, pronounced physical or mental overexertion [or trauma], childbirth or emotional stress.' Goldstein's work offers possible explanations for some fibromyalgia patients; however, whether his hypothesis can be translated broadly across the spectrum of FMS patients is questionable.

Selye, in his original research, showed that stressors – whether physical (trauma, inactivity, infection, weather, etc.), chemical (alcohol, caffeine, drugs, toxins, etc.) or psychological (fear, anger, grief, anxiety, etc.) – could elicit a stress response which included serotonin, ACTH and beta endorphin and possibly prostaglandin E_1 release in the brain, followed by the adrenal response and glycogen release. Over time, the effects of stress would result in 'breakdown' in the 'weakest organ' or weakest organ system, whatever the total stress. The ultimate effects of the stress of life would negatively influence genetic or acquired susceptibilities (Selye 1950).

On this subject, Randolph (1976), one of the primary workers in the evolution of clinical ecology, reminds us that the unique characteristics of the individual will determine the way in which symptoms evolve: 'It is well known that different persons may develop rhinitis, asthma, hives, eczema, colitis, urgency and tenesmus, fatigue, headache, fluid retention, myalgia, arthralgia, depression or other behavioural or psychotic manifestations from the impingement of a given environmental substance.'

This is not quoted to suggest that all the symptoms of FMS (or CFS) could possibly derive from allergy/sensitivity, although clearly in given circumstances they might be a key feature (see Ch. 3), but to emphasize that there is not a linear and predictable outcome in terms of what symptoms will emerge in response to different stressors or aetiological factors in different people. A combination of the individual's unique characteristics, together with the stressor elements (biochemical, biomechanical, psychosocial) determine illness expression. The examples which Randolph (1976) offers do, however, have very strong echoes of the main symptom picture of FMS and CFS, and the possibility of allergy/sensitivity involvement needs to be borne in mind when the aetiological elements of the condition are considered.

In Chapter 3 a more detailed examination is offered of some of fibromyalgia's associated conditions.

Selye's message (Selye 1946, 1952) (Fig. 2.4)

As the often complicated biochemical pictures of what is happening in the tissues of people with FMS emerge, and as broad hypothetical models

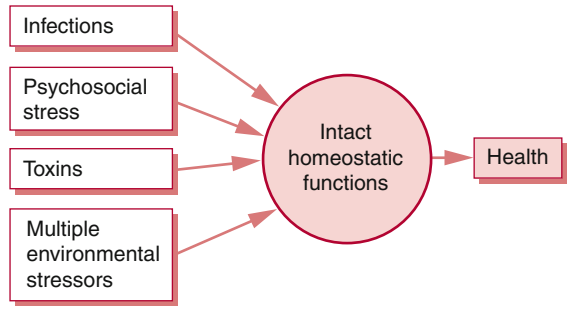


Figure 2.4 A • Homeostasis.

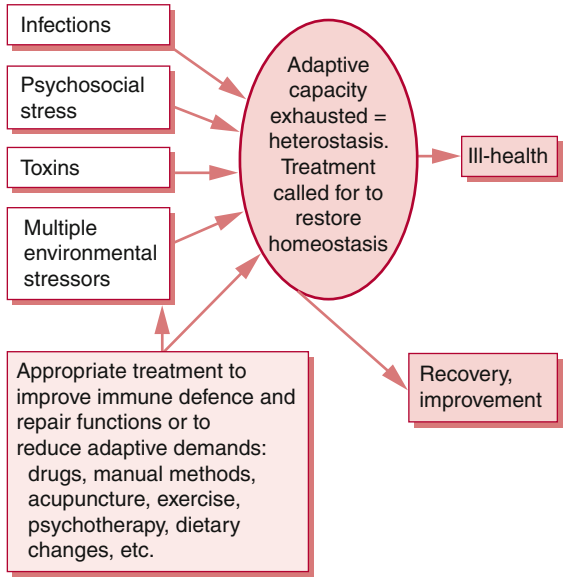


Figure 2.4 B • Heterostasis.

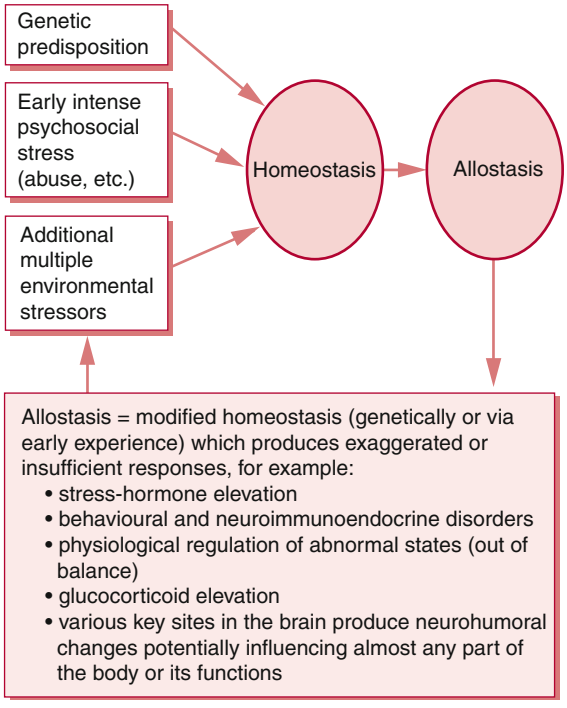


Figure 2.4 C • Allostasis (McEwan 1994, Sapolsky 1990, 1994). See Neurosomatic influences, p. 65, and Neurosomatic hypothesis, p. 124.

which try to explain them are considered, a therapeutic model may be usefully restated (see Fig. 2.5).

The catalogue of information derived from research into FMS and its associated conditions offers insights into what may be happening in the body and why. And while these insights allow the practitioner/therapist a huge range of treatment options, it is worth considering that these can only be focused in a limited number of ways; that is, towards:

- enhancing immune, defence, repair, detoxification functions
- reducing the biochemical, biomechanical and psychogenic stress load
- symptomatic palliation.

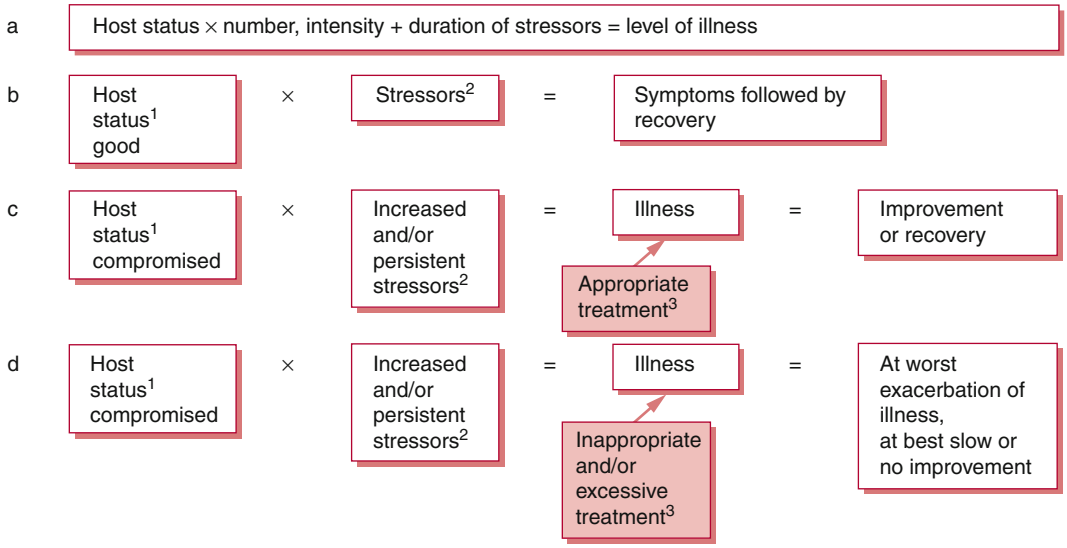
In his early research, Selye demonstrated that homeostatic mechanisms, when operating optimally, deal efficiently with many of the stressor elements. When overloaded – i.e. when adaptive demands are beyond the ability of the homeostatic repair and defence systems to maintain normal function – symptoms appear and ill-health evolves.

At this stage *heterostasis* is the label Selye offered for the situation. In a heterostatic setting 'something' needs to be brought into the equation from an external source to assist restoration of homeostatic efficiency. This 'something' is treatment (externally applied or self-generated) which either reduces the stressor influences ('lightens the load') or enhances homeostatic defence and repair functions.

Apart from these choices, all that can usefully be done is to reduce the intensity of symptoms, hopefully without adding further toxic or other stresses to the adaptation demands oppressing the body–mind complex.

Selye reminds us of a further twist to this saga: the fact that since stress is defined as anything which demands an adaptive response, *all* forms of treatment should be seen as forms of stress. Only those treatment methods which are appropriate, which 'provoke' a beneficial adaptive (homeostatic) response, and which do not further compromise the already extended defence/repair potentials are useful in promotion of a healing response. All other treatments either make matters worse or offer no benefits.

Selye showed that while in many instances a mild degree of therapeutic stimulus achieved a positive response from the organism, the same stimulus amplified made matters worse (Fig. 2.5). When



[1]Host status = current homeostatic efficiency (including estimation of degree of susceptibility, level of vitality, systems function, etc.) resulting from genetically inherited and acquired influences and characteristics
[2]Stressors = infection, psychosocial stress, trauma, toxicity, etc.
[3]Treatment (itself a form of stress) = improving host status or moderating stressors or palliation of symptoms

Figure 2.5 • A therapeutic intervention model for FMS.

confronted with an individual with FMS whose adaptive coping agencies are working overtime, whose energy reserves are low, whose vulnerability and susceptibility to stress of any sort is great, the practitioner/therapist should tailor therapeutic interventions to meet the needs of what is clearly a limited adaptive capacity; to do as little as possible rather than as much as may seem necessary all at once. Clinically this may mean either:

- very precise interventions, slowly modulating stressors and augmenting function, while safely modifying symptoms

or:

- very general, 'constitutional' approaches which do not have a specific aim but which allow homeostatic mechanisms to operate more efficiently. Examples of this include relaxation and meditation methods, although there are many others (outlined in Ch. 14 where treatment options are considered; see also Box 2.2).

The suggestion which Selye's observations on 'treatment as a potentially useful stressor' leads to is that the more compromised the defence/repair functions are, and the greater the levels of dysfunction and pain being experienced, the more limited (in dosage, degree, intensity, number, etc.) any therapeutic intervention should initially be – or the more general and non-specific it should be (see Fig. 2.5).

In caring for people with FMS, interventions (whether externally applied or self-generated) which ignore the underlying dysfunctional patterns existing in the digestive, immune, neuroendocrine

Box 2.2

Potentially useful complementary health care measures

Potentially useful complementary health care measures and modalities, commonly used in concert with standard medical methods, include the following:

- **nutritional support and balanced eating patterns (and/or vegetarian diet)**
- **attention to food and environmental allergies, sensitivities and intolerances**
- **stress reduction methods, including, if appropriate, counselling and psychotherapy**
- **behaviour modification, education**
- **relaxation methods including meditation, guided imagery, autogenic training, etc.**
- **physical conditioning including moderate exercise, aerobics, stretching methods (e.g. yoga, Pilates)**
- **breathing retraining**
- **structural normalization (osteopathy, chiropractic, massage, neuromuscular therapy, etc.) and/or deactivation of myofascial trigger points**
- **non-toxic antifungal, antiviral, antibacterial, antiparasitic medications (herbal and standard pharmacological), including endocannabinoids**
- **probiotics (and prebiotics) to assist in bowel flora normalization, especially following antibiotic or steroid usage**
- **acupuncture and Traditional Chinese Medicine (TCM)**
- **microcurrent**
- **exogenous cannabinoids**
- **immune support, including herbs, nutrients, psychoneuroimmunology**
- **detoxification methods, including fasting and liver support strategies**
- **endocrine support, particularly relating to thyroid and adrenal function**
- **homeopathic constitutional care**
- **hydrotherapeutic (and hyperthermic) methods**
- **non-specific 'constitutional' methods including bodywork (massage), Reiki, etc.**
- **healing, Therapeutic Touch.**

Most of these methods are discussed in later chapters.

and other systems, or which attempt to force an improvement in symptoms without taking into account the fact that treatment is itself a form of stress (due to the demands that treatment of any sort makes on adaptive functions), may, at worst, produce harmful results or, at best, offer only short-term benefits.

In the next chapter the conditions most commonly associated with fibromyalgia are examined in some detail.

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Chapter Three

3

Conditions associated with fibromyalgia

CHAPTER CONTENTS

The possible interconnections between the pathophysiology of FMS and a number of its associated conditions are evaluated in this chapter. The specific connections between FMS and myofascial pain syndrome are examined in depth in Chapters 6, 8 and 9, and thyroid dysfunction as a possible associated and contributory condition is covered in detail in Chapter 10 (summarized in this chapter). Aspects of patient care, particularly relating to the topics covered in this chapter, will be found in Chapters 11 through 18.

The topics considered in this chapter are:

- the polysymptomatic patient
- allergy/chemical sensitivity
- Chiari malformations
- cytokines and pain
- depression and other psychological factors
- dysregulation of brain function (and allostasis)
- fatigue
- growth hormone deficiency
- hypermobility
- hyperventilation and FMS
- infections: bacterial (including *Mycoplasma*) and viral
- irritable bowel syndrome (including fungal infection)
- leptin, obesity, toxic adipose residues and inflammation ('metabolic syndrome')
- menstrual cycle and FMS
- silicone implant toxicity
- sleep disorders
- thyroid dysfunction
- trauma (particularly whiplash) and post-traumatic stress effects
- vaccination.

It should be clear from the evidence already provided in Chapters 1 and 2 that the clinical reality is that people with FMS seldom present with single symptoms. The majority report combinations of symptoms, most commonly including pain, fatigue, sleep disturbance and gut dysfunction – and more. Therefore, before summarizing key aspects of these associated conditions, in so far as they relate to FMS, an overview is offered of polysymptomatic patients, variously labelled as having functional somatic syndrome, central sensitivity syndrome, affective spectrum disorder, etc.

As will be seen in Chapter 4 (where the major hypotheses as to causation are outlined), a number of these syndromes and symptoms appear to involve genetic predispositions. Also presented in Chapter 4 is evidence derived from various forms of imaging regarding central nervous system and brain changes linked to FMS.

The individual topics, briefly discussed below, are not exhaustive, but represent the commonest set of associated conditions/symptoms/features as reported by, or noted as being linked to, people with FMS and CFS.

The polysymptomatic patient

The Functional Somatic Syndrome (FSS) and 'medically unexplained symptoms'

Masuko & Nakamura (2007) note that patients with multiple symptoms can usefully be subsumed into what is termed the Functional Somatic Syndrome (FSS). This is defined as a group of related syndromes, characterized more by the symptoms experienced than by structural or functional abnormalities.

The diagnostic criteria and/or symptoms of FSS-related conditions frequently overlap, with comorbidity a common feature. For example, patients with irritable bowel syndrome often suffer from chronic pain, and may well fall into the current definition of fibromyalgia. Increasingly, evidence is emerging indicating the presence of visceral and somatic hyperalgesia as a common feature of FSS, with central sensitization appearing to play an important role. This feature of sensitization – facilitation – appears to be a repetitive aspect of the processes involved in many polysymptomatic patients – see discussion of facilitation/sensitization and 'wind-up' in Chapters 1 and 4, as well as notes on central sensitivity (CS) (Yunus 2007) below.

Nimnuan et al (2001) have investigated a plethora of functional somatic syndromes, including atypical facial pain (AFP), temporomandibular joint (TMJ) dysfunction, fibromyalgia syndrome (FMS), chronic fatigue syndrome (CFS), irritable bowel syndrome (IBS), non-ulcer dyspepsia (NUD), non-cardiac chest pain (NCCP), multiple chemical sensitivity (MCS), globus syndrome (GS), hyperventilation syndrome (HVS), tension headache (TH), premenstrual syndrome (PMS) and chronic pelvic pain (CPP). They identified a great deal of overlap in the symptoms reported by patients previously identified/diagnosed with one or other of these 'syndromes', and note that in one survey 'almost two-thirds of medical outpatients were presented with multiple symptoms' (Kroenke et al 1990). As a result they state: 'Our findings question the diagnostic validity of discrete Functional Somatic Syndromes, and suggest that attempts to classify syndromes into different categories on the grounds of a single main presenting symptoms may be misguided.' Further, they argue that: 'an appreciation of the fundamental unity of those syndromes may reduce the potential for iatrogenic harm whilst encouraging continuity of care.'

In a similar vein, Van Houdenhove (2007) makes a plea that patients with 'medically unexplained symptoms', notably the large group with persistent stress intolerance and pain hypersensitivity, who meet diagnoses of 'chronic fatigue syndrome' (CFS) and/or 'fibromyalgia' (FM), (i.e. FSS) should receive more streamlined medical care and understanding.

Central sensitization

Yunus (2007) has defined what he terms a central sensitivity syndrome which offers an understanding of common mechanisms in the aetiology of the cluster of symptoms discussed above. Yunus argues that terms such as functional somatic syndrome and 'medically unexplained symptoms' do not explain or identify one presumed common mechanism, central sensitization.

> *Central sensitivity syndromes (CSS) comprise an overlapping and similar group of syndromes without structural pathology, and are bound by the common mechanism of central sensitization (CS) that involves hyperexcitement of the central neurons through various synaptic and neurotransmitter/neurochemical activities.*
> *CS is manifested as hypersensitivity to various noxious (e.g. pressure and heat) as well as nonnoxious (e.g. touch) stimuli. Fibromyalgia syndrome (FMS) and similar conditions have been called 'functional', 'functional somatic syndromes', and medically unexplained symptom, among others.* None of these nomenclatures, however, clearly states two essential criteria of CSS, i.e. an overlapping relationship between these syndromes and an appropriate pathophysiological mechanism (e.g. CS) that is common to them.

See Figure 3.1 and additional notes on CSS in Chapter 4.

Yunus notes that apart from those conditions and syndromes that he has included in his current model of the CSS, additional prospective conditions, such as premenstrual tension syndrome and vulvodynia, may also belong to the CSS spectrum on clinical grounds, but that 'at this time they do not satisfy the two criteria mentioned above' (overlapping relationship between these syndromes, and an appropriate pathophysiological mechanism). He notes that Gulf War syndrome (GWS) has also not been listed as a separate entity, as it seems to be a mixture of several CSS conditions: FMS, CFS, MCS, IBS and post-traumatic stress disorder (PTSD).

As with so much in FMS, the superbly argued case for an understanding of central sensitization as a major feature of FMS and associated conditions needs to be balanced by other perspectives.

Peripheral sensitization?

Staud (2006a) broadens the discussion by citing the possible involvement in FMS of peripheral

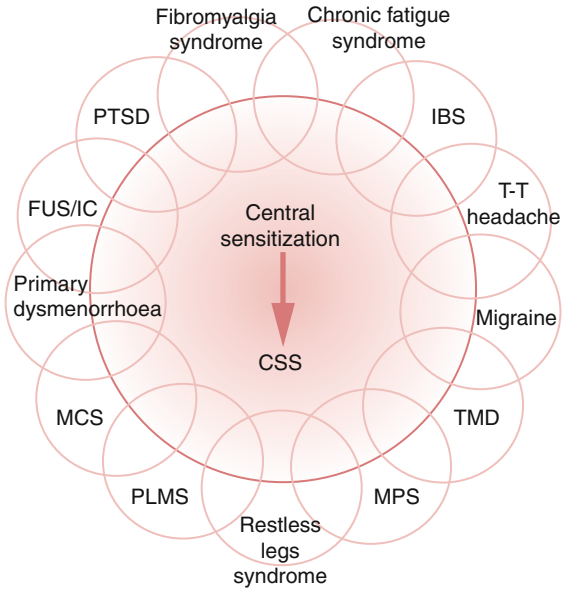


Figure 3.1 • Currently proposed members of the CSS family with overlapping relationships and a common pathophysiological link of CS. IBS, irritable bowel syndrome; T-T headache, tension-type headache; TMD, temporomandibular disorders; MPS, myofascial pain syndrome; PLMS, periodic limb movements in sleep; MCS, multiple chemical sensitivity; FUS, female urethral syndrome; IC, interstitial cystitis; PTSD, post-traumatic stress disorder. Depression may also be a member (see text). (Reproduced with permission from Yunus 2007.)

nociceptor input as a key feature, along with central sensitization (as discussed above), and incorporating psychological factors (see affective-spectrum syndrome discussion below), while also offering thoughts on therapeutic options:

> *FM is a chronic pain syndrome that is characterized by widespread pain in peripheral tissues, psychological distress, and central sensitization. Whereas the role of psychological factors in FM patients' pain has been well established, little is known about the origin of the sensory abnormalities for pain. Deep tissue impulse input is most likely relevant for the initiation, and/or maintenance of, abnormal central pain processing and represents an important opportunity for new treatments and prevention of this chronic pain syndrome. Three important strategies for FM therapy appear useful at this time: reduction of peripheral nociceptive input, particularly from muscles; improvement or prevention of central sensitization; and treatment of negative affect, particularly depression. The first strategy is most likely relevant for acute FM pain exacerbations and includes physical therapy, muscle relaxants, muscle injections, and anti-inflammatory analgesics. Central sensitization can be successfully ameliorated by cognitive behavioral therapy, sleep improvement, NMDA receptor antagonists, and antiseizure medications. The pharmacological and behavioral treatment of secondary pain affect (anxiety, anger, depression) is equally important and may currently be one of the most powerful interventions for FM pain.*

Psychology: the affective-spectrum syndrome model

Evidence for the existence of an affective-spectrum of conditions is supported by a huge multinational study of depression and somatization, conducted by Simons et al (1999), involving 25 916 primary care patients from 15 primary care centres in 14 countries. Of these, 10% met criteria for major depression, and 50% of this 10% reported three or more unexplained somatic symptoms.

Whitehead et al (2002) suggest that one subgroup of IBS patients have a primarily biological basis for their symptoms, while others have a primarily psychological basis. They suggest that comorbidity with other disorders, and excessive general somatic symptoms, are markers for somatization, helping to identify the group with a predominantly psychological IBS aetiology. Patients with IBS and no comorbid conditions, apart from a few general physical complaints, are more likely to have a biological basis for IBS symptoms.

Starting from a different perspective, Hudson & Pope (1990) carried out a systematic review of the literature to identify all disorders that showed a consistent response to two or more classes of antidepressants (tricyclics, monoamine oxidase inhibitors, selective serotonin reuptake inhibitors and atypical agents). They reasoned that disorders that respond to the same treatments probably share common aetiological elements. Their review identified eight such disorders: major depression, bulimia, panic disorder, obsessive-compulsive disorder, attention deficit disorder with hyperactivity, cataplexy, migraine and IBS.

Genetics?

Buskila (2007) has strongly suggested that an explanation involving genetic predisposition exists for the evolution of many of the chronic pain conditions associated with these models of polysymptomatic patients. 'Polymorphisms of genes in the serotoninergic, dopaminergic and catecholaminergic systems have been suggested to play a role in the aetiopathogenesis of FMS. These polymorphisms are not specific for FMS, and are associated with other FMS-related syndromes, the affective spectrum disorder or functional somatic disorder. The mode of inheritance of FMS is unknown, but it is most probably polygenic.'

Evidence of genetic connections, and other hypotheses, is discussed further in Chapter 4, and in other chapters of the book.

Comment

Current thinking seems to favour the involvement of a combination of biopsychosocial features in the aetiology of FMS and associated polysymptomatic conditions, incorporating peripheral, central and psychological sensitization features and processes, possibly overlaid on genetic predisposition.

Allergy/chemical sensitivity

What degree of chemical (ingested, inhaled, etc.) sensitivity exists in patients with FMS? How much does the immune system's reaction to foods or environmental chemicals influence the pain and other symptoms being experienced?

A study in Seattle (Buchwald 1994) evaluated the similarities and differences among three groups of patients referred to a university-based clinic with a diagnosis of chronic fatigue syndrome (CFS), fibromyalgia syndrome (FMS) or multiple chemical sensitivities (MCS). The variables assessed included demographic features, symptom characteristics, psychological complaints, measures of health locus of control and health care information. What emerged was a picture of three conditions which were frequently difficult to distinguish from one another, irrespective of the original diagnosis, particularly in terms of demographic characteristics and symptom patterns. Fully 70% of the patients with an FMS diagnosis and 30% of those with multiple chemical sensitivities met all the criteria for CFS. The researchers state that: 'Patients with CFS and FMS frequently reported symptoms compatible with Multiple Chemical Sensitivities.' Their conclusion was: 'The demographic and clinical factors and health locus of control do not clearly distinguish patients with CFS, FMS and MCS. Symptoms typical of each disorder are prevalent in the other two conditions' (Buchwald 1994).

A Turkish study evaluated the frequency of major symptoms as well as allergy in a group of more than 30 patients with a diagnosis of 'primary fibromyalgia' compared with matched (age and sex) controls (Tuncer 1997). Symptom prevalence in the FMS group (apart from pain, which was 100%) was migraine 41%, IBS 13%, sleep disturbance 72%, and morning stiffness 69%. There was a frequent finding of allergy history in the FMS group, with elevated (though not significantly) IgE levels; 66% of the FMS patients tested were positive for allergic skin tests.

A study at the school of medicine of East Carolina University in 1992, involving approximately 50 people with hay fever or perennial allergic rhinitis, found that approximately half those tested fitted the American College of Rheumatology criteria for FMS (Cleveland 1992).

Researchers at Georgetown University evaluated what they termed the 'irritant rhinitis score' (IRS) based on how sensitive an individual was to nine different irritants, such as tobacco smoke, perfume, volatile substances and meteorological conditions (Baraniuk et al 2000). The study involved 114 controls and 120 individuals with CFS. They found that irritant rhinitis was present in 11% of the controls and 47% of the CFS patients. The CFS individuals with irritant rhinitis were also tested dermographically to see whether they demonstrated true allergic responses, as rhinitis. The findings showed that 51% of those with allergic rhinitis also had high irritant rhinitis scores. A conclusion can be drawn that people with CFS (and presumably FMS) are commonly going to display multiple chemical sensitivities (MCS), often manifesting as rhinitis and associated with chronic systemic ill-health.

Questions

One question that these four studies raises is whether the allergy factors are causal or, together with other FMS symptoms, whether they represent

common results of an underlying feature – possibly increased intestinal permeability, or immune system over-reactivity, or some other common central causal phenomenon, such as Goldstein's 'neurosomatic disorder' (Goldstein 1996).

Another question relates to the difference between a toxic and an allergic reaction. Four patients diagnosed with FMS for between 2 and 17 years, who had all undergone a variety of treatments with little benefit, all had complete, or nearly complete, resolution of their symptoms within months after eliminating monosodium glutamate (MSG), or MSG plus aspartame, from their diet (Smith et al 2001). The four patients were women with multiple comorbidities prior to elimination of MSG, and all have had recurrence of their FMS symptoms whenever MSG was ingested. The researchers noted that *excitotoxins* are molecules (such as MSG and aspartate) that act as excitatory neurotransmitters, and which can lead to neurotoxicity when used in excess. They proposed that these four patients may represent a subset of FMS that is induced or exacerbated by excitotoxins or, alternatively, may comprise an excitotoxin syndrome that is similar to fibromyalgia. Or these patients could also simply be allergic to MSG.

Dr Anne Macintyre, medical adviser to the UK organization ME Action, an active patient support group for patients with chronic fatigue conditions, supports an 'immune dysfunction' model as the underlying mechanism for CFS(ME)/FMS (see Chs 4 and 5 for more on this hypothesis). She states: 'The immune dysfunction in ME may be associated with increased sensitivities to chemicals and/or foods, which can cause further symptoms such as joint pain, asthma, headache and IBS' (Macintyre 1993).

Randolph's clinical ecology model

Dr Theron Randolph has, over many years, recorded a sequence of changes that may occur clinically as an individual passes through stages of 'reaction' to chemicals (in food or as hydrocarbons in the environment, for example) (Randolph 1976). He divides these reactions into those which relate to the active stimulation of an immune reaction by the allergen and those which relate to withdrawal from it (see Fig. 3.2 for a schematic representation of the 'reaction cycle').

During some of the stages, most notably 'systemic allergic manifestations', most of the major symptoms associated with FMS may become apparent, including widespread pain, fatigue, mental confusion, insomnia and irritable bowel. Randolph used the knowledge of these stages, both in active test situations as well as in assessing a patient's reported symptom patterns in relation to possible allergy connections. Randolph notes that health care professionals seldom see patients at levels zero or +1, where adaptation to their allergens (from their perspective) is not causing problems, and may be felt to be mildly beneficial ('alert, responsive, witty', etc.). It is when maladaptation exists, where more pronounced symptoms emerge of a physical or psychological nature (stage '++' or '−−' or more) that help may be sought, and allergy might usefully be suspected (Table 3.1).

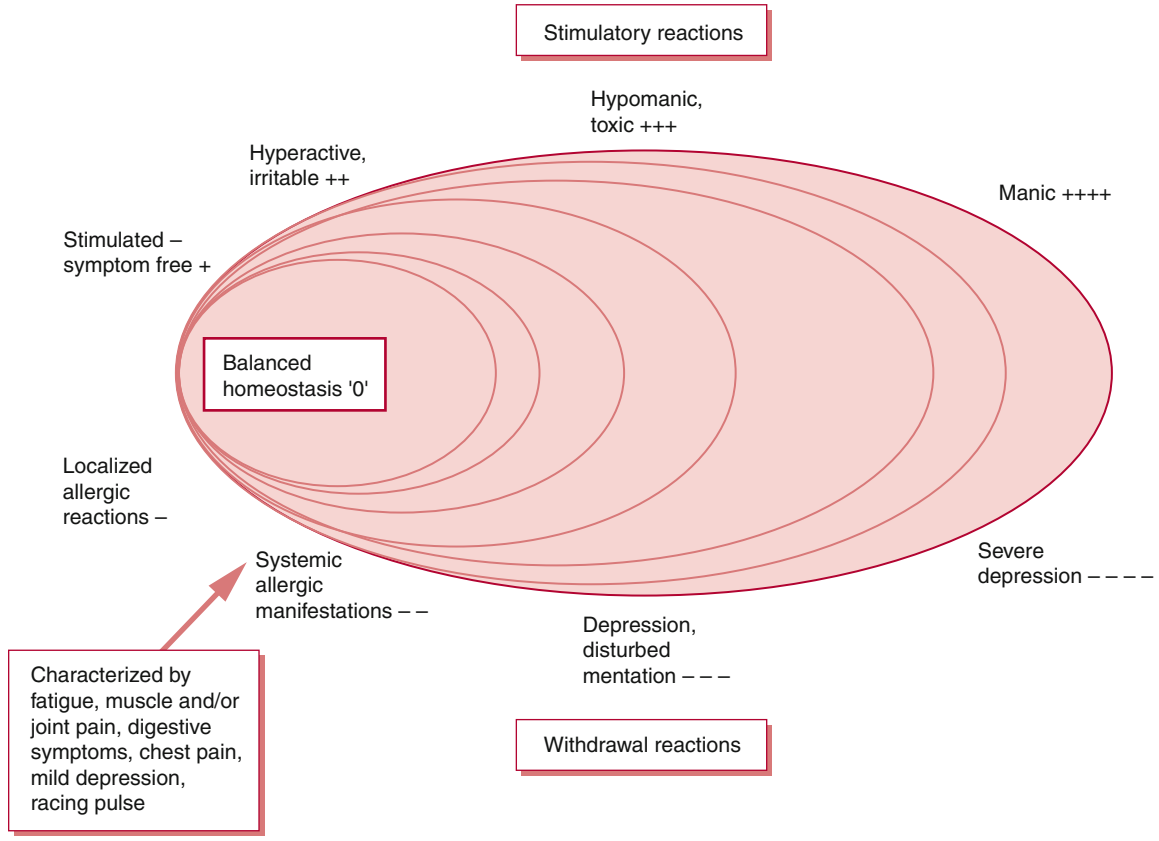
Where particular food allergens are consumed daily, reactions are usually not acute, but may be seen to be chronically present. The clinical ecology model suggests that the individual may by then have become 'addicted' to the substance and that the allergy is then 'masked' by virtue of regular and frequent exposure to it – preventing the withdrawal symptoms which would appear if exposure was stopped, as detailed in Table 3.1.

Feingold (1973) states:

> *If a reacting individual associates the stimulatory effect [of an allergen] with a given exposure, he tends to resort to this agent as often as necessary 'to remain well'. The coffee addict for example who requires coffee to get started in the morning, tends to use it through the day as often as necessary and in the amount sufficient to keep going. Over a period of time, a person so adapting tends to increase the frequency of intake and the amount per dose to maintain the relatively desirable effect. The same holds true for other common foods.*

Why does the individual fail to maintain adaptation?

Over time adaptive responses may become less predictable, and the suggestion is that this may relate to additional 'load' (as outlined in Ch. 1, Fig. 1.2 and Ch. 2, Fig. 2.3). Randolph states that: 'This development may be induced and maintained by an increase in the total load of specific



Note: Starting from the left side centre move clockwise. Stimulatory reactions reach a particular level before merging with approximately the corresponding withdrawal level, then receding. See Table 3.1 for more detail of individual stages.

Figure 3.2 • Schematic representation of the reaction cycle (adapted from Randolph 1976, p 157).

materials to which adaptation is being attempted. Nonspecific exposures, such as concurrence of an infectious process, especially a viral infection, may also induce specifically maladapted responses.'

Research over the past 20 years has confirmed much of Randolph's work and has elaborated on what might be happening in relation to allergy, in so far as myalgic pain is concerned (summarized in Fig. 3.3).

Allergy–hyperventilation synergy and confusion

A section later in this chapter examines possible connections between dysfunctional breathing patterns (e.g. hyperventilation) and FMS. A further complicating element exists, namely the way in which some forms of allergic response, or intolerance/sensitivity, can produce symptoms which include breathing dysfunction, so that causes become blurred.

An element of this confusion arises because hyperventilation increases circulating histamines, making allergic reactions more violent and possibly more likely (Barelli 1994).

Brostoff (1992) states that some experts are dismissive of the concept of food intolerance and believe that large numbers of people so diagnosed are actually hyperventilators. He considers that 'hyperventilation is relatively uncommon and can masquerade as food sensitivity'.

Is hyperventilation (at least at times) a manifestation of an allergic reaction? Does hyperventilation make allergic reactions more likely?

Table 3.1 Clinical stages and features of allergic reactions (adapted from Randolph 1976, p 159)

Levels of ecological disturbance	Key signs and symptoms[2]
+4 Manic	Distraught, excited, agitated, enraged, panicky; circuitous or one-track thoughts, *muscle twitching, jerking of extremities*[3,4] (convulsive seizures, altered consciousness may develop)
+3 Hypomanic, toxic, anxious, egocentric	Aggressive, loquacious, clumsy (ataxic), fearful/apprehensive; alternating chills and flushing, ravenous hunger, excessive thirst; giggling or pathological laughter
+2 Hyperactive, irritable	Tense, jittery, talkative, argumentative, sensitive, over-responsive, self-centred, hungry and thirsty, possibly flushing, sweating and chilling, *insomnia*
+1 Stimulated – relatively symptom free	Active, alert, lively, responsive and enthusiastic with unimpaired ambition, energy, initiative and wit; considerate of views and actions of others (this phase is often regarded as 'normal' behaviour)
0[1] Balanced, normal, homeostasis	Normal behaviour, asymptomatic
–1 Localized allergic reactions	*Running and stuffy nose*, clearing throat, coughing, wheezing, (asthma), itching, eczema and hives, *gas, diarrhoea, constipation* (colitis), *urgency and frequency of urination*, various eye and ear related symptoms
–2 Systemic allergic reactions	Tired, dopey, somnolent, mildly depressed, oedematous with painful syndromes (headache, neckache, backache, neuralgia, myalgia, myositis, chest pain, arthralgia, arteritis) and *cardiovascular effects* (*racing pulse*, etc.)
–3 Depression, disturbed mentation	*Confused*, indecisive, moody, sad, sullen, withdrawn or apathetic, emotional instability and *impaired attention, concentration, comprehension and thought processes* (*aphasia, mental lapses* and blackouts)
–4 Severe depression, possibly altered consciousness	Non-responsive, lethargic, disorientated, melancholic, incontinent, regressive thinking, paranoid orientations, delusions, hallucinations, sometimes amnesia and finally comatose

[1]**The table should be read from the middle** – from the notation marked '0' reading upwards for symptoms considered predominantly **stimulatory**, and downwards (from '0') for symptoms which are considered predominantly related to **withdrawal**.
[2]All the terminology and the descriptors are those of Randolph (1976).
[3]The symptoms which are commonly associated with FMS are in italics.
[4]Marked changes in pulse rate or skipped beats may occur at any level of the sequence of reactions.

Here we have two phenomena – allergy and hyperventilation – both of which can produce symptoms reminiscent of the other (including many associated with FMS), each of which can exacerbate the effects of the other (hyperventilation by maintaining high levels of histamine, allergy by provoking breathing dysfunction), and both of which commonly coexist in individuals with CFS and FMS. Are they mutually causal, or are they both part of a larger milieu? Box 3.1 briefly discusses the need to see further than obviously apparent 'causes'.

Allergy and muscle pain

In Randolph's model (see Fig. 3.2 and Table 3.1) the phase he calls 'systemic allergic reaction' is characterized by a great deal of pain, either muscular and/or joint-related, as well as numerous symptoms common in FMS.

In Chapter 1, Box 1.1 noted the pioneering work in the 1920s and 1930s of Dr A. H. Rowe, who demonstrated that widespread chronic muscular pains – often associated with fatigue, nausea, gastrointestinal symptoms, weakness, headaches,

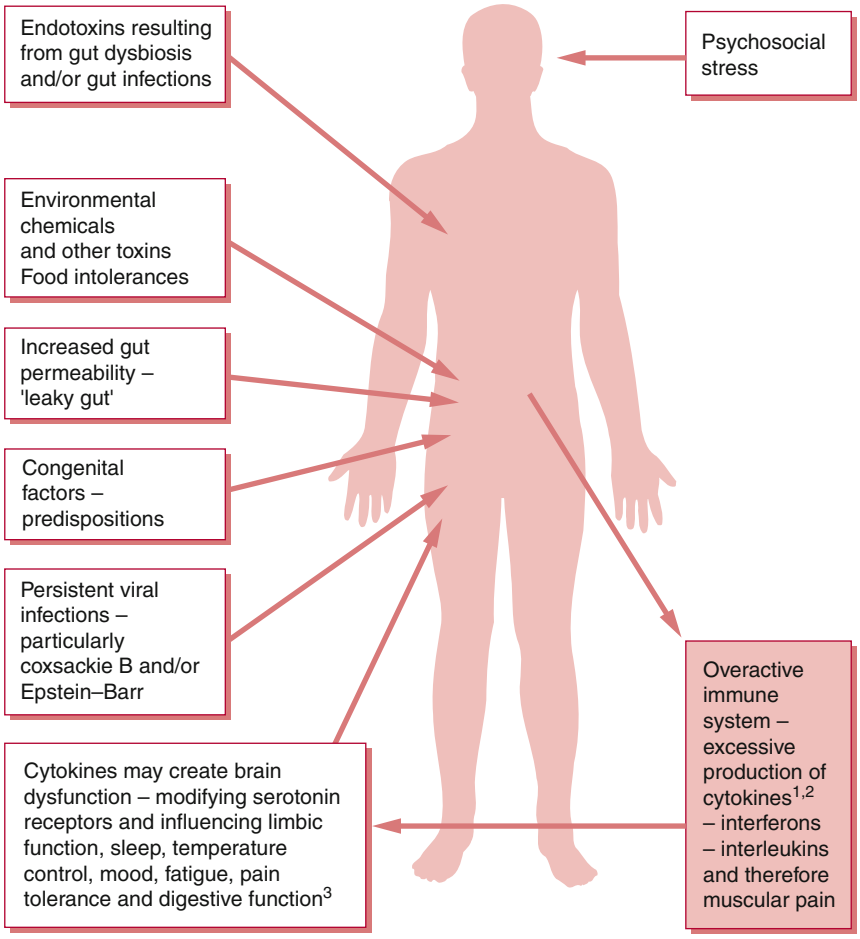


Figure 3.3 • The allergy–myalgia connection ([1]Oldstone 1989, [2]Landay 1991, [3]Bakheit 1992).

drowsiness, mental confusion and slowness of thought, as well as irritability, despondency and widespread bodily aching – commonly had an allergic aetiology. He called the condition 'allergic toxaemia' (Rowe 1930, 1972).

Randolph in particular has studied the muscular pain phenomenon in allergy and his plea for this possibility to be considered by clinicians is based on long experience of it being ignored:

> *The most important point in making a tentative working diagnosis of allergic myalgia is to think of it as a possibility. The fact remains that this possibility is rarely considered, and is even more rarely approached by means of diagnostico-therapeutic measures capable of identifying and avoiding the most common environmental incitants and perpetuants of this condition – namely, specific foods, addictants, environmental chemical exposures and house dust. (Deamer 1971)*

Randolph points out that when a food allergen is withdrawn from the diet it may take days for the withdrawal symptoms to manifest: 'During the course of comprehensive environmental control [fasting or multiple avoidance] as applied in clinical ecology, myalgia and arthralgia are especially common withdrawal effects, their incidence being exceeded only by fatigue, weakness, hunger and headache.'

The myalgic symptoms may not appear until the second or third day of avoidance and start to recede after the fourth day. He warns that in testing for

Box 3.1

Pathophysiological synchronicity

There are both linear and spatial ways of interpreting what happens in life in general, and to the body in health and disease, in particular. Cause and effect represent the way many people in the West understand the relationships between events (causality), i.e. one thing causes, or is caused, or is at least strongly influenced, by another.

An alternative way of viewing two events is to see them as being part of a complex continuum, each being part of the same (larger) process, but with neither event dependent on the other, linked perhaps by a synchronistic connective principle. The words synchronicity and 'simultaneity' are used to describe this way of viewing patterns and events (Jung 1973). Examples that relate to this particular text might include the following:

- Overbreathing (hyperventilation) is commonly associated with anxiety; therefore, some may assume that hyperventilation 'causes' anxiety.
- Anxious individuals commonly overbreathe; therefore some may assume that anxiety causes hyperventilation.

Or, it might be said that anxiety and overbreathing not only influence each other, but that they may also be triggered and/or aggravated by many other factors, including hypoglycaemia, increased progesterone levels, sympathetic arousal, toxic factors, adrenal stimulation, pain, metabolic acidosis, climatic conditions, altitude, emotional stimuli, allergic reactions, and so on, and on.

Therefore, should we not more appropriately assume that anxiety and hyperventilation are part of a larger continuum, involving all or any of these (and numerous other) factors, interacting with the unique genetic and acquired biochemical, biomechanical and psychological features of the person affected?

Similar complex continuities can be found in most chronic conditions. As noted in the text on rhinitis in this chapter, allergy and sensitivity are often associated with CFS/FMS, but does this mean that FMS is caused by allergy? Or are both conditions manifestations of a far more complex underlying disturbance?

This way of viewing the patient's problem involves placing it in context – the problem within the patient (in all his/her acquired and inherited uniqueness and complexity), within the patient's environment, and that environment within the broader environment ... etc.

The demonstrated symptoms and the evidence gained by examination and assessment can be seen as the tip of an iceberg, with the vast unseen remainder of the iceberg out of sight and hard to assess and measure. The larger context in which the visible portion (and the invisible remainder) of the iceberg exists is, of course, the ocean – the ever changing environment.

This way of trying to make sense of extremely complex processes which interact in particular conditions can be termed 'pathophysiological – or biological – synchronicity' (Chaitow 2001), for if we are looking to find 'causes' of symptoms we need to think as broadly as possible, so that, with a wide enough lens, we may discern a pattern, a web of influences, which we may be able to help the patient untangle.

Solutions, albeit partial, may possibly be found in nutritional and/or medication strategies, stress-reducing methods, psychological support, biomechanical balancing, and any of numerous other approaches, none of which can 'cure' the individual, but all of which might allow or encourage self-healing to take place. When treatment is seen in this way, it becomes another feature in the contextual pool ('ocean'?) of influences interacting within the individual. The therapeutic outcome should, therefore, not be seen as an effect resulting from a cause (treatment), but rather the emergence of (hopefully) positive change out of that particular complex context.

Conclusion: A way of discerning where the therapeutic encounter enters the picture requires a spatial vision of combinations of synchronous events, whether biochemical, biomechanical, psychosocial or energetic (or spiritual), with 'treatment' designed to be a coherent, beneficial influence, encouraging self-healing.

(stimulatory) reactions to food allergens (as opposed to the effects of withdrawal), the precipitation of myalgia and related symptoms may not take place for between 6 and 12 hours after ingestion (of an allergen-containing food), which can confuse matters, as other foods eaten closer to the time of the symptom exacerbation may then appear to be at fault (see Fig. 3.2 and Table 3.1).

Other signs that can suggest that myalgia is allied to food intolerance include the presence of a common FMS-associated symptom, restless legs, a condition which also commonly coexists with and contributes to insomnia (see below) (Ekbom 1960).

When someone has an obvious allergic reaction to a food this may well be seen as a causal event in the emergence of other symptoms. If, however, the

reactions occur many times every day, and responses become chronic, the cause and effect link may well be more difficult to make.

If symptoms such as muscular pain may at times be seen to be triggered by food intolerance or allergy, the major question remains – what is the cause of the allergy? One possibility is that the gut mucosa may have become excessively permeable, so allowing large molecules into the bloodstream where a defensive reaction is both predictable and appropriate. Is a 'leaky gut' then a cause of some people's allergy? And if so, what caused the leaky gut (Paganelli 1991, Troncone 1994)? These issues are addressed later in this chapter in relation to irritable bowel syndrome and bowel dysbiosis.

Classic allergy – such as asthma and muscle pain

A Norwegian survey (Tollefsen et al 2007) involving over 8800 adolescents found a strong correlation between those with asthmatic ('wheezing') symptoms and a range of associated symptoms including headache, neck and shoulder pain, joint and muscle pain and abdominal pain: 'All subjective health problems were significantly more prevalent in current wheezers compared to non-wheezers.'

While this does not apply to all adolescent (or adult) asthmatics, Roberts & Lack (2003) state that: There is considerable epidemiological evidence to suggest that there is a link between asthma and food allergy.' And where this is established: 'There is a rationale for the rigorous and complete removal of any food allergen that has a significant role in a child's asthma. The removal of such an allergen in subjects with asthma will reduce their chance of experiencing a severe allergic reaction and potentially improve their asthma control.'

Cases of lactose-derived glucose overload and muscle pain – MATHS

Mathews & Campbell (2000a) described a case involving a 59-year-old man of Sri-Lankan origin who presented with a 26-year history of severe muscle pain, headache, fatigue, tachycardia and labile hypertension. 'The symptoms could arise from absorption of lactose or a bacterial metabolite produced when gut bacteria undergo a sudden glucose overload under hypoxic or anaerobic conditions.'

Expanding on this report, Mathews & Campbell (2000b) note:

> *We first examined the index case when he was aged 59 years. He had been investigated by many doctors. Mitochondrial muscle disease was excluded. After 26 years no-one had succeeded in reaching a diagnosis, or finding an effective treatment. Even creatine kinase returned to normal on removal of milk from the diet. Our diagnosis of lactose intolerance has transformed his life, as it has the lives of 12 other people who had the same clutch of symptoms and who had also remained undiagnosed. In addition, there are nine other cases, including relatives, where the full-blown syndrome has yet to be fully investigated. We believe that this is a new syndrome* – Muscle pain, Allergy, Tachycardia and Tiredness, and Headache *(MATHS), caused by sugar overload in the large intestine. Colonic bacteria metabolise sugars to produce systemic toxins (e.g. acetaldehyde, formate, diacetyl, acetoin, butan-2,3-diol, propan-1,3-diol and hydrogen). When these reach a critical level the MATHS rubicon is crossed.*

The similarity between FMS and MATHS (muscle pain, allergy, tachycardia and tiredness, and headache) is obvious, suggesting that food intolerances and reactions should always be considered when such a combination of symptoms coexists.

Allergy, hyper-reactive immune function and muscle pain

As part of the allergy link with myalgic pain, the immune system may be seen to be reacting to multiple or chronic infections as well as to a range of antigens, maintaining cytokine production at an excessively high level (see Fig. 3.3).

A viral connection is often suggested in the aetiological progression to FMS and CFS. Macintyre (1993) offers research evidence for this, and states:

> *The onset of ME usually seems to be triggered by a virus, though the infection may pass unnoticed. Most common in the UK are enteroviruses including coxsackie B and Epstein–Barr virus (Gow 1991) . . . Many people say they were fit and well before a viral infection which started*

their ME. But it is possible that in many such patients there have been other factors such as emotional stress, pesticide exposure, surgical or accidental trauma [see Whiplash below] some months before the triggering infection.

(See also notes on viral activity in FMS later in this chapter.)

Because of the very close similarities between the complex aetiologies and symptoms of CFS (ME/post-viral fatigue syndrome) and FMS, the use of examples relating to one condition seem appropriate when considering the other (see Ch. 5).

Immune hyperactivity may therefore continue due to a persistent viral presence, the existence of some other toxic immune stimulant (pesticides for example) or to repetitive allergic responses, as suggested by Randolph. If so, high levels of cytokines resulting from excessive immune activation will produce a variety of flu-like symptoms (Oldstone 1989).

Brain function may also be affected if, for example, interleukin-1 (IL-1) passes the blood–brain barrier, as has been shown to be possible. IL-1 (a cytokine) seems to modify brain function by modulating serotonin receptor sites (Bakheit 1992). If such changes occur in the hypothalamus, which seems plausible, a wide range of involuntary bodily functions could be affected, including endocrine production, sleep, temperature control, digestion, cardiovascular function, etc. (Demitrack 1991, Goldstein 1993). The interconnectedness of dysfunctional patterns involving the immune system and bodywide systems and functions can be seen to be possible in such a scenario (see Fig. 3.3). Cytokines are discussed more fully below.

Treatment for 'allergic myalgia'?

Randolph recommends: 'Avoidance of incriminated foods, chemical exposures and sometimes lesser environmental excitants.' How this is to be achieved in a setting other than a clinic or hospital poses a series of major hurdles for the practitioner and for the patient. If particular foods or other irritants can be identified, it makes perfect sense for these to be avoided, whether or not underlying causes (such as possible gut permeability issues) can be, or are being, addressed.

According to the newsletter of Fibromyalgia Network, the official publication of fibromyalgia/chronic fatigue syndrome support groups in the USA, the most commonly identified foods which cause problems for many people with FMS and CFS (ME) are wheat and *dairy products, sugar, caffeine, Nutra-Sweet®, alcohol and chocolate* (Fibromyalgia Network Newsletter 1993; italics added). Maintaining a wheat-free, dairy-free diet for any length of time is not an easy task, although many manage it. Issues involving patient adherence deserve special attention as the way information is presented and explained can make a major difference in the determination displayed by already distressed patients as they embark on potentially stressful modifications to their lifestyles (see Ch. 15).

A study in 1998 by Deuster & Jaffe demonstrated just how effective elimination of an 'immunoreactant dietary load' can be. In this study cell responses to foods were evaluated and those which produced a lymphocyte response were eliminated in a treatment group of 40 people with FMS (these suspect foods were replaced with 'metabolic intermediates'). There was also a control group of 11 people who maintained their normal diet and lifestyle throughout the study. All the participants (treated and controls) participated in a biweekly support group meeting for 6 months, and completed questionnaires at the outset and after 3 and 6 months. At the end of the study the control group reported increased pain and depression levels and no change in their stiffness or fatigue. The treatment group, who had eliminated irritant foods, showed 50% less pain, 70% less depression, 50% more energy and 30% less stiffness. The researchers concluded that: 'These data suggest that reducing the immunoreactant load in FMS, while stimulating repair, may help re-establish homeostasis and neuroimmune hormonal control.'

Other therapeutic choices

Pizzorno (1996) has reviewed a range of detoxification and bowel enhancement methods which have been tested both clinically and in controlled studies, which demonstrate that if the bowel mucosa can be assisted to heal, gut flora replenished, liver function improved, allergens restricted, nutritional status evaluated and if necessary supplemented, marked improvements can be achieved in patients with chronic symptoms such as those evident in the discussion of allergy, including chronic myalgic pain conditions.

Information regarding elimination, rotation and exclusion patterns of eating are offered in Chapter 15, as are detoxification measures which have been shown effectively to reduce the degree of reactivity of sensitive individuals to their allergens (Randolph's 'excitants') (Bland 1995).

Comment

The evidence suggests that for many people with FMS there is a connection between allergy/intolerance and their fibromyalgia symptoms. The clinical ecology model outlined above offers a possible explanation for the varied associated symptoms, including allergic myalgia, as is the MATHS hypothesis. At the very least the possibility of environmental/food allergens should be considered as part of the aetiology of any condition involving chronic muscle pain and associated symptoms, since, when identified, this offers the potential for remedial action through exclusion/rotation and other non-invasive approaches, as described in Chapter 15.

Chiari malformations

Chiari malformations (CM) are relatively common congenital anomalies of the posterior fossa and hindbrain, characterized by caudal displacement of the cerebellar vermis, medulla or pons. Many individuals with these malformations suffer chronic headaches, most usually occipital, which are similar to cervicogenic headaches. Exertional headaches, or those worsening with application of the Valsalva manoeuvre, should create suspicion of possible CM. Type I Chiari (aka Arnold–Chiari) malformation symptoms usually appear in childhood or adolescence, with symptoms such as cervical myelopathy, bulbar and cerebellar anomalies being common.

Thimineur et al (2002) note that abnormalities of central sensory processing may play a role in the pathogenesis of chronic pain. In particular they observe that in Chiari I malformation, the congenital hindbrain anomaly characterized by protrusion of the cerebellar tonsils into the upper cervical canal has variable effects on the lower brainstem and cervical cord. A retrospective study was undertaken in which pain, mood and sensory function in 32 patients with chronic pain who had mild Chiari I malformation were compared with that in 53 patients with chronic pain who had moderate to severe compression of the cervical spinal cord and 52 patients with chronic pain who had no apparent CNS disorder. The extent of pain and mood disturbance was greatest in the Chiari I group and least in the group with no CNS disorder. Complex regional pain syndrome, fibromyalgia and temporomandibular joint disorder were more common among the Chiari I malformation group than among the other groups. It is postulated (Kesler & Mandizabal 1999) that: 'The actual cause of acute occipital and suboccipital pain in CM type I is the caudal displacement of the cerebellar tonsil rather than stretching of cervical nerve roots.'

Some CM malformations have been associated with fibromyalgia, controversially attracting surgical intervention – with mixed outcomes. Kesler & Mandizabal (1999) note that surgery offers 'variable results', and state: 'Surgical treatment of CM type I associated headaches includes posterior fossa decompression, suboccipital craniectomy, duraplasty … and resection of the arch of the atlas. [These procedures] are generally well tolerated. Nevertheless, formation of subarachnoid fistula requiring further CSF shunting is a potential complication.' Response of CM type I headache to traditional migraine therapy has, say Kesler & Mandizabal, been disappointing: 'Osteopathic manipulation may be beneficial. Soft tissue techniques to the semispinalis capitus, splenius capitus and trapezius as well as the cervical spine may be attempted.' Although no controlled studies exist to support the possibility that these manual methods might prove beneficial, clinical experience suggests their usefulness.

Does surgery help?

A 2003 study (Dones et al) retrospectively reviewed 27 patients with Chiari I malformations that had been operated on between 1988 and 1997. Only one patient who presented with neck pain improved. One patient reported new onset headache, and one patient described his headache resolved. Vertigo resolved in three patients; two patients stated mild improvement, and one patient reported worsening. Nystagmus improved or resolved in six patients. Weakness improved in only two patients who did not have syringomyelia.

Dysphagia improved in two patients, and in the others it remained unchanged. Diplopia, spasticity, atrophy and numbness remained unchanged. The study provides evidence that the main benefit of surgical management in patients with Chiari I malformation, with or without syringomyelia, is to arrest the progression of the disease.

Comment

The relatively rare incidence of Chiari malformation should be kept in mind where headache and CNS disorders coexist with FMS. Surgery does not appear to be an ideal treatment choice, although it may delay progression of symptoms.

Cytokines and pain (and sleep issues)

Cytokines, as discussed above in relation to a myalgia/allergy connection, deserve to be better understood. They comprise a very large group (more are being discovered on a regular basis) of low molecular weight, regulatory proteins, secreted by white blood cells as well as a number of other cells in the body in response to stimuli. There are also membrane-bound forms of some of the secreted cytokines.

Cytokines regulate the intensity and duration of immune responses by either stimulating or inhibiting the activation, proliferation and/or differentiation of various cells, and by regulating the secretion of antibodies or other cytokines (Moldofsky & Dickstein 1999, Wallace 1990, 2000, Wallace et al 2001).

Wallace (2000) asks and answers: 'Why should fibromyalgia and cytokines have anything in common? These chemicals have been shown to cause sleep disorders, reduce a person's pain threshold, induce "fibro fog", and lead to severe states of fatigue. Even stress and anxiety disorders are linked to problems with cytokines.'

In particular, Wallace et al (2001) have identified specific cytokines with relevance to fibromyalgia, suggesting that there is evidence that the behaviour of these particular cytokines is abnormal in people with FMS:

- Interleukin-8 (IL-8), which produces pain throughout the sympathetic nervous system, was found by Wallace et al to be at virtually twice normal levels in FMS patients.
- Interleukin-1 receptor antagonist (IL-1ra), which appears to 1) block the pain-enhancing effects of IL-1, 2) increase the response to stress, and 3) counterbalance the effects of IL-8, was also found by Wallace et al to be present in almost double normal quantities in FMS patients.
- Interleukin-6 (IL-6) is a pro-inflammatory cytokine secreted by T cells and macrophages to stimulate immune response to trauma. It increases pain, fatigue, alters mood and increases the response to stress. Wallace found that although usually at normal levels in FMS patients, this cytokine was produced at vastly increased levels when white blood cells were stimulated (as they would be in response to infection for example).

They concluded: 'Because IL-8 promotes sympathetic pain and IL-6 induces hyperalgesia, fatigue and depression, it is hypothesized that they may play a role in modulating FMS symptoms' (Wallace et al 2001).

Cyclical behaviour of cytokines

Cytokines related to inflammatory and defensive roles in immune function seem to operate cyclically. Research has demonstrated the existence of diurnal patterns which profoundly influence inflammatory and pain-inducing processes. This explains why inflammation, and often pain, is commonly more intense at night. In normal circumstances, a cyclical pattern results in inflammatory processes alternating with those aspects of immune functions concerned with defence against infection; however, these diurnal patterns are capable of being disrupted by a number of factors (Petrovsky & Harrison 1998, Petrovsky et al 1998).

Those systems of the body that defend against attack by bacteria or viruses are usually far more active between roughly 10 a.m. and 10 p.m. This involves key elements of the immune system's surveillance and defence capabilities, for example T-helper cells 1 (Th1) which assist B cells and other T cells, and which are involved in the secretion of cytokines such as IL-2, IL-12 and interferon gamma (IFN-γ), promoting the transformation of CD8 suppressor cells into natural killer (NK) cytotoxic cells, which play a vital role in the inactivation of virally infected and mutagenic cells.

In contrast, those defensive and repair processes of which inflammation is a part are more active between roughly 10 p.m. and the following 10 a.m. In this regard Petrovsky & Harrison (1998) state:

> *Cytokine production in human whole blood exhibits diurnal rhythmicity. Peak production of the pro-inflammatory cytokines . . . occurs during the night and early morning at a time when plasma cortisol is lowest. The existence of a causal relationship between plasma cortisol and [cytokine] production is suggested by the finding that elevation of plasma cortisol, within the physiological range . . . results in a corresponding fall in pro-inflammatory cytokine production. The finding of diurnal cytokine rhythms may be relevant to understanding why immuno-inflammatory disorders such as rheumatoid arthritis, or asthma, exhibit night-time or early morning exacerbations and to the optimisation of treatment for these disorders (Gudewill 1992).*

Monro (2001) reports that: 'A natural cycling between the defensive and repair modes of aspects of the immune system is disturbed in ill-health and a chronic cytokine shift may lock the body into a pro-inflammatory state.'

Normal cytokine patterns are, therefore, capable of being disrupted. Various events and circumstances – that can largely be described as 'stressful events' – seem capable of altering their diurnal rhythms, so that the inflammatory phase can stay 'switched on' for most of the time, not just at night. When this happens the defensive phase of the cycle is relatively weakened, creating a greater likelihood of infection. This can occur because of:

- multiple vaccinations (see notes on Gulf War syndrome later in this chapter under the subheading 'Vaccination and FMS')
- exposure to carbamate and organophosphate insecticides which inhibit IL-2, essential for Th1 function
- intake of steroids, such as cortisone or elevated levels of cortisol (stress hormone)
- 'Stress, both psychological and physical. Stress activates the hypothalamo–pituitary–adrenal axis and leads to increased production of cortisol. Excessive exercise and deprivation of food or sleep also result in a falling ratio of DHEA to cortisol and an increase in a Th1 to Th2 shift. It is known that Epstein–Barr virus antibody titers rise amongst students facing examinations and that this virus is usually controlled by a Th1 response. Stress causes increased viral replication and hence antibody production' (Monro 2001).[1]
- 'Many of the risk factors for cancer, such as carcinogenic chemicals or tobacco smoke, also cause long-term inflammation and lower Th1 levels' (Monro 2001).

Sleep, pain and cytokines

Additional to these influences, a disturbed sleep pattern can produce negative effects on pain and recovery from injury. Any disruption of stage 4 sleep results in reduction in growth hormone production by the pituitary gland, leading to poor repair of irritated, inflamed and damaged tissues, and longer recovery times (Griep 1994, Moldofsky & Dickstein 1999). Monro (2001) adds:

> *The interaction of the circadian sleeping–waking brain and the cytokine–immune–endocrine system are integral to preserving homeostasis. . . . there may be host defense implications for altered immune and endocrine functions in sleep-deprived humans. Activation of cytokines and sleepiness occur during the acute phase response to bacterial or viral disease. There are disturbances in sleep and cytokine-immune functions in chronic protozoal and viral disease . . . Sleep-related physiological disturbances may play a role in autoimmune diseases, primary sleep disorders and major mental illnesses.*

The stress factors listed by Monro (above), as well as awareness of the cyclical nature of inflammation and pain amplification, are important informational features of which patients should be made aware. As will be explained in Chapter 15, there are nutritional tools which may allow a degree of influence over inflammatory processes (without actually switching them off!) which can offer the patient a sense of control over pain – a powerful empowerment, especially in chronic conditions.

Research into cytokine activity, and how to manipulate, modify and modulate these versatile

[1]T-helper cells: Th1 – participate in cell-mediated immunity and are essential for controlling intracellular viruses and certain bacteria; Th2 – provide help for B cells and, in so doing, are essential for antibody-mediated immunity.

chemicals, forms a major part of current research, particularly in relation to allergy, but increasingly in relation to pain and inflammation, including FMS.

Cytokines, vasoactive neuropeptides and FMS – an autoimmune hypothesis

Staines (2004) has convincingly outlined a hypothetical model that takes account of many aspects of our growing understanding of mechanisms at work in FMS, including cytokine activity. He proposes that immunological aberration is probably involved in FMS, and that this may prove to be associated with an expanding group of novel vasoactive neuropeptides.

Vasoactive neuropeptides (VN) apparently act as hormones, neurotransmitters, immune modulators and neurotrophes, and are readily catalysed to small peptide fragments. VN and their binding sites are immunogenic and are known to be associated with a range of autoimmune conditions. VN play a vital role in maintaining vascular flow in organs, and in thermoregulation, memory and concentration. They are co-transmitters for acetylcholine, are potent immune regulators with primarily anti-inflammatory activity, and have a significant role in protection of the nervous system to toxic assault and the maintenance of homeostasis.

Failure of these substances has adverse consequences for homeostasis. Staines describes a biologically plausible mechanism for the development of FM based on loss of immunological tolerance to the VN:

> *The proposed mechanism of action is that inflammatory cytokines are provoked by tissue injury from unaccustomed exercise or physical injury. This may trigger a response by certain vasoactive neuropeptides which then undergo autoimmune dysfunction as well as affecting their receptor binding sites. The condition may potentially arise de novo perhaps in genetically susceptible individuals. FM is postulated to be an autoimmune disorder and may include dysfunction of purine nucleotide metabolism and nociception.*

Microcurrent, cytokines and FMS

In Chapter 9 Carolyn McMakin outlines the use of microcurrent in the treatment of a particular subset of FMS patients, specifically those whose aetiology involves trauma such as whiplash.

In a retrospective study (McMakin et al 2005), based on analysis of subjective visual analogue scale (VAS) pain scores for 54 patients, symptoms of fibromyalgia following cervical spine trauma were successfully treated with microamperage current. In some of these patients, subjective pain improvement scores were accompanied by substantial reduction in serum levels of the inflammatory cytokines IL-1, IL-6 and tumour necrosis factor alpha (TNF-α), and the neuropeptide substance P. In addition, beta-endorphin release and increases in serum cortisol were observed in these patients during the same treatment period. The patient's subjective outcomes scores, in conjunction with objective biological markers for pain and pro-inflammatory cytokines, observed in response to this treatment protocol, represent important preliminary findings.

Comment

Understanding the role of cytokines in chronic conditions such as FMS is important. Recent research findings – for example in relation to leptin (see later in this chapter) function – have added to this understanding and offer potential therapeutic strategies. Microcurrent therapy is one such option.

Depression (and anxiety)

Many of the symptoms of FMS are similar to those experienced during depression, and there is ample evidence that mild antidepressant medication assists in symptom relief (sleep and pain) for many (but by no means all) patients with FMS. As noted in Chapter 2, one of the main therapeutic approaches used by the medical experts surveyed showed that antidepressant medication was the most utilized pharmacological approach.

The various surveys in Chapter 2 show that depression is clearly a part of *some* people's FMS experience. Additionally, antidepressant medication is perceived by approximately 6 out of 10 patients (see Table 2.7) to be helpful. The surveys in Chapter 2 also highlight a range of other psychological/emotional features. For example, Table 2.3 shows that depression is listed as a comorbid

condition by 40% of the 2569 responders to the survey, while anxiety is listed by 38%. Table 2.5 notes that 83% of responders reported that emotional distress was the most important feature that aggravated their FMS symptoms (as distinct from 68% who found 'mental stress' an aggravating factor). When asked about 'triggering events', the following were reported: chronic stress 41.9%; emotional trauma 31.3%.

Is FMS a result of depression – or is FMS simply depressing?

Several major reviews have concluded that whilst there is indeed an association between depressive illness and conditions such as FMS, what this association is remains unclear. There have been suggestions, despite some equivocal evidence, that there exists a direct association (Hudson 1996), while others feel that both depressive illness and FMS (as well as CFS, IBS, premenstrual dysphoric disorder, migraine and atypical facial pain) may possibly all share a common aetiological step (Gruber 1996).

- Williams (2003) is clear that: 'When depression and pain coexist, depression is most frequently the consequence of having pain, rather than its initial cause.' He goes further to state: 'The literature on both FM and pain in general, suggests that when depression is co-expressed with FM, it needs to be treated *in addition* to, but not in place of, FM.'
- Raphael et al (2006) conducted a detailed community survey involving both physical and psychological evaluations of women who fulfilled the criteria for a diagnosis of FMS. They concluded that: 'Results suggest a complex relationship between major depressive disorder and FMS in which current *but not lifetime risk* of depression is elevated. There was also confirmation of high rates of anxiety disorders in women with FMS.'
- Nordahl & Stiles (2007) agree that a central clinical issue involves the extent to which FMS is a form of depression or an affective spectrum disorder. Basing their conclusions on detailed research, they state that although there might be a common gene polymorphism in FMS and major depression: 'These disorders differ with regard to depressogenic personality style and that *major depression in patients with FMS occurs primarily as a sequel to fibromyalgia*.' This suggests, unsurprisingly, that the presence of FMS and associated symptoms is a depressing experience that invokes feelings of anxiety.
- Schneider et al (2006) offer a useful thought when they observe: 'It is too simplistic to state that all cases of classic FMS merely represent a somatic manifestation of clinical depression or anxiety, because not all patients with depression or anxiety disorders experience the symptom of widespread allodynia with multiple tender points.'
- Chronic fatigue syndrome (CFS) research by Janal et al (2006) has led to similar conclusions. When rates of depression and anxiety disorder were evaluated, these were found to be similar in all subtypes of CFS (whether the aetiologies were thought to be musculoskeletal/FMS, infection or neurological). Prevalence of depression and anxiety was not found to increase with symptom reports, suggesting that these disorders may reflect the general influence of chronic illness, rather than a specific comorbidity.

The contrary view

The argument for a connection between FMS and depressive illness is based on the following facts:

- they have an overlapping symptomatology
- they display similar patterns of comorbid disorders
- patients with FMS report high rates of depressive disorders among relatives
- depressives and FMS patients demonstrate similar responses to psychological tests and rating scales, as well as high lifetime rates for mood disorders.

Comorbidity of FMS, CFS and depression adds confusion to attempts which aim to establish causal links. One investigation involved examining individuals with CFS from a community-based study. A randomly selected sample of 18 675 respondents in Chicago were interviewed by telephone. A group of these individuals with chronic fatigue, accompanied by at least four additional minor symptoms associated with CFS, were given medical and psychiatric examinations. From this sample, a physician review group diagnosed individuals with CFS. These individuals were then subclassified based on a variety of categories, including comorbidity with fibromyalgia and comorbidity with pre-morbid,

lifetime and current psychiatric diagnoses, including depression.

Important differences between these subgroups emerged relating to measures of sociodemographics, symptoms, functional disability, stress and coping. Individuals with CFS and comorbid fibromyalgia demonstrated more symptom severity and functional impairment than individuals with CFS alone. Those with CFS and current or lifetime psychiatric diagnoses demonstrated greater fatigue and functional limitations.

The conclusion of the research was that discrepancies among CFS and FMS research findings may be, in part, attributable to comorbidity with other medical and psychiatric illness (including depression) which might confuse the connections between CFS, FMS and depression (Jason et al 2001).

Support for a link between depression and FMS also comes from the evidence that antidepressant medications, irrespective of their chemical class, are generally useful in treatment of FMS and associated conditions, although prescribed beneficially in very low doses as compared with amounts employed in treating major depressive illnesses.

Arguments against a link

There also exists a strong degree of argument against a direct depression–FMS connection:

- As noted, dosage of antidepressants which often assist in FMS (though not always) are lower than would be used in treatment of depression.
- There is little correlation between improved psychological status following antidepressant medication and the physical symptoms being experienced.

For example, a study conducted at a Toronto hospital (Reid et al 1997) examined and compared psychological adjustment and family functioning in patients with primary juvenile fibromyalgia and juvenile rheumatoid arthritis. There were almost no differences noted in the psychological adjustment of either the children or their parents, or in the ratings of family functioning or coping strategies. It was noted that a number of psychological adjustment, pain, fatigue and coping variables were significantly associated with functional disability, irrespective of the underlying condition. The conclusion of the researchers was that FMS is not a psychogenic condition (Reid et al 1997).

Yunus' thoughts on psychological stress

Mohammad Yunus (1994a) makes a number of important observations. He states that although up to 35% of FMS patients in some studies are reported to display significant psychological distress, most such reports are based on patients at speciality rheumatology clinics where psychological problems may well be over-represented due to referral bias. Referring to 'psychological stress' in general, Yunus reports that patients with FMS show a significantly greater degree of mental stress, as well as 'life event' scores, compared with patients with rheumatoid arthritis or normal controls as evaluated by Hassles Scale and the Life Event Inventory (Dailey 1990).

Yunus is clear that his investigation shows that: 'presently available data indicates that FMS is not a psychiatric condition'. Studies by Clark et al (1985) and Yunus et al (1991) specifically suggest that psychological abnormality is not essential for the development of FMS. However, it is important to realize that pain and perhaps fatigue may be more severe and difficult to manage in a minority subgroup of patients with psychological distress. These patients need special understanding and management by a caring physician.

Goldenberg's view

Goldenberg (1994a) has investigated the question of depression and FMS. Comparing FMS patients with CFS and rheumatoid arthritis (RA) patients, he found that there may be a greater lifetime and family history of depression in FMS compared to RA and controls, as well as greater levels of daily stress. However, he found that most patients with FMS do not have psychiatric illness and was able to demonstrate that no correlation existed between FMS symptoms or treatment response and psychological factors.

Goldenberg emphasizes the importance of the high levels of daily stress, reminding us that there is a growing body of evidence which shows that stress levels, including adaptation to chronic illness, have a profound effect on immune function, making viral infection more likely (Cohen 1991), and that neurohormonal dysregulation can be shown to correlate with stress levels (Griep et al 1993).

The views of Bradley et al

Research at the University of Alabama compared current FMS patients with non-patients who were either normal and healthy, or who met the ACR

criteria for FMS but who had not sought treatment for the past 10 years (Bradley et al 1994). The findings were as follows:

- FMS patients show significantly lower pain thresholds at tested points (tender points and control points) as well as reporting greater symptom severity and disability compared with normal controls and the non-patient FMS individuals.
- FMS patients, when compared with non-patients, met the criteria for a greater number of lifetime psychiatric diagnoses.
- The findings support the concept that the high level of psychological distress is not a primary feature of FMS but that, in combination with high pain levels and disability, psychological distress may cause the individual to seek medical care.
- As compared with normal controls, both FMS groups demonstrated lowered pain thresholds and significantly higher levels of fatigue, suggesting that central factors such as sleep disorder or neuropeptide levels are contributory features of their problems.
- The researchers confirm that they have found that FMS patients show reduced regional cerebral blood flow to the caudate nucleus and that the degree of this strongly correlates with pain thresholds.

The arguments for and against a causal depression link with FMS remain unresolved; however, on balance, while an association is agreed, depression is seen to emerge from FMS more frequently than acting as a trigger. While there appear to be benefits from the use of low dosage antidepressants, which, in some patients, offer symptomatic relief, possibly improving sleep patterns and reducing fatigue and pain levels, this approach does not seem to be dealing with underlying causes.

Comment

That there is a link between FMS and depression is not in question. What is strongly asserted by many experts (see above) is that in the vast majority of cases this link is not causal. The link with anxiety and other psychological or emotional states is equally unclear. It is very difficult to imagine that living with the cluster of symptoms associated with FMS could be other than depressing and anxiety provoking.

Dysregulation of brain function (and allostasis)

In an attempt to develop a model that explained adaptation to the stresses of life and the maintenance of internal physiological and metabolic stability, Cannon (1932) framed these, and many other phenomena, into a larger picture that he summarized in his book, *The Wisdom of the Body*. Coining the term *homeostasis*, he viewed organisms as engaging in continuously ongoing reflexive processes that ensure an adequate internal environment for every vital activity.

A more recent evolution of homeostatic concepts has been termed *allostasis*, which Schulkin (2003) describes as 'the process by which an organism achieves internal viability through a bodily change of state (especially central motive state)'.

The concept of allostasis was proposed by Sterling & Eyer (1988) to describe an additional process of re-establishing homeostasis, but one that responds to a challenge instead of to the subtle ebb and flow of metabolic and physiological activity. This theory suggests that both homeostasis and allostasis are endogenous systems, responsible for maintaining the internal stability of an organism. The concept of allostasis, maintaining stability through change, is a fundamental process through which organisms are seen to actively adjust to both predictable and unpredictable events.

Allostatic load refers to the cumulative cost to the body of allostasis, with allostatic overload being a state in which serious pathophysiology can occur – as in the exhaustion stage of Selye's (1952) general adaptation syndrome (see Ch. 2). See also Table 3.2.

It should be noted that at present there is no generally agreed upon definition for allostasis (Power 2004).

Neurosomatic influences and allostasis

The main brain centres involved in dysfunctional behaviour with direct influence on FMS and CFS can, according to Goldstein (1996), be influenced by 'many triggering agents in the predisposed individual', including viral infections which influence neural function, 'immunizations which deplete biogenic amines' (Gardier et al 1994), toxic

Table 3.2 From homeostasis to pathology

Homeostasis	Allostasis	Pathology
Normal set point	Changing set point	Breakdown
Physiological equilibrium	Compensated equilibrium	Outside equilibrium
No anticipation of demand	Anticipation of demand	No anticipation anymore
No adjustment based on history	Adjustment based on history	No adjustment possible
Adjustment carries no price	Adjustment and accommodation carry a price	External interventions needed: treatments
No pathology	Leads to pathology	Disease

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organophosphates or hydrocarbons, trauma to the head, difficulties in delivery, electromagnetic fields, sleep deprivation, general anaesthesia and stress (whether mental, emotional or physical). To these potential influences on brain circulation and function might be added the effects of hyperventilation as discussed above, as well as specific allergic reactions.

Goldberg et al (1999) examined the relationship between traumatic events in childhood, such as sexual and physical abuse, alcoholism and drug addiction, in relation to three types of chronic pain – facial pain, myofascial pain and FMS pain. These groups were compared with a heterogeneous control group who suffered from 'other' forms of pain. The different subgroups were evaluated for significant differences in relation to sexual, physical and verbal abuse histories, alcoholism, drug dependence, major upheavals, medications, childhood illness, death of a family member or friend, and separation/divorce of parents. All groups showed a history of abuse exceeding 48% (FMS 64.7%) and more than 38% had a family history of alcoholism. 'Logistic regression showed patients who were female, with an alcoholic parent, using non-narcotic drugs, were more likely to be members of the facial, myofascial and FMS groups. Childhood traumatic events are significantly related to chronic pain.' Goldberg's findings should be seen in the context of the observations of Goldstein (described below and also in Ch. 4).

Goldstein (1996) has examined the effects of certain childhood influences on eventual central control changes which help to explain some influences on his concept of a neurosomatic cause of FMS and CFS (and many other apparently non-organic conditions). Some of his key observations are summarized below:

- Conventional EEG and brain electrical activity mapping (BEAM) show the left frontotemporal region of the brain to display abnormalities in the majority of people who have a history of childhood abuse.
- Evaluation of patients with CFS shows approximately 40% to have similar abnormalities in this region.
- Early childhood experience of major stress increases cortisol levels which can affect hippocampal function and structure (Sapolsky 1990, 1994), suggesting a natural plasticity which allows environmental influences to 'programme' evolving biological responses to stimuli which are threatening.
- In this way variations in genetic influences, as well as upbringing and exposure to stress, together help to produce the patterns whereby the individual responds to subsequent stress, allowing exaggerated (or insufficient) responses to emerge to stressful influences as the norm for the individual.
- This would become even more likely, it is suggested, if essentially non-stressful events are misinterpreted, leading to both behavioural and neuroimmunoendocrine disorders.
- In contrast to normal homeostatic responses (where changes in hormonal and other variables result in stabilization via adaptation), these potentially pathological responses have been dubbed allostasis – the physiological regulation of abnormal states which are not in balance.

- Allostasis is seen to involve a degree of arousal – and consequent stress-hormone elevation – resulting from anticipated adversity, as well as a sense of events being unpredictable, with a feeling that little personal control is possible.
- These altered homeostatic (allostatic) responses are accompanied by a complex array of well-researched biochemical modifications to the norm, involving glucocorticoid elevation at various key sites in the brain which, when abnormally influenced, produce a chain reaction of neurohumoral changes potentially influencing almost any part of the body or its functions (McEwan 1994).
- For example, animal studies show that lesions in the ventromedial medulla result in depressed immune function (natural killer cells in particular), a feature of CFS.
- Dysfunction of this part of the brain also produces a reduction in growth hormone production with major implications for tissue repair.
- A change in the thermoregulatory setpoint is another result of dysfunction in this region of the brain, possibly accounting for temperature intolerance common in FMS and CFS.
- Goldstein reports 'constantly' seeing just such abnormalities in CFS and FMS patients, and has gone into great detail to explain the link between the pathophysiological changes affecting different brain regions as a result of this sequence of events, and many of the multiple symptoms experienced by CFS/FMS patients including pain, sleep disorders, poor cold tolerance, etc.

In the section on fatigue and FMS (below), some of Goldstein's additional evaluations of central dysfunctional influences are also summarized, as is the work of other FMS researchers (see also Fig. 4.7).

An example of a study that supports Goldstein's 'early developmental stress' hypothesis is one conducted by Van Houdenhove et al (2001), who evaluated the prevalence and characteristics of different forms of victimization in 95 patients suffering from CFS or FMS, compared with a chronic disease group, including rheumatoid arthritis (RA) and multiple sclerosis (MS) patients, and a matched healthy control group. The researchers assessed prevalence rates, nature of victimization (emotional, physical, sexual), life period of occurrence, emotional impact and relationship with the perpetrator by a self-report questionnaire. CFS and FMS patients showed significantly higher prevalences of emotional neglect and abuse and of physical abuse, *with a considerable subgroup experiencing lifelong victimization*. The family of origin and the partner were the most frequent perpetrators. With the exception of sexual abuse, victimization was more severely experienced by the CFS/FMS group. No differences were found between healthy control subjects or RA/MS patients, and between CFS and FMS patients. These findings support a pivotal aetiological connection between victimization, involving abuse of all sorts, and CFS and FMS, possibly by creating the changes in brain regulation suggested by Goldstein's research.

Altered pain perception

Research has also shown just how influential such changes in brain function can be in altering pain perception (Gracely et al 2002). The researchers noted that FMS is characterized by subjective reports of increased tenderness and sensitivity to pressure stimuli suggestive of allodynia. Pressure was applied to the left thumbnail beds of 16 right-handed patients with FM and 16 right-handed matched controls. Each FM patient underwent functional MRI (fMRI) while moderately painful pressure was being applied. The functional activation patterns in FM patients were compared with those in controls, who were tested under two conditions: the 'stimulus pressure control' condition, during which they received an amount of pressure similar to that delivered to patients, and the 'subjective pain control' condition, during which the intensity of stimulation was increased to deliver a subjective level of pain similar to that experienced by patients.

Using fMRI, the researchers evaluated pain-evoked activity in brain structures produced by equally painful pressure in 21 patients meeting ACR criteria for fibromyalgia and in 16 control subjects while the brain was scanned. The results showed that equally painful stimuli significantly increased regional cerebral blood flow (rCBF) in common regions, including the contralateral primary/supplemental sensory cortex (SI/SSS), secondary somatosensory cortex/retro-insular parietal operculum (SII, RI-PO), putamen, insular cortex, superior temporal gyrus (BA22,38) and ipsilateral anterior cerebellum. The fact that comparable subjectively painful conditions resulted in activation patterns that were similar in patients and controls, whereas similar pressures resulted in no common regions of activation

and greater effects in patients, supports the hypothesis that FM is characterized by cortical or subcortical augmentation of pain processing. 'The fMRI technology gave us a unique opportunity to look at the neurobiology underlying tenderness, which is a hallmark of fibromyalgia. These results, combined with other work done by our group and others, have convinced us that some pathologic process is making these patients more sensitive. For some reason, still unknown, there's a neurobiological amplification of their pain signals.'

The researchers found that it took only a mild pressure to produce self-reported feelings of pain in the fibromyalgia patients, while the control subjects tolerated the same pressure with little pain: 'In the patients, that same mild pressure also produced measurable brain responses in areas that process the sensation of pain. But the same kind of brain responses weren't seen in control subjects until the pressure on their thumb was more than doubled.'

Though brain activity increased in many of the same areas in both patients and control subjects, there were striking differences too. Patients feeling pain from mild pressure had increased activity in 12 areas of their brains, while the control subjects feeling the same pressure had activation in only two areas. When the pressure on the control subjects' thumbs was increased, so did their pain rating and the number of brain areas activated. But only eight of the areas were the same as those in patients' brains. This somewhat academic research shows definitively that something certainly happens to the brain in people with FMS to cause it to behave differently in response to pain stimuli. Why should that happen? Various possibilities are discussed in the notes on fatigue below.

Comment

The concepts of allostasis, as discussed above, have added to the understanding of how the body/mind deals with stressor demands – whether toxic, infectious, emotional, physical trauma, overbreathing, immunological or anything else. It is hard to see how it can be possible to make sense of complex conditions such as CFS/FMS without the foundational explanations that these processes (allostasis etc.) offer.

Fatigue (and altered permeability across the blood–brain barrier)

Although CFS and FMS are not identical, there is a large overlap between individuals diagnosed as having CFS and those told they have FMS, and many have a dual diagnosis (see survey evidence, and discussion of CFS in Ch. 2).

The diagnosis offered may well relate more to the areas of interest of the specialist making the diagnosis, rather than the symptoms and constitutional features. The reported symptoms of individuals with FMS and CFS are all too frequently subjectively identical, despite having different aetiological and metabolic characteristics.

- For example, Meeus et al (2007) point out that when CFS and FMS are compared there is evidence for differences such as immunological features (Suhadolnik et al 1999) and autonomic abnormalities (Naschitz et al 2001) typically seen in patients with CFS, and not in patients with FMS.
- There are also commonly marked pain processing pattern differences. Functional brain activity in patients with FM is quite different from that in patients with CFS. Patients with CFS, relative to controls, frequently show significantly lower blood perfusion in the brainstem (Meeus et al 2007).

See notes on blood–brain barrier issues below. These and many other differences between CFS and FMS are discussed more fully in Chapter 5.

Blood–brain barrier issues

Altered pain perception and brain function could involve the presence in the brain of chemicals that are not usually able to pass through its protective barriers. A variety of factors have now been shown to increase permeability across the blood–brain barrier (BBB), allowing an unnatural degree of access to substances capable of altering brain function, particularly in relation to CFS, and presumably to FMS.

Bested et al (2001) note that there is considerable evidence that CFS is a disorder involving the central nervous system (CNS). They hypothesize that altered permeability of the blood–brain barrier may contribute to ongoing signs and symptoms found in CFS. To support this hypothesis, agents that can increase the blood–brain barrier permeability (BBBP), as well as those that may be

involved in CFS/FMS, were examined. It was found that the factors that can compromise the normal BBBP include:

- viruses (see later in this chapter)
- certain cytokines (see notes on cytokines above)
- 5-hydroxytryptamine
- peroxynitrite
- nitric oxide
- stress (see below)
- glutathione depletion
- essential fatty acid deficiency
- *N*-methyl-D-aspartate overactivity (see notes on excitotoxins in allergy above).

It is possible that breakdown of normal BBBP leads to CNS cellular dysfunction and disruptions of neuronal transmission in CFS (and FMS).

Chronic fatigue is reported by approximately 90% of people with a diagnosis of FMS (and pain by 100%), and is one of the main presenting symptoms. Yunus (1994b) believes that, as with global pain, the widespread and pervading nature of the fatigue complained of probably has a neurohumoral basis. The similarities and differences between FMS and CFS are examined in Chapter 5: what is absolutely clear is that the differences between these two overlapping conditions are far fewer than the similarities and that the two conditions probably share common underlying causes.

As part of his 'neurosomatic' hypothesis (see Ch. 4, and the notes on early developmental influences above), Goldstein has given a detailed description of the biochemical patterns which may be operating as a major part of chronic fatigue as it occurs in FMS and CFS. Reference to his book *Betrayal by the Brain* (Goldstein 1996) is suggested for more detailed appreciation of the complexity of this explanation.

Goldstein's work, and that of others, indicates that:

- The ventromedial hypothalamus (limbic system) controls energy metabolism as well as regulating glucocorticoids and other stress hormones.
- This part of the brain is also involved in regulating, via sympathetic routes, glucose uptake by skeletal muscles as well as by brown adipose tissue and the heart.
- Muscular contraction induced by active (not passive) stretching or pressure influences ergoreceptors – unmyelinated and myelinated non-nociceptor nerve fibres – causing release of substance P and other neuropeptides in various brain sites (such as the ventrolateral medulla) and the spinal cord.
- Substance P in particular has been shown to be present in elevated amounts in both CFS and FMS patients where inappropriate excessive production occurs, post-exercise.
- Substance P is normally released by spinal cord tissues (afferent neurons) as a response to painful stimuli; therefore excessive levels would increase pain perception (Malmberg 1992).
- The neuromodulator serotonin, and tryptophan from which it derives, are both noted as being significantly reduced in FMS patients, and this has been shown to correlate with pain symptoms (Russell et al 1993).

Russell suggests a model for FMS in which abnormal levels of serotonin (low) and substance P (high) in the brain and spinal cord lead to a number of neuroendocrine, nociceptive and general functional abnormalities, including sleep disturbance, exaggerated pain perception and dysfunctional bowel symptoms. Relative tryptophan deficiency could be responsible for poor protein synthesis and its consequences (Russell 1994a).

Block (1993) summarizes the possible factors associated with the abnormal response to stress noted in FMS, which some of the findings highlighted above may help to explain:

- over-sensitive nociceptors
- dysfunctional levels of neurohumoral transmitter substances or their receptors
- over-efficient or poorly modulated pain pathways
- heightened cerebral perception of pain and/or increased reaction to pain
- diminished tolerance to pain or over-reporting of perceived pain
- all of these elements influenced by psychological, physical or environmental stressors.

Russell has described the biochemical association between serotonin, substance P and the phenomenon of pain (Fig. 3.4). Serotonin is an inhibitory neurotransmitter involved in the initiation and maintenance of restorative sleep (Moldofsky 1982). It is also suggested that serotonin acts in the thalamus as a regulator of pain perception as well as its additional role as a regulator of hormonal release, including growth hormone. What has been established is that serum levels of serotonin are indeed lower in FMS patients than in controls (Russell et al 1992). These low levels observed in FMS

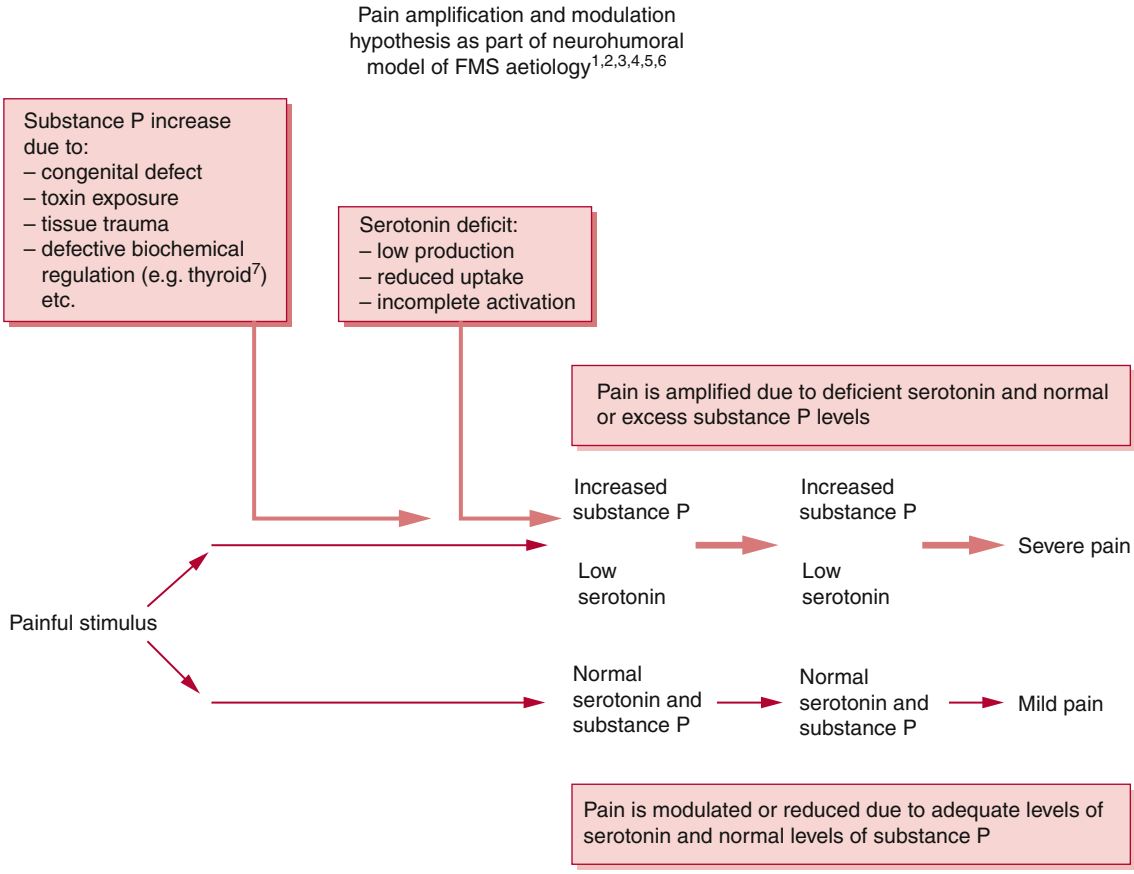

Figure 3.4 • Biochemical association between serotonin, substance P and the phenomenon of pain ([1]Russell et al 1992, [2]Russell et al 1993, [3]Yunus et al 1992, [4]Malmberg 1992, [5]Russell 1994b, [6]Moldofsky 1982, [7]Yellin 1997).

patients could result from inadequate serotonin manufacture (in the intestinal tract, from tryptophan, derived from protein digestion) or from lower uptake of serotonin by platelet cells, or from less efficient platelet activation during clotting.

Additional research confirms that serum tryptophan levels are also lower in FMS patients and that tryptophan in FMS patients has more difficulty in crossing the blood–brain barrier (Yunus et al 1992). Serotonin has a dampening influence on pain perception – the opposite of the influence of substance P, which assists in transmission of peripheral pain messages to the brain. Thus:

- if serotonin and substance P levels are normal, the amplitude of pain messages will be moderated
- if serotonin levels are lower than normal, or if levels of substance P are higher than normal, pain transmission will be amplified.

This would suggest that, even if only normal afferent pain messages ('discomfort') are being transmitted, these would be enhanced and might be perceived as intense discomfort or pain. Chemical communication processes would be presenting inaccurate information. It is suggested that antidepressant medication may help to retain greater levels of serotonin and so explain their apparent usefulness in FMS treatment.

These concepts, Russell suggests (1994b), support a neurohumoral mechanism for the pathogenesis of FMS.

Growth hormone deficiency

The similarities between FMS and growth hormone (GH) deficiency have led to numerous investigations of the possibilities of a link between growth

Comment

The cycle of causes and effects, in relation to fatigue, and the overlap of fatigue and pain in many individuals, seems constantly to be evaluated from different positions, with the same elements regularly appearing. Even Goldstein, who holds strongly to a primary central dysfunctional cause of all that follows in symptom terms in cases of FMS and CFS, acknowledges the numerous possible influences that can produce these dysfunctional neurohumoral patterns.

His choice is to focus on treatment using a variety of drugs (see Ch. 4) to help restore functional balance in the disturbed biochemistry. Others choose to see the neurohumoral and brain dysfunctions operating in FMS and CFS as being the result of other influences (including allergy, toxicity, infection, psychological stressors, altered permeability of the blood–brain barrier, etc.) acting on a possibly predisposed individual, which may be capable of being influenced by therapeutic intervention addressing these wider influences, the perpetuating factors (see Genetic hypothesis in Ch. 4 and Fig. 4.2).

hormone deficiency/disturbance and fibromyalgia. After analysing 26 different research studies, involving over 2000 individuals, Jones et al (2007) conclude that while patients with growth hormone deficiency (GHD) and FM patients share many of the same symptoms (see Table 3.3), pituitary function is normal in FMS, and that reported changes in the hypothalamic-pituitary–growth hormone–insulin-like growth factor-1 (HP–GH–IGF-1) axis are most likely hypothalamic in origin.

GH and trigger points

Jones et al (2007) note that it is possible that reduced GH levels *in some FM patients* (Bennett 2005) may predispose to muscle microtrauma and the development of myofascial trigger points. Trigger points have recently been shown to contain a milieu of algesic and inflammatory molecules (Shah et al 2005). It is conjectured that resultant muscle pain can not only be a potent generator but it may also perpetuate central sensitization (Staud 2006b). The role of myofascial trigger points in the development and maintenance of fibromyalgia pain is therefore currently an area of increasing research interest (see Chs 4 and 8 for further discussion of growth hormone issues).

Comment

While GH deficiency appears to have a role in FMS, it seldom seems to be a major aetiological feature. Two common targets in helping people with FMS involve encouraging normal sleep and regular exercise, both of which enhance GH production.

Hypermobility

Hypermobility can be benign, and simply a normal variant of the degree of elasticity of connective tissue. Far less commonly, hypermobility can be part of a disease process such as Ehlers–Danlos or Marfan syndromes (Jessee et al 1980). When rheumatology clinic patients have been evaluated there is strong support for a link between 'loose ligaments' and musculoskeletal pain (Hall et al 1995, Hudson et al 1998, Mallik et al 1994). A subset of people with FMS have been noted to demonstrate an excessive degree of joint laxity, ligamentous slackness and hypermobility (Acasuso-Diaz & Collantes-Estevez 1998, Karaaslan et al 2000). Researchers such as Hudson et al (1998) suggest that physical conditioning and regular, but not excessive, exercise are probably protective.

Examples of the FMS connection include a study in which the prevalence, diagnostic associations and clinical features of hypermobility were evaluated in a series of consecutive newly referred patients to a rheumatology clinic (Hudson et al 1998). Hypermobility was identified in 50 of 378 patients (13.2%). The most common clinical diagnosis in the hypermobile patients, compared with controls (those without hypermobility), was soft tissue rheumatism, observed in 67% vs 25% ($P<0.001$). Fibromyalgia syndrome was the common specific rheumatological diagnosis in 30% vs 8% ($P<0.001$) and inflammatory arthritis the least common diagnosis in 4% vs 32% ($P<0.001$) of hypermobile versus non-hypermobile patients, respectively. Hypermobile patients complained of previous pain, including widespread or multiple localized sites of pain and spinal pain. Although clinic-based studies may not accurately reflect disease patterns as seen in the population,

Table 3.3 Clinical overlap between fibromyalgia and adult growth hormone deficiency syndrome

	Fibromyalgia	Adult growth hormone deficiency
Reduced aerobic capacity (with postexertional muscle soreness)	✓	
Decreased muscle mass	✓	✓
Central adiposity	✓	✓
Feeling of poor health overall	✓	✓
Low energy levels	✓	✓
Cold intolerance	✓	✓
Impaired memory and concentration	✓	✓
Dysthymia	✓	✓
Widespread body pain	✓	Never evaluated
Pain in muscle–tendon tender points	✓	Never evaluated
Low resting serum IGF-1	Approximately 1/3 of patients	80% of patients
Poor growth hormone response to non-insulin stimulating testing (acute exercise, L-dopa, clonidine, arginine)	✓	75% of patients
Poor growth hormone response to hypoglycaemia induced through insulin tolerance test or arginine/growth hormone-releasing hormone stimulation	Usually normal response	85% of patients

Reproduced with permission from Jones et al (2007).

these results suggest an association between hypermobility and soft tissue rheumatic complaints and should be useful to the clinical rheumatologist.

An earlier study evaluated hypermobility in children with FMS (Gedalia et al 1993). The objectives included testing the hypothesis that joint hypermobility may play a part in the pathogenesis of pain in fibromyalgia. A group of 338 children (179 boys, 159 girls; mean age 11.5 years, range 9–15 years) from one public school in Beer-Sheva, Israel, were examined for the coexistence of joint hypermobility and fibromyalgia. Children were considered to have fibromyalgia if they fulfilled the 1990 American College of Rheumatology criteria for the diagnosis of fibromyalgia. The blind assessments of joint hypermobility and fibromyalgia were carried out independently. Of the 338 children, 43 (13%) were found to have joint hypermobility and 21 (6%) fibromyalgia; 17 (81%) of the 21 with fibromyalgia had joint hypermobility and 17 (40%) of the 43 with joint hypermobility had fibromyalgia. Joint hypermobility and fibromyalgia were found to be strongly associated. The researchers concluded that it is possible that joint hypermobility may play a part in the pathogenesis of pain in fibromyalgia.

Nijs (2005) points out that generalized joint hypermobility appears to be associated with anxiety disorders (Martin-Santos et al 1998). Hypermobility has also been linked with both FMS (Thieme et al 2004) and CFS (Skapinakis et al 2003).

Fitzcharles (2000) has concluded that at least a subgroup of patients with FMS are hypermobile, which appears to be supportive of the published data.

Why would hypermobility encourage FMS?

- Recurrent microtrauma to ligamentous structures in hypermobile individuals may well lead to

repeated pain experience, and could possibly trigger disordered pain responses.

- It is worth remembering that the tender points, which are used to confirm the existence of FMS, are located mostly at musculotendinous sites (see Ch. 1).
- Tendons and ligamentous structures, in their joint stabilizing roles, endure repetitive high loads and stresses during movement and activity.
- A possible reason for recurrent joint trauma in hypermobile people may be the observation of proprioceptive impairment, observed in hypermobile joints (Hall et al 1995, Mallik et al 1994).

In a review of the topic, Grahame (2000) noted that:

> *Pain dominates the lives of many patients with hyperlaxity syndromes, most commonly the Benign Joint Hypermobility Syndrome (BJHS/EDS). As a result they may experience psychological problems, which in many cases severely affects their healthy functioning. Above all is the overriding chronic pain in joints, muscles and ligaments, which arises from an inherent predisposition to the effects of everyday trauma, but other factors such as associated osteoarthritis and fibromyalgia are also important . . . The management of pain and distress in the hyperlaxity syndromes requires skill, patience, compassion and understanding. Often the results of conventional anti-rheumatic therapy . . . are disappointing and innovative approaches are required. Amongst these, for which evidence of efficacy is available, are physiotherapeutic and orthotic stabilization of hyperlax joints, proprioceptive enhancement and the newer pain management techniques including cognitive behavioural therapy.*

Some prevalence rates of hypermobility

- Caucasian adults 5% (Jessee et al 1980)
- Middle Eastern (younger) women 38% (Al-Rawi et al 1985)
- Hypermobility among Caucasian rheumatology patients is reported as ranging from 3% to 15% (Bridges et al 1992, Hudson et al 1995).

Recognizing hypermobility

What constitutes hypermobility may vary. Lewit (1985) noted that: 'What may be considered hypermobile in an adult male may be perfectly normal in a female or an adolescent or child.' Greenman (1996) discussed three types of hypermobility:

1. Those due to conditions such as Marfan and Ehlers–Danlos syndromes. In these syndromes there is an altered biochemistry of the connective tissue, which often reflects as extremely loose skin and a tendency for cutaneous scarring ('stretch marks'). It is believed that Abraham Lincoln had Marfan syndrome, which is characterized by long slender limbs. There may also be vascular symptoms such as mitral valve prolapse and dilation of the ascending aorta.

2. Physiological hypermobility, as noted in particular body types (e.g. ectomorphs) and in ballet dancers and gymnasts. Joints such as fingers, knees, elbows and the spine may be able to demonstrate greater than normal degrees of range of motion. Greenman reports that 'Patients with increased physiological hypermobility are at risk for increased musculoskeletal symptoms and diseases, particularly osteoarthritis.'

3. There may also be compensatory hypermobility resulting from hypomobility elsewhere in the musculoskeletal system. Greenman, discussing the spine, points out that: 'Segments of compensatory hypermobility may be either adjacent to or some distance from the area(s) of joint hypomobility. Clinically there also seems to be relative hypermobility on the opposite side of the segment that is restricted. In most instances hypermobile segments need little or no direct treatment but respond nicely to appropriate treatment of hypomobility elsewhere.'

Treatment choices

Stabilization

Nijs (2005) states that: 'When considered of clinical importance to the individual patient, joint hypermobility can be treated by stabilizing exercise therapy, postural advice, movement advice, self-management strategies, and the application of protective and supportive devices.'

Prolotherapy

Sclerosing type injections (prolotherapy) are used by some practitioners to increase connective tissue proliferation and enhance stability. A study on fibromyalgia and prolotherapy (Reeves 1993) demonstrated improvements in pain levels and functional ability after injection. The results of this study are supportive of tendon and ligaments being a potential source of symptomatology in fibromyalgia.

Comment

When fibromyalgia coexists with hypermobility, appropriate strategies include enhancement of muscle tone and, at times, prolotherapy.

Hyperventilation and FMS

Breathing 'badly' is usually a habit (Lum 1994), just as poor posture is usually habitual. And as with most habits, because they are repetitive or constant they 'feel normal', and the internal guidance system as to what is correct posture or correct breathing accommodates to these feelings. An habitual upper chest breather can no more produce a normal breathing pattern than can someone with habitually poor posture 'stand up straight'. Additionally, over time, functional habits such as these (postural and/or breathing patterns of use) tend to evolve structural repercussions, adaptive changes which prevent a return to normal function (Garland 1994, and see below).

People suffering with FMS show a significantly higher degree of anxiety when compared with normal controls or patients with other painful conditions such as rheumatoid arthritis. Anxious people tend to breathe dysfunctionally, and the breathing patterns involved (largely upper chest with minimal diaphragmatic involvement) can exacerbate FMS and CFS symptoms, and may actually cause or aggravate many of them (Dailey 1990, Uveges 1990).

A study evaluated tendencies to hyperventilation in a range of conditions. Hypocapnia (reduced levels of CO_2, regarded as the objective measure of hyperventilation), was diagnosed in 9–27% of patients with fibromyalgia, CFS and dizziness, as compared with between 0% and 2% of control subjects. The researchers concluded that: 'Because unrecognized hypocapnia is common in CFS, fibromyalgia, and nonspecific dizziness, capnography should be a part of the evaluation of patients with such conditions. Hyperventilation (and its objective measure, hypocapnia) reduces serum CO_2, a common feature of fibromyalgia syndrome (FMS)' (Naschitz et al 2006).

The female:male ratio of breathing pattern disorders such as hyperventilation occurrence has been suggested to range from 2:1 to 7:1 in different studies. Relative to men, women have a higher rate of respiration which is exaggerated during the luteal phase of the menstrual cycle. (*Note*: Menstrual influences on FMS are discussed more fully later in this chapter.)

As suggested in the discussion of synchronicity in Box 3.1, anxiety is one of the most immediate symptoms of hyperventilation, while it also tends to encourage breathing pattern disorders such as hyperventilation. The question is whether one or the other is causal, or whether both are the result of a wider dysfunction. What is certain is that reducing the effects of hyperventilation through breathing retraining and appropriate treatment can minimize many of the symptoms of FMS, including pain, fatigue and emotional distress.

The repercussions of chronic dysfunctional breathing – with a hyperventilation tendency – can severely compromise the musculoskeletal structures involved, and can also produce widespread dysfunctional influences, as outlined below, and illustrated in Figure 3.5.

Notes on the myofascial manifestations of emotional turmoil

Courtney & Cohen (2006) observe that: 'Dysfunctional breathing is being implicated in many conditions commonly seen by osteopaths, including fibromyalgia and chronic pain (Schleifer 2002), and work related musculo-skeletal problems.'

Frank hyperventilation has been extensively studied with regard to its relationship to both physical and emotional symptoms, most notably anxiety and panic attacks (Bass & Gardner 1985, Perkin & Joseph 1986).

Lum (1994) has discussed a vicious cycle of events:

> *Although Kerr et al (1937) pointed out that the clinical manifestations of anxiety were produced*

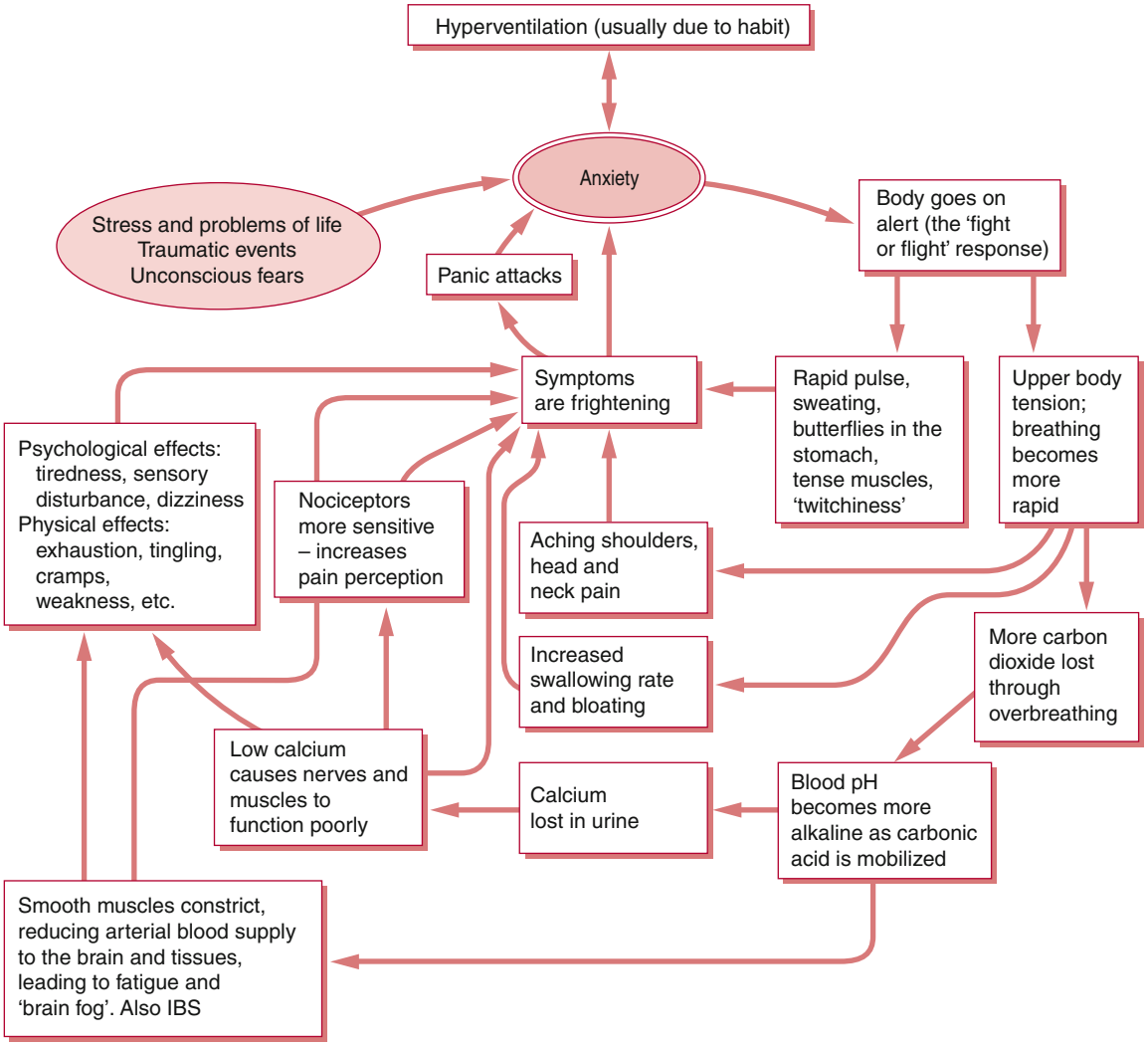

Figure 3.5 • The hyperventilation–anxiety connection. (Reproduced with permission from Peters et al 2001.)

by hyperventilation, it was Rice (1950) who turned this concept upside down by stating that the anxiety was produced by the symptoms and, furthermore, that patients could be cured by eliminating faulty breathing habits. Lewis identified the role of anxiety as a trigger, rather than the prime cause. Given habitual hyperventilation, a variety of triggers, psychic or somatic, can initiate the vicious cycle of increased breathing, symptoms, anxiety arising from symptoms exacerbating hyperventilation and thus generating more symptoms and more anxiety.

British physician Philip Barlow (Barlow 1959), a student of F. Methias Alexander, developer of the Alexander technique, noted that: 'There is an intimate relationship between states of anxiety and observable (and therefore palpable) states of muscular tension.'

EMG readings have shown a statistical correlation between unconscious hostility and arm tension as well as leg muscle tension and sexual concerns (Sainsbury 1954). Wolff (1948) demonstrated that the majority of patients with headache showed 'marked contraction in the muscles of the neck … most commonly due to sustained contractions associated

with emotional strain, dissatisfaction, apprehension and anxiety.'

Barlow explains:

> *Muscle is not only the vehicle of speech and expressive gesture, but has at least a finger in a number of other emotional pies, for example, breathing regulation, control of excretion, sexual functioning and above all an influence on the body schema through proprioception. Not only are emotional attitudes, say, of fear and aggression, mirrored immediately in the muscle, but also such moods as depression, excitement and evasion have their characteristic muscular patterns and postures.*

Half a century after the work of Barlow, Sainsbury and Wolff (as summarized above), remarkable evidence emerged as to the means by which muscular, and perhaps even more importantly, fascial, tone can be influenced – generally and locally – by changes resulting from breathing pattern disorders such as hyperventilation. Staubesand & Li (1996, 1997) studied the fascia cruris with electron photomicroscopy and found multiple smooth muscle cells embedded within the collagen fibres. They also described a rich intrafascial supply of capillaries, autonomic nerves and sensory nerve endings and concluded that these intrafascial smooth muscle cells enable the autonomic nervous system to regulate a fascial pre-tension independently of muscular tonus (Staubesand & Li 1997). They suggest that this understanding of fascia as an actively adapting organ may have far-reaching clinical implications.

Schleip (2003) notes that it is highly probable that the smooth muscle cells in fascia are involved in the regulation of an intrafascial pre-tension. Additionally, since it is known that increased levels of alkalinity, due to excessive CO_2 exhalation, result in automatic smooth muscle contraction, the implications for a bodywide increase in fascial tone is clear.

Additional research has shown that a small number of motor units in particular muscles may display almost constant or repeated activity when influenced psychogenically (Waersted et al 1993). Low amplitude levels of activity (using surface EMG) were evident even when the muscle was not being employed: 'A small pool of low-threshold motor units may be under considerable load for prolonged periods of time ... motor units with Type 1 [postural] fibres are predominant among these. If the subject repeatedly recruits the same motor units, the overload may result in a metabolic crisis.'

Anxiety and apprehension emerge rapidly as a result of (and often preceding) hyperventilation patterns of breathing. As noted, the accessory breathing muscles of the upper chest and neck and shoulder region are particularly involved. This evidence of selective regions of muscles becoming constantly activated during periods of emotional distress leads to a picture which explains the ischaemia, pain, fatigue and general dysfunction. These changes have strong parallels with the description of the aetiology of myofascial trigger points, as suggested by Simons (Simons et al 1999, Wolfe & Simons 1992).

Assessment and hyperventilation

Assessment by means of palpation and observation, in so far as it relates to emotional states, requires that practitioners/therapists acquire the ability to observe patterns of use, posture, attitudes, tics and habits. And most importantly, it is necessary to be able to discern inappropriate muscular activity during upper chest breathing, epitomized by the extremes of hyperventilation. Hyperventilation is diagnosed by a combination of observation, assessment, capnography and the use of instruments such as the Nijmegen questionnaire (Vansteenkiste et al 1991).

The usefulness of a questionnaire to identify hyperventilation (the Nijmegen Questionnaire) was evaluated by Dutch physicians van Dixhoorn & Duivenvoorden (1985). They compared the results of use of the questionnaire when completed by 75 confirmed HVS patients and 80 non-HVS individuals. There were three dimensions measured in the questionnaire: breath shortness, peripheral tetany and central tetany: 'All three components had an unequivocally high ability to differentiate between HVS and non-HVS individuals. Together they provided a 93% correct classification. Statistical double cross validation resulted in 90–94% correct classifications. The sensitivity of the Nijmegen Questionnaire in relation to diagnosis was 91% and the specificity 95%.'

Acute hyperventilation pattern

It is not hard to see the physical signs of acute hyperventilation as the rate of breathing and the excursion of the rib cage are characteristic,

producing a heaving of the upper chest. When this is the result of emotion rather than activity there is a reduction in diaphragmatic activity with less expansion of the lower ribs. The upper ribs are pulled into inspiration, quickly followed by a fall on expiration.

Chronic hyperventilation pattern

This is easy to miss during observation, with the breathing rate often no more than the upper limit of normal, around 16 per minute. The more usual rate, however, is between 20 and 25 per minute in chronic hyperventilation in which a pattern of sighing and arrhythmic, shallow breathing is common. Upper rib movement is marked, with breath holding during activity (standing from sitting for example) and often during mental concentration.

Definition of hyperventilation (Timmons 1994)

Breathing in excess of metabolic requirements (i.e. ventilation is excessive relative to the rate of CO_2 production), leading to fall in P_{CO_2} below normal range (arterial hypocapnia), hypoxia.

Background to upper chest breathing

Breathing is the interface between mind and body, and any prolonged dysfunction such as upper chest breathing (hyperventilation) in which 'psychology overwhelms physiology' represents a damaging pattern of behaviour with consequences which are biologically unsustainable, and which may influence a wide array of mind/body functions, producing muscular imbalances, weaknesses, shortening and fibrosis, and impacting on spinal, neck, rib and shoulder function, leading to pain, headaches, etc., as well as to increased energy usage.

Biochemical effect of hyperventilation

As a tendency towards upper chest breathing becomes more pronounced, biochemical imbalances occur when excessive amounts of carbon dioxide are exhaled, leading to relative alkalosis, automatically producing a sense of apprehension and anxiety. This frequently leads on towards panic attacks and phobic behaviour, recovery from which is possible only when breathing is normalized (King 1988, Lum 1984).

Since carbon dioxide is one of the major regulators of cerebral vascular tone, any reduction due to hyperventilation patterns leads to vasoconstriction which could account in large part for the 'foggy brain' symptom so often complained of by people with FMS (see Figs 3.5 and 3.6).

Along with heightened arousal/anxiety and cerebral oxygen lack, there is also a tendency for what oxygen there is in the bloodstream to become more tightly bound to its haemoglobin carrier molecule, leading to decreased oxygenation of tissues. All this is accompanied by a decreased threshold of peripheral nerve firing.

Thyroid dysfunction and hyperventilation

In Chapter 10, Dr John Lowe explains the connection between hypothyroidism and fibromyalgia in many individuals. A complex link has also been identified between hypothyroidism and breathing pattern disorders, including hyperventilation, sleep apnoea and diaphragmatic dysfunction (Duranti et al 1993, Laroche et al 1988, Lee & Levine 1999, Martinez et al 1989).

FMS symptoms increased by poor breathing

In modern inner cities in particular, and late 20th/early 21st century existence in general, there exists a vast expression of respiratory imbalance ('paradoxical breathing'), in which breathing function is seen to be at least an associated factor in most chronically fatigued and anxious people and almost all people subject to panic attacks and phobic behaviour. Many of these individuals also display symptoms of irritable bowel, multiple musculoskeletal symptoms and a tendency to be easily aroused emotionally, with mood swings, 'foggy brain' (concentration and memory impairment) and a sense of oppression/heaviness in the chest (dyspnoea). 'I can't take a proper breath', 'I keep sighing', 'I feel as though there is a rock on my chest' . . . are all key expressions which are repeated over and over again at consultation. Many such individuals fall into a category of having 'medically unexplained symptoms'.

Katon & Walker (1998) estimate that 14 common physical symptoms are responsible for almost half of all primary care visits. Yet over a 1-year period, only about 10–15% of these symptoms are found to be caused by an organic illness. Abdominal pain, chest pain, headache and back pain are commonly found to be medically unexplained. Primary

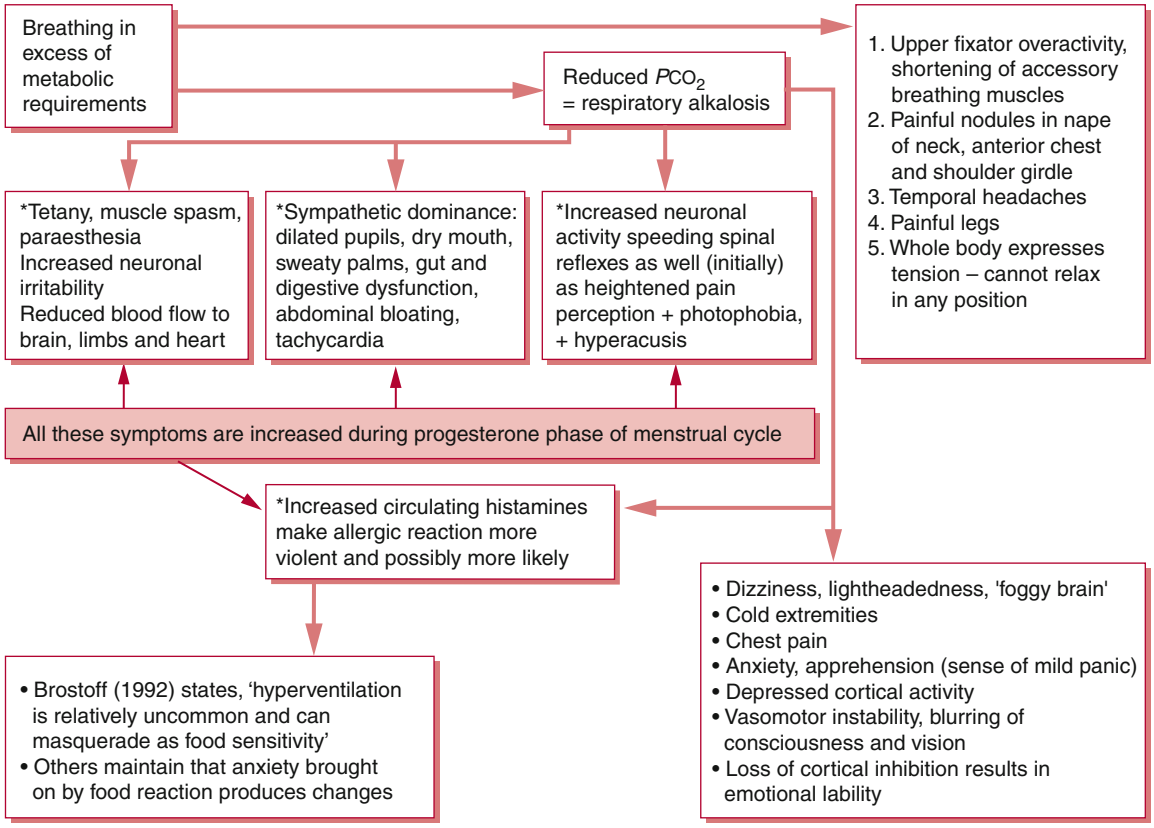

Figure 3.6 • Breathing and the FMS connection (Lum 1994, Brostoff 1992).

care physicians find such frequent attending patients frustrating, as they tend to account for a disproportionate amount of health care resources.

Reid et al (2001) examined the records of the 361 patients who attended outpatients most frequently (i.e. the top 5%). In 208 of the 971 consultation episodes, after full investigation, their symptoms were 'medically unexplained'. It is suggested that there is ample evidence that many of the symptoms in such patients may be caused, aggravated and/or maintained by the biochemical, biomechanical and psychological effects of breathing pattern disorders (Chaitow et al 2002).

A Norwegian study evaluated the prevalence of panic attacks in FMS patients, as compared with controls and with a group of individuals with functional dyspepsia (Malt et al 2000). It was found that among FMS patients a significantly higher

proportion reported lifetime panic disorders (which are directly linked to hyperventilation).

Dyspnoea ('air hunger') is a common symptom of breathing pattern disorders, and is frequently reported by people with FMS. Using the World Health Organization dyspnoea classification system, Çetin & Sivri (2001) evaluated the presence of dyspnoea in 35 female patients with FMS, whom they compared with 20 normal matched (for age and body mass) controls. They found that dyspnoea was the fifth most common associated symptom, and that it was noted in 57.1% of the FMS patients. They then performed spirometric examination to evaluate pulmonary function (including forced vital capacity, forced expiratory volume in 1 second, peak and forced expiratory and inspiratory flow, and maximum voluntary ventilation) in both the patients and the controls. Despite their symptoms, the FMS patients' spirometric results were within normal parameters, which should be of comfort to these individuals (Box 3.2). The results did, however, show that there was a statistically significant positive correlation between pain scores measured by visual analogue scale and the WHO dyspnoea grade (the greater the symptoms of dyspnoea, the more pain was being reported). The WHO dyspnoea grade was also found to be positively correlated with the degree of chest pain. The researchers concluded that: 'Dyspnea is a common symptom in patients with FMS and is not explained by pulmonary causes, but may partly be due to chest wall discomfort and pain intensity. Understanding the cause of this symptom in FMS may help in the management of these patients who are suffering from dyspnea.' Another way of seeing these findings would be to reverse this thinking, and to suggest that normalizing the breathing pattern may well minimize many of the symptoms of FMS, in particular pain.

Box 3.2

Pulmonary function as predictor of mortality (Schunemann 2000)

A 29-year prospective study involved a randomly selected sample of 554 men and 641 women, aged 20–89 years, from all listed households in Buffalo, New York State. Baseline measurements (1960/61) were taken of pulmonary function based on FEV (forced expiratory volume in 1 second) expressed as normal % predicted (FEV_1%pred).

FEV_1%pred, adjusted by age, body mass index, systolic BP, education and smoking status, was inversely related to *all-cause* mortality, in both men and women. A sequential survival analysis of participants who had survival times of at least 5, 10, 15, 20 and 25 years after enrolment in the study was also performed.

It was observed that a statistically significant negative association existed between FEV_1%pred and all-cause mortality. FEV_1%pred was also inversely related to ischaemic heart disease mortality: 'These results suggest that pulmonary function is a long-term predictor for overall survival rates in both genders and could be used as a tool in general health assessment.'

The good news for those people with breathing pattern disorders is that (based on the study by Çetin & Sivri (2001), see text) this does not seem to translate into altered pulmonary function, and therefore into a shorter life expectancy.

Comment

Breathing exercises alone cannot adequately correct chronic dysfunctional breathing patterns because, in addition to habituation, the individual will have developed structural modifications (short, tight muscles, restricted rib and spinal structures, etc.) which simply cannot allow a more desirable pattern to be imposed or relearned, unless and until the restricted areas are stretched, relaxed and released, at least partially.

Why do people hyperventilate?

Lum (1984) discusses the reasons for people becoming hyperventilators: 'Neurological considerations can leave little doubt that the habitually unstable breathing is the prime cause of symptoms. Why they breathe in this way must be a matter for speculation, but manifestly the salient characteristics are pure habit.' Breathing retraining has been used to correct hyperventilation. Lum reported that in one study more than 1000 patients were treated using breathing retraining, physical therapy and relaxation. Symptoms were usually abolished in 1–6 months, with some younger patients requiring only a few weeks. At 12 months, 75% were free of all symptoms, 20% had only mild symptoms and about one patient in 20 had intractable symptoms.

Effects of hyperventilation (see Fig. 3.6)

- Reduction in P_{CO_2} causes respiratory alkalosis via reduction in arterial carbonic acid, which leads to major systemic repercussions.
- The first and most direct response to hyperventilation is cerebral vascular constriction, reducing oxygen availability by about 50%.
- Of all body tissues, the cerebral cortex is the most vulnerable to hypoxia, which depresses cortical activity, causing dizziness, vasomotor instability, blurring of consciousness ('foggy brain') and vision. Many of these symptoms are noted in most cases of FMS.
- Loss of cortical inhibition results in emotional lability.

Neural repercussions

- Loss of CO_2 ions from neurons during moderate hyperventilation stimulates neuronal activity, producing muscular tension and spasm, speeding spinal reflexes and producing heightened perception (pain, photophobia, hyperacusis) – of major importance in chronic pain conditions such as FMS.
- When hypocapnia is more severe or prolonged it depresses neural activity until the nerve cell becomes inert.
- What seems to occur in advanced or extreme hyperventilation is a change in neuronal metabolism; anaerobic glycolysis produces lactic acid in nerve cells, lowering pH, which then diminishes neuronal activity so that in extreme hypocarbia, neurons become inert. Thus, in the clinical condition, initial hyperactivity gives way to exhaustion, stupor and coma (Lum 1984).

Tetany

- Tetany is secondary to alkalosis. Muscles which maintain 'attack–defence' mode – hunched shoulders, jutting head, clenched teeth, scowling – are those most likely to be affected, and these are common sites for pain in FMS.
- Painful nodules develop and are easily felt in nape of neck, anterior chest and shoulder girdle.
- Temporal headache, centred on painful nodules in the parietal region, is common.
- Also present in some, but not all, are painful legs.
- 'The whole body expresses tension and patients cannot relax in any position.'
- Sympathetic dominance is evident by virtue of dilated pupils, dry mouth, sweaty palms, gut and digestive dysfunction, abdominal bloating and tachycardia.
- Allergies and food intolerances are more common due to increased circulating histamines.

Hyperventilation symptoms

Table 3.4 summarizes the symptoms self-reported by 400 consecutive patients who were referred for a diagnosis of hyperventilation syndrome (Grossman & De Swart 1984).

The signs and symptoms examined by the Nijmegen Questionnaire (see earlier in this section) might therefore usefully be used as a starting point (see also Figs 3.5 and 3.6). Any patients, especially those whose symptom presentation includes FMS/CFS, who display or who report a number of the following signs or symptoms might be considered as suitable candidates for respiratory treatment:

- a feeling of constriction in the chest
- shortness of breath

Table 3.4 Self-reported symptoms in hyperventilation syndrome (Grossman & De Swart 1984)

	% HVS	% Non-HVS
Feeling of suffocation	54.5	41.0
Restless/panic	54.5	38.5
Pounding heart	50.0	27.0
Headaches	47.0	51.0
Tiredness	64.0	55.5
Tenseness	51.5	36.5
Hands tremble	38.5	25.0
Feeling of heat	42.0	34.0
Tingling in feet	20.0	17.0

- accelerated or deepened breathing
- unable to breathe deeply
- feeling tense (the questionnaire avoids the use of the word anxiety)
- tightness around the mouth
- stiffness in the fingers or arms
- cold hands or feet
- tingling fingers
- bloated abdominal sensation
- dizzy spells
- blurred vision
- feeling of confusion or losing touch with environment.

Structural effects of hyperventilation

Garland (1994) summarizes the structural modifications which inhibit successful breathing retraining as well as psychological intervention, including:

- visceral stasis/pelvic floor weakness
- abdominal and erector spinae muscle imbalance
- fascial restrictions from the central tendon via the pericardial fascia to the basiocciput
- upper rib elevation with increased costal cartilage tension
- thoracic spine dysfunction and possible sympathetic disturbance
- accessory breathing muscle hypertonia and fibrosis involving shortening of muscles such as sternomastoid, scalenes and upper trapezius (see Whiplash below)
- promotion of rigidity in the cervical spine with promotion of fixed lordosis
- reduction in mobility of second cervical segment and disturbance of vagal outflow.

These changes, Garland states:

> *. . . run physically and physiologically against biologically sustainable patterns, and in a vicious circle promote abnormal function which alters structure which then disallows a return to normal function. In hyperventilation, where psychology overwhelms physiology, if assistance can be given to the individual by minimising the effect of somatic changes [as described above] and if these structural changes can be provided with an ability to modify, therapeutic interventions via breath retraining and counselling will be more effective.*

Not life threatening!

Remarkably, despite the cascade of symptoms and changes relating to hyperventilation, it should be emphasized that, as shown in the research by Çetin & Sivri (2001), pulmonary function is seldom impaired, and this habitual pattern is not a disease. The importance of this, in terms of life expectancy, was demonstrated by the finding in an important 30-year prospective study which showed that where forced expiratory volume was impaired, there was an increased risk of mortality (see Box 3.2).

Summary

There is a clear link between abnormal breathing patterns, excessive use of the accessory breathing muscles, upper chest breathing, etc. and increased muscle tone, which is itself a major cause of fatigue and pain, over and above the impact on the wider economy of the body of reduced oxygenation, particularly to the brain, and the unbalanced, malcoordinated patterns of use which stem from the structural and functional changes detailed by Garland.

Patients with this pattern of breathing will probably be fatigued, plagued by head, neck, shoulder and chest discomfort and a host of minor musculoskeletal problems, as well as feeling apprehensive or frankly anxious. Many will have digestive symptoms such as bloating, belching and possibly hiatal hernia symptoms etc. associated with aerophagia which commonly accompanies this pattern of breathing, as well as a catalogue of other symptoms.

There is always a spectrum in such cases, with some individuals being patent and obvious hyperventilators, others being borderline, and many being somewhere on their way towards a point where they will indeed show evidence of arterial hypocapnia and thus achieve the status of 'real' hyperventilators. The fact is that, just as in the case of FMS and the 'tender point count', before someone displays all the required (for a diagnosis) symptoms they will have been progressing towards that state for some time. It is important in conditions such as CFS and FMS to recognize people who are borderline hyperventilators, and to address this.

Upper chest breathing: further implications and connections

Dr Janet Travell has confirmed that among the many factors that help to maintain and enhance trigger point activity is the low oxygenation of tissues

which is aggravated by muscular tension, stress, inactivity and poor respiration. Travell and Simons also discuss 'paradoxical breathing' in their *Trigger Point Manual* (Travell & Simons 1983):

> *In paradoxical respiration the chest and abdominal functions oppose each other; the patient exhales with the diaphragm while inhaling via the thoracic muscles, and vice versa. Consequently a normal effort produces inadequate tidal volume, and the accessory respiratory muscles of the upper chest, including the scalenes, overwork, to exchange sufficient air. The muscular overload results from the failure to coordinate the different parts of the respiratory apparatus.*

As is made clear in Chapter 6, in which FMS and myofascial pain syndrome are compared, anything that exacerbates trigger point activity should be minimized ('lessen the load') as this will reduce overall pain input as well as improving coping mechanisms (reduced anxiety levels) and general function (more efficient oxygenation).

Anti-arousal breathing technique

Ample research evidence exists to indicate that arousal levels can be markedly reduced via the habitual use of specific patterns which can be incorporated into breathing retraining. Cappo & Holmes (1984) and Grossman et al (1985), among others, have shown that breathing retraining is a valid approach.

Cappo and Holmes have incorporated into their methodology a form of traditional yoga breathing which produces specific anti-arousal benefits. The pattern calls for a ratio of inhalation to exhalation of 1:4 if possible, but in any case for exhalation to take appreciably longer than inhalation (see Ch. 17 for details of this approach).

Comment

Rehabilitation of breathing pattern disorders offers a cost-effective and effective intervention for individuals who habitually overbreathe. It is suggested that breathing patterns should be examined in all patients presenting with a diagnosis of CFS or FMS (see Ch. 15, Treating associated conditions).

Infection: bacterial (including *Mycoplasma*) and viral

- The possible involvement of fungal overgrowth is touched on in the section on irritable bowel syndrome (below), while viral and bacterial infections are considered here.
- Additional discussion (and treatment choices) of fungal (e.g. candida) involvement is outlined in Chapter 15.
- The possible link between FMS/CFS and Lyme disease is discussed in Chapter 5; see also discussion of various hypotheses in Chapter 4, particularly integrated hypothesis 2.
- Notes on Gulf War syndrome are to be found in various locations, including notes on toxicity, infection and vaccination in this chapter.

Infection and FMS

Goldenberg describes two possible pathways via which infection could be associated with FMS:

- An infectious agent directly invades tissues or activates immune mediators (cytokines) and produces the symptoms of pain and neural dysfunction.
- An infection triggers an adaptive response which leads to the symptom picture. In this model, infection is just one possible trigger resulting in avoidance ('sickness') behaviour involving altered sleep patterns, emotional changes, increased muscle tension and reduced activity.

Goldenberg says that the first model is unsupported by any evidence of the presence of infectious agents in either peripheral tissues or the nervous system. The provocation of cytokine production (such as IL-2) does, however, result in symptoms similar to FMS and CFS (Goldenberg 1994b).

Both models are worthy of further research, although Goldenberg is clear that: 'It is unlikely that a single infection is the cause of most cases of fibromyalgia. Studies of the complicated integration of mind, body and patient's psychological milieu are more likely to provide meaningful answers to all potential factors, including infections, that may be associated with fibromyalgia.'

British physician Anne Macintyre (Macintyre 1993), herself afflicted with myalgic encephalomyelitis (aka CFS), writes:

The incidence of new cases [of ME] peaks in late summer and autumn, coincident with the peak time of year for enteroviral infections. It is likely that enteroviral infection accounts for the majority of ME illness in this country [UK], even if other factors (stress, trauma) are present. There may also be a genetic predisposition, evidenced by the higher than expected number of parents with ME whose children also develop it some years after the parents (Dowsett et al 1990).

The evidence for a link between infection and FMS and CFS seems to be compelling in some individuals; however, the issue is extremely controversial and the evidence conflicting, as outlined below.

It should be noted that a proposed link between infection and FMS does not necessarily mean that the infection is the cause of FMS; it may simply reflect the presence of opportunistic organisms, taking advantage of lowered immune function, or of local environmental situations. Clearly concurrent infections add to the burden of symptoms.

Eliminating chronic infections, whether viral, bacterial or fungal, requires possibly targeting the organism, but most certainly should involve enhancing the immune system's ability to exercise control of the invading pathogen.

Gran (2003) has performed a useful epidemiological survey of fibromyalgia patients. He found that in infectious disorders, FMS has been detected in 5–16% of patients with hepatitis C (Goulding et al 2001), in 11–29% of individuals with HIV infection (Buskila et al 1990), in 19% of those with acute viral infection (Rea et al 1999) and in 8% of cases of Lyme disease (Dinerman & Steere 1992). In their study, Rea et al (1999) observed that while 19% of patients exhibited clinical evidence of FMS at presentation and at 2 and 6 months, only 3% and 1%, respectively, suffered from FMS.

In the survey reported on in Chapter 2, conducted by Bennett et al (2007), 43% of responders noted (Table 2.5) that infections worsened their symptoms and 26.7% noted (Table 2.6) that 'acute illness' (unspecified nature) was the perceived trigger for the onset of their FMS.

The Fibromyalgia Network survey (1999) contained the information that 43% of responders reported fever blisters prior to the onset of symptoms (suggesting viral infection). Additionally, 20% reported a diagnosis of mononucleosis, 9% herpes, 7% hepatitis and 1% Lyme disease prior to the onset of their FMS symptoms.

Bacterial infection (*Mycoplasma*)

Root-Bernstein (1993) explains some of the characteristics of these unusual bacteria:

Mycoplasma *is a genus name for [approximately] 50 different species of bacteria. Mycoplasmas differ from most other bacteria in being relatively small and lacking an outer cell wall. They are often among the most difficult bacteria to isolate. They can cause a range of disease manifestations, including pneumonia, when present in the lungs, and proctitis, when they infect the rectum. Animals infected with mycoplasmas often become immune suppressed.*

Microplasmata are primitive bacteria that have the ability to incorporate into their own surface structures parts of host cell membranes that contain important host membrane antigens, creating the opportunity for autoimmune responses (Baseman & Tully 1997). These micro-organisms are now considered important pathogens involved in various chronic illnesses including (in many individuals) CFS and FMS by some researchers and clinicians (Nasralla et al 1999, Nicolson et al 2000, 2002, 2003).

There is controversy over the claims by some (see notes on Nicolson's work below) that mycoplasma infection is commonly systemic in people with CFS, FMS and Gulf War syndrome. The treatment protocol recommended for systemic mycoplasma infection involves up to a year of multiple antibiotic use.

There is also a contrary viewpoint which suggests that the testing methods used by proponents of the mycoplasma aetiology theory are flawed, and that the antibiotic protocols recommended are dangerous to the individual, creating havoc with their internal ecology, and promoting even greater antibiotic resistance, something which is causing great concern as ever more 'superbugs' evolve (see notes on Urnovitz's critique of the mycoplasma theory, and Lo's research, below).

Specifically in relation to CFS, Nicolson et al (2002) offer these observations about the mycoplasmata:

In CFS patients we have found that chronic infections are a rather common feature of the illness. Previously we studied American and European CFS patients and found that most had

Mycoplasmal infections. . . . When we examined the incidence of particular Mycoplasmal infections in CFS, we found that most patients had multiple infections (two or more species of Mycoplasma), which were for the most part combinations of M. fermentans *and other Mycoplasma species. For example, in studying the prevalence of multiple Mycoplasmal co-infections we found that double or triple infections occurred only when one of the species was* M. pneumoniae *and/or* M. fermentans. *In a study on European CFS patients a slightly different picture was found. Examining 261 consecutive patients seen at a CFS clinic in Belgium, 68.6% of patients were found to have one or more species of Mycoplasma in their blood. In contrast to North American patients, however, the most common species found was* M. hominis. *This could indicate differences in demography and exposures between North American and Belgian CFS patients. We also found that more than 50% of North American patients with rheumatoid arthritis had Mycoplasmal infections, and in the majority of these patients multiple infections with more than one species was found (18). Mycoplasmas are found commonly in the oral cavity, urogenital tract and as symbiotic gut flora, but some species can cause acute and chronic illnesses when they penetrate into the blood vascular system and systemically colonize organs and tissues. For example,* M. penetrans, M. fermentans, M. hominis *and* M. pirum *can enter a variety of tissues and cells and cause systemic signs and symptoms. Mycoplasmas have also been shown to have a complex relationship with the immune system. They are very effective at evading host immune responses, and synergism with other infectious agents has been seen.*

Mycoplasmata and FMS

According to Nicolson et al (1998), mycoplasmal infection has been observed in approximately 70% of FMS, 60% of CFS and 50% of Gulf War syndrome and rheumatoid arthritis patients. Many of these patients were found to have principally one infectious species of mycoplasma, *M. fermentans*. (See also the notes on thyroid dysfunction, later in this chapter, linking mycoplasmal infection with hypothyroidism; Sack et al 1989.)

According to Nicolson & Nicolson (1995), the majority of patients with confirmed pathogenic mycoplasmal infections eventually recover 50–100% of their premorbid health on therapies that are directed specifically against their chronic infections, rather than against possible psychological problems. The recommended treatment (Nicolson & Nicolson 1995) for confirmed mycoplasmal blood infections is long-term antibiotic therapy, usually involving multiple 6-week cycles of doxycycline (200–300 mg/day), together with a number of other antibiotics. They justify this protocol as follows:

Multiple [antibiotic] cycles are required, because few patients recover after only a few cycles, possibly because of the intracellular locations of the infections, the slow-growing nature of these microorganisms and their inherent insensitivity to antibiotics. We now recommend that patients who have been diagnosed with blood infections receive continuous oral antibiotics for at least 6 months before using the 6-week cycles of treatment. . . . Although patients starting such therapy usually have Herxheimer [die-off] reactions and feel initially worse due to die-off or release of toxic materials from damaged microorganisms, they eventually stabilize within days to a few weeks and then slowly begin to recover. Unfortunately, the treatment requires long-term therapy, and recovery is usually very slow. Patients that have been sick for many years are unlikely to recover within a year of therapy.

Comment

Doxycycline is one of the tetracyclines, with untoward reactions generally typical of that class of antibiotics, with an increasing degree of resistance being manifested by organisms sensitive to it (O'Grady et al 1997).

In addition to the antibiotic attack, Nicolson (1998) also recommends nutritional support for the immune system when treating mycoplasmal infection:

In addition to antibiotics, patients with CFS, FMS or GWI [Gulf War Illness] have nutritional and vitamin deficiencies that must be

corrected. For example, these patients are often depleted in vitamins B, C and E and certain minerals. Unfortunately, patients with these chronic illnesses often have poor absorption. Therefore, high doses of some vitamins must be used, and others, such as vitamin B complex, cannot be easily absorbed by the gut, so sublingual natural B-complex vitamins in small capsules or liquids should be used instead of oral capsules that are swallowed. General vitamins plus extra C, E, CoQ-10, beta carotene, folic acid, bioflavoids and biotin are best. L-cysteine, L-tyrosine, L-carnitine and malic acid such as zinc, magnesium, chromium and selenium. Some recommend doses as high as 300 mg/day sodium selenite for a few days, followed by lower maintenance doses.

Antibiotic use that depletes normal gut bacteria can result in over-growth of less desirable bacteria. To supplement bacteria in the gastrointestinal system yogurt and especially Lactobacillus acidophilus *tablets are recommended. One product is a mixture of* Lactobacillus acidophilus, Lactobacillus bifidus *and FOS (fructooligosaccharides) to promote growth of these 'friendly' bacteria in the gut. In addition, a number of natural remedies that boost the immune system, such as ginseng root, herbal teas, whole lemon/olive extract drink or an extract of olive leaves with antioxidants are available and are potentially useful, especially during or after antibiotic therapy has been completed. Although these products appear to help some patients, their clinical effectiveness in GWI/CFS/FMS patients has not been evaluated. They appear to be useful during therapy to boost the immune system, or after antibiotic therapy in a maintenance program to prevent relapse of illness.*

Comment

Many of these nutrients are discussed in relation to FMS and associated conditions in later chapters, particularly Chapter 15.

Additional support for the mycoplasma hypothesis

A further study by Nicolson et al (2003) reported a 52% prevalence of mycoplasmal infection among 200 patients with CFS; simultaneously, 7.5% of the same patients were found to show evidence of infection with *Chlamydia pneumoniae* and 30.5% infection with human herpesvirus 6 (HHV-6). Prevalence of infection among 100 control patients in this study was low: 6% were infected with *Mycoplasma*, 1% with *Chlamydia* and 9% were infected with HHV. The study reports that patients with coinfections tended to suffer from more severe signs and symptoms.

In a review, Endresen (2003) pointed out that the incidence of mycoplasma infection among patients with CFS was around 50%, and was much higher than the rate in healthy controls which was around 10%. Many of the patients with CFS appeared to improve after antibiotic treatment aimed against mycoplasma.

Noting that Nicolson reported chronic active infection by plausible organisms (mycoplasmids and others) in approximately half of the thousands of Gulf War syndrome patients he has surveyed, Garrison & Breeding (2003) state: 'Because of reliance on DNA probes, and other hyper-specific technologies, his methodology eliminates the false positives of other methods, but will *underestimate* the true numbers of patients with chronic infection.' [italics added] (See also the section in Chapter 4 on Garrison & Breeding's chronic metabolic debilitation syndrome that attempts to merge infectious and endocrine (particularly thyroid) aetiologies into a coherent model that explains many of the associated symptoms.)

The contrary view on mycoplasmata

In contrast to the view promoted by Nicolson (with some support from others), Urnovitz (2002) who has conducted his own research into Gulf War syndrome (GWS) and mycoplasma (Urnovitz et al 1999), is scathing about the idea that systemic mycoplasmal infection is widespread:

> *My position on the role of mycoplasma in CFS and GWS was stated* under oath *to the US Congress in January 2002: '... The mycoplasma causal theory for GWS was based on poorly conducted research and the claims had never been validated. Finally, an excellent* controlled scientific experiment *has put this matter to rest' (Lo et al 2000). In other words, I believe the controlled study, using conventional clinical laboratory methods, has done an excellent job in*

suggesting that mycoplasma plays little or no role in GWS. So, why does one study using a well-established clinical laboratory method claim no role for this organism, while another research team claims GWS and CFS patients have 'systemic infections'?

Urnovitz's main criticism of papers which support the mycoplasma aetiology for FMS etc. relates to the evidence apparently gained from polymerase chain reaction (PCR) tests (Urnovitz 2002):

So what is the problem with the mycoplasma papers? The abstracts of these studies seem to always claim that the patients are suffering from 'systemic infections'. If there were a truly systemic infection, where are the data showing the results of mycoplasma cultures? Correlating PCR tests with microbial culture data is standard clinical laboratory practice. . . . The authors correctly used the PCR technique as a pre-screen for culture (Waring et al 2001). All that is published in the mycoplasma PCR papers [that promote the mycoplasma aetiology theory] are tables and charts claiming to show what percentage of patients is 'positive', but never any correlative culture data. We cannot find any proper validation study comparing PCR and mycoplasma culture data for any of the mycoplasma species that some researchers claim are causing systemic infections in CFS and GWS patients. The only proper conclusion that can be drawn from these GWS/CFS studies is: a large percentage (not even close to 100%) of CFS and GWS patients have genetically reactive samples, i.e., inconclusive laboratory results.

Urnovitz (2002) is also concerned at the damage which could be caused by the treatment protocol advised for attacking mycoplasma infection. He expresses the problem cogently:

The argument is that, since the antibiotics can kill bugs like mycoplasma, it must be the fact that mycoplasma is being killed by the antibiotics that's making the patients feel better. Not only is this a circular argument, we're learning that the conventional wisdom that antibiotics work solely on microbes is inaccurate. The reasoning behind requiring manufacturers to describe an antibiotic's adverse side effects in package inserts is that these chemotherapeutic agents work on human genetic and protein material as well as microbial material. The number and severity of these adverse side effects is why regulatory agencies demand rigorous clinical trials on chemotherapeutic agents before they are allowed on the market. One cannot conclude that patients feel better on an antibiotic because it is killing mycoplasma without a shred of clinical microbiological evidence. Our concern is that this unethical, off-label prescribing of antibiotic combinations will have significant adverse side effects on the patients taking them, as we have seen in the failure of anti-retrovirals prescribed to 'treat' HIV.

Additional studies that fail to support the mycoplasma hypothesis include that of Vernon et al (2003), who found no evidence of infection with mycoplasma species among 34 patients with CFS, and that of Donta et al (2004) whose rigorous, placebo-controlled double-blind study focused on 491 patients with detectable blood mycoplasma DNA, suffering from Gulf War syndrome, a condition with many characteristics of FMS and CFS, including pain. These patients received doxycycline, 200 mg per day, or placebo for 12 months. No statistically significant difference was found between the doxycycline and placebo groups, while side-effects such as nausea and photosensitivity were more common among patients receiving doxycycline.

The negative results obtained by Donta et al (2004) contrast with the positive results reported by Nicolson (1998), where antibiotic use was far more extensive and prolonged, supported by a comprehensive nutritional support protocol (see above).

Viral infection

The possibility of viral infection being associated with the onset of FMS has been noted in several of the major associated conditions discussed in this and previous chapters: as a trigger impacting someone genetically predisposed to FMS, as a factor in promoting neurohumoral dysfunction, as a feature creating excessive immune response demands, as a precursor to widespread allergy and central neurological dysfunction, etc.

Comment

The analogy of flies swarming round a pile of garbage comes to mind when considering that unhealthy, possibly toxic and/or nutritionally deficient, immune compromised tissues might provide a fine environment for opportunistic organisms (viruses, fungi, mycoplasmata, etc.). Can infectious agents cause conditions such as FMS? Or is it not more likely that the situation which allows the active presence of these organisms is associated with many of the underlying aetiological features of conditions such as FMS and CFS, and that the organisms, while certainly adding to the adaptive burden, may not, in themselves, be causal? (See Box 3.1 on synchronistic pathophysiology.)

Even Nicolson & Nicolson (1995), who enthusiastically recommend antibiotic therapy in treating mycoplasmal infections, acknowledge that these organisms are unlikely, in themselves, to offer an explanation for FMS:

> *Do chronic infections explain illnesses like FMS? It is unlikely that there is only one, or even a few explanations for complex chronic illnesses like FMS or CFS. Rather, these illnesses are probably due to a combination of multiple toxic exposures, chemical and biological, in combination with genetic susceptibility (immune systems and/or detoxification systems, cellular metabolism) that determines whether a person becomes chronically ill. These considerations probably also play an important role in determining who will recover to various extents on different types of therapy.*

In a preliminary study, Tennant & Herman (2004) noted that seven patients with FMS, who had experienced numerous symptomatic treatments and were maintained with opioids at 400–1000 mg/dl of morphine equivalence were studied. They report that:

> *Pain control was judged to be poor to fair. Subjects demonstrated positive serum titers at least two times normal to two or more of the following viral agents: (1) cytomegalus; (2) rubella; (3) varicella; (4) herpes simplex; (5) Epstein Barr. Titers indicated either previous or possibly current infection. Patients were treated with either acyclovir, 400 to 1000 mg/d, or valacyclovir, 500 to 1000 mg/d. After one month patients were evaluated for pain reduction, endurance, well-being, and side-effects. If improved pain control was reported, viral suppression was indefinitely continued. All patients reported improvement in pain control, endurance, energy, and well-being. Two patients reported decrease in cervical lymph node size. Discontinuation of viral suppression for one week, in three patients, resulted in a resurgence of pain and other symptoms.*
>
> *This preliminary study suggests that fibromyalgia patients with severe persistent pain and positive viral titers may experience enhanced pain control with viral suppression therapy. It also suggests that there is some unclear neuro-mechanism by which a previous or current viral infection may produce pain.*

Some of the major influences of viral infection suggested by various researchers to be linked to CFS/FMS are summarized below:

- HHV-6, a lymphotrophic herpesvirus, has been found to be more prevalent in FMS/CFS patients than in controls, with elevated antibody titres being observed (Buchwald et al 1992).
- British research implicates enteroviruses which have been found to be more prevalent in stools as well as muscle biopsies, with blood antigens also higher (Behan 1993, Gow 1991).
- An association has been recognized between hepatitis C infection (particularly in women) and fibromyalgia (Buskila et al 1997b).
- A study conducted in Spain, however, found no increase in the prevalence of hepatitis C among patients diagnosed with fibromyalgia as compared with healthy controls (Narvaez et al 2005).
- Fibromyalgia symptoms have also been increasingly described in patients with hepatitis B infection (Adak et al 2005).
- Buskila et al (1990) and Simms et al (1992) have both reported on the presence of FMS symptoms in patients infected by HIV.
- Chronic coxsackie B virus infection has been shown to mimic FMS symptoms (Nash 1989). See also the notes on post polio syndrome, below.
- Parvovirus has likewise been associated with FMS (Leventhal 1991).

'Post polio syndrome'

Another infectious hypothesis exists, involving what has been called 'post polio syndrome' (PPS). Bruno (2001) asserts that something 'unexpected, frightening and totally unrecognized happened after the polio vaccine was distributed: the number of cases of CFS/ME went through the roof'.

Bruno reports that British infectious disease specialist Elizabeth Dowsett plotted the cases of CFS/ME she and CFS/ME pioneer Melvin Ramsay had seen in their practice since 1919 against reported cases of polio in England. When the Salk and then Sabin vaccines virtually eliminated British polio cases in the early 1960s, the number of CFS/ME patients increased dramatically. Throughout the world, 32 CFS/ME outbreaks were recorded after the polio vaccine was distributed. So something other than the poliovirus was causing CFS/ME.

The suggestion is that the vaccine that eliminated polio had an unintended consequence. The elimination of the poliovirus left a vacuum that was filled by enteroviruses that inhabited the gut and were able to multiply, spill into the bloodstream and enter the spinal cord and brain.

In 1990 Dr Dowsett looked for antibodies to non-polio enterovirus in her CFS/ME patients. Fifty percent had antibodies to the first non-polio enterovirus ever discovered – the coxsackie B virus. Apparently, neuron damage, weakness, paralysis and symptoms of brain fatigue caused by non-polio enteroviruses can be so similar as to be indistinguishable from the actions of polioviruses. One coxsackie virus, named A7, produces paralytic symptoms so similar to polio that it has been named poliovirus type IV (see Nash's (1989) linking of this virus with FMS, cited above).

The hypothesis is that the 'disguised form' that polio may now be taking is not a disguise at all, but replacement by another enterovirus. This suggests that the oral polio vaccine is 'causing' chronic fatigue syndrome by making way for other enteroviruses to grow in the intestines and be able to do damage such as that caused by the poliovirus, except that with CFS/ME the damage is most frequently found in brain-activating system neurons leading to fatigue, not in the spinal cord causing paralysis.

An overview

A review in 2006 by Ablin et al that evaluated an infectious aetiology for FMS concluded that '[an infectious] causation remains tentative and that evidence of the utility of antibiotic or anti-viral treatment in fibromyalgia or CFS is lacking' as a result of contradictory research studies.

Comment

Anecdotal connections between infection and FMS are common. Studies are contradictory. Antiviral and antibiotic medication alone does not seem to offer predictable benefits. There is more to learn about the possible aetiological role of infectious agents in the evolution of FMS and CFS. (See notes on a possible vaccination connection with FMS, later in this chapter.)

Irritable bowel syndrome (including fungal infection)

The most frequent gastrointestinal problem for which specialist advice is sought is irritable bowel syndrome (IBS). The major symptoms include abdominal discomfort or pain, intermittent diarrhoea or constipation, bloating and distension. It is thought that an initial distinction can be made between IBS and organic bowel disease by virtue of the presence (in IBS) of the associated symptoms of urinary frequency, premature satiety, backache and fatigue (Maxton et al 1991). As in FMS and CFS, the patient with IBS is far more likely to be a young adult female, displaying no clear laboratory evidence for the problem, and with no obvious pathology (Yunus 1989).

There are various schools of thought as to the cause(s) of IBS:

- stress-related influences including anxiety/hyperventilation (Nyhlin 1993)
- allergy, sensitivity influences (particularly wheat, corn, dairy products, coffee, tea, citrus fruits), possibly effected by enzyme or HCl imbalances (Jones et al 1982)
- infection and possible overgrowth, by fungi and/or bacteria, or parasitic infection (particularly *Giardia*, threadworms, *Ascaris* and *Amoeba*). Yeast overgrowth in particular has been blamed for damaging gut mucosa and precipitating malabsorption, and consequent allergic responses, including IBS symptoms (Alexander 1967, Holti 1966, Phaosawasdi 1986). British physicians Stephen Davies and Alan Stewart

state: 'Apart from the simple matter of overgrowth with candida, some people are hypersensitive to it. . . . the main places candida takes hold are the GI tract, the mouth and the vagina. It has been reported that some people with the symptoms of IBS are allergic to the yeast' (Alexander 1975, Davies & Stewart 1988)

- use of antibiotics (Henry 1995).

Antibiotics usage can trigger a sequence which results in yeast overgrowth followed by bowel irritability. Dr John Henry (1995), chief medical editor for the British Medical Association's book *A New Guide to Medicines and Drugs*, who is not antagonistic to the use of antibiotics, says:

> *A risk of antibiotic treatment, especially if it is prolonged, is that the balance of micro-organisms normally inhabiting the body may be disturbed. In particular antibiotics may destroy bacteria that limit the growth of Candida, a yeast often present in the body in small amounts. This can lead to overgrowth of Candida in the mouth, vagina, or bowel.*

Dr Joseph Pizzorno, of Bastyr University, Seattle, indicates the implications of this as follows (Pizzorno 1996):

> *In a study of 55 injured patients admitted to the trauma service of a hospital, all were given broad spectrum antibiotic therapy during some point of their stay. 67% developed elevated candida antigen levels in their blood during their hospital stay, indicating that candida were overgrowing in their intestines (and/or the vagina in women). The researchers also found that the white blood cells of patients with candida antigens were not able to inhibit candida albicans growth as effectively as white blood cells from patients who did not have candidal antigens in their blood. In other words, when patients receive antibiotics, the level of candida in their intestines increases so much, and the intestines become so damaged, that fragments of the candida leak into their bloodstream and inhibit the function of their immune system.*

A meta-analysis, published in the British Medical Journal (D'Souza et al 2002), has shown a clear linkage between antibiotic use and the onset of acute diarrhoea (which as noted above is often a precursor of IBS), and importantly highlights the value of probiotics in prevention of this when antibiotics have to be used. (Strategies for treatment are to be found in Ch. 14.)

- When local gut irritation (caused by hypersensitivity of gastrointestinal mechano- and chemoreceptors caused by initial trauma) prevails, it is thought that visceral hyperalgesia may occur, leading to central sensitization (visceral afferents influence dorsal horn neurons which subsequently affect the hypothalamus) (Mayer 1993).
- This (visceral hyperalgesia) model is what Goldstein (1996) calls a 'bottom-up' version of what he sees as a 'top-down' process in his neurosomatic model of FMS aetiology (see Ch. 4): 'Thalamic and dorsal horn dysregulation in IBS would stem from prefrontal cortical dysfunction in this paradigm. There is no . . . reason to complicate matters by invoking some peripheral lesion, although some may occur, just as primary immune dysfunction may occasionally cause CFS, and post-traumatic myofascial pain syndrome may produce fibromyalgia.'

In considering the merits of the sensitization model, in which visceral irritants are seen to create central dysfunctional behaviour (termed in this hypothesis 'visceral hyperalgesia'), it may be useful to recall the research of Korr (described in Ch. 1) relating to facilitation. The process of localized or segmental facilitation, as it occurs in the neural structures operating in the musculoskeletal system in response to repetitive stress, seems to have strong echoes as to what is hypothesized to be happening in the brain in response to visceral dysfunction.

Price et al (2006) have come to a similar conclusion. They suggest that a combination of research studies of human IBS patients, as well as animal studies, strongly point to a mechanism wherein both primary visceral hyperalgesia and secondary widespread cutaneous hyperalgesia are dynamically maintained by tonic impulse input from the non-inflamed colon and/or rectum. They suggest that secondary hyperalgesia is likely to be at least partly related to sensitization of spinal cord dorsal horn neurons, and in this respect might be similar to other persistent pain conditions such as fibromyalgia.

Questions to ask in irritable bowel syndrome

In order to make sense of a patient's irritable bowel condition, the following differentiations need to be

made by means of questioning, examination, testing and, if necessary, hospital investigation:

- Is the problem related to gynaecological, urinary, liver or biliary, musculoskeletal or purely gastrointestinal factors?
- Is it modified by menstruation, defecation, urination, certain foods (fatty etc.), work or rest?
- Do emotions relating to work, family, relationships or other factors influence the problem?
- Is there evidence of infection (particularly bacterial or yeast overgrowth), inflammation, trauma, neoplasm, metabolic disturbance or degenerative disease?
- Is there a link between IBS and use of steroid medication or antibiotics?
- What is the status of the gut flora and what can be done to enhance normal gut ecology?

Treatment should depend upon the answers to these questions.

How common is IBS in association with FMS?

- Between 20 and 32% of patients with irritable bowel syndrome have been found to suffer from fibromyalgia and 4.2–11% from chronic widespread pain (Barton et al 1999, Sperber et al 1999, Lubrano et al 2001, Whitehead et al 2002).
- Using insurance data (US provider), a large cohort of 97 593 people with IBS, and a comparison cohort of 27 402 people receiving routine medical services, were evaluated for coexisting conditions. People in the IBS cohort had a 40–80% higher prevalence odds of migraine, fibromyalgia and depression in comparison to people without IBS (Cole et al 2006).
- In Chapter 2 it was noted that Clauw (1995) found 60% of his surveyed FMS patients to have IBS symptoms.
- The Forrest Hospital survey found over 50% with IBS (Fibromyalgia Network Newsletter 1999).
- Jessop observed that, of her in excess of 1000 patients with CFS and FMS, fully 82% had yeast cultured, and 30% had parasites, in their purged stool samples (Fibromyalgia Network Newsletters 1990–94).
- Prior to the onset of their CFS/FMS, Jessop's patients were recorded as having had a high proportion of IBS (89%), with 80% reporting a history of 'constant gas' or bloating, and 58% chronic constipation.

Figure 3.7 outlines schematic representations of possible connections between bowel dysfunction in general and IBS in particular. Goldstein's neurosomatic model is outlined in Chapter 4.

Comment

Sensitization mechanisms appear to offer an explanation of the known high incidence of IBS in individuals with a diagnosis of FMS. A number of practical guidelines for the treatment of IBS are to be found in Chapter 14.

Leptin, obesity, toxic adipose residues and inflammation ('metabolic syndrome')

Leptin

Once thought to be an inert tissue, mainly devoted to energy storage, white adipose tissue (WAT) is now known to be an active participant in regulating physiological and pathological processes, including immunity and inflammation (Juge-Aubry et al 2005). WAT/leptin also plays a primary role in the development of a number of hormonal imbalances, including leptin resistance, adrenaline resistance and insulin resistance.

Central obesity has been shown to be associated with various morbidities that have collectively emerged as 'syndrome X', a metabolic syndrome characterized by a group of metabolic risk factors including abdominal obesity, dyslipidaemia, prothrombotic state, hypertension, insulin resistance and a pro-inflammatory state (Juge-Aubry et al 2005). The main features include increased visceral adipose tissue mass, displayed as an inflated waistline, apple-shaped figure (android body type) and increased systemic inflammation (Berg & Scherer 2005).

Empirical data, particularly in relation to the study of leptin (Fantuzzi 2005, Yamauchi et al 2001), have identified some of the myriad regulatory functions of adipose hormones, including

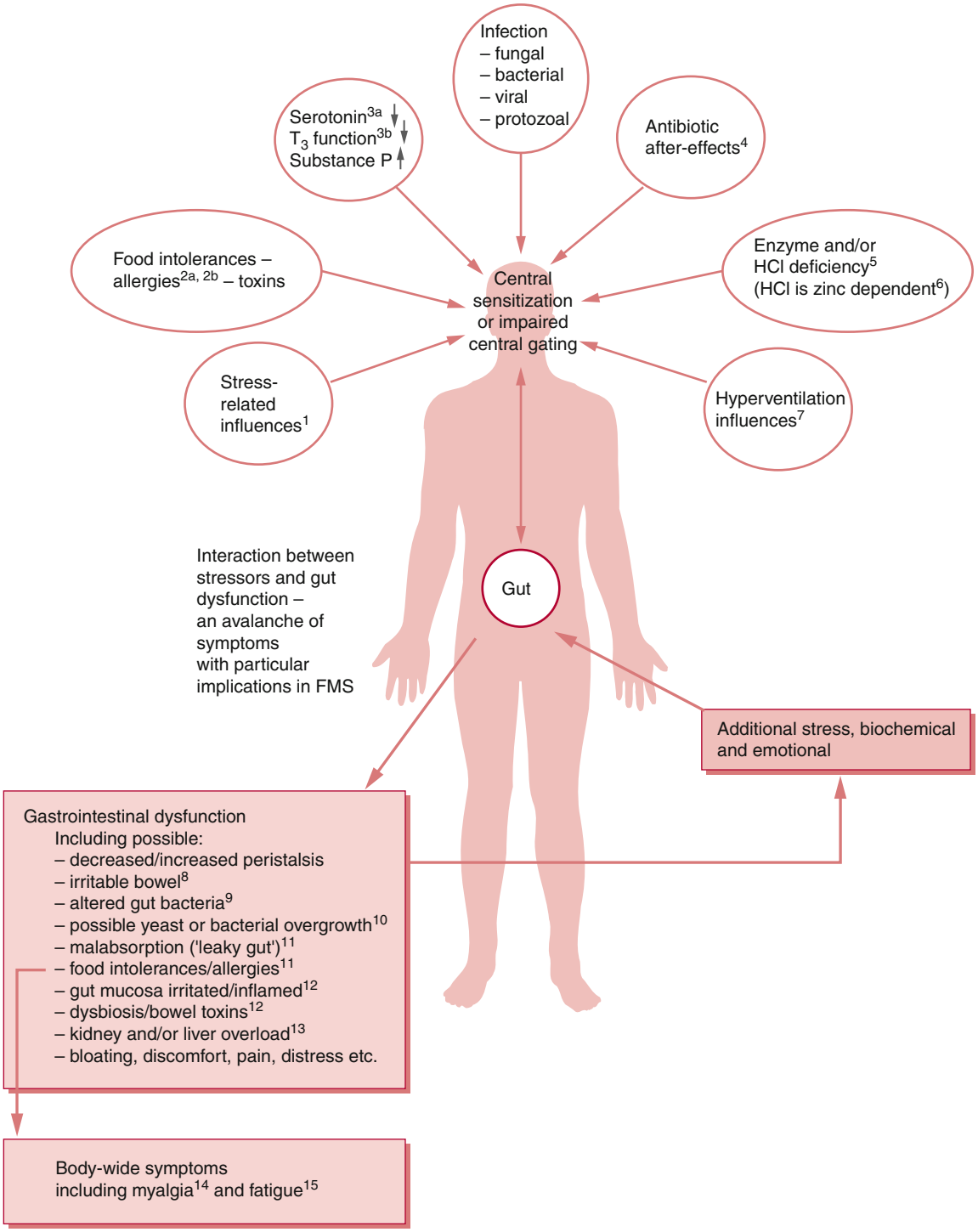

Figure 3.7 • Stressors and gut dysfunction ([1]Langeluddecke 1990, [2a]Dicky 1976, [2b]Russell 1965, [3a]Haseqawa 1988, [3b]Lowe 1997, [4]Ball 1997, [5]Barrie 1995, [6]Cho 1991, [7]Timmons 1994, [8]Sivri 1996, [9]Ninkaya 1986, [10]Simon 1981, [11]Warshaw 1974, [12]Chadwick 1992, [13]Liehr 1979, [14]Tuncer 1997, [15]Rae 1992).

roles in cravings, cognitive function, energy level and inflammation, as well as changes in adipose hormone levels associated with drug use (Cecchini & LoPresti 2007).

Under certain conditions, leptin upregulates cell-mediated immune responses often associated with fatigue, and body pain (Hassan et al 1998). Conditions that may emerge from this aetiology include myofascial pain symptoms.

Shapiro et al (2005) have demonstrated that weight loss significantly, statistically and clinically predicts a reduction in symptoms of FMS, including pain.

Metabolic syndrome

Metabolic syndrome refers to individuals identified by metabolic, anthropometric, neuroendocrine and clinical measures. The clinical definition of metabolic syndrome requires meeting three or more of the following criteria:

- abdominal obesity (waist circumference >88 cm in women)
- high triglyceride level (≥150 mg/dl)
- low high density lipoprotein (HDL) cholesterol level (<50 mg/dl in women)
- high blood pressure (≥130/85 mmHg)
- high fasting plasma glucose level (≥110 mg/dl) (Executive Summary 2001).

Loevinger et al (2007) compared 109 women identified as having metabolic syndrome with 47 control/healthy women. They found that: 'Women with chronic pain from fibromyalgia are at an increased risk for metabolic syndrome, which may be associated with relatively elevated norepinephrine levels, in conjunction with relatively reduced epinephrine and cortisol secretion.'

Toxic residues in adipose tissue

Industrial, agricultural and pharmaceutical chemicals with lipophilic characteristics are detectable in the adipose tissues of most individuals. Substantial data exist demonstrating that, in addition to pollutants, drugs and their metabolites reside in tissues high in fat content, including brain and adipose (Barquet et al 1981). The possibility exists that toxic adipose accumulations may be associated with patterns of ill-health similar to those resulting from exposure to xenobiotic chemicals.

Sauna as part of a detoxification approach?

Crinnion (2007) notes that saunas can be used very effectively 'as a means to enhance the mobilization of fat-soluble [heavy metals and chemical] xenobiotics'.

Protocols for elimination of toxic residues commonly include exercise, sauna bathing, and vitamin and mineral supplementation (Cecchini & LoPresti 2007). One such programme is outlined as involving the following elements (Ben 1984):

- polyunsaturated oil supplements
- aerobic exercise
- sauna at 140–180°F to induce sweating
- nutritional supplements centred around gradually increasing doses of niacin
- calcium and magnesium supplements
- water and salts taken as needed to avert dehydration or salt depletion due to concentrated sweating
- an orderly daily schedule with balanced meals and adequate sleep.

Comment

Modern human adipose tissue inevitably contains toxic residues. If (or once) released into the tissues or bloodstream, these drugs, metals and chemicals are capable of provoking a variety of symptoms. Sauna and nutritional/exercise/lifestyle strategies exist to assist in their elimination.

White adipose tissue (WAT) is itself the source of a range of hormones, including leptin, that have profound influences on metabolic processes, including inflammation. The more obese the individual, the more likely it is that leptin imbalance will develop, with potentially disastrous consequences.

Weight loss in the obese patient with FMS leads to significant improvement in symptoms and well-being.

Menstrual cycle and FMS

As noted earlier in the section covering hyperventilation, relative to men, women have a higher rate of respiration. This is exaggerated during the luteal phase of the menstrual cycle due to increased levels

of progesterone, which encourages hyperventilation and hypocapnia (Slatkovska et al 2006).

During the postovulation/premenstrual phase of the cycle, CO_2 levels drop on average 25%. Additional stress can subsequently 'increase ventilation at a time when carbon dioxide levels are already low', leading directly to respiratory alkalosis (Damas-Mora et al 1980).

FMS often follows a fluctuant course, affected by the menstrual cycle, during which pain sensitivity varies, even in healthy women. In a 2007 study it was noted by Dunnett et al that several participants 'changed' FMS diagnosis during the course of a menstrual cycle, fulfilling the diagnostic criteria during the menstrual or luteal phase, but never during the follicular phase.

Page et al (2006) compared pain perception, levels of sex hormones and *diffuse noxious* [*pain*] *inhibitory control* (DNIC) in 45 women with FMS and 20 normal healthy women. They concluded that there were no significant correlations between sex-hormone levels, pain perception and DNIC, probably reflecting the complexity of the mechanisms implicated in the pathophysiology of FMS. However, they did note significant differences during the phases of the menstrual cycle in regard to DNIC, where greater DNIC activation was found in luteal ($P<0.05$) and ovulation phases ($P<0.05$) in FMS patients. The results suggest that: 'Endogenous pain control mechanisms are deficient among fibromyalgic patients and modulated by menstrual cycle.'

Comment

With influences on pain perception, management of pain and respiratory rate (with implications explained earlier in this chapter under the heading of hyperventilation), it can be seen that the changes occurring during the menstrual cycle may have profound influences on the FMS patient.

Silicone implant toxicity

The influence of toxicity on FMS/CFS is discussed in various sections of this chapter, see:

- Allergy/chemical sensitivity and dysregulation of brain function
- Fatigue
- Leptin, obesity, toxic adipose residues and inflammation
- Vaccination (and Gulf War syndrome).

The profound influence of multiple toxic substances in the aetiology of Gulf War syndrome (GWS) is an example of the widespread effects on bodily function of such poisons. The possible association between multiple vaccinations and the development of chronic fatigue/GWS is discussed below under the heading 'Vaccination'.

Silicone implants and FMS

An area of particular concern to some women with CFS and FMS has been the fear that they have been exposed to systemic toxicity via silicone implants. This has now been investigated, with sometimes conflicting results emerging.

Brown et al (2001) assessed whether breast implant rupture or extracapsular silicone is associated with selected symptoms of self-reported physician-diagnosed connective tissue disease (CTD). Women with silicone gel breast implants responded to a questionnaire that included questions on health status, satisfaction with implants, symptoms of CTD and physician-diagnosed disease. These women then had magnetic resonance imaging (MRI) of their breasts to determine the status of the implants with respect to rupture and extracapsular silicone. It was found that women with breast implant rupture, as diagnosed by MRI, were no more likely to report a diagnosis of CTD than those with intact implants, or those with implants of indeterminate status. *However*, women with silicone gel outside of the fibrous scar that forms around breast implants were more likely to report (to a statistically significant degree) having fibromyalgia than other women in the study. The researchers concluded that: 'These data suggest an association between extracapsular silicone from ruptured silicone breast implants and FM. If this association persists in other studies, women with silicone gel breast implants should be informed of the potential risk of developing fibromyalgia if their breast implants rupture and the silicone gel escapes the fibrous scar capsule.'

In contrast, Nyrén et al (1998) conducted a retrospective cohort study of all women in the Swedish national inpatient registry who had undergone breast augmentation surgery with artificial implants during 1964–93, compared with women who

underwent breast reduction surgery during the same period. In all, 7442 women with implants for cosmetic reasons or for reconstruction after breast cancer surgery and 3353 women with breast reduction surgery were examined to evaluate the relationship between CTD and related conditions and breast implants. The researches found that 29 women with implants had been hospitalized for definite CTD compared with 25.5 expected based on general population rates. There were no diagnoses of systemic sclerosis, and no significant excess in risk for polymyalgia rheumatica, fibromyalgia and several related disorders. Among women who underwent breast reduction surgery, 14 had been hospitalized for definite CTD compared with 10.5 expected. This large nationwide cohort study shows no evidence of association between breast implants and CTD.

The connection between FMS and implants therefore remains controversial and unproven, with conflicting results emerging from different studies. On balance, the more recent study quoted (Brown et al 2001) might be seen as more relevant because of its detailed MRI evaluations of silicone leakage, which the researchers then compared with reported symptoms.

Additional toxicity influences on FMS may include substances to which the individual is sensitive/allergic (see notes earlier in this chapter) or which are 'excitotoxins' (such as MSG and aspartame).

Comment

There appears to be a link between toxicity and chronic pain and fatigue in some individuals, although the link with silicone remains unclear. Notes on detoxification are to be found in the section on leptin and adipose toxicity (above), as well as in Chapter 14.

Sleep disorders

(See also notes on Sleep, pain and cytokines, under the heading 'Cytokines and pain', earlier in this chapter.)

Non-restorative sleep is a common – perhaps *the* most common – associated symptom noted in FMS apart from pain and fatigue. In terms of treatment it has already been noted that antidepressant medication is among the most widely used medical approach to FMS, largely in order to enhance sleep patterns (as opposed to treating actual depression – see notes in Ch. 2 relating to Jessop's findings regarding depression and FMS).

The value of antidepressant medication for sleep enhancement was demonstrated by the results of a meta-analysis of 13 randomized, placebo-controlled trials where it was shown that there was moderate benefit in terms of enhanced sleep (O'Malley et al 2000).

In another meta-analysis involving 16 controlled trials, in which tricyclic drugs were employed in the treatment of FMS, it was found that the largest improvement was associated with measures of sleep quality, while the most modest improvement was found in measures of stiffness and tenderness (Arnold et al 2000).

Is antidepressant medication used in this way actually treating depression?

This is not the objective in most instances, according to the majority of physicians prescribing antidepressants for FMS. One study that makes this clear was conducted by Hannonen et al in Finland (1998). The objective was to study the usefulness of moclobemide and amitriptyline in the treatment of fibromyalgia (FM) in females free from clinically meaningful psychiatric problems. Four different centres were involved in a 12-week study in which 130 female FMS patients who were not suffering from psychiatric disorders were randomized to receive antidepressant medication or placebo. It was found that approximately 50% of those on the tricyclic antidepressant amitriptyline (25–37.5 mg) improved in terms of sleep quality and quantity, as well as in general health, pain and fatigue. Those patients receiving the monoamine-oxidase inhibitor moclobemide (450–600 mg) showed improvement in pain level but not in terms of sleep.

Comment

There are side-effects from use of all antidepressants; however, on balance, it seems that low dosage amitriptyline offers benefit to a significant number of FMS patients in terms of better sleep patterns. There are undoubtedly other ways of achieving this end, as will be outlined in Chapters 14 and 15.

Is sleep poor in FMS because of the pain?

Do people in pain sleep poorly or does sleeping poorly produce pain?

A Swiss study (Schneider-Helmert et al 2001) evaluated this question by measuring various parameters ('polysomnographic investigation') in people with non-organic pain complaining of insomnia, and insomniacs with no pain. The conclusion was that: 'Insomnia in chronic pain is of the same type and degree as primary insomnia ... suggesting that the interpretation of insomnia as [being] secondary to pain, as it is usually made by the patients themselves, is a misattribution. It is suggested that insomnia in chronic pain patients should be taken seriously and treated by specific methods.'

This study did not evaluate the contribution to pain made by missed alpha sleep, but simply noted that pain was not the cause of the lost sleep. Other research (see below) has defined how, over time, disturbed sleep creates an environment where pain is likely to emerge.

How does sleep impact on FMS?

Just how easily sleep disturbance can upset muscular status was demonstrated by Moldofsky in a study in which six volunteers had their stage 4 sleep disrupted for three nights in a row. They all developed fatigue, widespread aching muscles and specific tenderness on palpation of the appropriate sites used to diagnose fibromyalgia (Moldofsky 1993).

Is sleep disturbance in FMS a result of influences which derive from higher centres, or is it a primary cause of the dysfunctional patterns which accompany it? Franklin Lue (Lue 1994) has reviewed some of the important issues around the FMS/sleep disturbance issue, summarized below:

- In pain clinics, those patients reporting sleep disturbance (70%) complain of more pain, disability and emotional distress than the 30% who do not complain of sleep problems.
- In FMS, patients' sleep disturbance is associated with greater pain and general symptom severity (e.g. fatigue), as well as greater morning stiffness.
- The intrusion of alpha-wave sleep during non-rapid eye movement (NREM) phases of sleep has been identified by a number of researchers as an index of non-restorative sleep in FMS; however, this feature is not universally accepted, partly because of a lack of standardization in the measurement processes and their interpretation. Observation is also made of (some) people with alpha-wave disturbances in their sleep who are asymptomatic, and of people with severe FMS who have normal sleep patterns. The putative link between FMS and the alpha-wave intrusion phenomenon remains unproven at this stage, although there is little question that sleep disturbance is a major symptom of most people with FMS.
- Bennett (1992) demonstrated that in a significant number of patients with FMS, non-restorative sleep patterns were associated with reduced production of growth hormone.
- Two key proposals for explaining the observed link between sleep disturbance and increased muscular pain are:
  1. disruption of tissue repair and restoration resulting from growth hormone deficit (leading to poor protein synthesis and energy ATP decrease)
  2. disturbance of the immunomodulatory role of sleep (IL-1 levels decrease).
- Criticisms of these proposals have been noted, with the differences in sex hormones and the time of sleep both being seen to create sufficient variation to confuse any simplistic assessment of the influence of sleep on immune function in particular. 'Separating sleep and circadian changes is very difficult. Rhythmic variations – circannual, circadian and circahemidian – in immune functions have been reported in many studies' (Moldofsky 1993).
- The area of research into sleep patterns remains potentially useful, but difficult.

A study that has looked at this phenomenon provides a further insight. Spanish researchers evaluated two features – possible sleep apnoea syndrome and oxygen saturation of haemoglobin in arterial blood (Sa_{O_2}%) during sleep in normal controls and in patients with FMS. They found that 'patients with FMS showed small overnight falls in Sa_{O_2}% and spent more time during the night in Sa_{O_2}% below 92% than did the control group. These alterations are not as a whole due to sleep apnoea and could be important in FMS musculoskeletal pathophysiology' (Alvarez Lario et al 1996). The significance of the Sa_{O_2}% finding, in terms of generation of pain, may well be significant; Travell and

Simons have noted the relative importance in generation and maintenance of myofascial pain problems of tissue hypoxia (see Box 6.1).

A possibility exists that upper-chest breathing patterns persist throughout sleep and are directly responsible for the observed reduction in Sa_{O_2}% discussed above. Goldstein (1996) reviews some of the influences of sleep on the biochemistry of the body in general, and in relation to FMS/CFS in particular:

- Slow-wave sleep induces the replenishment of astrocytic glycogen which is depleted during wakefulness.
- Reduction in cerebral glucose causes increased synthesis of adenosine, stimulating adenosine receptors, producing increased sleep need (EEG evidence exists for this).
- The levels of adenosine (an inhibitory neurotransmitter) are inversely related to ATP. Therefore, lower levels of ATP (energy) increase adenosine, so promoting sleep onset as well as NREM sleep.
- Benington & Heller (1995) call sleep disturbance a 'defect of adenosine metabolism'.
- Adenosine is formed from *S*-adenosylmethionine, which, when supplemented in several double-blind studies, has been shown to offer effective treatment of FMS (improved activity, reduced pain, fatigue and morning stiffness, as well as elevated mood) (Jacobsen 1991).
- Excessive levels of neuromodulators such as substance P can overcome the adenosine influence, and since substance P is known to be present in higher than normal levels in patients with CFS/FMS, this might account for disturbed sleep patterns as well as associated symptoms such as bruxism, nightmares, restlessness and sweating.
- The underlying cause of this disturbance could relate to one of number of causes of a complex nature which Goldstein details (Goldstein 1996, pp 113–118).

Figures 3.8A and 3.8B provide a framework of information regarding restorative and non-restorative sleep influences. Whether sleep disturbance is part of the aetiology of FMS or is an associated symptom resulting from a common central cause is not clear. Sleep enhancement strategies can be seen to be helpful in either case and these are outlined in Chapter 15.

Comment

Enhancing sleep in patients with FMS or CFS should be a primary focus, as insomnia is one of the defining features of these conditions, with a variety of metabolic, psychological and physical repercussions.

Thyroid dysfunction

A hypothesis exists, supported by placebo-controlled, double-blind trials, that asserts that gene transcription inadequacy can result in an individual who is euthyroid, having symptoms of hypothyroidism and, as a result, FMS. This hypothesis involves a process of cellular resistance to thyroid hormone and claims that most of the symptoms of FMS can be accounted for via this explanation (see Ch. 4 for a summary and Ch. 10 for a detailed presentation of this hypothesis utilizing triiodothyronine (T_3) in its treatment).

Another reason for thyroid dysfunction may be that thyrotropin (thyroid-stimulating hormone) may bind inappropriately to organisms such as mycoplasma (see bacterial infection notes, earlier in this chapter, for more on mycoplasma and FMS) (Sack et al 1989).

The section in Chapter 4 describing Garrison & Breeding's chronic metabolic debilitation syndrome attempts to merge infectious (e.g. mycoplasma) and endocrine (particularly thyroid) influences into a coherent model that explains many of the associated symptoms of FMS.

Antisera prepared against *Mycoplasma gallisepticum* and *M. pneumoniae* may bind to human thyroid membranes, suggesting that receptors on human thyroid tissues and on mycoplasmal cells may have similarities in antigenicity. Radiolabelled human (hTSH) and bovine (bTSH) thyroid-stimulating hormone were shown to bind to five species of *Mycoplasma*. As will be noted later in this chapter, various mycoplasma strains have been implicated in relation to FMS, and this particular link with thyroid function may offer one of the mechanisms by means of which this occurs.

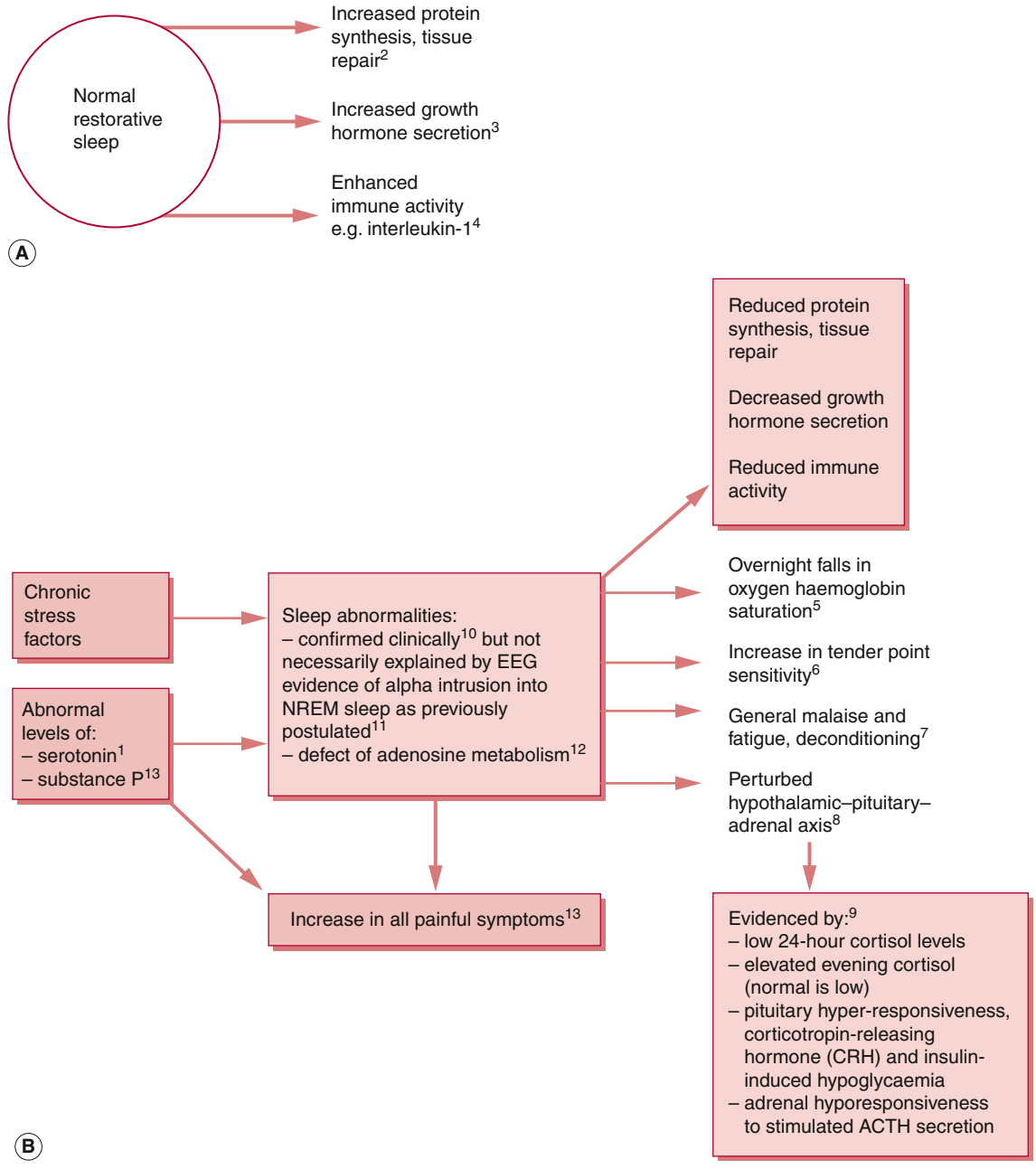

Figure 3.8 A,B • Restorative and non-restorative sleep influences ([1]Russell 1993, [2]Adams 1977, [3]Griep 1994, [4]Gudewill 1992, [5]Alvarez 1996, [6]Jacobsen 1989, [7]Hawley 1988, [8]Bennett 1997, [9]Crofford 1994, [10]Affleck 1996, [11]Shaver 1997, [12]Hrycaj 1993, [13]Benington & Heller 1995).

Pizzorno (1996) has outlined the importance of nutritional balance in re-establishing normal thyroid function. He states that, apart from the more obvious insistence on adequate iodine intake, the amino acid tyrosine as well as zinc, copper and selenium are essential in order to ensure that adequate thyroid hormone secretion is achieved and that T_4 is capable of being converted to T_3. (See Pizzorno (1996, pp 231–232) for more information regarding nutritional approaches.)

Comment

The link between thyroid imbalance and FMS and other associated conditions appears to have strong support from research for a subset of FMS patients. Possible links with chronic infection, and other influences, are developed and argued in later chapters.

Trauma (particularly whiplash) and post-traumatic stress effects

Trauma is seen to be one of the major triggers for the onset of FMS. A diagnosis of 'secondary FMS' or 'post-traumatic FMS' distinguishes such patients from those who develop FMS spontaneously, without an obvious triggering event.

An Ohio study evaluated the progress of 176 individuals who had been seen between 1980 and 1990 with a diagnosis of post-traumatic FMS. They were examined and completed a lengthy questionnaire about symptoms and treatment experiences. Over 60% of these patients had been involved in a vehicle accident shortly before onset of their condition; 12.5% had had a work-related accident, 7% started symptoms following surgery, and just over 5% had suffered sports injuries, with the remainder having experienced a variety of traumas not fitting these categories (Waylonis & Perkins 1994).

Whiplash as a trigger – the suboccipital model

A study involving over 100 patients with traumatic neck injury as well as approximately 60 patients with leg trauma evaluated the presence of severe pain (fibromyalgia syndrome) an average of 12 months post-trauma (Buskila et al 1997a). The findings were that 'almost all symptoms were significantly more prevalent or severe in the patients with neck injury ... The fibromyalgia prevalence rate in the neck injury group was 13 times greater than the leg fracture group.'

Pain threshold levels were significantly lower, tender point counts were higher and quality of life was worse in the neck injury patients as compared with leg injury subjects. Over 21% of the patients with neck injury (none of whom had chronic pain problems prior to the injury) developed fibromyalgia within 3.2 months of trauma as against only 1.7% of the leg fracture patients (not significantly different from the general population). The researchers make a particular point of noting that: 'In spite of the injury or the presence of FMS, all patients were employed at the time of examination and insurance claims were not associated with increased FMS symptoms or impaired functioning.'

Why should whiplash-type injury provoke FMS more effectively than other forms of trauma? One answer may lie in a particular muscle, part of the suboccipital group.

Rectus capitis posterior minor (RCPM)

A discovery in 1995 revealed new anatomical knowledge. A human dissection performed using a sagittal rather than a coronal incision revealed that rectus capitis posterior minor (RCPM) has a unique connection to the dura at the atlanto-occipital junction. Subsequent research has shown it to have a major potential for symptom production – especially chronic pain – when damaged in whiplash-type injuries, or when it is severely stressed (Hack et al 1995).

The superior insertion of the muscle, which arises from a tendon on the atlas, is into the medial part of the inferior nuchal line on the occipital bone, between the nuchal line and the foramen magnum. The orientation of the muscle is described as being perpendicular to the dura, an arrangement which 'appears to resist movement of the dura towards the spinal cord'.

The dissection referred to above demonstrated that a connective tissue extension ('bridge') links this muscle to the dura mater which provides it with the potential to influence the cranial reciprocal tension membranes directly. Because of its siting, close to the posterior cranial fossa and the cisterna magna, the relative 'health' of this muscle has particular implications relating to cerebrospinal fluid fluctuation. It might also have the potential to influence the functioning of the vertebral artery and the suboccipital nerve which could affect hypertonus of the region.

The researchers at the University of Maryland, Baltimore, state:

> *In reviewing the literature, the subject of functional relations between voluntary muscles and dural membranes has been addressed by*

Becker (1983) who suggests that the voluntary muscles might act upon the dural membranes via fascial continuity, changing the tension placed upon them, thus possibly influencing cerebrospinal fluid pressure. Our observation, that simulated contraction of the RCPM muscle flexed the posterior atlanto-occipital membrane–spinal dura complex and produced CSF movement, supports Becker's hypothesis.

They note that:

- During head extension and anterior translation the spinal dura is subject to folding, with the greatest amount occurring in the area of the atlanto-occipital joint (Cailliet 1991).
- A possible function of RCPM may be to resist dural folding, thus assisting in the maintenance of the normal circulation of the CSF.
- Trauma resulting in atrophic changes to the RCPM muscle could possibly interfere with this suggested mechanism (Hallgren et al 1993).
- The observed transmission of tension created in the spinal dura to the cranial dura of the posterior cranial fossa is consistent with the described discontinuity between the spinal and intracranial parts of the dura mater (Penfield & McNaughton 1940).
- Not only has the dura which lines the posterior cranial fossa been shown to be innervated by nerves that subserve pain (Kimmel 1961), but it has also been confirmed that pressure applied to the dura of the posterior cranial fossa in neurosurgical patients induces pain in the region of the posterior base of the skull (Northfield 1938).

The researchers postulated that the dura of the posterior cranial fossa can be irritated and become symptomatic if stressed to an unaccustomed extent by the RCPM muscle acting on the dura mater.

Further research

Additional research at the Department of Osteopathic Medicine at the College of Osteopathic Medicine at Michigan State University, utilizing magnetic resonance imaging of both RCP major and minor, which was performed on six patients with chronic head and neck pain, as well as on five control subjects, produced remarkable findings (Hallgren et al 1994):

- In the subjects with chronic pain, the muscles were shown to have developed fatty degeneration in which muscle tissue had been replaced by fatty deposits.
- This was not seen in the control (normal) subjects.

The researchers suggest that the reduction in proprioceptive afferent activity in these damaged muscles may cause increased facilitation of neural activity which is perceived as pain.

Professor Philip Greenman, a major researcher in both the studies reported above, has found, utilizing EMG testing, that RCPM is not an extensor of the head, as is suggested by most physiology texts. When tested, the muscle does *not* fire during extension, but rather does so when the head is translated forwards, in a 'chin poking' manner, as would be the case, for example, if bilateral sternocleidomastoid shortening existed, something that would commonly result from chronic upper-chest breathing which automatically involves the accessory breathing muscles such as sternocleidomastoid (P Greenman, personal communication, October 1997) (see Fig. 3.9).

Greenman further suggests (P Greenman, personal communication, October 1997) that denervation of the muscle may lead to the reported fatty degeneration following severe trauma such as whiplash. He also states that in some instances he has observed that the muscle hypertrophies and is then involved in severe headache problems. It is also hypothesized that joint dysfunction in this region may contribute towards fatty degeneration of RCPM, such as has been noted in the multifidus muscles of the low back when spinal joint damage or major restriction has occurred in that region.

C. Chan Gunn observes (Gunn 1983) that pain management is simplified when it is realized that, following trauma, three sequential stages may be noted:

1. *Immediate*: a perception of noxious input which is transient unless tissue damage is sufficient to cause the next stage
2. *Inflammation*: during which time algesic substances are released which sensitize higher threshold receptors
3. *Chronic phase*: where there may be persistent nociception (or prolonged inflammation). Hyperalgesia may exist where normally non-noxious stimuli are rendered excessive due to hypersensitive receptors.

This sequence seems to prevail in relation to RCPM following whiplash, and treatment objectives should

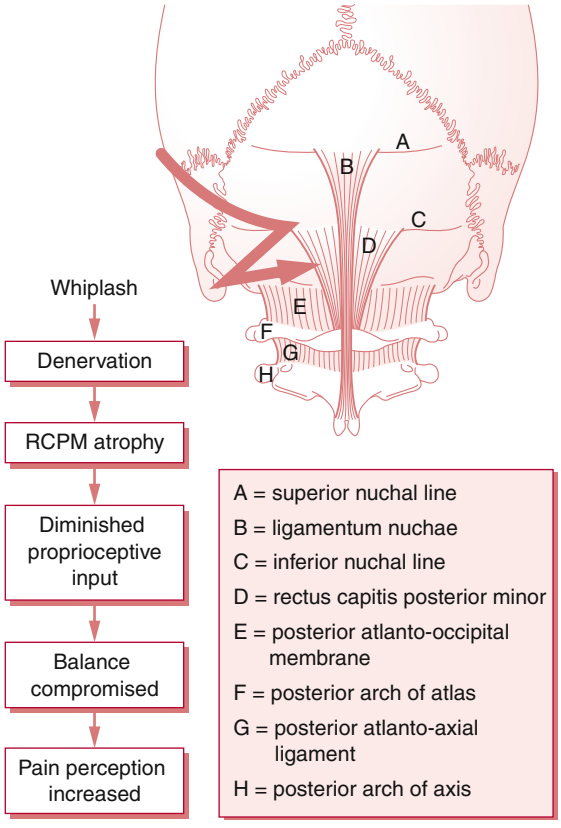

Figure 3.9 • Schematic representation of key tissues and processes possibly involved in whiplash damage to the subocciput, as a precursor to onset of fibromyalgia symptoms. RCPM, rectus capitis posterior minor. (Reproduced with permission from Chaitow 2000.)

include attempts at desensitization of the hyperalgesic structures.

A close similarity can be observed between facilitation concepts (as outlined in Ch. 1) and the sequence described by Gunn.

A number of possible links can be suggested between these musculoskeletal observations and some of the major symptoms of FMS:

- The link between cranial venous circulation as well as CSF circulation and a traumatically induced dysfunctional pattern in the upper cervical region has been suggested. This could relate to a number of the symptoms observed in FMS – most notably pain perception – as well as those hypotheses which are based upon brain/neurological dysfunction as a central aetiological feature.
- It seems probable that excessive demands on the stabilizing function of the suboccipital extensor muscles and RCPM in particular (posturally induced 'chin poking' for example, aggravated by upper-chest breathing) could induce hypertrophy of RCPM and consequent headache symptoms, as noted by Greenman, without trauma.
- The findings in the whiplash study described above, and the MRI observations of Greenman and his colleagues regarding fatty degeneration of RCPM following whiplash trauma, suggest that specific injury to this vulnerable cervical region offers a possible explanation for the onset of FMS in some patients.

Another theory linking whiplash to FMS

In Chapter 9 Carolyn McMakin says:

> *I believe that cervical trauma cracks the disc annulus and exposes the spinal cord to the nucleus pulposus and neurotoxic concentrations of phospholipase A_2 (PLA_2). PLA_2 is known to reduce the firing of nerves and may damage the anterolateral pathways, which are directly adjacent to the portion of the disc found to be injured in trauma. If the function of the anterolateral pathways was sufficiently slowed it could constitute a chemical lesion, or functional deafferentation, in the nociceptive system creating what is essentially central or thalamic pain. The pain descriptors for central pain and its affective quality are strikingly similar to the descriptors and affective quality seen with CTF [cervical trauma fibromyalgia]. This hypothesis was developed after a literature search when we found that we could eliminate the pain by treating the spinal cord.*

For a full explanation of this model, see Carolyn McMakin's detailed descriptions, and her treatment protocols, in Chapter 9.

Post-traumatic stress disorder (PTSD) and chronic widespread pain/fibromyalgia

PTSD is a disorder in which an overwhelming traumatic event results in intense fear, helplessness, horror and avoidance of stimuli associated with the

trauma. There have been reports of a link between PTSD and FMS (Amir et al 1997). Several studies support this hypothesis.

- Researchers working with twins (1042 monozygotic pairs, 828 dizygotic pairs and 121 pairs of undetermined zygosity) found a strong association between PTSD symptoms and chronic widespread pain that was not explained by a shared familial or genetic vulnerability (Arguelles et al 2006).
- A telephone-based study found no association between fibromyalgia and sexual abuse, but did report a three-fold increase of FMS in women who had been raped. Thus, it was hypothesized that chronic stress, in the form of PTSD, may mediate the relationship between rape and FMS (Ciccione et al 2005).
- Schneider et al (2006) note that PTSD is frequently associated with serious emotional or mental health issues. They note that patients affected in this way often experience a significant sleep disorder, which probably represents a state of hypervigilance due to overactivity of the limbic system. As with FMS patients, those affected by PTSD display unusually low cortisol and elevated catecholamine patterns. In patients with this pattern, psychological counselling and stress-reducing lifestyle modifications are imperative.

Comment

The words of Garrison & Breeding (2003) clearly summarize the connections between injury/post-traumatic stress disorder and fibromyalgia: 'FMS has long been appreciated to exacerbate following cervical flexion–extension injury, childbirth, general anaesthetic, and overwhelming psychological trauma, most prominently including rape.'

Vaccination and FMS (and Gulf War syndrome)

Is FMS linked to vaccination?

Ablin et al (2006) report that a number of intriguing lines of evidence have evolved implicating a possible role for vaccination in the aetiology of FMS.

- Allen (1988) suggested a connection between rubella immunization and CFS/FMS. He pointed out significantly elevated serum IgG antibodies against rubella in patients with CFS and 'fibrositis' (as FMS was termed at that time). Allen also noted an apparent epidemiological association between the introduction of a new rubella vaccine (strain RA27/3) in 1979, and the upsurge of reports regarding chronic fatigue over the next few years.
- The US Federal Court of Claims has recognized a causal relationship between rubella vaccines and a spectrum of musculoskeletal complications, including fibromyalgia, arthralgia, arthritis and various non-specific symptoms, not restricted to the skeleton (Weibel & Benor 1996).
- Rubella seronegativity is often screened for early in pregnancy, with the rubella vaccine administered in the postpartum period in order to prevent seronegativity in subsequent pregnancies. A randomized, placebo-controlled trial compared complications developing after this procedure. It was found that rubella vaccine use was significantly associated with the development of acute arthralgia and arthritis. The increase in frequency of chronic arthralgia and arthritis was marginally significant (Tingle et al 1997).
- Lathrop et al (2000) screened all adverse events related to vaccination with Lyme vaccine in the USA between December 1998 and July 2000. Arthralgia, myalgia and pain were the most common reactions, accounting together for over 66% of adverse events altogether.

Gulf War syndrome and vaccination

Ablin et al (2006) observe that Gulf War syndrome (GWS) is characterized by chronic fatigue, general malaise, irritability and cognitive impairment, as well as by musculoskeletal symptoms (Fukuda et al 1998, Lange et al 2001). It is also commonly associated with post-traumatic stress disorder, and has major similarities with FMS and CFS (Ford et al 2001).

Comparing personnel who served in the Persian Gulf in 1990–1991 with those serving in Bosnia, or with those not serving in war zones, has revealed the presence of many symptoms such as fatigue, post-traumatic stress and psychological distress, particularly amongst those deployed in the Persian Gulf (Unwin et al 1999). The study by Unwin et al also revealed that, in addition to the multiple routine vaccinations administered, the concern (in relation to the invasion of Iraq) regarding use of

unconventional weapons of mass destruction also led to administration of vaccinations directed against biological agents.

In a study analysing the relationship between ill-health after the Gulf War, and administration of vaccines before and during deployment in the Gulf (Hotopf et al 2000), multiple measures were assessed, including fatigue, post-traumatic stress reaction, psychological distress, health perception, physical functioning and the presence of 'multi-symptom illness'. The results indicated that the administration of multiple vaccinations *prior to deployment* in the Gulf was associated with only one of these six measures (post-traumatic stress reaction), while administration of vaccines *during deployment* in the Gulf was associated with five out of the six (all but post-traumatic stress reaction). The authors concluded that while multiple vaccinations in themselves did not appear to be harmful, the combination between administration of such vaccinations and the concurrent stress associated with deployment in the combat zone (and possible other factors) may increase the risk of developing ongoing ill-health, including fatigue and multiple additional symptoms.

A follow-up study indicated that while multiple vaccinations were important in initiating GWS, risk factors more important in perpetuation of symptoms over the long run were the severity of initial symptoms and the associated psychological distress (Hotopf et al 2004).

Although most of this research did not specifically measure fibromyalgia as an endpoint, the clinical overlap between fibromyalgia and chronic fatigue, as well as additional conditions such as post-traumatic stress reaction (Raphael et al 2004), raises the possibility that multiple vaccinations could be associated with fibromyalgia as well.

Mechanisms: how vaccination may have triggered GWS

What are the possible mechanisms through which multiple vaccinations may have triggered Gulf War syndrome? One immunoregulatory hypothesis set out by Rook & Zumla (1997) suggests that a shift from Th1- to Th2-type reactions could be of pathogenic significance in this context. This hypothesis draws on a number of observations.

- First, patients with CFS tend to have an increased frequency of allergic reactions, low natural killer cell activity and low production of both IFN-γ and IL-2 (Strauss 1996).
- Individuals deployed in the Persian Gulf were faced with a large antigenic load, due to the simultaneous administration of vaccination against plague, anthrax, typhoid, tetanus and cholera. This load was associated in some cases (particularly in British troops) with the administration of pertussis vaccine as an adjuvant, which is a known Th2 inducer (Mu & Sewell 1993).
- Additional factors such as the stress associated with deployment in an area of combat could have Th2-inducing effects mediated through an increase in levels of cortisol and a fall in levels of androgens such as DHEA (Bernton et al 1995, Ramirez et al 1997).

In interpreting these results it must be pointed out that although increased Th2 activation has been reported in CFS unrelated to Gulf War syndrome (Skowera et al 2004), differences in the immunological profile of these conditions undoubtedly exist (Brimacombe et al 2002–2003); moreover, the application of these profiles to fibromyalgia is clearly not automatic.

Comment

The evidence for a possible link with rubella (and Lyme disease) immunization seems convincing. Clearly additional features – possibly acquired, possibly genetic – must also be present, or the entire immunized (with rubella vaccine) population would display the symptoms of FMS. Multiple vaccinations combined with almost inconceivable levels of psychological stress appear to offer one explanation for the 'fibromyalgia-like' symptoms of GWS.

Conclusion

This chapter's review of some of the main symptoms of FMS, and where they are thought to fit (by various experts, without any great consensus as yet) into the spectrum of cause and effect, should assist the review of hypotheses for the development of FMS (outlined in Ch. 4).

A common feature of several hypotheses seems to involve abnormal responses:

- by pain receptors following sensitization or facilitation

- of neurohumoral responses due to congenital or acquired abnormalities
- of homeostasis which in some instances evolves to allostasis due to congenital or early stress influences
- of central (limbic) processing of information.

Helping FMS patients might involve: reducing allergic activity, improving breathing function, enhancing and normalizing bowel function, promoting better sleep patterns, modifying the abnormal biochemistry, assisting circulation to and drainage from the brain, and reducing dysfunctional muscular influences, especially in the upper cervical region. All or any of these measures should reduce the stressor load as well as improving aspects of homeostasis.

A model of care which aims to reduce those factors to which the body is adapting, while trying to enhance adaptive capabilities, while also offering symptomatic attention, seems to cover the essential areas which can allow recovery to occur spontaneously, if slowly.

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Chapter Four

4

The causes of fibromyalgia: various hypotheses explored

CHAPTER CONTENTS

Having examined some of the proposed and known influences of associated conditions and dysfunctional patterns (sleep, irritable bowel, allergy, hyperventilation tendency, etc.) on fibromyalgia, an awareness will have emerged of differing emphases ascribed to the roles of one or other of these associated conditions, by leading researchers, depending to some extent upon their particular beliefs and interests.

Some conditions are seen to have the potential to have a (partially?) causal link, while others are merely expressions of dysfunction deriving from a common (or a different) set of aetiological factors impacting the individual, possibly associated with genetic predisposition.

A number of hypotheses try to explain the evolution of FMS, and some of the leading ones are summarized in this chapter. Space does not permit a full elaboration on the minutiae of these concepts; however, it is hoped that the condensed form in which they are presented will allow the reader to form a view of FMS which makes sense, has scientific and clinical validity, and which above all helps in formulating strategies for therapeutic action.

The evidence seems to suggest that there is almost certainly more than one form of FMS, with a genetic predisposition possibly being a basic requirement, followed by either a single major traumatic experience (physical, particularly whiplash, or psychological) or an infection (viral as a rule, or *Mycoplasma*), or the compound effect of multiple minor stresses, hormone imbalance or toxic overload, with central sensitization as an outcome. Associated features such as sleep disorder, hypermobility, hyperventilation, irritable bowel syndrome and others may then be seen as symptoms of the underlying causes, and/or as exacerbating rather than aetiological factors.

We already see that FMS is sometimes described as primary (where no obvious predisposing trigger can be identified), while at other times it is described as secondary (where a trigger is – or multiple triggers are – well established). The pathway which follows

one or other of these possible aetiological patterns might then be the same, involving, eventually, a large degree of central dysfunction as proposed by Goldstein (1996) (see Neurosomatic hypothesis and Fig. 4.6, below) and Yunus (2007) (see central sensitization discussion in Ch. 3), along with all that flows from this concept.

Should FMS be reclassified as 'classic' or 'pseudo'?

Schneider & Brady (2001) offer the suggestion that FMS should be seen as having a pure 'classic' form, and that those people presenting with the many other disorders which have much the same symptomatology as the so-called classic FMS, may usefully be regarded as having 'pseudo' FMS. The evolution of their thinking evolved as follows:

> *Our clinical experience, coupled with an intense interest in following FMS literature . . . has led us to ponder answers to the following questions:*
>
> - *Why do some FMS patients seem to experience substantial and long-term relief with manual treatment, whereas others derive little or no benefit from such therapy?*
> - *Why do some FMS patients benefit from low dose antidepressants, and yet others feel worse or experience no effect?*
> - *Why do dietary manipulation, vitamins and herbal remedies relieve the gastrointestinal symptoms and fatigue of some cases of FMS, but not all?*
> - *Why are some patients misdiagnosed with FMS, when in reality they have an organic disease that could readily be found with appropriate diagnostic testing?*
> - *Why do some patients experience dramatic 'cures' of their FMS symptoms when placed on thyroid or oestrogen replacement therapy?*
>
> *To answer these questions, a paradigm shift is required in which we alter the traditional view of FMS as one grand syndrome.*

Schneider & Brady (2001) propose a rethinking, a reclassification of fibromyalgia, suggesting that both classic and pseudo FMS patients could present with the main symptom of widespread pain/tenderness and fatigue; however, classic FMS also includes all, or some, of the following symptoms in their presenting picture or history:

- sleep disorders
- anxiety syndrome
- depression
- alterations in brain and CNS chemistry
- brain injury.

Additionally:

> *These patients do not respond well to standard manual treatments, such as chiropractic, physical therapy, or massage, because their condition is not primarily caused by any abnormality in the muscles or joints; it is a state of global lowered pain threshold caused by abnormal brain processing of sensory stimuli. This has led Russell (1996) to redefine FMS as 'Central allodynia', and Donaldson et al (1998) to call FMS a type of 'CNS Myalgia'.*

So, apart from the obvious symptoms, the definition of classic FMS involves 'CNS dysfunction, "fibro-fog", memory problems, lowered pain threshold, sleep disorders, and other brain-processing difficulties'. This, suggest Schneider & Brady, is what differentiates the category definitions that they propose.

'Pseudo' FMS may have (as well as the pain/fatigue symptoms) some of the symptoms listed above (sleep disturbance etc.), but may also be further subdivided as involving:

1. *Organic diseases*: anaemia, Lyme disease, hypothyroidism, seronegative rheumatoid arthritis, occult carcinoma, multiple sclerosis.
2. *Functional disorders*: improper diets, functional nutritional deficiencies, intestinal dysbiosis, dysfunction of liver detoxification.
3. *Musculoskeletal*: multiple trigger points (i.e. myofascial pain syndrome), joint dysfunction, muscle imbalance, postural distortion, undiagnosed disk/facet lesions.

Acknowledging that their suggestions are speculative and hypothetical, Schneider and Brady plead for clinicians of all schools to 'study the FMS literature carefully and become well-versed in the nuances of this condition'.

Comment

Any attempt to reduce the complexity of FMS is laudable. However, there is a risk that such an attempt at reductionist reclassification may lead to the bigger picture being overlooked. As discussed in earlier chapters, many apparent 'causes' are in fact symptoms, evidence of a breakdown in homeostasis, or of homeostasis in action (see Figs 2.1–2.5). The 'big picture' approach to any complex condition is also epitomized in Figures 1.2 and 1.3, where the person in their environmental context is seen to be assailed by biochemical, biomechanical, psychosocial and genetically generated stressors, with which or to which they are coping, adapting, compensating and decompensating to varying degrees. Symptoms emerge out of this background. If these and other individual features and characteristics of the patient are taken into account, the subsets of FMS, as meticulously summarized by Schneider & Bradley (2001), will emerge automatically.

Certainly some patients with FMS will have a trauma history, or an infection, or emotional disturbance as a trigger for their condition; some will be anaemic, or have hormonal imbalances, or allergies, or gut dysbiosis, or yeast overgrowth, or mycoplasmal infection, or a liver which is failing to cope with the toxic load it is processing; or hyperventilation, anxiety, depression or nutritional deficiencies (or any combination of the above) may be evident as cofactors.

Treatment strategies will be based on any unique, idiosyncratic combination of inherited and acquired features that can be identified. Whatever is identified, the bottom line in therapeutic endeavours which aim to enhance health has to be to work with the self-regulating mechanisms of the body, in order to 'lighten' the adaptive load and enhance functional ability to cope with the load, to allow healing and regeneration.

Schneider & Brady (2001) have usefully pointed out that many of the symptoms of FMS may be dealt with by, for example, rebalancing thyroid hormone, deactivating trigger points, healing the gut, replenishing deficiencies, assisting the liver, reducing allergic responses, etc., as appropriate. These are all ways of 'lightening the load' and, in many instances, of enhancing function. Schneider et al (2006) have developed an algorithm (Fig. 4.1) that offers ways for the clinician to work through the maze of possibilities towards an accurate diagnosis.

A variety of hypotheses

The remainder of this chapter summarizes some of the major FMS hypotheses. They are listed in alphabetical order rather than any hierarchy of importance or validity. In a sense they all (or almost all) have credibility, and represent examples of the same multiple phenomena being scrutinized and interpreted from differing perspectives. They are:

- central sensitization hypothesis
- chronobiological hypothesis
- complexity and chaos theory and the dysautonomia hypothesis
- genetic hypothesis
- immune dysfunction hypothesis
- infection hypothesis (see Ch. 3, and integrated hypothesis 2)
- integrated hypothesis 1
- integrated hypothesis 2 (overlaps with thyroid hypothesis)
- inflammatory hypothesis
- neurosomatic hypothesis
- nociceptive hypothesis
- retention hypothesis
- stress hormone hypothesis
- thyroid hormone dysfunction hypothesis
- vaccination hypothesis.

Central sensitization hypothesis (Yunus 2007)

A topic heading in Chapter 3, 'The polysymptomatic patient', includes in its discussion central sensitization syndrome (CSS; see Fig. 3.1). This subject could arguably have been placed in this chapter, and the reader is referred to it in relation to the various hypotheses listed below.

The choice of Chapter 3 for the discussion of CSS, rather than here, relates to the feature of sensitization not being aetiological, but rather representing the endpoint of a variety of possible aetiological factors. Nevertheless, mention at this point is considered pertinent to an overall appreciation of current thinking in regard to FMS.

One feature of Yunus' (2007) paper is the evidence he reports based on functional magnetic resonance imaging (fMRI) results. He reports:

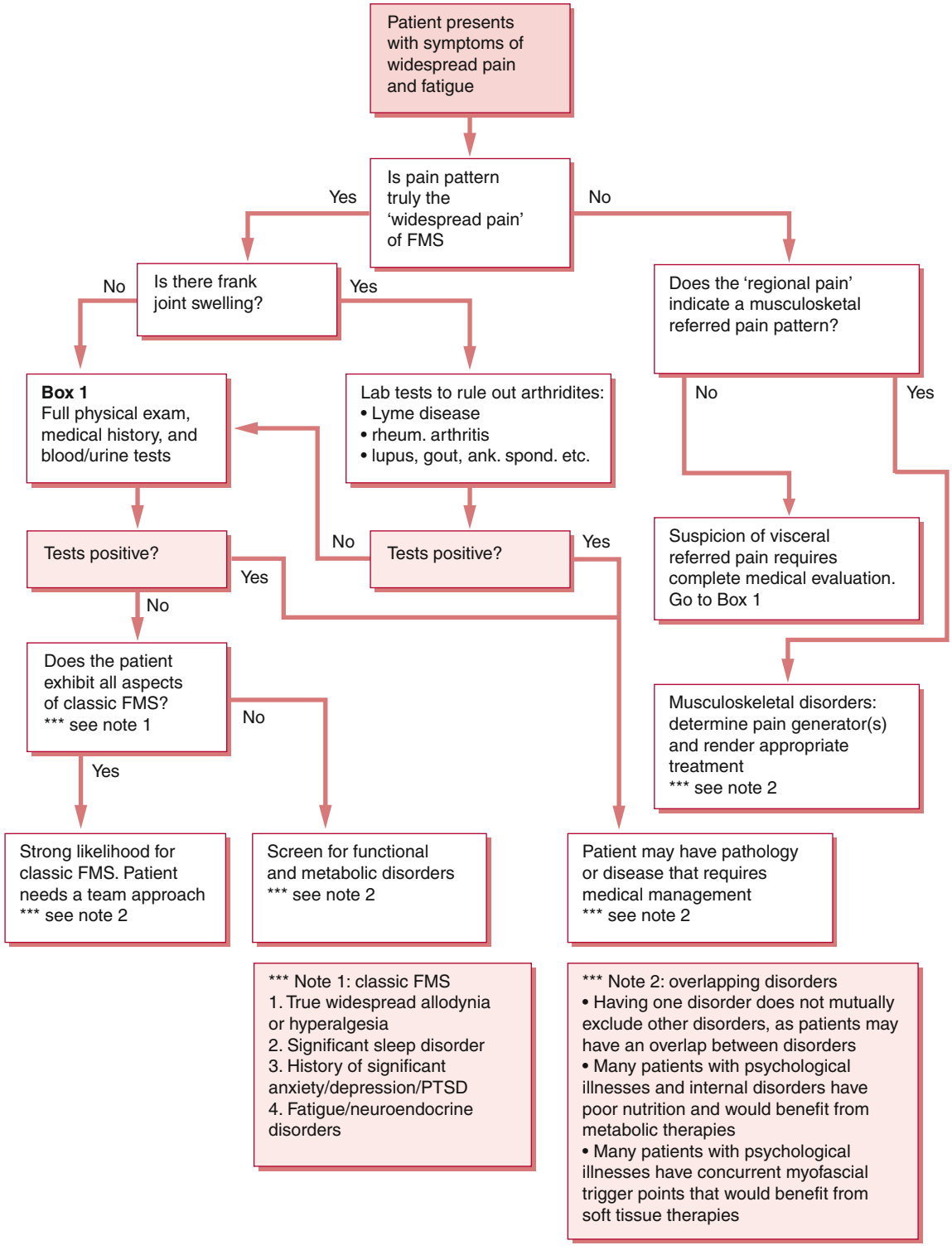

Figure 4.1 • A fibromyalgia algorithm. (Reproduced with permission from Schneider et al 2006.)

Augmented pain sensitivity has been reported in FMS by objective fMRI findings in response to peripheral stimuli by pressure (Gracely et al 2002) and both noxious and innocuous heat (Cook et al 2004). A recent study showed a lack of inhibitory control in the brain to nonpainful repetitive somatosensory stimuli (by examining event-related potentials recorded by electroencephalogram (EEG) (Montoya et al 2006), suggesting CSS).

Examples of imaging evidence, relating to altered brain morphology in FMS, are given in Box 1.3.

Chronobiological hypothesis (Moldofsky 1993)

Harvey Moldofsky, professor of psychiatry and medicine at the University of Toronto, has proposed a pathway to FMS which is the result of altered biological rhythms, including diurnal physiological functions, seasonal environmental influences and psychosocial and behavioural influences:

- Moldofsky describes a 'non-restorative sleep syndrome' which is characterized by pain, fatigue and cognitive difficulties (often following a febrile illness), as well as irritable bowel problems.
- This non-restorative sleep syndrome is seen to emerge from central nervous system disturbances, associated with altered metabolic functions including those of serotonin, substance P, interleukin-1, growth hormone and cortisol.
- He reports that environmental disturbances affect brain functions as well as somatic symptoms.
- Further, he states that altered sleep physiology along with the somatic and psychological symptoms may result from acute traumatic incidents, such as those involved in an accident.
- Moldofsky has traced the patterns of well-being (mood, capacity for intellectual function, performance skills, wakefulness and optimal behavioural functioning) experienced over a 24-hour period by normal healthy individuals and compared this with the common experience of patients with FMS and CFS.
- This research indicates that the norm is to wake refreshed and for a slow decline to occur throughout the day, with a minor improvement in the early evening. FMS patients, on the other hand, wake feeling 'awful' and slowly improve to midday (optimal function is between 10.00 a.m. and 2.00 p.m.) and then decline steeply until early evening when they plateau with feelings of greater exhaustion and pain.
- Increased sensitivity to dolorimeter pressure was observed in normal individuals when slow wave sleep was disturbed (by noise). Normal pain thresholds were restored by a night of undisturbed sleep.
- Moldofsky relates the altered pain sensitivity directly to intrusive alpha waves into the early hours of sleep. He reports that slow wave sleep has been shown to depend upon the presence of appropriate neurotransmitters and immunologically active peptides (including serotonin, interleukin-1 and factor S).
- He highlights the fact that with sleep disturbance, growth hormone production decreases, and indicates that while average 24-hour cortisol levels are unaffected by sleep deprivation, a change in pattern occurs so that instead of a late nocturnal increase (in cortisol) being noted, this occurs earlier when sleep is disturbed.
- Moldofsky has evaluated the effects on sleep patterns of industrial or vehicle injuries, and subsequent development of FMS symptoms. In a longitudinal prospective study involving 150 individuals who had experienced industrial injury involving a similar degree of soft tissue strain or damage, he has shown that, over a period of 21 months, the symptoms of pain and fatigue in those who remain off work correlated directly with the degree of disturbance in their sleep patterns. He states: 'Study of the evolution of pain symptoms and the ability to return to work are related to psychological distress, sleep disturbance and fatigue. The temporal patterns are consistent with the chronobiological theoretical model for understanding the evolution of persistent pain, fatigue and non-restorative sleep' (Moldofsky 1993).
- He suggests that a chronobiological model allows consideration of the dynamics of CNS mechanisms as they are involved in FMS. The model takes into account variations associated with biological rhythmic activity so that the involvement of behaviour, brain function and somatic factors can be evaluated over time.
- The notes in Chapter 3 relating to cytokines reported research which supports Moldofsky's

work. This shows that there is normally a cyclical pattern in inflammatory processes which alternate with those aspects of immune functions concerned with defence against infection (Petrovsky & Harrison 1998, Petrovsky et al 1998). Monro (2001) reports that there exists 'A natural cycling between the defensive and repair modes of aspects of the immune system [that] is disturbed in ill-health … [so that] a chronic cytokine shift may lock the body into a pro-inflammatory state.'

Conflicting evidence

- A pattern of disturbed circadian rhythms has been found to apply in children with CFS. A study was performed to investigate the biological rhythms in paediatric patients with CFS. Sleep pattern, circadian rhythm of core body temperature (CBT) and plasma cortisol were measured in 41 patients with CFS, aged between 10 and 19 years, with no other physical or psychiatric disorders. They had been diagnosed as having CFS on the basis of published criteria. The amplitude of circadian core body temperature changes was significantly smaller in the patients than in healthy subjects. Additionally, the circadian rhythm of plasma cortisol in the patients appeared to be quite different when compared to healthy subjects. The findings suggest that the symptoms (mainly fatigue and sleep disturbance) might be closely related to the desynchronization of their biorhythms, particularly the circadian rhythm of body temperature and cortisol rhythm (Tomoda et al 2001).
- Conflicting results were noted by Klerman et al (2001), who evaluated the circadian rhythms of 10 women with fibromyalgia and 12 control healthy women. The protocol controlled factors known to affect markers of the circadian system, including light levels, posture, sleep–wake state, meals and activity. The timing of the events in the protocol was calculated relative to the habitual sleep–wake schedule of each individual subject. Under these conditions, they found no significant difference between the women with fibromyalgia and control women in the circadian amplitude or phase of rhythms of melatonin, cortisol and core body temperature. The differences between children with CFS and women with FMS are marked, and the question raised is as to whether this is due to gender, age, size of study, the conditions under review or aspects of methodology.
- Further research has indicated that seasonal variations, involving both climate and light availability, affect symptom severity more dramatically in patients with FMS than normal controls or individuals with rheumatoid arthritis. FMS symptoms were reported as being more intense between November and March (autumn/winter) and improved between May and August (spring/summer). Guedj & Weinberger (1990) evaluated the effects of seasonal change of various forms of rheumatic disease and concluded that while a number of factors – including rain, temperature and barometric pressure – affected people with osteoarthritis, the most significant climatic influence on FMS was a change in barometric pressure.

Comment

Clearly natural cyclical biological rhythms have an importance when trying to understand complex conditions such as FMS and CFS. It was the research of Ringsdorf & Cheraskin (1980) which demonstrated that the more widely basic biological rhythms fluctuate throughout the day (whether this represents blood pressure, heart rate, blood sugar levels or anything else which is periodically measurable), the less well homeostatic functions are operating. This is an obvious method for eliciting evidence of homeostatic efficiency (Ringsdorf & Cheraskin 1980). The differences between the CFS (Tomoda et al 2001) and FMS (Klerman et al 2001) circadian rhythm studies, described above, leave questions unanswered. See Chapter 5 for consideration of similarities and differences between CFS and FMS.

Complexity and chaos theory and the dysautonomia hypothesis (Martinez-Lavin et al 2008)

Martinez-Lavin et al (2008) propose that the essence of disease is dysfunction and not structural damage. Studies using novel non-linear instruments have shown that fibromyalgia and similar maladies may be caused

by the degraded performance of our main complex adaptive system, and that this dysfunction explains the multifaceted manifestations of these changes.

They maintain that conditions such as CFS and FMS can be better understood in a bio-psycho-social context rather than attempting to explain diverse symptoms as involving the presence of specific anatomical or serological alterations. They suggest that the use of non-linear instruments, based on the complexity theory, has revealed degraded complex adaptive systems in FMS and related syndromes, with faulty performance of the autonomic nervous system offering a coherent explanation for the multifaceted manifestations of these syndromes.

Complexity theory calls for a change in paradigms, from reductionism to holism. This shift recognizes chaos, fractals, and complex systems as essential elements in human physiology, and offers a different perspective in which health is perceived as *resilient adaptation*, and some chronic illnesses are perceived as *rigid dysfunction*.

Interventions that have proven to be partly effective in treatment of FMS and CFS involve multidisciplinary programmes that consider the individual, and which offer education, cognitive behavioural therapy, and various exercise programmes (Bennett et al 1996, Goldenberg et al 2004) that improve resting autonomic tone.

A linked concept is the *dysautonomia hypothesis* (Martinez-Lavin & Hermosillo 2005). Observing that patients with fibromyalgia demonstrate symptoms consistent with what they term 'relentless sympathetic hyperactivity', that is more prominent at night, including orthostatic sympathetic derangement, Martinez-Lavin & Hermosillo (2005) have proposed that 'autonomic dysfunction (dysautonomia) explains all fibromyalgia (FMS) symptoms'. Noting that fibromyalgia (FMS), chronic fatigue syndrome and Gulf War syndrome (GWS) have overlapping clinical features, characterized by diffuse musculoskeletal pain, chronic fatigue and cognitive impairment, they note that Haley et al (2004) analysed aspects of heart rate variability in GWS veterans and found that there was evidence of blunted parasympathetic activity at night compared with controls, suggesting sympathetic overexpression. Martinez-Lavin et al (1998) had previously identified similar changes in FMS patients.

Basing their conclusions on evidence derived from controlled clinical studies, Martinez-Lavin & Hermosillo (2005) suggest that the core features of FMS (chronic widespread pain and widespread allodynia) can be explained by the processes involved in sympathetically maintained pain:

- patients with FMS display signs of sympathetic hyperactivity
- FMS pain is responsive to sympatholytic interventions
- FMS pain is rekindled by norepinephrine injections (Martinez-Lavin 2004).

Martinez-Lavin & Hermosillo (2005) assert that the findings on which these conclusions are based are supported by a number of other investigators (Bou-Holaigah et al 1997, Cohen et al 2000, Keleman et al 1998, Raj et al 2000).

Comment

Sympathetic arousal in an individual with chronic pain and the associated symptoms of FMS may at least in part be the result of the condition, but – as has been demonstrated – can also contribute to it. The overlap with other aetiological features, such as poor sleep patterns, obesity ('metabolic syndrome'; Loevinger et al 2007) and breathing pattern disorders, adds to a 'chicken and egg' confusion of interacting features. By variously focusing on heightened sympathetic and altered parasympathetic functions, with the autonomic nervous system at the core of failing adaptive potential, the proposers of these hypotheses offer a usefully broad approach to understanding complex conditions such as FMS.

Genetic hypothesis

Goldstein's hypothesis, and those of many others, depends for cogency upon a genetic predisposition. Is there any evidence for this in FMS?

- There are, in some studies, clear indications of familial tendencies to the development of FMS (Pellegrino et al 1989).
- Israeli research by Dr Dan Buskila has concluded that FMS has a major genetic component (Fibromyalgia Network 1996a).
- FMS has been associated in some studies with joint laxity, and a Danish study noted that 43% of 42 FMS patients had generalized joint hypermobility, an apparently genetically acquired trait which is more common in females (Fibromyalgia Network 1996b) (see notes on hypermobility in Ch. 3).

- Mitral valve prolapse has been reported in 75% of patients with FMS, a far higher rate than that noted in the general population (Fibromyalgia Network Newsletter 1995). This is also associated with connective tissue laxity as occurs in extreme hypermobility conditions such as Ehlers–Danlos or Marfan syndromes.
- Particular patterns of human leukocyte class II antigens were identified when the blood of over 100 patients with chronic fatigue syndrome was analysed and compared with healthy controls (Keller & Klimas 1994).
- When HLA typing was carried out by Mohammad Yunus, involving four multi-case families (in which at least two members of the same family had FMS), statistically significant genetic linkage was established. Such findings are thought to offer strong support for a genetic hypothesis in the aetiology of FMS (Fibromyalgia Network 1996b).
- Researchers at the University of Miami, led by immunologist Dr Nancy Klimas, have evolved a model for the evolution and perpetuation of CFS and FMS. This involves an initial predisposition followed by an 'aetiological event'; this might involve a single trauma, a reactivation of dormant viral activity or a one-off infection. One or other such event seems to lead to a major ongoing immunological response which is perpetuated either by further activation of infectious agents (viral as a rule) or by a dysfunctional hypothalamic–pituitary–adrenal (HPA) axis related to stress influence (Klimas 1995).

Interview with Jeff Bland

Functional genomics derived out of the human genome project, in which it was thought that by dissecting the code of life in our 23 pairs of chromosomes people would be able to understand how they were going to die. They would see locked in their genes heart disease, cancer, diabetes, arthritis, whatever it might be, and they would tell from these genetic imperfections what day, and what disease, they would finally fall prey to . . . the discovery of the code of life through the dissection of the encyclopaedia of our chromosomes has not told us how we're going to die, but told us how we're going to live. Mendelian determinism . . . said that locked into our genes, when the sperm met the egg, were these strengths and weaknesses that we call the recessive and dominant characteristics of inheritance, that we could not get out from under.

Comment

A genetic predisposition to FMS seems likely, and since at this time many scientists believe that little can be done about this, the therapeutic focus is on the events which surround the triggering and perpetuation of the condition. This seems a reasonable clinical approach for many (see Figs 2.2 and 4.2).

Klimas suggests that: 'Treatment is basically symptomatic. Our concept is to treat anything we can. If someone has sleep disturbance we treat it. If we can take 20% of the miseries away by giving someone restorative sleep and we can eliminate 20% of the symptoms by treating their allergy overlay, then they are 40% better and that's significant.' These thoughts support the suggestions outlined in Figures 1.2 and 2.1 – i.e. 'to lessen the load'.

However, there are others who see matters differently, as evidence mounts that gene expression can indeed be modified, and not only by tinkering with the genes themselves, but also by encouraging them to express themselves more normally. Jeff Bland, one of the founders of functional medicine, has discussed this in an interview (Martin 2001).

That basically if we had the genes for cancer we would die of cancer. If we had the genes for heart disease we would die of heart disease. It turns out that the human genome project has discovered that the genes that we thought were hard-wired to produce these diseases, are not hard-wired at all. Within our genes are multiple messages, and the message that is expressed at any moment – that's in our phenotype – is a consequence of the environmental messages including diet, lifestyle, environment, that wash over our genes to give rise to different expression paths of the genes . . . some may be healthy, some may be unhealthy, depending upon the experiences that are washing over our genes . . . what we're really seeing is that the major determinants for the expression of genetic patterns, over decades of living, are the decisions that we make, either consciously or subconsciously, every day. How we exercise, how we work, what our stress patterns are.

Research by Ames et al (2002) has now shown that these concepts are indeed accurate, and that gene

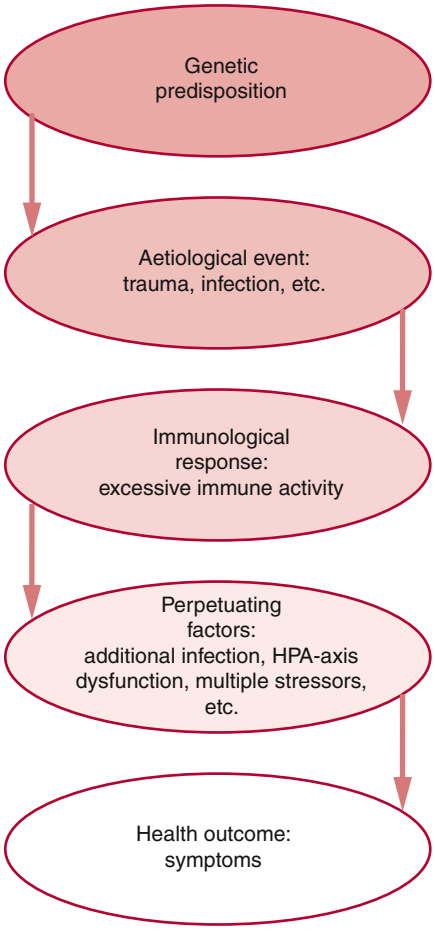

Figure 4.2 • Genetic predisposition hypothesis.

expression can often be dramatically modified by nutritional strategies. Ames and colleagues list more than 50 genetic diseases successfully treated with high doses of vitamins and other nutrients, most of them rare inborn metabolic diseases due to defective enzymes. This evidence supports the other concept outlined in Figures 1.2 and 2.1 – i.e. 'to enhance function'.

Immune dysfunction hypothesis (Bakheit 1992, Landay 1991, Macintyre 1993, Oldstone 1989)

As outlined in Chapter 3 (see Fig. 3.3), a general hypothesis exists in which 'something' – or a variety of somethings – provokes the immune system into excessive responses, resulting in increased cytokine production (see notes on cytokines in Ch. 3).

The nature of the potential triggers, and the variety of the possible subsequent negative results of overstimulated immune function are summarized in Figure 4.3 (see also Fig. 3.3).

Infection hypothesis

Notes on the possible link between FMS and infectious agents, including viruses, yeasts, mycoplasma and bacteria, are evaluated in various sections/chapters, particularly Chapter 3 (under the heading 'Infection: bacterial (including *Mycoplasma*) and viral'), as well as in the section headed 'Integrated hypothesis 2' in this chapter.

Integrated hypothesis 1 (Bennett 1993)

Robert Bennett, professor of medicine at Oregon Health Sciences University, Portland, Oregon, is one of the leading researchers into fibromyalgia. He observes that there are currently two broad ideas regarding the pathogenesis of FMS – those which hold to a central aetiology and those which support a peripheral aetiology (Bennett 1993). Bennett's hypothesis attempts to blend these. He points out that: 'No global muscle defect has ever been demonstrated [in FMS]. On the other hand several studies suggest focal muscle changes in terms of: reduced high energy phosphates, scattered red-ragged fibres, focal changes in oxygen tension and repetitive "contraction bands".'

These altered states of muscle may derive, Bennett believes, from muscle microtrauma (MMT) following unaccustomed exercise. MMT results in changes that are well understood, particularly in relation to the changes seen in myofascial pain syndrome where, as myofascial trigger points evolve, taut bands appear due to a combination of Ca^{2+} ion influx following tissue damage, contraction of the involved sarcolemmal units (so forming the bands) and an inability due to energy (ATP) deficit of the tissues to pump excess Ca^{2+} out of the cells. Muscle spindle resetting is then thought to lead to stiffness sensations. Many of the features described in this model are noted to be prevalent in FMS patients (Jacobsen 1991).

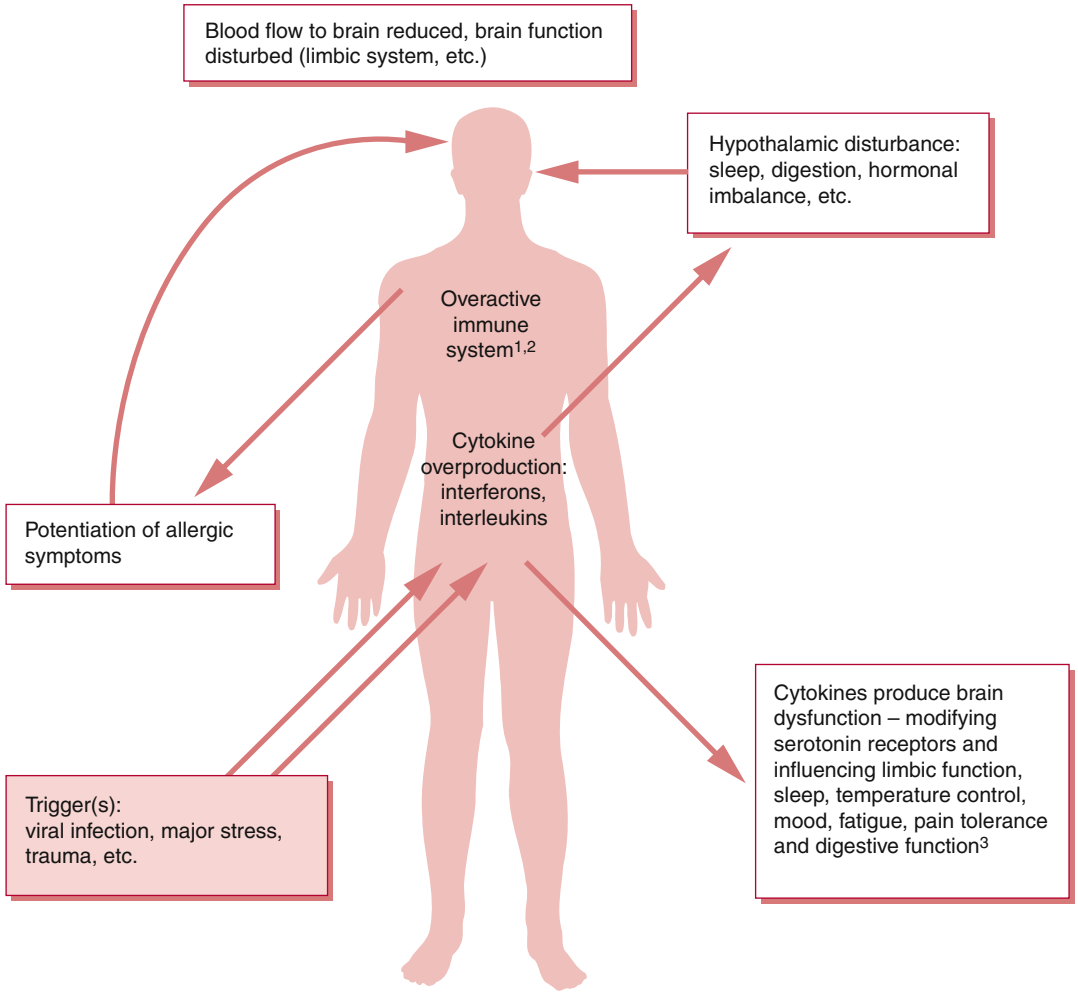

Figure 4.3 • Overactive immune system ([1]Oldstone 1989, [2]Landay 1991, [3]Bakheit 1992).

Bennett suggests that this form of muscle response is genetically predetermined: 'It is envisaged that there is a genetic polymorphism in susceptibility to MMT and that fibromyalgia patients are at one extreme end of the curve. Most susceptible people will not develop FMS unless they also develop alpha–delta sleep anomaly … an acquired central defect which may provide a 'double-hit' in the form of impaired growth hormone secretion' (see Fig. 4.4).

Since growth hormone (released largely during stage 4 sleep) is essential for normal muscle repair and homeostasis, a combination of a deficit in this regard plus repetitive tendency to tissue damage may be the scenario for the onset of chronic muscular pain. Aspects of these changes are discussed in greater detail in Chapter 6 which evaluates the relationship between myofascial pain and FMS.

Comment

Once again it is possible to step back in order to see the bigger picture, where a genetically predetermined susceptibility (to muscle damage and dysfunction) can be seen to be waiting to be expressed, when triggered by an event (in this instance a sleep pattern disorder). Figures 1.2, 2.1 and 2.2 offer a model which demonstrates the therapeutic choices: 1) if possible, reduce the susceptibility (see notes on Ames et al above); and 2) reduce the stress load, in this instance by doing whatever is possible to restore sleep patterns and normal growth hormone production.

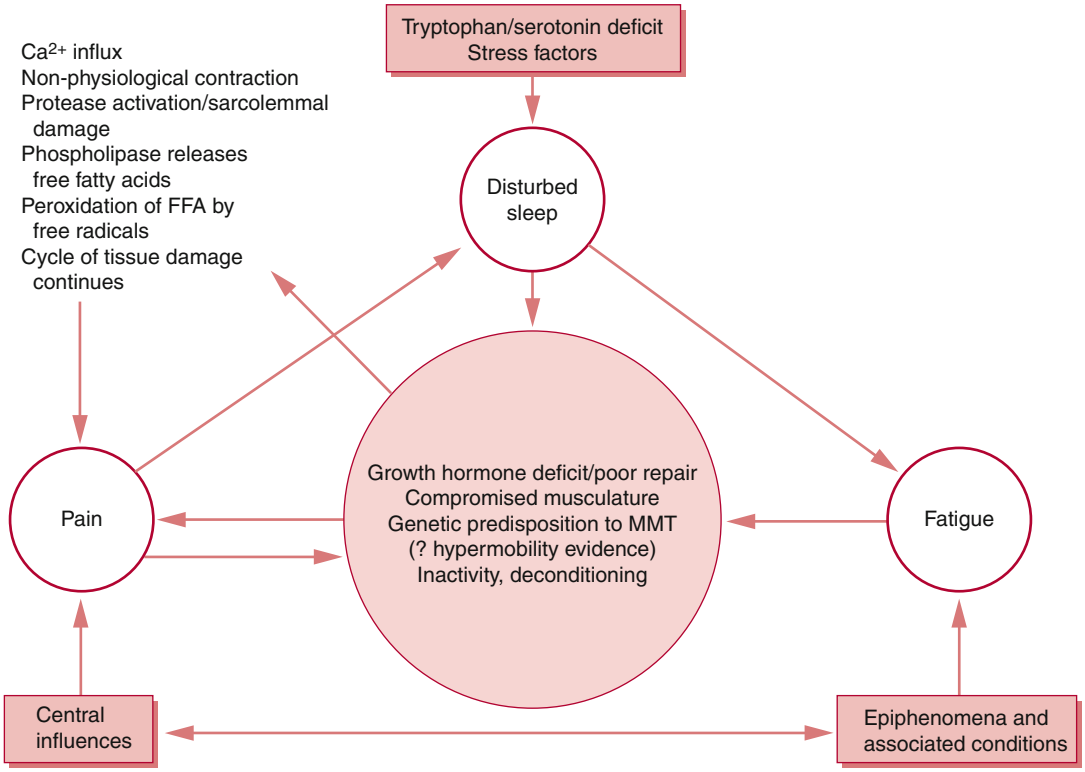

Figure 4.4 • Integrated hypothesis (adapted from Bennett 1993).

Integrated hypothesis 2 (Garrison & Breeding 2003)

A more recent integrated hypothesis has been proposed by Garrison & Breeding (2003). This suggests sequential interactions that occur between various pathophysiological mechanisms:

1. infection by an indolent infectious agent (see notes on 'Infection: bacterial (*Mycoplasma*) and viral' in Ch. 3), *followed by*
2. the initiation and maintenance of a chronic coagulopathy (involving one or more of the following: elevated fibrinogen, elevated thrombin/antithrombin complexes, elevated fibrin fragments I and II, elevated soluble fibrin monomer or hyperactivated platelet aggregation), *followed by*
3. perpetual stimulation of thyroid resistance, *followed by*
4. numerous hypometabolic manifestations, including interference with capillary diffusion, *followed by*
5. development of multiple hormonal resistances.

Garrison & Breeding have summarized their hypothetical model as follows:

> *Preliminary evidence suggests that serum hyaluronic acid is a simple, inexpensive, sensitive, and specific test that identifies fibromyalgia. Overlapping symptom complexes suggest that chronic fatigue syndrome, Gulf War syndrome, premenstrual syndrome, post-traumatic stress disorder, breast implant silicone sensitivity syndrome, bipolar affective disorder, systemic candidiasis, myofascial pain syndrome, and idiopathic environmental intolerance are similar enough to fibromyalgia to merit investigation for possible thyroid resistance. Acquired resistance may be due most often to a*

recently recognized chronic consumptive coagulopathy, which itself may be most often associated with chronic infections with mycoplasmids and related microbes or parasites. Other precipitants of thyroid resistance may use this or other paths as well. In addition to experimentally proven treatment with supraphysiologic doses of thyroid hormone, the thyroid-resistant disorders might be treatable with anti-hypercoagulant, anti-infective, insulin-sensitizing, and hyaluronolytic strategies.

A diagnostic test involving elevated serum levels of hyaluronic acid (HA) is proposed (Yaron et al 1997).

Comment

By incorporating a number of common aetiological features (toxicity, infection, endocrine resistances [including thyroid hormone], various pathophysiological changes, together with biomarkers) into a logical sequence, Garrison & Breeding offer clinically useful insights and potentially practical protocols.

Inflammatory hypothesis (Blanco et al 2004, 2005)

A deficiency, in relation to FMS, of an anti-inflammatory substance, α_1-antitrypsin (AAT), has been suggested. AAT, which has a broad anti-inflammatory spectrum and modulates most inflammatory reactions occurring in the human body, was first described over 40 years ago by Laurell & Eriksson (1963) (Blanco et al 2004, 2005). A possible relationship between AAT deficiency and fibromyalgia has been raised, with the finding that intravenous infusions of purified human AAT efficiently controlled fibromyalgia symptoms in two patients with severe hereditary AAT deficiency.

Researchers have also described abnormal levels of inflammatory cytokines in serum, mononuclear cells and tissues of some FMS patients (Wallace et al 2001). This and separate studies involving 177 FMS patients and 121 healthy controls identified significantly increased levels of inflammatory markers in the serum, plasma and supernatants of blood mononuclear cells of FMS patients (Gur et al 2002, Maes et al 1999). Additionally, other studies have identified a variety of markers of oxidative stress such as pentosidine, as well as reduced levels of superoxide dismutase (a marker of antioxidant capacity) in some FMS patients (Pache et al 2003).

Blanco et al suggest that that at least a subset of FMS patients (up to 30%) 'could suffer from an inflammatory subtle process, mediated by cytokines, proteases and inflammation mediators, probably located in soft body tissues. This inflammatory process could result from an abnormal imbalance between proinflammatory products (i.e. cytokines, proteases and inflammation mediators) and anti-inflammatory biological substances'. Repercussions involving activated nociceptors and central sensitization are suggested (see Fig. 4.5).

Comment

It seems probable that in at least a subset of patients with FMS inflammation plays an aetiological role, encouraged by a combination of upregulation of inflammatory substances and deficiencies of anti-inflammatory agents.

Neurosomatic hypothesis (Goldstein 1996)

Goldstein has proposed a neurosomatic hypothesis to explain a wide range of disorders, including FMS (Fig. 4.6). He explains a possible sequence:

- A variable genetic susceptibility. If this is strong, neurosomatic symptoms will develop early in life. If it is a weak 'predisposition', other factors are required to cause expression of the traits.
- If hypervigilance develops during the period between birth and puberty, this could lead to a tendency for misinterpretation of sensory input, associated with increased substance P levels as well as transiently elevated cortisol, together with a 'downregulation' of the HPA axis. Central noradrenaline (norepinephrine) levels could also be lowered, adding to dysautonomia.
- Persistent infections in neurons and glia may occur (viral encephalopathy), possibly without an immune response. This would be 'largely genetically predetermined' or could be influenced by 'situational perturbations of an immune response'. Persistent CNS viral infections are seen to be

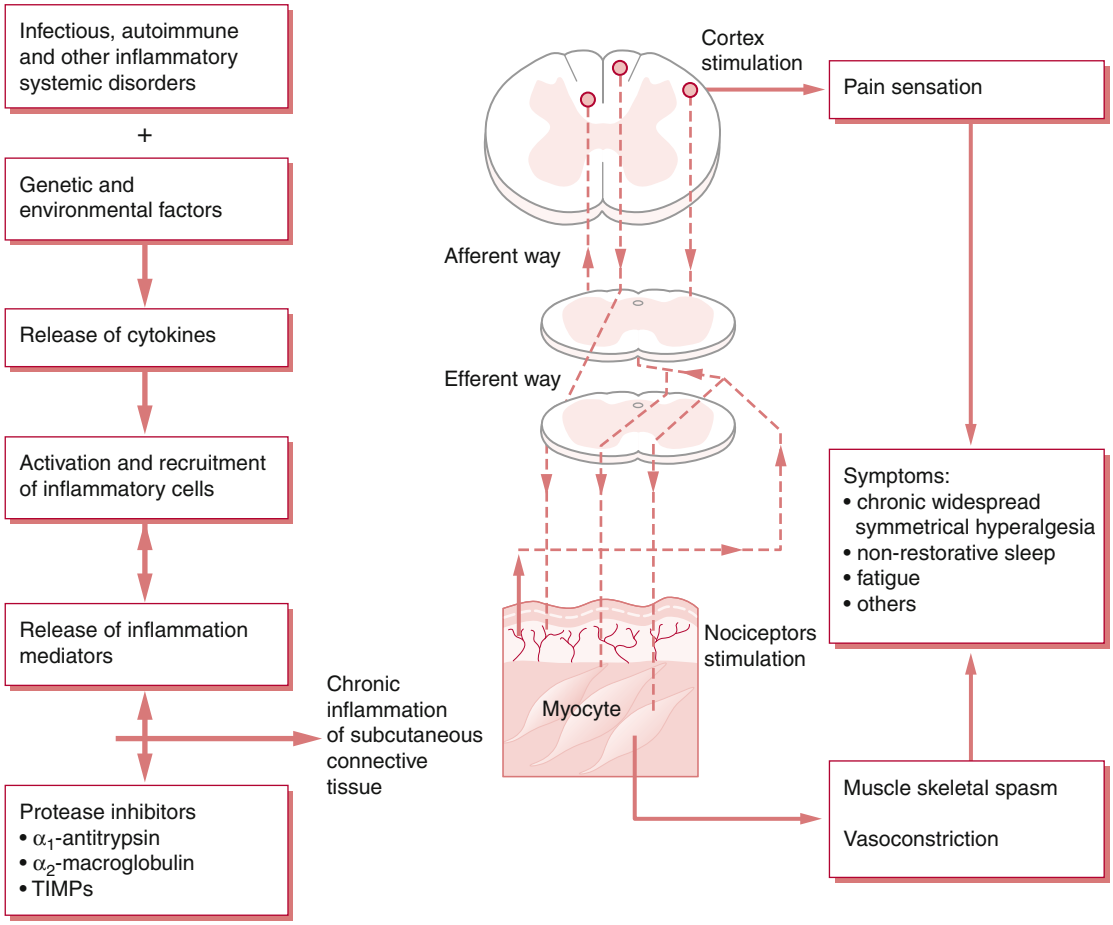

Figure 4.5 • Inflammatory hypothesis. (Reproduced with permission from Blanco et al 2005.)

capable of altering neurotransmitter production as well as modifying cellular behaviour.

- Due to reduction in 'neural plasticity', increased susceptibility to environmental stressors could develop. If the combined genetic and developmental influences outlined above interact, the flexibility of the brain to modify neural networks to cope with internal and external demands could be impaired.

Goldstein offers an example relating to the memory problems so common in patients with FMS (or, as Goldstein calls them, 'neurosomatic patients').

> *In order to encode a memory, a fragile neural network must be strengthened. This process may occur by augmenting secretion of glutamate from firing presynaptic neurons by secretion of a retrograde messenger such as nitric oxide (NO) by the post-synaptic neuron. NO diffuses in a paracrine manner into firing neurons in the locality, enhancing glutamate secretion. If insufficient glutamate or NO is secreted, neural networks will not be appropriately reorganized (strengthened) and encoding will be fragile. Neurosomatic patients have an impaired neural plasticity. Deficiency in the neurobiological encoding is one example of this pervasive disorder. Thus the individual who is predisposed to develop a neurosomatic disorder may have neural network function dysregulated by overtaxing his capacity for neural plasticity.*

Goldstein suggests utilizing any of a very long list of medications, applied sequentially, until the neural behaviour is normalized and the patient is asymptomatic.

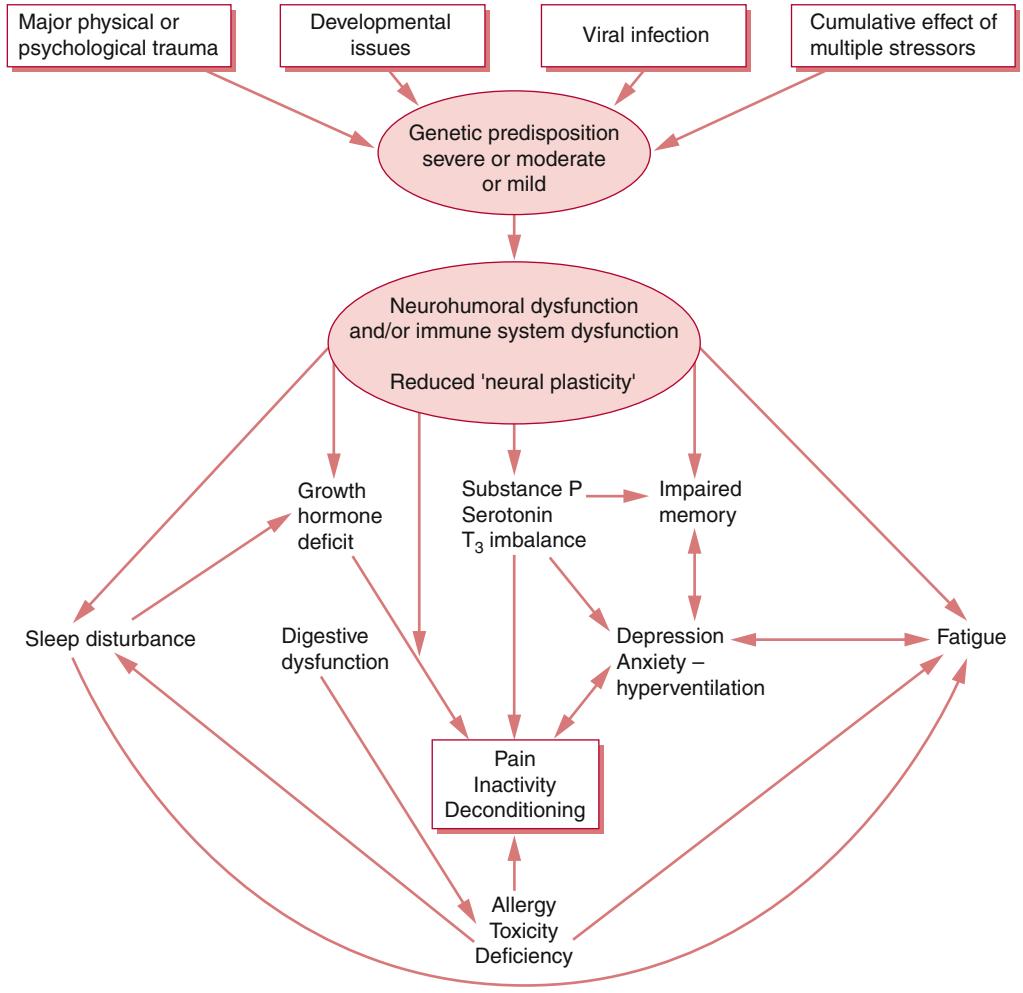

Figure 4.6 • Neurosomatic hypothesis – hypothetical FMS evolution.

Comment

As discussed in Chapter 3, the evidence which supports Goldstein's concepts is growing. It is doubtful that his neurosomatic hypothesis can explain the onset of all cases of FMS; however, it does seem to be the case that a variety of neurosomatic influences can lead to misinterpretation by the brain and its network, with awful consequences. In this model, allostasis is seen to be operating instead of homeostasis (see Fig. 2.3C). It is in this way that the multiple stressors influencing such patients are seen to produce their negative effects following anything which triggers and maintains increased hypothalamic activity – whether infection or exposure to chemical, physical or emotional stress.

Nociceptive hypothesis

If pain is the final major symptom of FMS, it may also be the cause.

Wolfe (1994) in the USA and Croft et al (1992), among many researchers, have contributed a wealth of information regarding FMS and its characteristics. Croft observes a sequence of:

- no pain
- increased tenderness
- transient pain
- chronic regional pain
- chronic widespread pain
- psychological distress
- FMS symptoms.

Wolfe proposes that:

- chronic pain stimuli lead to lowered pain threshold
- pain amplification (lowered threshold) then progresses, influenced by genetic (especially childhood onset FMS), disease (mainly viral), sleep disturbance and psychological factors (psychosocial stress and the way with which it is coped)
- FMS evolves (see Fig. 4.7).

Wolfe suggests that there may be many fibromyalgias:

> *Does the distressed older patient with chronic back and neck pain and FMS have the same disease process as the middle aged person developing the syndrome after an apparent viral illness? Are they the same as those with pain from childhood or with major psychological abnormalities? Do these subsets have the same neurohumoral and biochemical changes that are said to be characteristic of FMS generally?*

Central nervous system dysfunction

Within this nociceptive hypothesis another model exists that envisages FMS as an imbalance between aspects of the central nervous system, in which the pain-inhibition and the pain-amplification functions fail to operate adequately (Jasmin & Thorson 2000). This might involve:

- increased amplification of pain messages
- non-pain messages being perceived as pain messages
- neurotransmitter (e.g. noradrenaline (norepinephrine)) imbalances resulting in painful sensations where pain stimuli are absent, leading to hyperalgesia
- inadequate performance of inhibitory features when nociceptive impulses are active (see Fig. 4.8).

Retention hypothesis (St Amand 1997)

St Amand (1997) suggests that FMS is a 'retention' disease similar to gout, but with a wider range of tissue involvement. He notes that although patients respond to uricosuric medications, urates are not

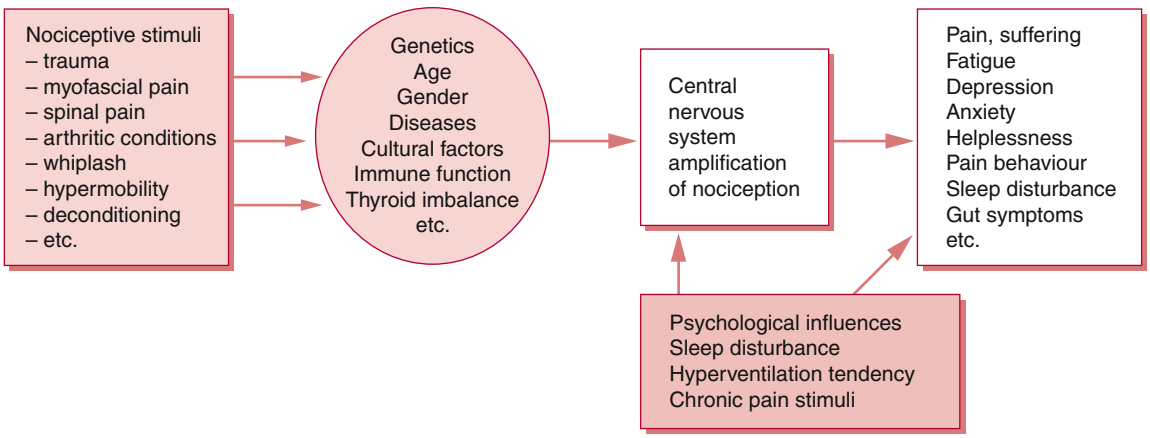

Figure 4.7 • Nociceptive hypothesis (adapted from Wolfe 1994).

Comment

It does seem to be logical to attempt to categorize people with FMS, as Wolfe has done, into subgroups with common aetiological features. This can be helpful, for example in separating patients with FMS symptoms which appear to be emerging from a background of infection, toxicity and/or allergy, from those with conditions resulting from a background of emotional overload, thyroid dysfunction or whiplash injury. All too frequently, however, individuals who manifest FMS can be linked to a number of categories, rather than having a straightforward 'cause and effect' history (see Box 3.1, Pathophysiological synchronicity, for discussion of non-linear aetiologies).

Or FMS may manifest as one causal element interacts with another. Croft (2000) observes that: 'It is my professional opinion that some patients are predisposed to develop FMS or do already have a minor, but tolerable, case of FMS. These cases are then precipitated or aggravated by certain forms of trauma, resulting in long-term discomfort.'

In Chapter 9, Carolyn McMakin describes six broad subgroups of FMS. They result largely from:

1. prolonged emotional or physical stress
2. gut-related changes leading to allergies and intolerances
3. exposure to organic chemicals, heavy metals or pesticides
4. genetic predisposition which may be associated with food sensitivities
5. post immunization or viral illness
6. post whiplash injuries, cervical trauma, or after surgery.

McMakin says: 'These different types have the same neuroendocrine and central sensitization features described in the fibromyalgia research but they each respond to different treatment strategies.'

However patients with FMS are categorized, it is certain that they do not form a homogeneous group, except for the nature and degree of their main and associated symptoms. People with FMS are no more uniform than are trees, automobiles or healthy humans.

involved: 'The ubiquitous symptoms and number of organs and systems affected [in FMS] point to a metabolic misadventure induced by an

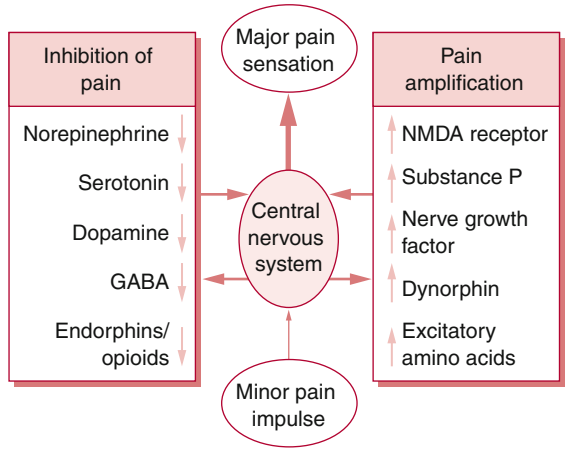

Figure 4.8 • Central nervous system pain control system imbalances.

accumulation of an anion different from urates. This putative ion wreaks havoc throughout many systems and yet evokes no inflammatory response. It is obviously perceived as a normal tissue constituent.' The agent considered most likely to fit this description is inorganic phosphate.

The metabolic processes most affected include ATP generation: 'The most plausible theory of fibromyalgia is that of defective ATP generation from a fully operational citric acid (Krebs) cycle that produces heat instead of energy.' An as yet unidentified enzyme, receptor or pump defect is suggested as a reason for systemic accumulation of phosphate.

Treatment recommendation is for use of the expectorant guaifenesin, a weak uricosuric, along with calcium which lowers the required dosage. Results are claimed to be good, and without side-effects, despite the possibility of a period of aggravation of symptoms at the outset until dosage requirements are fine-tuned to meet individual needs.

It is suggested by the proponents of the use of guaifenesin that inadequate production of energy, combined with 'overstimulated areas' which utilize excess energy, creates a relative hypoglycaemic effect as noted in many FMS patients ('40% of fibromyalgic females and 20% of males'). A rise in adrenaline (epinephrine) has been noted prior to the greatest trough in blood sugar levels which requires separate (from medication) dietary control measures. This phenomenon, which is often accompanied by diverse symptoms including apparent panic attack (noted to be a 'carbohydrate intolerance'), is seemingly unresponsive to carbohydrate ingestion, due to ATP production inadequacy.

A double-blind, placebo-controlled trial of use of guaifenesin was conducted at the University of Oregon in 1995, with no difference being noted between placebo and the medication group. The study has been criticized by St Amand for failing to fully implement precautions during the trial relating to the use by patients of salicylate-containing substances (including cosmetics) which are said to block the effects of the medication, as well as the failure to exclude hypoglycaemics from the study (Bennett 1996).

Comment

Despite the lack of clinical trial evidence for the efficacy of guaifenesin in treating FMS, several industrious advocates continue to press the claims for its usefulness (as a web search will show). No clinical trials have been conducted which validate guaifenesin's use at this time.

Stress hormone hypothesis (Adler et al 1999)

Adler et al (1999) have researched the hypothesis that FMS involves a deficiency in cortisol, whether triggered by an infection, trauma or psychosocial events. They observe that the symptoms of cortisol deficiency are very similar to those of FMS (see Fig. 4.9).

Since cortisol is produced in response to most stress events, including hypoglycaemic episodes, infection, inflammation, low blood pressure, exercise and emotional stress, the need for its abundant presence is clear (Schedlowski 1992). Deficiency in cortisol is characterized by fatigue, weakness, muscle and joint pain, bowel symptoms, nausea, increased allergic reactions and mood disturbance.

In the first edition of this book it was noted that research into this hypothesis was ongoing at that time, in order to evaluate:

- whether FMS patients have inappropriately low cortisol levels in either stressed or unstressed situations over a 24-hour period and at known peak times in normal individuals
- which sites within the HPA axis might be associated with cortisol deficit
- the effects of induced hypoglycaemia as a stressor to provoke adrenocorticotropic hormone (ACTH) and cortisol release (Haouri et al 1997)

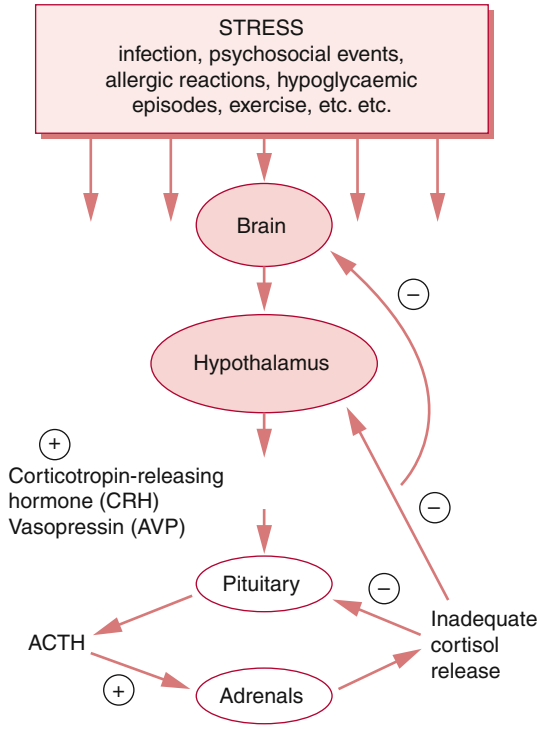

Figure 4.9 • The stress hormone hypothesis (adapted from Adler 1995).

- pituitary production of ACTH in response to corticotropin-releasing hormone in people with and without FMS
- adrenal response to ACTH in individuals with and without FMS.

Since the above was written, evidence of lower than normal cortisol levels in people with FMS has been definitively demonstrated, for example in a study in which low overall production of cortisol was noted in patients with FMS in contrast to the findings in depression, where a higher than normal cortisol level was found (Demitrack et al 1998).

In another study, Adler and colleagues, including Goldenberg (Adler et al 1999), performed a detailed comparison of the HPA axis and the sympathoadrenal system in women with and without fibromyalgia. Fifteen premenopausal women with fibromyalgia and 13 healthy premenopausal women were studied. Baseline 24-hour urinary free cortisol levels and evening and morning ACTH and cortisol levels were measured, both with placebo and with serum glucose levels decreased from 5.0 to 2.2 mmol/l. Women with fibromyalgia had normal 24-hour urinary free cortisol levels and normal

diurnal patterns of ACTH and cortisol. There was a significant, approximately 30%, reduction in the ACTH and adrenaline (epinephrine) responses to hypoglycaemia in women with fibromyalgia, compared with controls. It was concluded that patients with fibromyalgia have an impaired ability to activate the hypothalamic–pituitary portion of the HPA axis as well as the sympathoadrenal system, leading to reduced ACTH and adrenaline (epinephrine) responses to hypoglycaemia.

Malt et al (2002) hypothesized that while a substantial proportion of the subjectively experienced variance in pain in fibromyalgia patients could be explained by psychological factors alone, a combined model that included neuroendocrine and autonomic factors as a base of the symptomatology would give the most likely explanation of variance in pain. They note that studies have provided convincing evidence that the adrenal gland is hypoactive in stress-related states such as post-traumatic stress disorder, in healthy individuals living under conditions of chronic stress, as well as in patients with several bodily disorders including chronic fatigue syndrome, fibromyalgia, other somatoform disorders, rheumatoid arthritis and asthma (Heim et al 2000, Neeck & Crofford 2000). It has also been hypothesized that a persistent lack of cortisol availability in traumatized or chronically stressed individuals may promote an increased vulnerability for the development of stress-related bodily disorders (Heim et al 2000). The main finding in the study by Malt et al (2002) is that a biopsychosocial model, including psychological factors as well as factors related to perturbation of the autonomic nervous system, and the HPA axis, was necessary to explain the variance of pain in the fibromyalgia patients.

Is there a beneficial effect associated with lowered cortisol levels?

Fries et al (2005) propose a different interpretation of lowered stress hormone presence in people with FMS (and associated conditions such as CFS and PTSD). They note that the negative effects of hypocortisolism included the following:

- Increased sensitivity to glucocorticoid negative feedback, as indicated by cortisol supersuppression in the dexamethasone suppression test (DST) (Heim et al 2000).
- FMS patients displayed higher basal plasma noradrenaline (norepinephrine) levels, as well as exaggerated noradrenaline (norepinephrine) responses (Torpy et al 2000).
- Early innate and inflammatory immune responses may be overactive, whereas adaptive immunity seems to be unchanged or depressed (Rohleder et al 2004).
- 'Hypocortisolaemic symptoms' (fatigue, pain, stress sensitivity) after prolonged periods of stress, e.g. work stress, infection or social stress (Van Houdenhove & Egle 2004).

Fries et al also observe that evidence suggests that despite symptoms such as pain, fatigue and high stress sensitivity, hypocortisolism may also have beneficial effects on the organism. This assumption is underlined by studies suggesting protective effects of hypocortisolism for the individual, as follows:

- The dampening of chronic HPA axis activity, thereby reducing the damaging effects of the glucocorticoid response to daily stress events at the expense of symptoms such as high stress sensitivity, pain, and fatigue (Fries et al 2005).
- Raison & Miller (2003) note that prolonged or repeated exposure to immune stimuli might predispose an individual to reduced glucocorticoid signalling as a means of freeing bodily defences from inhibitory control in the face of an ongoing infectious threat. In this way an enhanced release of inflammatory compounds may be adaptive under conditions in which recurrent infection is likely and immune readiness is an attendant requirement.
- Van Hoof et al (2003) hypothesize that atypical depression, common in CFS patients, constitutes a 'sickness response'. This refers to the non-specific symptoms (fatigue, increased pain sensitivity, depressed activity, concentration difficulties, anorexia) that accompany the response to infection resulting in a decrease in energy consumption, assisting subsequent recuperation, and serving as an important function for survival.
- Kudielka et al (2004) report a higher allostatic load index (the wear and tear of the body and brain resulting from chronic overactivity or inactivity of physiological systems involved in adaptation to environmental challenge) in older, compared to younger subjects, with the exception of hypocortisolaemic elderly, who had a comparable allostatic load to young people, even though they scored far higher on perceived stress scales.

This suggests that a hypocortisolaemic response to stress may be protective rather than damaging.

Comment

Stress hormone levels drop in the fibromyalgia patient, with the fascinating possibility that this trade-off serves a protective function, at the price of some of exacerbation of the major symptoms of pain and fatigue.

Thyroid hormone dysfunction hypothesis (Garrison & Breeding 2003, Lowe 1997)

Lowe (1997) has traced the clear connection between FMS and thyroid dysfunction. This is explained in Chapter 10.

- Lowe et al (1997) propose that when thyroid function is apparently normal (euthyroid) in patients with FMS, this condition may be the result of a failure of normal thyroid hormone concentrations to regulate gene transcription. They report that various trials have been conducted which support this hypothesis involving medication with T_3 in excess of normal physiological dosages. No adverse effects were noted alongside the observed benefits of T_3 medication in five measures of FMS status in double-blind, placebo-controlled studies (see Ch. 10 for more detail).
- The symptoms of FMS closely resemble those of hypothyroidism (Sonkin 1985, Wilke 1981), including depression, mental fatigue, anxiety, poor memory, sleep disturbance, headaches, gastrointestinal dysfunction, menstrual irregularities, fatigue, hypoglycaemia, sensitivity to cold, increased susceptibility to infection, musculoskeletal symptoms and skin problems.
- A diagnosis of FMS is not an uncommon associated condition in many people with a diagnosis of hypothyroidism (Ferraccioli 1990).
- Inadequate gene transcription in a euthyroid individual might be the result of cellular resistance to thyroid hormone (Refetoff 1993). The clinical features of FMS might be seen to result from by-products of inadequate regulation of gene transcription, phosphodiesterase, Gi proteins and adrenoceptors (which are stated to occur in both hypothyroidism and cellular resistance to thyroid hormone).
- Yellin (1997) notes that: 'Thyroid hormone regulates substance P in discrete nuclei of the brain, in the anterior pituitary, in the lumbar cord and the dorsal root ganglia . . . inadequate regulation of gene transcription by thyroid hormone could not only account for high substance P levels but for all other objective findings and associated symptoms of FMS.'

As noted in Chapter 3, antisera prepared against *Mycoplasma gallisepticum* and *M. pneumoniae* may bind to human thyroid membranes, suggesting that receptors on human thyroid tissues, and on mycoplasmal cells, may have similarities in antigenicity. In this case any thyroid hypofunction, emerging from a background of genetic predisposition, can be seen to require infection by these particular mycoplasmata in order to manifest (Sack et al 1989). (See Ch. 10 for a full description of this hypothesis and treatment protocols.)

Vaccination hypothesis

The possible aetiological connections between vaccination and CFS, FMS and Gulf War syndrome are presented in Chapter 3 (Ablin et al 2006) under the heading 'Vaccination and FMS (and Gulf War syndrome)'.

Summary

It is clear from examination of the various hypotheses outlined above that many of the same set of variables are being assembled in slightly different ways, with different degrees of emphasis, so that while the ingredients making up the mixture remain much the same, the flavour changes.

Out of this cocktail of ingredients – genetics, stress of various types (physical, chemical and/or psychological), allergy, infection, obesity, inflammation, sensitization, etc. – it is necessary to discern which elements are operating in any given case, and to work with what is possible in terms of moderating the factors aggravating or maintaining these dysfunctional patterns, and/or enhancing functional possibilities.

In the next chapter focus is given to a comparison of CFS and FMS, both their similarities and their differences.

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Chapter Five

5

Chronic fatigue syndrome and fibromyalgia compared

CHAPTER CONTENTS

Definitions

The history of FMS, of its associated conditions, and of the many hypotheses which try to explain it (and such associated conditions as CFS), represents a mosaic of interlocking elements and contributing features which seem to have a constantly shifting focus:

- Is this a biochemical (i.e. due to viral infection, toxic exposure, allergy, etc.) phenomenon with psychological as well as physical manifestations?
- Is this a psychosocial condition (such as anxiety, depression, etc.) which produces biochemical and musculoskeletal changes?
- Is this a biomechanical condition (such as acute whiplash, postural and respiratory dysfunction, etc.) with repercussions affecting the individual biochemically and emotionally?
- Or is this really a condition emerging out of a warped or overloaded homeostatic function – allostasis – which is thought by some to result from excessive adaptation demands made on immature defence and immune capabilities early in life as a result of violent physical or emotional events (Goldstein 1996) which subsequently affects all aspects of the mind/body complex?

In individual cases, one or other (or more than one) of these possibilities may operate. Certainly, if we look at the common associated conditions and contributing features, we can see that some degree of fatigue is bound to emerge from any of them, whether it be sleep disturbance, allergy, viral infection, depression, hyperventilation, irritable bowel, chronic pain or any combination of these.

It is also reasonable to ask whether the conditions defined as fibromyalgia (FMS) and chronic fatigue syndrome (CFS) are not in fact simply variations on the same theme, with similar aetiologies and symptoms. Does the diagnosis depend more on which physician is making the assessment than on real differences which define each condition?

Experts differ in their answers to these questions. Wolfe (1994) suggests that: 'Chronic nociceptive stimuli can lead to lowered pain threshold and . . . [this] . . . might be influenced by genetic, disease and psychological factors.' With regard to the various hypotheses which explain these events and how they lead to FMS (see Ch. 4), Wolfe (1994) suggests that: 'there may be many fibromyalgias'.

Is the fatigued older patient with chronic neck and back pain and a diagnosis of FMS likely to be manifesting the same systemic dysfunctional neurohumoral processes as a younger patient whose

symptoms are apparently associated with a viral infection, or a whiplash injury, or a major psychological illness – all of which may have chronic fatigue as one of the key presenting features?

It may be useful to refer back to the definition of fibromyalgia as officially specified by the American College of Rheumatology (Ch. 1, and Box 1.2) and compare this with the summarized definition of CFS given below (as defined by the US Centers for Disease Control (CDC) in 1988, revised 1994).

1. A new, unexplained, persistent or relapsing chronic fatigue which is not a consequence of exertion, is not resolved by bed rest, and which is severe enough to significantly reduce daily activity.
2. The presence of four or more of the following symptoms for at least 6 months:
   - **a.** headaches
   - **b.** concentration and short-term memory impairment
   - **c.** muscular pain
   - **d.** multiple joint pain *not* accompanied by swelling or redness
   - **e.** poor and unrefreshing sleep
   - **f.** post-exertion malaise lasting more than 24 hours
   - **g.** tender lymph nodes in the neck or armpits.

Someone with the muscle and joint features of this selection of symptoms, together with (say) the sleep disturbance and fatigue traits, would easily fit an FMS diagnosis (if 11 of the tested sites were sufficiently painful). Similarly, someone with the full FMS set of attributes would almost certainly have enough of the CFS characteristics to qualify for that diagnosis.

Conditions that *do* exclude a diagnosis of CFS:

1. any other current illness that causes fatigue, or drug side-effects
2. any past illness causing fatigue that might not have completely gone away
3. past or current psychiatric disorders such as depression, 'with psychotic or melancholic features', bipolar, schizophrenia, anorexia or bulimia
4. alcohol or drug abuse within last 2 years
5. severe obesity.

Table 5.1 Similarities between fibromyalgia syndrome and chronic fatigue syndrome (Block 1993, Goldenberg 1989, Yunus 1989)

	FMS	CFS
Age	Young adult	Young adult
Primary sex	Female	Female
Prevalence	Common	Common
Cause	Not known	Not known
Chronic	Yes	Yes
Laboratory studies	Normal	Normal
Pathological findings	None	None
Disabling	Yes	Yes

Conditions that *do not* exclude a diagnosis of CFS include: fibromyalgia, anxiety, non-psychotic or melancholic depression, neurasthenia and multiple chemical sensitivity disorder.

The similarities between fibromyalgia syndrome and chronic fatigue syndrome are listed in Table 5.1.

Are CFS and FMS the same?

While for many people the two labels attached to these distressing and disabling conditions are interchangeable (and many confusingly enjoy both diagnoses), the answer would seem to be 'not always, and not quite'. A toxic cocktail, or a variety of infections (and/or other factors), may be the trigger for either CFS and/or FMS, and the diagnosis may depend on the particular severity of some symptoms compared to others, or it may depend on which medical specialist makes the diagnosis.

Goldenberg (1994a) characterizes the similarities between CFS and FMS as follows: 'Both are chronic disorders with no known cause, no highly effective therapy and similar clinical and demographic characteristics. Studies of potential pathophysiologic abnormalities have been strikingly similar, including studies of muscle and immune function, sleep, as well as neurohormone alteration.'

In his research Goldenberg has found that approximately 70% of patients with chronic fatigue (who meet CDC criteria for CFS diagnosis) also meet the ACR diagnostic criteria for FMS. All those

patients with CFS who also reported chronic musculoskeletal pain met the FMS diagnostic criteria. Maquet et al (2007) agree that: 'About 70% of CFS patients display symptomatic signs of FMS, whereas 42% of FMS patients meet CFS criteria and 37% of CFS subjects meet FMS criteria.'

Goldenberg acknowledges, however, that other researchers have not found this same degree of overlap and believes that: 'Studies of the complicated integration of mind, body and the patient's psychosocial milieu are most likely to provide meaningful answers to all potential factors, including infections, that may be associated with FMS.'

Wessely et al (1999) note that CFS, FMS and irritable bowel syndrome are polymorph expressions of the same somatic and psychological disorder. Both groups of patients frequently suffer sleep disturbances, both suffer fatigue and are affected by weather changes, and muscular pain is a common feature of both.

Comment

See also discussion of nitric oxide (NO) in Chapter 4, which offers reasoning whereby NO is seen to be involved in the aetiology of a cluster of similar conditions, CFS, FMS, post-traumatic stress disorder (PTSD) and chronic chemical sensitivity (CCS).

CFS/FMS response to exercise

As noted in Chapter 14, numerous studies (with some exceptions that disagree) demonstrate benefit from graduated, regular, aerobic – or moderate levels of – exercise for patients with FMS.

Physical training has also been recommended in rehabilitation programmes for CFS patients. For example, Fulcher & White (1997) allocated 66 CFS patients to a daily (30 min/day) aerobic exercise programme (cycling, walking or swimming with an intensity corresponding to 60% of oxygen maximal consumption) or to a programme combining relaxation and flexibility exercises (30 min/day, five times per week). Subjects performing the aerobic exercise programme showed significant improvements in well-being (55% versus 27%).

Despite such studies, systematic reviews have not always agreed that exercise programmes are helpful for individuals with either FMS or CFS (Sim & Adams 2002). In addition, the way that people with FMS respond to exercise seems different from the way those with CFS respond. Smith (1999/2002) points out that research at the Universities of Newcastle and Adelaide by Walsh (1999/2002) suggests that, for CFS patients: 'Aerobic exercise can do no good and could be positively harmful.'

A number of the conditions associated with FMS do, however, appear to benefit from exercise, for a variety of reasons:

- reduced anxiety and depression (Clark et al 2001)
- increased pain threshold (Koltyn 2000)
- increased tolerance to symptoms (Clark et al 2001)
- release of endorphins resulting from stimulation of the opioid system (Koltyn 2000) when efforts exceed the aerobic threshold, or when they last more than 60 minutes (Schwartz & Kindermann 1992), or with exercises at a lower level of intensity when performed by subjects severely deconditioned (Goldfarb & Jamurtas 1997)
- improved mood, well-being and self-confidence, as well as a decrease of feelings of helplessness (Ramsay et al 2000)
- improved quality of sleep (McCain et al 1988).

A literature review by Maquet et al (2007) concludes that:

> *Several studies investigated the benefits of graded exercise therapy for patients with FM or related syndromes. Although some systematic reviews have not established an unequivocal benefit of physical training, most authors report a benefit for patients with chronic pain or fatigue. Ideally, such a therapy should be a part of multidisciplinary program. Muscular rehabilitation is reserved for preventing the deconditioning syndrome often reported in patients and the vicious cycle of pain, avoidance and inactivity behaviors, or even kinesiophobia, deconditioning, incapacity and psychological distress.*

Pain in CFS and FMS

FMS is characterized by pain and CFS by fatigue, although patients in both categories suffer both symptoms to some degree. Lichtbroun (2002) states:

Findings suggest that both FMS and CFS are characterized by alterations in neural processing of sensory information. On the other hand, neuroendocrine studies suggest that in FMS hyperexcitability of the spinal NMDA receptors increases ascending sensory transmission to the brain that enhances pain perception. Persons with CFS usually experience musculoskeletal pain, but they do not show abnormal sensitivity to pressure stimulation at multiple anatomic sites, unless they also meet the criteria for FMS.

Are CFS patients more likely to have an infectious aetiology than FMS patients?

Komaroff (2001) is categorical that CFS is not causally related to infection, although synchronous infections are commonly associated:

No infectious agent has been convincingly shown to be a cause of CFS, and most investigators think it is unlikely that a single novel agent is the cause. Nevertheless, there is evidence from several controlled studies of the reactivation of several chronic viral infections in CFS. In our opinion, the evidence is strongest for human herpesvirus-6, a neurotropic and immunotropic virus. CFS has been documented following a variety of acute infections with viruses (such as following acute infectious mononucleosis), bacteria (such as following properly-treated Lyme disease), and other microbial infections (such as following Q fever).

De Becker et al (2002) are equally clear, but in precisely the opposite direction, suggesting an aetiological role for infections:

We collected data on 1546 CFS patients and 309 excluded fatigued patients who presented at the Fatigue Clinic at the Vrije Universiteit Brussel. Using extensive present and past medical history and lab reports as close as possible to the date of onset, an attempt was made to identify the agents that could play a role in the disease process . . . Differences in the types of event reported at onset were also noted for those subjects who reported a sudden as distinct from a gradual onset and when comparing the defined CFS patients and those excluded under the definitions. Odds ratio analysis revealed a series of subgroups of events that occurred at onset of CFS. Each of these onset event clusters was associated with an infectious event, blood transfusion or hepatitis B vaccination. In half of our study group two preceding factors were observed; an infectious event was often combined with a non-infectious event . . . Infectious agents seem to play an important role in the onset of CFS. Upper respiratory tract infection was the most common preceding illness before the development of CFS in our group of patients. The simultaneous occurrence of infectious and non-infectious factors seems to be important onset associated events of CFS. In summary, we can conclude that a number of different stressors and consequent immunological and neuroendocrinological changes can contribute to the onset of CFS.

De Meirleir et al (2001) sought to reveal the pathophysiological mechanisms in CFS. They report that:

It seems clear today that no single etiologic agent is responsible for the development of CFS. Instead, in this disorder there are a number of onset and predisposing factors that compromise immunity (changes in cytokine balance, T cell activation, poor cellular immunity). Intracellular and opportunistic infections and viral reactivation will result in increase of the protein kinase R and ribonuclease L activity and poor ds(or ss)-RNA inducers will augment RNase L monomers that are prone to proteolytic cleavage. . . . All the ABC transporters that are analogous to RLI play a role in physiology of which dysfunction can be related to various symptoms in CFS. Thus several symptoms observed in CFS patients could be the result of an acquired channelopathy. In a group of 206 CFS patients, using PCR with nucleoprotein gene tracking, we found that approximately 70% showed mycoplasmal infection; compared to the patients who were mycoplasma spp negative, the mycoplasma positive patients had significantly

more cleavage fragments of RNase L. The following mechanism is proposed: mycoplasmas have been shown to overexpress an apoptotic-like endonuclease, which acts on the nuclear fraction of the host cells.

The evidence cited above, taken together with the notes on mycoplasmal infection in Chapter 3, suggests that Komaroff (see above) may be incorrect, and that infection does indeed play a major part in the actual aetiology of CFS (and possibly also of FMS), rather than simply being a cofactor or synchronous event.

Despite the fact that the swollen glands, sore throats and low grade fever experienced by many people with CFS are also reported by many FMS sufferers, some experts hold that a viral or bacterial origin is more likely to be operating in CFS than FMS (although not all agree; see Russell's opinion below).

What is the evidence?

Suhadolnik et al (1997) have developed a blood test showing that up to 88% of CFS sufferers have abnormal low molecular weight Rnase L, while only a small fraction of fibromyalgia patients and people with depression have the enzyme. Rnase L is an 'antiviral pathway enzyme' produced by the body to attack viruses.

Moldofsky (1993) tested patients with a diagnosis of CFS and also FMS patients whose symptoms had commonly started after a flu-like infection, as well as those whose symptoms started in other ways. He found that the brainwave patterns, tender points, pain and fatigue were virtually identical in all these groups (Moldofsky 1989). Moldofsky's research further suggests that neuroendocrine imbalances affecting sleep/wake functions were a key feature of both conditions (Moldofsky 1993).

Goldenberg has compared 50 patients diagnosed as having FMS with 50 patients diagnosed with CFS and found that symptoms of sore throat (54%), rash (47%), chronic cough (40%), swollen lymph glands (33%) and recurrent low-grade fever (28%) were virtually the same in both groups. Since these symptoms are common among CFS patients, it seemed to him likely that the diagnosis can often be interchangeable (Goldenberg 1993a).

To some specialists the possibility of viral infection being a key feature in the aetiology of CFS helps to define the difference between it and FMS, although numerous tests and trials have not as yet led to anything definitive being established in the way of a common infecting agent (Straus 1994).

Nevertheless, Russell asserts that FMS patients display little or no evidence of infection: 'I have over 400 fibromyalgia patients and I don't find patients with tender nodes or recurrent fevers. And I have chronic fatigue patients with both spouses involved and have never seen this in fibromyalgia' (Russell 1994).

The implication of Russell's statement is that infection seems to be a major aspect of CFS and not of FMS. Goldenberg, however, says that in FMS there is often strong evidence for an infectious link and reports on viral links with FMS including HIV, coxsackie and parvovirus (Goldenberg 1993a). He also reports on the well-known association between Lyme disease and FMS: 'The development of fibromyalgia as a consequence of infection with *B. burgdorferi* is now considered the worst complication of the disorder' (Steere et al 1993).

Goldenberg is clear that: 'It is unlikely that a single infection is the cause of most cases of fibromyalgia. Studies of the complicated integration of mind, body and patient's psychological milieu are more likely to provide meaningful answers to all potential factors, including infections, that may be associated with fibromyalgia' (Goldenberg 1994b).

Dr Anne Macintyre, herself afflicted with ME, writes (Macintyre 1993):

The onset of ME [the British name for severe chronic fatigue is myalgic encephalomyelitis, ME] usually seems to be triggered by a virus, though the infection may pass unnoticed (Gow 1991). . . . many people say they were fit and well before a viral infection which started their ME [CFS/FMS] but it is possible that in many such patients there have been other factors such as emotional stress, pesticide exposure, surgical or accidental trauma some months before the triggering infection.

Macintyre also states:

The incidence of new cases peaks in late summer and autumn, coincident with the peak time of year for enteroviral infections. It is likely that

enteroviral infection accounts for the majority of ME illness in this country [UK], even if other factors (stress, trauma) are present. There may also be a genetic predisposition, evidenced by the higher than expected number of parents with ME whose children also develop it some years after the parents (Dowsett et al 1990).

Some of the major (possible) influences of viral infection on FMS are summarized below:

- HHV-6, one of the herpesviruses, is more commonly found in FMS/CFS patients than other people (Buchwald et al 1992).
- British research which examined stool samples and blood evidence implicates enteroviruses (Behan 1993, Gow 1991).
- Buskila (1990) and Simms (1992) have both reported on the presence of FMS symptoms in patients infected by HIV.
- Chronic coxsackie B virus infection has been shown to mimic FMS symptoms (Nash 1989).
- Parvovirus has likewise been associated with FMS (Leventhal 1991).

If a major part of the background to CFS and FMS is a dysfunctional pattern which involves immune function, then infection would be a logical association and, to an extent, Goldstein – in his all-embracing concept of neurosomatic disorders (see Ch. 4 and Fig. 4.6) – expresses such a viewpoint. He sees little if any difference between CFS and FMS aetiology and offers a detailed explanation of the complex biochemical changes involved in the origins and maintenance of these and other conditions as outlined in previous chapters (Goldstein 1996).

Other fibromyalgia experts do not believe that FMS and CFS are the same, although they may coexist in many patients. For example, Starlanyl & Copeland (1996) state: 'FMS has many subsets, depending on which neurotransmitters are affected. Some of these subsets are similar to CFS. People with well-managed FMS may have little or no fatigue at all.'

So the question remains, are these virtually the same condition, with a slight difference in the degree and emphasis on one symptom or another (particularly muscular pain and fatigue), or are there clinically relevant differences which impact on how the condition is treated? For example, it seems clear from evidence that aerobic exercise benefits FMS patients (Goldenberg 1993b, McCain et al 1988). The performance of aerobic exercise, however, remains impossible for many CFS patients, for whom the pathological degree of fatigability and the repercussions of excessive effort are defining characteristics.

Straus for one also suggests that cognitive dysfunction (memory lapses, problems with calculating) as well as physical effort are far worse in CFS compared with FMS (Straus 1994). Certainly some of the functions of the brain seems to be compromised in CFS. Bested et al (2001) offer the explanation that this is due to altered permeability of the blood–brain barrier:

There is considerable evidence that CFS is a disorder involving the central nervous system (CNS). It is our hypothesis that altered permeability of the blood–brain barrier (BBB) may contribute to ongoing signs and symptoms found in CFS. To support this hypothesis we have examined agents that can increase the blood–brain barrier permeability (BBBP) and those that may be involved in CFS. The factors which can compromise the normal BBBP in CFS include viruses, cytokines, 5-hydroxytryptamine, peroxynitrite, nitric oxide, stress, glutathione depletion, essential fatty acid deficiency, and N-methyl-D-aspartate overactivity. It is possible that breakdown of normal BBBP leads to CNS cellular dysfunction and disruptions of neuronal transmission in CFS. Abnormal changes in BBBP have been linked to a number of disorders involving the CNS; based on review of the literature we conclude that the BBB integrity in CFS warrants investigation.

Toxicity

The 'life grid' in Chapter 2 (Fig. 2.2) demonstrates the complex manner in which multiple influences are modulated by an individual's unique genetic and acquired attributes. One concrete example relates to the end result of deliberate exposure (done with 'the best of intentions') to a cocktail of chemicals during the Gulf War, by tens of thousands of individuals, who now suffer CFS, FMS and other symptoms.

Evans (2002) reported:

Brain scans on Gulf War veterans in the United States who are suffering from debilitating diseases may have resolved why 130,000 US

and British servicemen and women complain of mystery illnesses. Research discovered that disabled veterans of the 1991 war suffered chemical changes in their brains, similar to the onset of Parkinson's and Huntington's disease. The findings of the research, which have not yet been published, were revealed . . . [at] . . . a US congressional hearing into so-called Gulf War syndrome, held in the Palace of Westminster. British veterans who were present looked shocked. After detailed medical examination of one battalion of 249 soldiers from the 700,000 US troops who were deployed to the Gulf, Robert Haley of the Southwestern Medical Center at the University of Texas found that the brain cellular structure of the sick veterans had been damaged. Speaking in a committee room of the House of Lords, Dr Haley said he had uncovered evidence of 'chemical disturbance' in the brain. A similar study of British veterans by Goran Jamal, consultant physician at Imperial College School of Medicine, London University, which also revealed brain damage, had been ignored by the authorities, Dr Haley said. His own research, he said, had also shown that Gulf War veterans were two to three times more likely to suffer from motor neurone disease than other people. The damage to the brain was likely to have been caused by the use of organophosphate pesticides to kill desert flies and lice at the American and British tented camps in Saudi Arabia; the anti-nerve gas tablets and vaccines given to frontline troops and inhalation of chemicals after the Americans bombed an Iraqi chemical weapons store.

The degree of toxic exposure, the type of exposure and the degree of vulnerability of the individual (genetic and acquired features) would seem to be the determining variables which decided whether the horrendous mix of toxins resulted in mild symptoms, severe symptoms (including many diagnosed as having CFS or FMS) or mortal damage.

Pall (2001) notes that chronic fatigue syndrome (CFS), fibromyalgia (FMS), multiple chemical sensitivity (MCS) and post-traumatic stress disorder (PTSD) all share common symptoms, and that many patients meet the criteria for diagnosis for two or more of these disorders. Pall observes that each of these disorders often appears to be induced by a relatively short-term stress, followed by a chronic pathology, suggesting that the stress may act by inducing a self-perpetuating vicious cycle. Such a vicious cycle mechanism, Pall suggests, may involve elevated levels of nitric oxide and its potent oxidant product, peroxynitrite.

Pall has summarized evidence supporting the role of elevated nitric oxide/peroxynitrite in these four diseases, including induction of nitric oxide by common apparent inducers of these disease states, and also points to the similarity of these conditions to both Gulf War syndrome and the chronic sequelae of carbon monoxide toxicity.

Clinical caution: do less rather than more

Probably the most important warning that can be given to anyone who is chronically fatigued with FMS, ME or post-viral fatigue conditions, whatever the degree of muscular involvement, is that a return to normal activity should be cautious and slow. If symptoms eventually improve, the single most damaging mistake is to try to do too much too soon. The natural desire to return to full activity needs to be well curbed so that gains can be built on and not destroyed by excessive activity before stamina and strength are restored.

From the clinical perspective, this highlights a vital warning, namely that we should offer only a modulated and limited degree of treatment at any given time, and should avoid overloading adaptation mechanisms. This means making simple changes (whether lifestyle, dietary, medication, exercise or anything else) one at a time, with ample time allowed for accommodation to new patterns, encouraging a degree of very gradual incremental conditioning – exercise or activity – well within tolerance levels but with a view towards a gradually expanding degree of effort rather than a contracting one.

A clinical management plan

Martinez-Lavin (2002) has proposed that FMS and CFS arise when the autonomic nervous system (ANS) becomes dysfunctional as a result of excessive sympathetic arousal, and inability of the parasympathetic nervous system to operate effectively is a consequence of adaptive overload. He has termed this *dysautonomia*, and offers an integrated series of suggestions to help in normalization of this. An enlightened observation by Martinez-Lavin

accentuates a model of care that is to be commended:

> *The use of medications should be reserved for those cases in which the intensity of the symptoms markedly constrains the patient's quality of life. It is clear that in this chronic illness with dramatic manifestations in diverse organs and systems of the body, polypharmacy should be avoided.*

He nevertheless (see below) advocates the possible use of a number of pharmacological products.

Non-pharmacological therapy

- Avoidance of sympathomimetic products (such as nicotine and caffeine)
- Graded aerobic exercises (Rowe et al 2000)
- Biofeedback (Buckelew et al 1998)
- Liberal intake of mineral water to assist in relief of idiopathic orthostatic hypotension (Jordan 2001)
- Fitted stockings to decrease blood pooling in the legs.

Pharmacological therapy (Martinez-Lavin 2002)

- Avoid polypharmacy
- Benzodiazepines (i.e. clonazepam) to improve sleep pattern and anxiety
- Low dosages of non-cardioselective beta-blocking agents (i.e. propranolol)
- Blood volume expansion with fludrocortisone
- Selective serotonin receptor antagonists (i.e. tropisetron).

Comment: There remains some disagreement and debate regarding the similarities and differences between CFS and FMS. They are not the same, but they do have distinct overlaps, and each can easily be misdiagnosed as the other; indeed, many people carry the distinction of having been variously diagnosed as having both CFS and FMS by different experts (e.g. neurologist and rheumatologist).

Orientation

The next eight chapters approach the problems of management of FMS (and CFS) from a variety of perspectives, by experts in the areas under discussion:

- Chapter 6 Acupuncture treatment of fibromyalgia and myofascial pain – Peter Baldry MB FRCP
- Chapter 7 Interdisciplinary pain management in fibromyalgia – Paul J. Watson BSc (Hons) MSc MCSP
- Chapter 8 Differential diagnosis of fibromyalgia – Jan Dommerholt PT MPS and Tamer Issa PT DPT
- Chapter 9 Microcurrent therapy in the treatment of fibromyalgia – Carolyn McMakin MA DC
- Chapter 10 The metabolic rehabilitation of fibromyalgia patients – John Lowe MA DC
- Chapter 11 Fibromyalgia and the endocannabinoid system – John McPartland DO MSc (Hons)
- Chapter 12 Therapeutic Touch in the treatment of fibromyalgia – Pat Winstead-Fry RN PhD and Rebecca Good MA RNC ACRN LP
- Chapter 13 Naturopathic hydrotherapy in the treatment of fibromyalgia – Eric Blake ND Dipl Acupuncture.

In Chapter 14, an overview is offered of 'what helps FMS', based on literature reviews and clinical experience. After that, Chapter 15 describes treatment of associated conditions; Chapter 16 evaluates the effects of physical modalities on FMS and describes appropriate manual methods; Chapter 17 focuses on the link between breathing pattern disorders and chronic pain in general, and fibromyalgia and chronic fatigue in particular, while Chapter 18 offers guidelines for home/self-care using strain-counterstrain, for pain management.

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Chapter Six

6

Acupuncture treatment of fibromyalgia and myofascial pain

Peter Baldry

CHAPTER CONTENTS

The main purpose of this chapter is to discuss the circumstances which led me to employ superficial dry needling (SDN) at myofascial trigger point (MTrP) sites in the treatment of the myofascial pain syndrome (MPS) and subsequently at myofascial trigger point and myofascial tender point (MTP) sites in the treatment of the fibromyalgia syndrome (FMS). Deep dry needling (DDN), electro-acupuncture and local anaesthetic injections will also be considered.

In order to explain the rationale for using any of these different forms of treatment in these two disorders, it will first be necessary to discuss their respective clinical manifestations.

Myofascial pain syndrome: clinical manifestations

MPS is a disorder in which pain of muscular origin is confined to one region of the body. This notwithstanding, it may in some cases affect several regions concomitantly. Factors responsible for the development of pain in this disorder include muscle trauma and muscle ischaemia. This is because both of these cause activity to develop in plexi of C (Group IV) nociceptor nerve endings at discrete sites known as trigger points.

Trigger points

The term trigger point (TrP) was first introduced by Steindler (1940), an American orthopaedic surgeon, because nociceptor activity at such a point triggers off the referral of pain to a site some distance from it (zone of pain referral). However, it was Janet Travell, an American physician, who brought the term into general use when, in the early 1950s, she showed that each muscle in the body has its own specific pattern of TrP pain referral (Travell & Rinzler 1952).

Diagnosis

The diagnosis of MPS depends on being able to demonstrate the presence of active pain-producing TrPs in muscles in any particular region of the body. The first physician to draw attention to this was John Kellgren when working under the direction of Sir Thomas Lewis at University College Hospital, London, in the 1930s (Kellgren 1938). Because of Kellgren's pioneer observations and Janet Travell's subsequent ones, it is now recognized that a muscle containing an active pain-producing TrP and muscles in the zone to which this pain is referred are slightly tender, but the TrP itself, because of trauma or ischaemia-induced activity in its nociceptor nerve endings, is so exquisitely tender as to make it a point of maximum tenderness. It is because of a TrP's excessive tenderness that pressure applied to it causes the patient to flinch involuntarily and to cry out. The eliciting of these two reactions at a TrP site are essential requirements for the diagnosis of this disorder. The application of sustained pressure to a TrP also causes pain to be referred to a site some distance from it (zone of pain referral).

There are, in addition, two other signs which it may or may not be possible to elicit. One is the presence of a firm elongated band of muscle at the TrP site (palpable band). The other is being able to evoke a twitch at a TrP site when a finger is moved sharply across the palpable band, containing it in a manner similar to that used for plucking a violin string (local twitch response). These signs, however, are of limited diagnostic value as it is only possible to elicit them when the muscle containing the TrP is situated near to the surface of the body. Furthermore, palpable bands are liable to be found in normal subjects (Njoo & Van der Does 1994, Wolfe et al 1992). It is now believed that a taut band does not, as previously assumed, develop in response to TrP activity but, conversely, is present prior to the development of it (Simons 1996).

Fibromyalgia syndrome: clinical manifestations

Diagnosis

Fibromyalgia syndrome (FMS) is, by contrast, a generalized pain disorder with a number of points of maximum tenderness scattered all over the body. These points in FMS have traditionally been called tender points (TPs) and the American College of Rheumatology's criteria for its diagnosis is that pain on palpation must be present at at least 11 of 18 specified TP sites (Wolfe et al 1990).

Points of maximum tenderness, tender points and trigger points

A TP's nociceptors in this disorder become activated and sensitized as a result of some as yet unknown systemic biochemical disorder. The difference between a TP and a TrP is that pressure applied to a TP causes pain to be felt locally around it, but pressure applied to a TrP causes pain to be referred to a site some distance from it (zone of pain referral). This has led to the clinical axiom that TPs are to FMS what TrPs are to MPS (McCain 1994). However, this unfortunately is an over-simplification because, as Margoles (1989) has shown from a study of a large number of patients with FMS, it is the rule rather than the exception for both TPs and TrPs to be present in this disorder. Also, Bengtsson et al (1986) have reported both TPs and TrPs to be present in it. And Bennett (1990), from studying the disorder for a considerable number of years, has been led to conclude that: 'Many patients with FMS have myofascial trigger points and many of the so-called tender points are in fact latent trigger points that have become symptomatic as a result of enhanced pain perception.'

Support for this belief has come from a survey carried out by Wolfe et al (1992) as this showed that taut bands, which are now generally agreed to be TrP precursors (Simons 1996), were present with nearly equal frequency in control subjects, MPS patients and FMS patients.

Concomitant MPS and FMS

It is not uncommon for a patient with MPS to develop, over the course of time, the characteristic symptoms of FMS (Bennett 1986a, 1986b).

Characteristic symptoms of FMS

Apart from pain, the two commonest symptoms are early morning stiffness of the muscles and non-restorative sleep. It is because of the latter that the patient wakes feeling as tired as before going to bed, despite having had a seemingly undisturbed night. These symptoms are not restricted to FMS.

They may also be present in other rheumatological disorders, particularly rheumatoid arthritis, but their frequency in FMS is significantly higher.

Other symptoms include paraesthesiae, subjective swelling of joints, tension headaches, irritable bowel syndrome and dysmenorrhoea. In addition, there may be sympathetic over-activity giving rise to coldness of the extremities, with 12% of FMS sufferers having a fully developed Raynaud's syndrome (Wolfe et al 1990).

Trigger point acupuncture for the treatment of MPS: historical review

The insertion of needles into muscles for the relief of pain is not some new concept: as long ago as the 6th century AD the Chinese physician Sun Ssu-Mo, in his books on acupuncture (*acus* (L) = needle), described how he treated pain of muscular origin by inserting needles into points of maximum tenderness, or what the Chinese call *ah shi* points (Lu & Needham 1980) and which in the West today are called myofascial trigger points.

News about the Chinese practice of acupuncture first reached Europe in the 16th century but the seemingly esoteric concepts upon which most of it is based for long proved to be unacceptable to physicians trained in Western medicine. However, at the beginning of the 19th century, an English physician named Churchill decided to employ Sun Ssu-Mo's technique for the treatment of what he called rheumatalgia, and in 1828 published books describing this and the results obtained with it (Churchill 1821, 1828). These books attracted only a limited amount of interest, with no more than a few physicians following his example. The most famous of these was Sir William Osler, professor of medicine at Oxford University who, in his student textbook *The Principles and Practice of Medicine*, published in 1912, described how in the treatment of lumbago he inserted, 'needles of from three to four inches in length (ordinary bonnet needles sterilised will do)... into the lumbar muscles at the seat of the pain'.

Despite this, the medical profession in general continued to view such treatment with incredulity and nothing further was heard of it until much later, in the 20th century, when Travell & Rinzler (1952), during the course of describing specific patterns of pain referral from TrPs and how such pain may be alleviated by injecting a local anaesthetic into them, mentioned in passing that it is possible to achieve the same effect with dry needling. However, it has only been in the last 20 years, during which time there have been considerable advances in knowledge concerning the neurophysiology of pain, that the scientific basis for this type of treatment has become increasingly widely accepted.

Trigger point injections in the treatment of MPS

When Kellgren (1938) demonstrated that pain in what has since become called myofascial pain syndrome (MPS) emanates from TrPs, he found that he could alleviate the pain by injecting a local anaesthetic (procaine) into them. Many physicians continue to use this method.

However, because the injection of a local anaesthetic into a TrP may occasionally give rise to serious and, at times, life-threatening hypersensitivity reactions, Sola & Kuitert (1955) decided to see whether an injection of saline might be equally effective. Their experience of doing this in 100 consecutive cases of MPS at the US Air Force hospital in Texas led them to state that, 'the use of normal saline has none of the disadvantages often associated with the use of a local anaesthetic but appears to have the same therapeutic value'. A year later, Sola & Williams (1956) were able to confirm this in 1000 patients with MPS treated at the same hospital. And subsequently Frost et al (1980), in a double-blind trial comparing the effectiveness of injecting either the local anaesthetic mepivacaine or saline into TrPs, found, to their surprise, that the group in which saline was used did better, with 80% of them reporting relief from pain as compared to 52% of those given mepivacaine injections.

Over the years, many other substances, including corticosteroids (Bourne 1984) and non-steroidal anti-inflammatory drugs (Drewes et al 1993, Frost 1986), have been injected into TrPs but there is no evidence to suggest that any of them give better results than those obtained with either a local anaesthetic or saline. The pain-relieving effect of such disparate substances therefore cannot be due to any specific properties each may possess but rather to the one factor common to them all, namely the nerve-stimulating effect of the needle through which they are injected.

Deep dry needling in the treatment of MPS

The first physician to use dry needling extensively for the deactivation of MTrPs in MPS was the Czechoslovakian physician Karel Lewit (1979) who reported favourably on the use of it in a series of patients treated by him during the years 1975–76. The method consisted of inserting a needle deep enough into the muscle for it to reach the MTrP itself. This, as Travell & Rinzler (1952) had stressed some years previously, is a very painful procedure but this in no way deterred Lewit for he wrote 'the effectiveness of treatment is related to the intensity of the pain produced at the trigger zone and to the precision with which the site of maximum tenderness is located by the needle'.

Gunn (1989, 1996, 1998) has since been an enthusiastic protagonist of a deep dry needling technique which he calls 'intramuscular stimulation'. This is now widely used but one of its main disadvantages is that it is a very painful procedure, with Gunn (1989) himself stating that when the needle is inserted into a tightly contracted band of muscle, 'the patient experiences a peculiar cramp-like sensation as the needle is grasped . . . the intensity of the cramp parallels that of the spasm. It can be excruciatingly painful, but gradually resolves as the spasm eases'.

Hong (1994a, 1994b), from the carrying out of comparative clinical trials, has concluded that in order to obtain the best results from deep needling it is necessary to evoke a series of local twitch responses by rapidly inserting the needle into a number of separate loci in the MTrP. There are several drawbacks to this procedure. One is that it is invariably followed 2–8 hours later by intense long-lasting soreness of the tissues as a result of needle-induced bleeding into them. In addition, with this and other deep needling techniques, there is also a significant risk of damaging nerves and other important structures. Also, one of the main disadvantages of Hong's method is that it demands considerable manual dexterity.

Superficial dry needling in the treatment of MPS

Although it is certainly essential to locate each TrP accurately, experience has led me to believe that it is not necessary to employ deep needling but easier, safer and just as effective to insert the needle into the superficial tissues overlying a TrP (Baldry 1993, 1998, 2001). My reason for adopting this superficial dry needling (SDN) technique is that when attempting to deactivate a TrP in the scalenus anterior muscle at the base of the neck some years ago, it seemed prudent to me, in view of the proximity of the apex of the lung, only to insert the needle for a short distance under the skin. I found that this was sufficient to relieve the pain referred down the arm from this TrP. Superficial needling at TrP sites elsewhere in the body was then tried and found to be equally effective. Not long after this, Macdonald et al (1983) confirmed my findings by showing that it is possible to alleviate low back pain by inserting needles to an approximate depth of only 4 mm at TrP sites.

Bowsher (1990) has now explained why SDN is all that is required by pointing out that the A-δ sensory afferents – which are the ones that need to be stimulated when deactivating a TrP – are present mainly, but not exclusively, in the skin and just beneath it.

In order to understand the neurophysiological basis for the use of SDN it has to be remembered that when a TrP is in an active phase, noxious information generated in it is conducted along thin unmyelinated C (Group IV) sensory afferents to a spinal cord's dorsal horn. From there this information is transmitted, via the contralaterally situated ascending spinoreticular pathway, to the brain with, as a consequence, the development of pain. Alleviation of this pain may be brought about by inserting a needle into the tissues overlying the TrP and by this means stimulating medium-sized myelinated A-δ nerve fibres in the skin and subcutaneous tissues. This is because one of the effects of doing so is to cause activity to develop in inhibitory interneurons (IIs) situated in the dorsal horn. These IIs then release enkephalin and this opioid peptide blocks the TrP's C (Group IV) sensory afferents' input to the spinal cord.

Dry needle stimulation of A-δ nerve fibres causes activity to develop in these IIs because:

- These nerve fibres, on entering the spinal cord, give off branches which connect directly with the IIs.
- The neospinothalamic tract up which pinprick information is conveyed to the brain gives off collaterals that project to the midbrain's

periaqueductal grey area at the upper end of a descending pain-inhibitory system. Axons in this system at the dorsal horn level also connect with these IIs (see Figs 6.1 and 6.2).

Responsiveness to needle stimulation

The amount of needle stimulation required depends on an individual's responsiveness to it. It has been estimated that about 10% of adults and almost all children with TrP pain are strong responders so that with them it may be necessary to do no more than insert a needle into the tissues overlying a TrP and then to withdraw it immediately. With these strong reactors, if the stimulation given is greater than this, the pain, rather than being alleviated, may be exacerbated. The majority of people are average responders but even with them it may only prove necessary to leave a needle in situ for 30–60 seconds. There is also a small group of adults who are weak responders and therefore require exceptionally strong needle stimulation. With them the needle has to be left in situ for several minutes and the strength of the stimulus may have to be increased by means of the needle being vigorously rotated.

When carrying out SDN for the first time there is no way of knowing whether the response to it will be strong, average or weak; it is therefore necessary to start with a light stimulus and for this to be increased only if it proves to be necessary. Initially, a needle should be inserted into the tissues overlying a TrP and left in situ for 30 seconds. Then, because the amount of stimulation required is the minimum necessary to abolish the TrP's exquisite tenderness, on withdrawing the needle, pressure as firm as before needling should be applied to the TrP to see whether or not this has been achieved. One 30-second period of needling is often all that is required; however, when appreciable tenderness is still found to be present the needle should be reinserted and left in situ for about 2–3 minutes. Very occasionally with a weak responder this is still insufficient and the needle then has to be once again reinserted and vigorously rotated in order to increase the strength of the stimulus.

As *acus* is Latin for needle, it is clearly etymologically correct to call SDN at TrP sites a form of acupuncture. Nevertheless, it is not necessary for doctors and physiotherapists who wish to employ it to undergo formal training in the somewhat esoteric practice of traditional Chinese acupuncture. They do, however, have to be shown how best to insert a needle into the superficial tissues overlying a TrP and above all have to receive training in TrP detection.

Deep dry needling in the treatment of FMS

The insertion of needles into TrPs and TPs of patients with FMS has not been reported and cannot be recommended as this would inevitably deliver too powerful a stimulus for patients with this disorder as they tend to be strong reactors. Because of this they would inevitably experience an exacerbation of the pain in the same way as they do in response to electro-acupuncture stimulation of these points (Deluze et al 1992).

Superficial dry needling in the treatment of FMS

The discovery that TrPs in MPS may be simply, safely and successfully deactivated with SDN prompted me to see whether it would be equally effective in deactivating the TrPs and TPs present in FMS.

Because of the large number of scattered points that have to be deactivated, it might be thought that each treatment session would take a considerable amount of time. However, this is not usually so as FMS sufferers tend to be strong responders and often only require each point to be needled for a very brief period. In some cases inserting the needle into the superficial tissues overlying a point of maximum tenderness and immediately withdrawing it is all that is required. In others, for the exquisite tenderness before needling to disappear, the needle has to be left in situ from a few seconds up to 30 seconds. Admittedly, the treatment involves both patient and doctor in a long-term commitment because, due to FMS invariably taking a chronic course, SDN has to be carried out once a week for 3–4 weeks and then at 4- to 6-week intervals on a long-term basis. Nevertheless, most patients find that this is worthwhile as the pain relief obtained appreciably improves the quality of their lives.

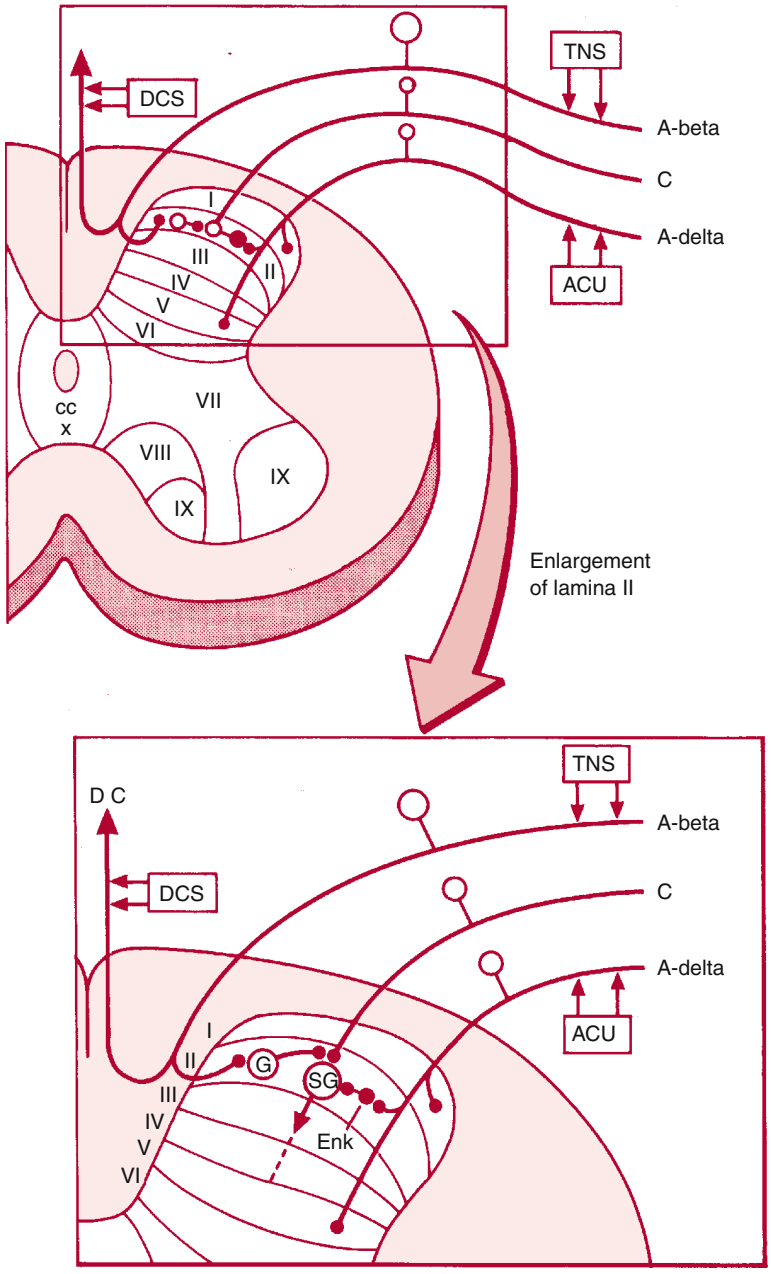

Figure 6.1 • Entry of primary afferents into the dorsal horn of the spinal cord, and circuits involved in TENS and acupuncture. Roman numerals refer to laminae numbers. The enkephalinergic interneuron is not only activated, as shown, by A-delta primary afferent terminals, but also by serotoninergic fibres descending from the brainstem (see Fig. 6.2). ACU, high-threshold, low frequency stimulation; CC, central canal; DC, dorsal column; DCS, dorsal column stimulation; Enk, enkephalinergic interneuron, postsynaptically inhibiting substantia gelatinosa neuron; G, GABAergic interneuron, presynaptically inhibiting primary afferent C fibre terminal; SG, substantia gelatinosa cell; TNS, low-threshold, high frequency stimulation. (Reproduced with permission from Bowsher 1990.)

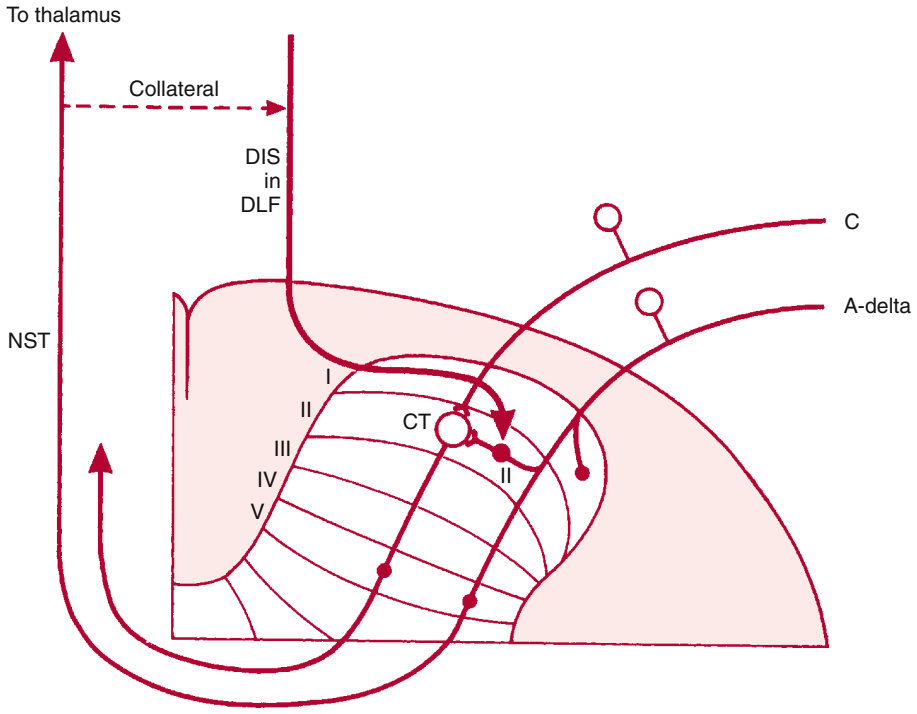

Figure 6.2 • Diagram of dorsal horn to show the local intraspinal connection between A-delta nerve fibres and enkephalinergic inhibitory interneuron (II), whose function it is to inhibit activity in C afferent terminal cell (CT). Also, to show the indirect A-delta link with inhibitory interneuron via the collateral connecting the A-delta afferent's ascending pathway – the neospinothalamic tract (NST) with the descending inhibitory system in the dorsolateral funiculus (DIS in DLF).

Electro-acupuncture

Deluze et al (1992) have carried out a controlled trial to assess the value of stimulating traditional Chinese acupuncture points by means of electro-acupuncture for alleviating the pain of fibromyalgia. In this study 34 patients were randomized to a control group and 36 to the treatment group. In the treatment group needles were inserted into the traditional Chinese acupuncture points Large Intestine 4 and Stomach 36 bilaterally, and also into six other such points 'depending on each patient's symptoms and pain patterns'. In the control group needles were inserted into points 20 mm away from those used in the treatment group. Such a trial design, however, is open to criticism because there is compelling evidence that the stimulation of both traditional Chinese acupuncture points and nearby so-called 'sham' points has a similar effect (Macdonald 1989, Mann 1996).

Support for this belief among experienced clinicians comes from work by Bing et al (1991) which showed that the recorded activity of the subnucleus reticularis in the rat in response to stimulation of the Stomach 36 point and of a nearby non-acupuncture point is the same.

The only difference between the two groups in this trial, therefore, was that the control group were given a non-specified weaker electrical stimulus, but treatment certainly must have had some neurophysiological effect because four in that group, as opposed to only two in the treatment group, had to withdraw from the trial because of the 'sham' procedure leading to an increase in symptoms. It thus follows that the reason why the treatment group was found overall to have done better than the sham group may only have been because the electrical stimulus employed for the latter was not as strong.

Considerations such as these have led Lewis (1993), when discussing this particular trial, to conclude that 'further studies of higher quality are needed'.

It nevertheless has to be stressed that the shortcomings of this particular trial in no way detract

from the possibility that electro-acupuncture applied to traditional Chinese acupuncture points may well have a beneficial pain-alleviating effect in fibromyalgia. However, one of the biggest disadvantages is that the employment of such techniques is restricted to doctors and physiotherapists who have been specifically trained in the practice of traditional Chinese acupuncture in general and in the use of electro-acupuncture in particular.

Local anaesthetic injections in the treatment of FMS

An open study of this type of treatment in 41 patients with FMS has been carried out (Inanici & Yunus 2001). In this trial the injection of a mixture of 1% lidocaine (lignocaine) (1/2 cc) and triamcinolone diacetate (1/4 cc) into a TP gave an average duration of pain relief at that site for 13 weeks. The disadvantage of this treatment, however, is that it causes such a severe post-injection flare at the treated site as to make it necessary for ice to be applied for several hours afterwards and for the affected part to be rested for 24–48 hours. It is because of these severe reactions that such treatment has to be restricted to not more than from one to four points at any one time.

Figuerola et al (1998) measured plasma metenkephalin (ME) levels in 15 women with FMS before and after treating five of them with local injections of lidocaine (lignocaine) into painful points, five with local injections of saline into such points and five with dry needling into them. Significant increases in plasma ME levels were observed 10 minutes after treatment in all of the patients, irrespective of the type of procedure carried out. They concluded from this that the benefits of TP injections would seem to be due to the mechanistic effects of the needling rather than to the pharmacological effect of any substance injected.

Summary (see also additional information in Boxes 6.1 and 6.2)

In this chapter various methods aimed at reducing nociceptor activity at TrPs and TPs in patients with FMS have been reviewed. They are:

- *Injection of local anaesthetic.* The injection of a local anaesthetic into TrPs has long been used in the treatment of MPS, and in recent years has been employed in the treatment of FMS. Because patients with this disorder tend to react strongly to

Box 6.1

Myofascial ('trigger point') pain and fibromyalgia syndrome

Leon Chaitow

In this chapter, Peter Baldry explains an effective means of pain control utilizing acupuncture ('dry needling') methods. He also outlines a brief overview of myofascial trigger point characteristics. This boxed information offers a summary relating to the relationship between fibromyalgia syndrome (FMS) and myofascial pain syndrome (MPS). The historical linking of myofascial (trigger point) pain and fibromyalgia can be seen to date from the early years of research into these topics, and is summarized in Box 1.1. There we see researchers from the 1930s onwards (Kellgren, Gutstein, Travell and others) wrestling with the phenomenon of pain being referred from localized areas to distant target tissues, as a part of what was variously being termed fibrositis, or myalgia, or myodysneuria (Fig. 6.3).

If, as seems likely, a significant degree of the pain suffered by anyone with fibromyalgia results from myofascial trigger point activity, then, one way or another, this should be able to be eased, modified, abated, removed (see Box 6.2) (Fig. 6.4).

Trigger points are characterized by:

1. **Localized, painful, discrete, palpable areas of altered soft tissue structure.**
2. **These lie in fine, taut bands which Simons hypothesizes evolve in stressed tissues of some individuals who may be genetically predisposed to these changes.**
3. **These bands may be maintained by virtue of excessive calcium in the muscle cells, which cannot be 'pumped out' due to poor ATP (energy) levels. In time neural structures become sensitized (facilitated) and pain develops which is referred to distant sites**

Box 6.1—Cont'd

where the cycle repeats itself. Travell & Simons (1986, 1993) have described the process of trigger point evolution as follows:

> *In the core of the trigger lies a muscle spindle which is in trouble for some reason. Visualise a spindle like a strand of yarn in a knitted sweater . . . a metabolic crisis takes place which increases the temperature locally in the trigger point, shortens a minute part of the muscle (sarcomere) – like a snag in a sweater, and reduces the supply of oxygen and nutrients into the trigger point. During this disturbed episode an influx of calcium occurs and the muscle spindle does not have enough energy to pump the calcium outside the cell where it belongs. Thus a vicious cycle is maintained and the muscle spindle can't seem to loosen up and the affected muscle can't relax.*

4. On pressure a trigger point is painful locally as well as referring pain to a distance ('target area') or radiating pain from itself. This is commonly referred to as 'regional' pain. The referred or radiating pain will often reproduce symptoms of which the patient is already aware.
5. Among the referred effects of an active trigger point, apart from pain, there may be numbness, tingling, weakness, lack of normal range of movement and altered sympathetic activity (Webber 1973).
6. A brisk stroke across the band evokes a response which is regarded as significant in identifying myofascial trigger point activity. To elicit the sign most effectively, one must place the relaxed muscle under moderate passive tension, and snap the band briskly with the palpating finger.
7. Activity involving the tissues housing the trigger usually increases the symptoms (pain, etc.), while rest usually eases them.
8. The premier researcher into pathophysiological processes involved in osteopathic manipulation, Irwin Korr, has described a process he calls facilitation, in which neural structures become sensitized and hyper-reactive in response to overuse, misuse or abuse. Myofascial trigger points would seem to fall into this definition (Korr 1970, 1976, 1977; see also Ch. 1).
9. The implications of hundreds of studies into the phenomenon of facilitation are that any form of stress impacting the individual, be it climatic, chemical, emotional, physical or anything else, will produce a rise in neurological output from facilitated areas (Beal 1983).
10. Wall & Melzack (1989), in their exhaustive investigation of pain, are clear that all chronic pain has myofascial trigger point activity as at least a part of its aetiology and that in many instances trigger points are major contributors to pain. These researchers have also shown that roughly 80% of major trigger point sites are on established acupuncture points.
11. Janet Travell (Travell 1957, Travell & Simons 1986, 1993) is on record as stating that if a pain is severe enough to cause a patient to seek professional advice (in the absence of organic disease), referred pain is likely to be a factor, and therefore a trigger area is probably involved.
12. A single trigger may refer pain to several reference sites and can give rise to embryonic or satellite triggers; for example, Travell describes how a trigger in the distal areas of the sternomastoid muscle can give rise to new triggers in the sternalis muscle, the pectoral muscle and/or serratus anterior (Travell & Simons 1986).

Among the research into the connection between myofascial trigger point activity and fibromyalgia, are the following:

- Yunus (1993) suggests that: 'Fibromyalgia and Myofascial Pain Syndrome (MPS) [trigger point-derived pain] share several common features [and] it is possible that MPS represents an incomplete, regional or early form of fibromyalgia syndrome since many fibromyalgia patients give a clear history of localized pain before developing generalized pain.'
- Granges & Littlejohn (1993) in Australia have researched the overlap between trigger points and the tender points in fibromyalgia and come to several conclusions, including: 1) tender points in FMS represent a diffusely diminished pain threshold to pressure while trigger points are the expression of a local musculoskeletal abnormality; 2) it is likely that trigger points in diffuse chronic pain states such as FMS contribute only in a limited and localized way to decreasing the pain threshold to pressure in these patients; 3) taken individually, the trigger points are an important clinical finding in some patients with FMS, with nearly 70% of the FMS patients tested having at least one active trigger point; 4) of these FMS patients with active trigger points, about 60% reported that pressure on this trigger 'reproduced a localized and familiar [FMS] pain'.
- Researchers at Oregon Health Sciences University studied the history of patients with FMS and found that over 80% reported that

Continued

Box 6.1—Cont'd

prior to the onset of their generalized symptoms they suffered from regional pain problems (which almost always involve trigger points). Physical trauma was cited as the major cause of their pre-FMS regional pain. Only 18% had FMS which had started without prior regional pain (Fibromyalgia Network 1995).

- Research at UCLA has shown that injecting active trigger points with the pain-killing agent Xylocaine produced marked benefits in FMS patients in terms of pain relief and reduction of stiffness but that this is not really significantly apparent for at least a week after the injections. FMS patients reported more local soreness following the injections than patients with only myofascial pain but improved after this settled down. This reinforces the opinion of many practitioners that myofascial trigger points contribute a large degree of the pain being experienced in FMS (Hong 1996).
- Travell & Simons (1993) are clearly of this opinion, stating that: 'Most of these [fibromyalgia] patients would be likely to have specific myofascial pain syndromes that would respond to myofascial therapy.'

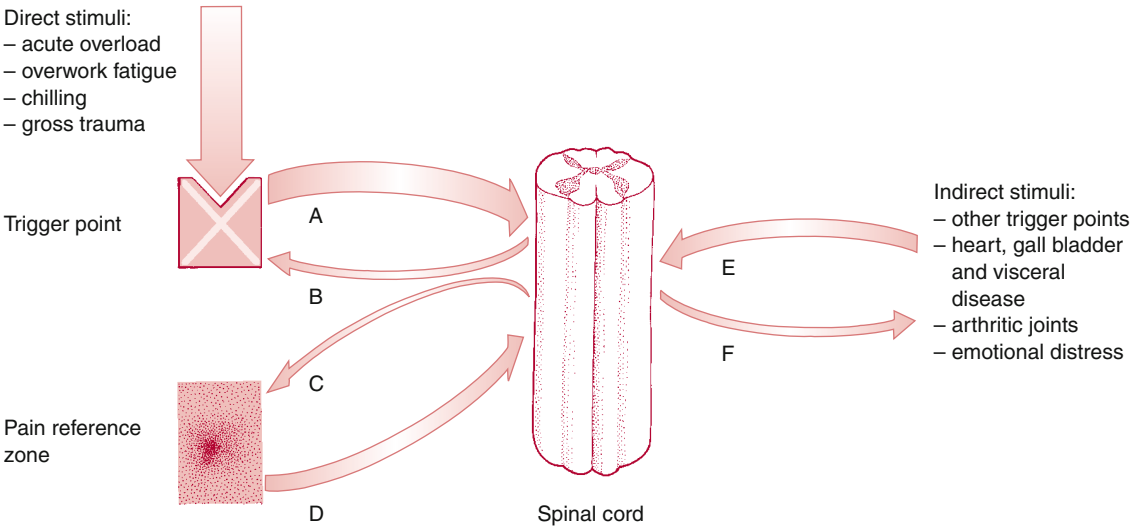

Figure 6.3 • Direct stress influence can affect the hyper-reactive neural structure of a myofascial trigger point, leading to increased activity (A–B) as well as referring sensations (pain, paraesthesiae, increased sympathetic activity) to a target area (C–D) which feed back into the cord to increase the background stress load. Other stimuli reach the cord from distant trigger points and additional dysfunctional areas (E–F).

any procedure that involves the insertion of a needle into either a TrP or TP, the method has to be restricted to a small number of particularly painful sites. However, even so, it gives rise to so much soreness that following treatment the application of ice and immobilization of the injected sites are essential.

• *Electro-acupuncture*. Electro-acupuncture with needles inserted into TPs has, for the same reason, been found to exacerbate the pain. In order to avoid this as far as possible, the needles should be inserted into traditional Chinese acupuncture points. The disadvantages of this method are that it requires expertise in delivering an electrical stimulus by this means and training in carrying out traditional Chinese acupuncture.

• *Deep dry needling of TrPs and TPs*. This technique, when employed in the treatment of MPS, has been found to give rise to much post-treatment soreness as a result of bleeding into the tissues. There is a risk of damaging not only blood vessels but also other important structures. The same would clearly apply to its use in the treatment of FMS. Furthermore, because patients with this

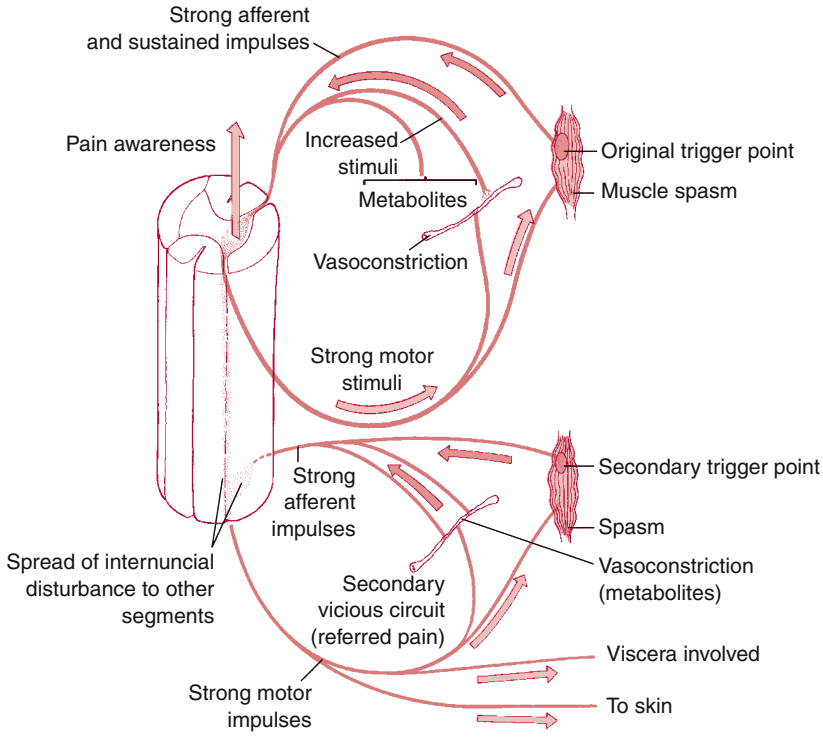

Figure 6.4 • Schematic representation of the secondary spread of neurologically induced influences deriving from acute or chronic soft tissue dysfunction, and involving trigger point activity and/or spasm.

Box 6.2

Treating trigger points (Fig. 6.5)

Leon Chaitow

Many methods exist for the obliteration of trigger points:

- These range from injection of pharmacological agents such as Novocaine or Xylocaine to application of coolant sprays, ultrasound and acupuncture techniques (as described in this chapter by Dr Peter Baldry), and manual methods.
- Manual methods of trigger point treatment include ischaemic compression, positional release and various stretching approaches.
- Clinical experience has shown that an absolute requirement for trigger point deactivation (apart from removal of the causes) involves the need to restore the muscle in which the trigger lies to its normal resting length. Failing the achievement of this goal, all methods of treating trigger points are likely to provide only short-term relief.
- Dr John Mennell (Mennell 1975) states that whatever the means used to 'block' the trigger activity, and whatever the neuropathological routes involved, the critical factor in the restoration of pain-free normality is that the affected muscle should have its normal resting length restored by stretching. Mennell favours chilling the trigger area by vapocoolant or ice massage – an approach supported by both

Continued

Box 6.2—Cont'd

Travell and Simons, who now advocate muscle energy technique (postisometric relaxation) stretching as well.

- Once symptoms have been relieved, the muscle containing the trigger must be gently stretched to its normal resting length or symptoms will return, irrespective of the technique used (chilling, pressure, injection, acupuncture, etc.).
- Such stretching should be *gradual* and *gentle*, and the recommendation of Lewit (1991) and Travell (Travell & Simons 1992) is that muscle energy technique (MET), in which gentle isometric contractions followed by stretch are employed, is the method of choice. Lewit suggests that, in many instances, stretching in itself is adequate in deactivating trigger point activity.
- CAUTION! In cases of fibromyalgia, stretching needs to be performed with the utmost care, as will be outlined in the manual treatment sections in Chapter 16.
- A combined sequence of treatment to achieve trigger point deactivation has been proposed, commencing with palpation/identification, followed by ischaemic compression, followed by adoption of a positional release posture (see bodywork treatment section, Ch. 16), followed by a stretching of the tissues housing the trigger point. The stretching in this sequence can follow a focused (to activate the fibres involved) isometric contraction. This sequence has been dubbed 'integrated neuromuscular inhibition technique' (INIT) (Chaitow 1994) (see p. 395).
- Dr Devin Starlanyl (Starlanyl 1994) advocates a combination of sine-wave ultrasound and electrostim, both diagnostically and for treatment of trigger points:

Ultrasound with electrostim causes pain immediately over the TP, pinpointing the location as it breaks up the TP . . . Care must be taken to start gently, and allow the patient to decide the amount of pain tolerable. I use this treatment followed by gentle stretching. Breaking up the TP can cause fatigue and activation of aches for a day, followed by relief. . . . I have also found ice is more effective in relieving spasticity and pain than heat if nerve entrapment is involved.

Clinical experience suggests that this advice is valid, whatever is done to a trigger point, especially in a patient with FMS: gentle approaches are best with stretching almost always necessary and, even if carefully applied, these lead to a 'reaction' for a day or so.

- The deactivation of myofascial trigger points offers one way of beginning to reduce the pain levels of patients with FMS.

latter disorder tend to be strong reactors, this type of therapy is liable to lead to an exacerbation of the pain.

- *Superficial dry needling.* This technique is readily carried out. It does not cause any local discomfort and for this reason can be used to reduce nociceptor activity at as many TPs as necessary. As FMS patients are in the main strong reactors, the stimulus provided by this method is sufficient to relieve the pain for a worthwhile period of time.

For these reasons, superficial dry needling is my preferred technique.

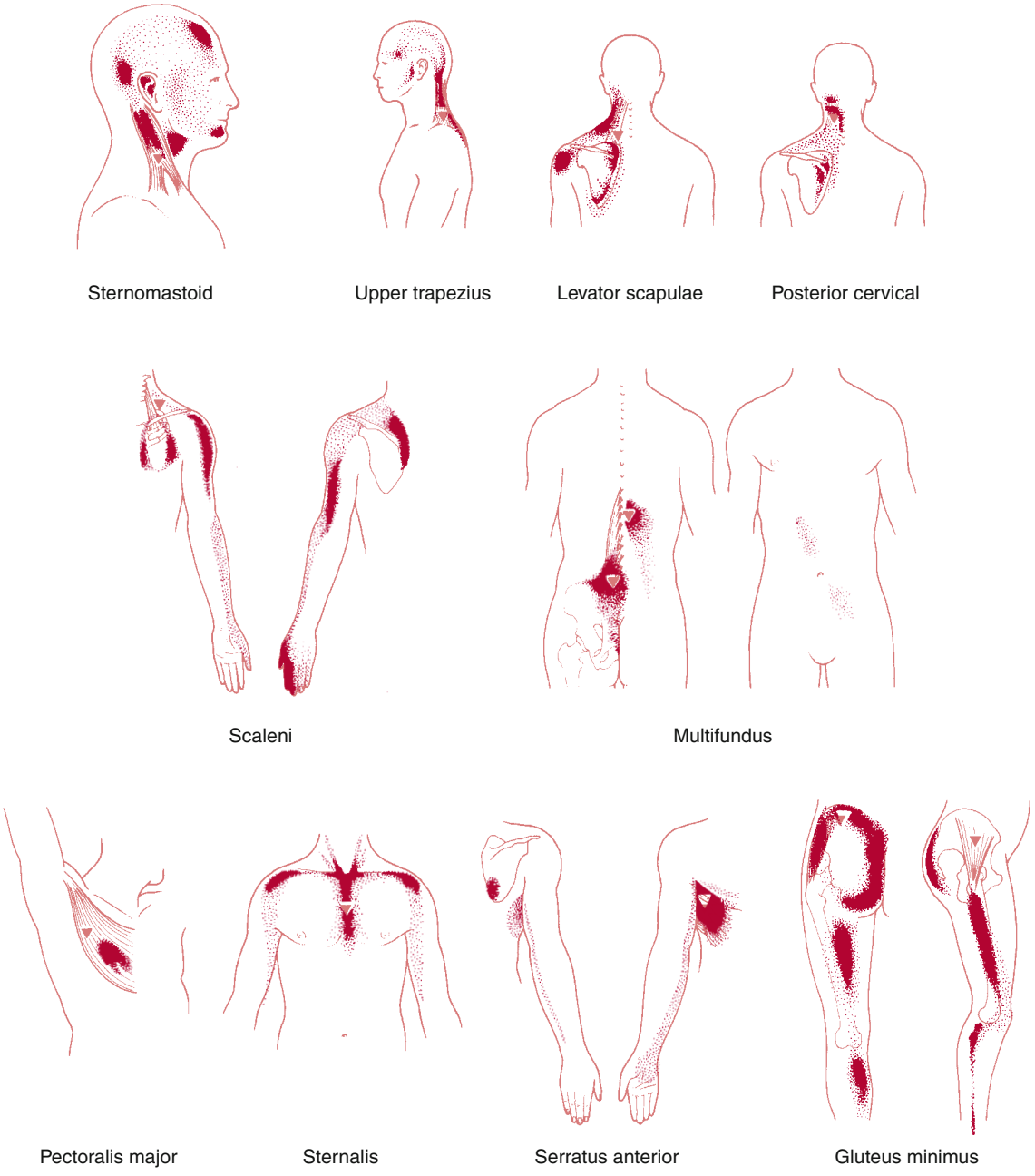

Figure 6.5 • Pain referral patterns from myofascial trigger points. ▼ = trigger point; shaded area = reference pain zone. (Reproduced with permission from Chaitow 1996.)

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Chapter Seven

7

Interdisciplinary pain management in fibromyalgia

Paul J. Watson

CHAPTER CONTENTS

There is growing consensus of opinion that chronic pain is a condition of such complexity that it can only be addressed by multidimensional assessment and treatment. Such an approach recognizes that pain is not merely the end product of a passive transmission of nociceptive impulses from receptor organ to an area of interpretation; it is a dynamic process of perception and interpretation of a wide range of incoming stimuli, some of which are associated with actual or potential harm and some of which are benign but interpreted and described in terms of damage.

The ongoing pain from fibromyalgia is physically limiting and demoralizing, leads to affective disorders and a reduction in social and personal contacts, and causes alteration in personal relationships, changes in social roles and increased reliance on health care and social services. The assessment of a patient with such a condition requires an evaluation of all these aspects of the condition.

The problem of the medical model in fibromyalgia

In the biomedical model, the patient's symptoms arise from abnormality of physiology and therefore an objective assessment of the physiology through objective testing for damage or malfunction will define the abnormality. Interventions are focused on the resolution of the problem; once repair has been effected, the symptoms will abate and normal function will be restored. The relationship between the objective tests, the severity of symptoms and the accompanying dysfunction should equate with each other. However, although there is a relationship between these factors, it is at best very modest and there is evidence that relationships between the factors vary according to the duration of symptoms and individual subgroups within conditions (Turk et al 1996, Waddell 1987, 1992). In those people with chronic pain in particular, the identified abnormal pathology does not predict the accompanying degree of functional incapacity or psychological distress. The level of distress and disability is better explained by the individual's beliefs about the nature of his condition and by his ability to cope with the pain. Furthermore, persistent pain over a

prolonged period is stressful and chronic stress may result in poor sleep, low mood and neuroendocrine dysfunction, which in turn alter the perception of pain and affect the individual's ability to cope with that pain still further – a cycle leading to further distress and physical decline.

In fibromyalgia the absence of an obvious source of ongoing nociception or inflammation makes the application of a medical model inappropriate. With the exception of some studies into the management of sleep disorders by pharmacological interventions, medical interventions in fibromyalgia have been relatively unsuccessful (Vancouver Fibromyalgia Consensus Group 1996, White & Harth 1996). This has led to an opinion among many of those that care for those suffering from this condition that management should have a biopsychosocial perspective and be delivered by either a multidisciplinary team where members of different professions bring individual skills to the patient or by means of an *interdisciplinary* approach where generic behavioural management skills are common to all members of the team but where specific skills are presented by specialist professions (Bennett et al 1996, Burckhardt et al 1994, Masi & Yunus 1991, Vancouver Fibromyalgia Consensus Group 1996). This type of programme should be patient orientated and return to patients a sense of control over their condition which is often lost in the round of medical consultations and passive therapies.

However, very few patients with chronic pain, which includes those with fibromyalgia, ever make it to chronic pain management clinics or programmes because of a lack of local service provision or financial constraints (Feuerstein & Zastowny 1996, Smith et al 1996). The requirement for skilled practitioners and the increase in demand for pain management programmes suggest that this scarce resource is likely to remain scarce; many practitioners will not have the luxury of referring patients to pain management programmes. It is hoped that these practitioners will find elements of this approach to help them in their own practice.

Aims of an interdisciplinary pain management programme

There exists a wide diversity in the content and delivery of pain management programmes (Flor et al 1992) which has dogged attempts to identify the elements most effective in bringing about a successful outcome. However, the principles and aims of these programmes remain the same. The Pain Society of Great Britain and Ireland (Pain Society 1997) clarified the overall aim of a pain management programme: 'The aim of a Pain Management programme is to reduce the disability and distress caused by chronic pain by teaching sufferers physical, psychological and practical techniques to improve their quality of life.' Note that the *relief* of pain is not a declared aim of pain management. Although reduction in the level of pain is a desirable outcome from pain management, the focus is on functional improvements.

Cognitive behavioural therapy

All modern pain management programmes are founded on the principles of cognitive behavioural therapy (CBT). CBT acknowledges that behavioural responses to illness are influenced by both positive and negative reinforcement, one of the tenets of operant behavioural theory. For example, if an activity is painful, not engaging in activity may relieve pain in the short term. Such a response is respondent conditioning. If the individual in pain is observed by a solicitous spouse to be in pain when executing a task, the spouse might perform the task instead. Further demonstration of pain-associated behaviour will elicit help from the spouse even in the absence of pain: such is operant conditioning, and it may lead to the relinquishing of activities over time.

CBT also incorporates the view that both cognitive and affective factors influence behaviour. Whether a person re-engages in activity, even though it may cause an increase in pain initially, will be influenced by his perception of what the increase in pain means to him. If patients have an unshakeable belief that pain is an indication of increased harm and damage they are unlikely to relinquish resting as a way of coping. The CBT approach to the management of chronic pain accords well with Melzack & Walls' (1965) description of the interpretation of pain in which pain and the resultant behaviour are a product of the interaction of nociception, its modulation by other efferent stimuli, and emotional, cognitive and motivational factors.

The objectives of such a programme are chiefly derived from Turk and colleagues (1983) and Bradley (1996). These objectives (Box 7.1) originally referred

Box 7.1

Objectives of interdisciplinary pain management

- Assist patients in altering their belief that their problems are unmanageable and beyond their control
- Inform patients about their condition
- Assist patients to move from a passive to an active role in the management of their condition
- Enable patients to become active problem solvers to help them cope with their pain through the development of effective ways of responding to pain, emotion and the environment
- Help patients to monitor thought, emotions and behaviours, and identify how these are infuenced by internal and external events
- Give patients a feeling of competence in the execution of positive strategies in the management of their condition
- Help patients to develop a positive attitude to exercise and personal health management
- Help patients to develop a programme of paced activity to reduce the effects of physical deconditioning
- Assist patients to develop coping strategies that can be developed once contact with the pain management team has ended

to the management of chronic pain in a behavioural context chiefly by psychologists and have been adapted here to incorporate the work of other professions.

The objectives are achieved through a number of essential components (Bradley 1996, Keefe et al 1996, Turk et al 1983). These are:

- education
- skills training
- skills rehearsal and feedback
- generalization of skills taught to everyday situations and novel situations
- strategies for maintenance and further improvement.

Assessment for pain management

Pain management is a process not an event, and the initial assessment is the start of good patient management. All patients require a thorough assessment of their current status. This should include an assessment of current symptom severity, functional ability through self-report and functional testing, and psychological distress and quality of life evaluation. These form a baseline for planning specific treatments and some measures are repeated at the end of the programme for evaluation of outcome.

Fibromyalgia is a condition that may develop from a previous injury or coexist with other physical conditions (e.g. myofascial pain, inflammatory arthritis) (Rosen 1994, Wolfe et al 1990, 1995). It is therefore essential that any condition amenable to other therapies is identified and addressed. Just as adherents to the medical model may not address the psychosocial issues, the biopsychosocial practitioner must not forget the 'bio' or medical part of the equation. The pain management team has a duty to ensure that the patient's condition has been adequately investigated and, where possible, that appropriate treatments have been used. Performing a full assessment should ensure that the patient feels his condition is being taken seriously and fully investigated; this should give him confidence that things have not been missed. Only once these fears are resolved can the patient accept increasing function as an alternative to pain relief. A lack of satisfaction with their care and a perception that their condition is not being taken seriously is often cited as the reason why patients reject orthodox medicine in favour of alternative therapies (Dimmock et al 1997).

Possible exclusions

An assessment should aim to identify possible exclusions to participation in group pain management. These would include major psychiatric or psychological problems (psychotic patients, those with current major depressive illness) or major substance abuse including prescription drugs. These issues need to be addressed before the patient can usefully participate in rehabilitation. The presence of other significant medical problems may preclude participation in an active rehabilitation programme (e.g. major cardiorespiratory disease, severe structural deformity); these patients may be better dealt with on an individual basis.

Participation in ongoing litigation or the receipt of large sums in wages compensation is not a barrier to pain management, provided the patient is aware

of the consequences of improved health on their financial position and can demonstrate that they are sufficiently motivated to change despite these consequences.

Barriers to progress

It is important that the assessment identifies barriers to progress which need to be addressed during the programme. Such barriers include:

- distorted cognitions of the patient and the partner about the nature of their pain and disability
- dysfunctional beliefs about pain and activity
- negative expectation about the future
- affective disorders that may contribute to the experience of pain (e.g. depression and anxiety)
- patients' perception of the control they have over the pain (Keefe et al 1996).

Assessing current activity

Current physical activity and social role and the patterns of activity are assessed. The patient's 'illness' and 'wellness' behaviours are assessed by questioning about the way in which patient and spouse currently behave when the patient is in pain. The amount of 'downtime' – time spent reclining or in inactivity – versus 'uptime' and the amount of time spent engaged in productive or meaningful activity are recorded. Some patients cope with pain by increasing their activity through walking or gentle exercise while others refrain from all exercise and resort to rest and consumption of medication. The pattern of activity can tell the team a lot about the patient's current ability to pace his activity. Activity levels in such patients can often be sporadic and contingent on the level of pain.

Once all the data are gathered, the team is in a position to determine whether the patient is liable to make progress. DiClementi & Prochaska (1982) developed a 'stages of change' model which is useful to refer to here. In this model those who make successful changes in behaviour go through a number of stages. Those who do not see their current behaviour as a problem that needs to be addressed, or who are unwilling to accept responsibility for change, are described as pre-contemplative – they do not see the need for a change in their behaviour and have little concept of what they can do to change. Once a person sees the need for change, he begins to weigh up the advantages, disadvantages and potential costs associated with that change; this is the stage of contemplation. Pre-contemplative individuals are unlikely to make progress in treatments that are designed to change behaviour. Those who are contemplating change need to be helped to move to the next stage of the model, towards preparation. Having identified the need for change, the patient then must start to make plans to change. Attendance on a programme is only one component of this; the patient must also plan to make change in the home and social environment.

Putting these plans into action is the next stage of change where behavioural change is enacted and goals are set. Movement may not be all one way. Patients often relapse into their old behaviours once faced by other stresses and other challenges, which in the case of fibromyalgia may be a flare-up of the pain. Clinicians must enable the patient to have the knowledge and skills and develop strategies, not to slide back into old ways.

The components of an interdisciplinary pain management programme

Education

Education of the patient starts at the first consultation. Initial education in pain management should give the patient information that is required to help him make an informed decision about participating in a programme. It should offer the patient a credible rationale for engaging in pain management. On attendance at assessment for the first time, patients may believe that they are about to embark on another round of medical interventions similar to those they have experienced in the past. It may be quite a shock to find that they are being asked to accept an approach where 'curing' their pain is not to be the focus of treatment.

Both the patients and their partners need to be informed of the results of the initial assessment at a feedback interview. The aims and objectives, the level of commitment required and the components of a pain management programme should all be made clear. It may not be possible to address all these issues at the initial assessment and many patients require a period of reflection and discussion with their partner and family, with additional

information and a review appointment with a member of the pain management team, before they are in a position to make a choice about commencing pain management.

Education as a treatment intervention alone has been demonstrated to be effective in a number of studies into fibromyalgia: it has been used as a control condition for multidisciplinary programmes and has been demonstrated to give clear improvements in the patient group (Goossens et al 1996). However, there is a problem in determining what should go into an educational programme and when an educational programme becomes a cognitive intervention programme. Education is a cognitive event. It is the giving of information which, one hopes, will lead to some behavioural change and the application of that education to relevant situations. Good educational programmes in any walk of life require not only the giving of information from the teacher to the student but also the application and practice of that information with correction, evaluation, feedback and explanation. The descriptions of education only studies in the literature make it difficult to clarify to what extent the educational programmes were 'low grade' cognitive intervention programmes. By contrast, those educational programmes that concentrate on didactic information giving by a teacher cannot be considered to be truly 'educational'.

There is a general agreement on the content of educational components of pain management programmes. Information on the condition itself is thought essential:

- the key features of fibromyalgia
- the prognosis of the condition
- the role of sleep and information about coexisting conditions (e.g. irritable bowel syndrome and fatigue).

A simple guide to pain physiology is a good starting point, particularly when this is linked to the psychosocial influences on the perception of pain and the development of incapacity, including the role of mood and emotion on pain. This can be done through a simple explanation of the factors which 'open' and 'close' the pain gate. It is essential that the patient understands that a multiplicity of factors may influence our perception of pain and that this does not always mean that the condition is worsening.

Separating the link between hurting and harming is vital in fibromyalgia patients. Many will believe that ongoing pain is a symptom of ongoing damage and that an increase in pain is evidence of further damage. If they are to participate in rehabilitation to the full, fibromyalgia patients must be sure that increases in symptoms following mild exercise are a normal bodily response in a deconditioned system.

The way in which others respond to the way the pain patient feels, especially the responses of well-meaning partners and family, helps both patient and family identify reinforcers of incapacity. Ergonomic influences on pain include education and advice about safe lifting and working postures, the identification of good and poor posture, and adjusting work posture and work practices to allow efficiency of movement. The effects of deconditioning and the benefits of exercise and healthy lifestyles are also included.

Didactic teaching has a limited role in the delivery of education. It may be seen as patronizing by some patients for a fit and pain-free professional to stand before them telling them what it is like to be in chronic pain. For this very good reason discussion groups and tutorial-based education drawing on the experiences of the group is more appropriate. The participation in the educational sessions of the partner (or at least one family member) is highly desirable.

Goal setting and pacing

Limited physical capacity and lowered pain tolerance restrict function in chronic pain patients. Engaging in activity may exacerbate the pain immediately or for some time after the activity has finished. Although the patient is educated to remain active despite the pain, it is necessary not to precipitate the pain to such an extent that activity has to be limited. Conversely, some patients avoid activity to such an extent that they do not progress and do not achieve improvement.

Pacing exercise has been described by Gill and colleagues (1988) as moderate activity–rest cycling. It is a strategy to enable patients to control exacerbations in pain by learning to regulate activity and, once a regime of paced activity is established, to gradually increase the activity level. The converse of this is the 'overactivity–pain–rest' cycle.

Chronic pain patients often report levels of activity that fluctuate dramatically over time. On questioning at initial assessment they report that they frequently persist at activities until they are prevented from carrying on by the resulting level of pain. This leads them to rest until the pain subsides

or until frustration moves them to action, whereupon they then try again until defeated by the increase in pain. How many times have we met the patient who tells us that they do as much as they can on a good day only to suffer for it over the following days? Over time the periods of activity become shorter and those of rest lengthen, disability increases and the individual becomes more anxious and even fearful of activity. The patient may also misattribute the normal muscle aching and stiffness which follows unaccustomed exercise in normal individuals as further injury and damage.

The physiological effects of this are a gradual physical deconditioning of the patient through the avoidance of exercise characterized by reduced strength and aerobic capacity (Bengtsson et al 1994, Bennett et al 1989, Jacobsen et al 1991). Excessive increases in pain following excessive exercise and engendered by post-exertional pain in an unfit individual can also serve to increase excitation of pain receptors in an already sensitive pain system, presumably through secondary central sensitization (Bennett 1996, Corderre at al 1993, Mense 1994).

The purpose of goal setting is to regulate daily activities and to structure an increase in activity through the gradual pacing of activity. Activity is paced by timing it or by the introduction of quotas of exercise interspersed by periods of rest or change in activity (Fordyce 1976, Gill et al 1988, Keefe et al 1996).

Goals should be set in three separate domains:

1. physical, which relates to the exercise programme the patient follows and sets the number of exercises to be performed or the duration of the exercise and the level of difficulty
2. functional/task, which relates to the achievement of functional tasks of everyday living such as housework or hobbies and tasks learned on the programme
3. social, where the patient is encouraged to set goals relating to the performance of activities in the wider social environment.

It is important that goals are personally relevant, interesting, measurable and achievable.

The concept of setting goals in pain management is supported by two influential pieces of psychological theory. Lock (1967) suggested that increased task performance was facilitated by the setting of specific, challenging but *attainable* goals. Demotivation and a sense of failure occur if the goals set are unattainable. Bandura (1977) formulated a concept of self-efficacy theory which has been very influential in pain management. In self-efficacy theory, increased performance occurs under two forms of expectation. These are:

- efficacy expectations, or the belief that one has the personal ability to perform actions that will lead to specific outcomes
- outcome expectations, or the belief that specific outcomes can be achieved as the result of specific behaviours.

Of these, efficacy expectations may be the most potent determinants of change in pain management. Previous research has demonstrated a close link between increased self-efficacy and good outcome from rehabilitation and pain management with respect to increased activity, increased positive coping and reduced pain behaviour (Buckelew et al 1994, Burckhardt et al 1994).

In the initial stages of the rehabilitation programme, patients may suffer from low self-efficacy. Increases in self-efficacy can be brought about in a number of ways:

1. by information from others, including professionals
2. through vicarious learning from others
3. by personal experience and practice
4. by physiological arousal – so-called 'psyching oneself up' to things.

Of all of these, personal experience and practice are the most influential. Increases in perceived self-efficacy in the performance of any task depend on the patient's perception of his own competence in the performance of that task. Failure to perform a task (total inability to perform an exercise) or incompetent performance of the task (failure to reach the required level of performance, e.g. required number of repetitions) leads to a fall in perceived self-efficacy. Achievement of a task or competence in a task will result in an increase in perceived self-efficacy and a willingness to explore other possibilities (more exercises or a more demanding task). Continued goal attainment will reinforce self-efficacy and lead to a perception of mastery over the task or problem (managing to exercise despite the pain). It is therefore important that goals are set which encourage success but are sufficiently challenging to assure progress.

The setting of goals should be a matter of negotiation between the patient and the therapist. The

use of goal-setting charts is essential. Patients set a target for activities each week and record their achievements on the charts. Through this exercise they not only monitor their progress but become more accurate in setting attainable goals.

Physical exercise

The main focus of physical exercise is to redress the effects of prolonged deconditioning (the key aims are given in Box 7.2). Although the long-term effects of deconditioning, decreased fitness, increased weight, joint stiffness and weakness are readily acknowledged by most people with fibromyalgia, the key to compliance with and acceptance of the beneficial effects of exercise is a reduction in the fear of activity.

Exercise should have two major components:

- stretching to increase soft tissue length and joint mobility
- aerobic conditioning to increase fitness.

Weight-resisted strengthening exercises, although not contraindicated, should be introduced with caution because of the likely effect of an increase in pain.

Stretching and range of motion exercises

It has already been stated that fibromyalgia may have started with an initial injury or condition, or occur with coexisting musculoskeletal problems. Although the pain is widespread, there may be areas where it is greatest. Stretching exercises need to be general to address the general loss of flexibility, and also specific to the individual's needs.

Motion through complete joint range is required to assist in the nutrition of the cartilage of synovial joints, as well as in the maintenance of the length and strength of the soft tissue of the joint, such as the joint capsule and ligaments. Repeated motion through a restricted range results in limitation of joint range through the shortening of such structures and an impoverishment of joint nutrition.

Low impact, full range, free exercises are an elementary component of a warm-up and warm-down programme in most exercise regimes and this is so in pain management programmes. They should be combined with stretching exercises to capitalize on increased range of motion.

There is a wide literature on the performance of stretching exercises and the physiological mechanisms will not be discussed here. There are two main schools of thought on stretching technique:

1. static/sustained, where the muscle is taken to its limit and the stretch is maintained for at least 5–6 seconds (although many authors suggest longer)
2. ballistic stretching, where dynamic, rhythmic bouncing exercises are performed at the outer range of the muscle.

Exaggerated guarding and increased myostatic stretch reflexes have been identified in those with painful muscles (Corderre et al 1993, Mense 1994). Additionally, psychological factors have been demonstrated to be closely associated with abnormal patterns of muscle activity (Watson et al 1997). Such abnormalities of movement could potentially lead to ineffective stretching and, at worst, injury to the muscle, therefore the ballistic stretching technique is inadvisable. Combining muscle relaxation skills (discussed below) with stretching will increase the effectiveness of the stretch.

Stretching exercises should be performed daily and should form part of a warm-up and warm-down from aerobic exercise sessions. Initially patients may not be able to sustain a stretch for more than a few seconds. Goal setting should encompass increases in the length of time the stretch is maintained as well as the number of stretches performed. Introducing regular stretching into daily work and home routines, especially between different activities and after periods of static work (e.g. reading, typing), is extremely desirable.

Box 7.2

Objectives of a physical activity programme

- Overcome the effects of deconditioning
- Challenge and reduce patients' fear of engaging in physical activity
- Reduce physical impairment and capitalize on recoverable function
- Increase physical activity in a safe and graded manner
- Help patients to accept responsibility for increasing their functional capacity
- Promote a positive view of physical activity in the self-management of health
- Introduce challenging functional activities to rehabilitation

Aerobic conditioning

Most of the studies on patients with fibromyalgia have concentrated on the role of aerobic conditioning as a way of improving their condition. Wigers and colleagues (1996) have described an intense aerobic conditioning regime for FMS patients (40 45-minute sessions over 14 weeks) where patients self-monitored their pulse rates and were instructed to reach a target maximum of 60–70% of age-related heart rate maximum during the programme. Measures at completion of treatment demonstrated significant beneficial changes in pain distribution, dolorimetry scores, depression and physiological work capacity. However, only pain distribution remained significant at 4-year follow-up. Short-term changes in pain perception and report for exercise alone were also described by Martin and colleagues (1996) following an aerobic, flexibility and strength training programme but there were no changes in function or self-efficacy. Burckhardt et al (1994) also combined stretching exercises with aerobic conditioning to effect changes in self-efficacy and physical function in a group of female fibromyalgia sufferers.

Paced walking, stationary exercise cycle, stair walking, a stair climber and non-impact aerobic classes have all been suggested as ways of increasing physical fitness in chronic pain patients (Bennett 1996, Bennett et al 1996, Burckhardt et al 1994, Haldorsson et al 1998, McCain et al 1988, Martin et al 1996). The exercises should be performed at least three times each week for best effect. Where possible, patients should exercise to 60–70% of aerobic capacity or should pace themselves up to achieve this level of intensity if maximum advantage is to be gained.

Most exercise programmes have reported a reduction in compliance with exercise following programmes (Lewthwaite 1990, Prochaska & Marcus 1994). Wigers and colleagues (1996) found that 73% of patients failed to continue an exercise programme when followed up, although 83% felt they would have been better if they had done so. There is no record of whether patient-centred goal setting was part of this research. Compliance with exercise is more likely if the individual finds it interesting and rewarding. Exercising in a gym may not be suitable for all. Some may not have access to such facilities; others may not be motivated by this form of exercise. Developing activities that are patient and family orientated and can be integrated into the normal daily routine will help to improve adherence with exercise. Exercise should become part of life, not an intrusion into it.

Psychological management

Managing anger

By the time that many patients arrive in pain management they will be disabled and have poor social interaction; many express anger. However, this anger may not be overt. Anger develops from attribution of blame, the deviation of the behaviour of another person from an anticipated course or norm which results in an unexpected and undesirable consequence. It may manifest itself in aggression but may also be a passive/aggressive form of anger in which the anger is expressed in non-compliance or lack of engagement in the rehabilitation process (Fernandez & Turk 1995). It is useful for patients to be helped to examine why they have developed this anger and resentment, which is usually related to loss of function and status. In such a situation the anger must be given a release valve, but concentrating on the anger is not fruitful and patients must be helped to turn their attention from what they have lost to what they currently have and the gains for which they are striving. In short, they must become future rather than past orientated.

In the course of their illness they may have been through a host of ineffective treatments and been given a lot of assurances about the efficacy of these treatments. In addition to this they may have encountered professionals who are, to say the least, sceptical of the diagnosis of fibromyalgia. It may have been suggested, or even stated baldly, that there is nothing wrong with them. Patients are often angry at the medical system and sometimes with good reason. In our own clinic, a specific session, taken by a physician, is set aside to discuss the matter of previous medical care. The aim is to try to help the patient understand that many doctors and therapists, when confronted by a distressed patient in a lot of pain, respond emotionally too. They try interventions simply because they wish to help with the tools they have available (drugs, manipulation). Additionally, patients are encouraged to discuss their own treatment history with the medical staff.

Unfortunately, the attitudes of some medical and paramedical professions experienced by some patients are very difficult to explain. The important

point is that the patients are helped to draw a line under the experience and look towards what they can achieve for the future. In a few cases the anger is so intense that patients may require individual therapy before they are ready to move forwards.

Reducing pain behaviour

Pain behaviours are 'all outputs of the individual that a reasonable observer would characterise as suggesting pain' (Loeser & Fordyce 1983). Most commonly, these are verbal complaints, altered postures and movement, and deviation from normal behaviour (lying down, resting for long periods). Patients are relatively unaware of their demonstration of such behaviour and the effect that it has on other people. Pain behaviours are closely associated not only with pain intensity but also with fear of activity, low self-efficacy and psychological distress (Buckelew et al 1994, Keefe & Block 1982, Waddell 1992, Watson & Poulter 1997).

The most florid pain behaviour is demonstrated during exercise sessions. Operant behavioural theories suggest that the physiotherapist should ignore all pain behaviours and recognize only well behaviours and improved function (Fordyce 1976). This may not be as productive as is often claimed. Patients with fibromyalgia are frequently of the opinion that their condition has not been taken seriously in the past. Well behaviours and achievements should be acknowledged, but simply ignoring pain behaviour without explanation can be counterproductive. The therapist should explain that they understand that everyone in the group is in pain, that is why they are there, and it is not useful for them, as the therapist, to respond to every demonstration of pain from each person in the group – the therapist knows that things are tough but will never ask the patients to do things that may result in injury. This can do a lot to head off any anger from those who may feel they are being ignored.

As has been mentioned above, family and partners often respond to pain behaviours in a solicitous manner and in doing so unwittingly reinforce the behaviour. This is rarely an overt manipulation by the patient. Asking the patients and the partners to identify the behaviours and their responses to them is useful way of demonstrating the interaction between the expectation of pain, beliefs about pain and their own reactions. Video recording the patients during standardized tasks is an established method of recording pain behaviours (Keefe & Block 1982, Watson & Poulter 1997), but video recording patients during the programme, especially when performing tasks and interacting with others, is also a useful way of confronting patients with their own pain behaviour.

Relaxation

Suffering chronic pain is a stressful experience and fibromyalgia patients often report feeling under stress from factors associated with the pain (poor family relations, guilt, anxiety) and have difficulty in truly relaxing despite feeling fatigued. In addition, people who have muscle pain may increase their muscle tension in response to pain and this may also contribute to pain (Flor & Turk 1989, Watson et al 1998). To help counter this, relaxation is included in many pain management programmes. There is little or no evidence that relaxation alone is useful in widespread muscle pain (Arena & Blanchard 1996) but is a useful adjunct to pain management.

Relaxation in pain management is learning to remain alert and in control while reducing muscle tension and developing a state of emotional calmness. By training in this skill the patients should be able to 'switch' into relaxation after a few minutes of application of the skills. There are a number of approaches to relaxation and patients may have to try more than one until they find the most effective. A combination of these techniques is favoured by many patients. Relaxation can also be augmented with the use of biofeedback but this will not be discussed here.

Progressive muscle relaxation was developed by Jacobsen (1929). In progressive muscle relaxation the patient learns to progressively relax major muscle groups systematically. The method utilizes the sensation of tensing the muscles prior to 'letting go' of that tension to achieve relaxation. Through this and self-monitoring of muscle activity by training awareness of tension, patients are able to establish an improved kinaesthetic feedback. Through self-monitoring they become more aware of the situations that led to increased tension and can more effectively monitor and reduce it.

In relaxed imagery relaxation the patient imagines a peaceful and relaxing scene. This could be walking through a forest or lying on a beach. The purpose of this is to choose an image that patients can readily access and rehearse until they are able to bring the image to mind within a few minutes

of beginning the relaxation. Imagery is idiosyncratic and each patient has to develop his own strategy with the help of the therapist.

Repeating relaxing phrases over and over is autogenic relaxation. Once again it is useful if patients develop their own phrases but there are lists of standardized phrases for patients to practise this technique (Blanchard & Andrasik 1985). The patient concentrates on the phrase and repeats it quietly to himself while developing a feeling of calmness.

Deep diaphragmatic breathing is one of the most useful techniques and one that is easily incorporated into the techniques above. Many chronic pain patients breathe rapidly and typically utilize primarily the upper chest during the breathing cycle. Using slow, controlled diaphragmatic breathing, the patient progressively reduces his breathing rate until he is breathing at a rate of about 6–8 breaths per minute. The effectiveness of relaxation or breathing control as a therapy in its own right is not established, and it is almost always used as an adjunct to other techniques, although it does give the patient a sense of control over his own body. It is important that patients feel this sense of control to give them a feeling of optimism that they can develop self-management strategies.

Whichever strategy the patients decide to adopt, they should practise relaxation at least twice per day. However, once patients identify those situations that increase stress and tension, they require a relaxation strategy that can be used in everyday activities. Keefe et al (1996) suggest the development of a 'brief relaxation method' once the patient is able to achieve a relative state of relaxation. Initially these are performed in sitting and are developed to more demanding situations, eventually leading to their introduction during conversation.

Sleep management

Poor sleep quality is one of the hallmarks of fibromyalgia and is deeply implicated in the development and maintenance of muscle tenderness (Moldofsky 1993, Wolfe et al 1990). These have been managed medically by low dose tricyclic antidepressants, especially amitriptyline and nortriptyline. Advice on sleep management and good sleep hygiene is important to fibromyalgia sufferers. Patients are advised about avoidance of caffeine and alcohol, and about the importance of establishing a routine for good sleep. This can be combined with the skills learned in the relaxation training.

Rehearsal of coping skills

Patients have to identify situations which they find threatening and 'high-risk' where their ability to cope with the pain may be compromised. By identifying possible ways of dealing with stressful situations through role play, and problem solving using video or written case studies, patients can 'try out' strategies. This may prove difficult for patients as many may have become dependent on others during the development of their disability – a learned helplessness. Learning from other members of the group who have successfully coped with stressful events is an important learning experience. Similarly, they can identify unsuccessful coping and how this might be better managed.

Patients find that the pain is less intrusive when they are occupied, distracted and in a positive frame of mind. Identifying those stressors that may compromise their coping strategies and the development of strategies for dealing with these is essential. It is not possible to address these factors here and the reader is directed to other books on the subject (Gatchel & Turk 1996, Jamison 1996, Phillips & Rachman 1996).

Persistent pain leads to the development of negative thoughts which are often self-defeating. Patients may believe that because they are not able to achieve as much as a 'normal' person they are of less worth. They generalize the inability to perform certain tasks into an inability to function in a wider social context. Catastrophic thinking styles evolve and in turn can lead to a feeling of helplessness and hopelessness (Flor et al 1993). These thoughts undermine the individual's confidence and result in depression, which in turn affects the perception of pain. Patients are made aware of this reaction and are encouraged to identify when they are making these bleak over-generalizations, to replace them with more accurate statements, and to identify which thoughts lead to positive actions that help them manage their condition and which may lead to inactivity and depression. Patients focus on current achievements and progress towards goals rather than measuring their progress by past (pre-fibromyalgia) levels of activity and interaction.

Prolonged adoption of a reduced social role and the relinquishing of tasks to other family members result in changed roles and responsibilities. Patients may find it difficult to regain roles lost to other

family members and may have to reassert themselves back into their former roles and to resume tasks. Assertiveness training may be required in some people to allow them to reclaim their role without risking confrontation. Assertiveness is a skill of particular importance in developing a good relationship with, and getting the best from, doctors and other health professionals.

Homework tasks are set for patients to reinforce learning. This is often in the form of case history examples: patients have to read these, identify such factors as barriers to change and strategies to overcome these, and prepare their responses for their next attendance on the programme. They are encouraged to work through them with their family members to help educate them about pain management. Homework also includes getting the patient to identify problems at home. These can be problems with functional tasks or, more challenging, problems with relationships. Homework assignments place the pain management process into a personal framework for the patient.

Relapse self-management

It is almost inevitable that fibromyalgia patients will, at some stage, experience a flare-up of their pain and a relapse in their condition. During the programme they should imagine situations that might make them prone to relapse. Fibromyalgia patients are just as liable to strains, pulled muscles and injuries as the rest of the population once they become active.

Relapse may not be entirely caused by an individual physical event. The build-up of daily stresses may produce challenges to patients' daily coping resources and their ability to manage their pain. Differentiating what is a new pain, associated with new pathology, and their usual fibromyalgia pain is essential. They need to be informed about drug usage during flare-ups and how to 'manage' their physician or other therapists to give them appropriate treatment for any new condition without compromising their own self-management strategies. The development of an 'emergency card' in collaboration with their family and partner can be useful in these situations. This is a written plan of how they will deal with increases in pain and/or new pathology. This includes developing criteria for visiting their physician, the taking of medication, relaxation, rest and pacing activity, and returning to normal activity as soon as possible. This of course cannot cover all eventualities but helps the patient to retain a feeling of control.

From time to time practitioners may encounter patients who have completed pain management programmes but who may turn to them in times of increased pain, requiring help to manage the flare-up. Patients with fibromyalgia are just as prone to minor injury as the rest of us and probably more so if they become more active. It is essential that therapists who are not experienced in pain management, but to whom the patient might turn as a source of short-term symptomatic relief, do not unwittingly encourage patients back into a round of treatment interventions which threaten their sense of self-control and their self-management programme.

The first approach is to reassure the patient that the increase in pain is not a sign of a worsening of the condition or an inevitable decline, but that it is part of the natural variation in the pain pattern (as is almost invariably the case). An increase in pain should not be taken by the patient as failure or evidence of an inability to manage his own condition. It is a challenge to self-management, not the end of it. Reassurance on these points and getting patients to identify how successful they have been thus far can help 'rescue' them at this stage. If new pathology is identified, then the management of this must be incorporated into the patient's own self-management. Control for the management of the new problem should be developed with the patient where possible, and the benign nature of musculoskeletal pain must be communicated.

Although resolution of fibromyalgia symptoms has been reported (Granges et al 1994), it is disingenuous of practitioners to suggest to fibromyalgia patients that they are able to cure the condition through their (the practitioner's) own approach. If any specific treatment is clearly indicated (e.g. manipulation, mobilizations, trigger point therapy), it must be time-limited and should be presented as a short-term measure to assist the patient over the crisis and to support him in getting back on track in his self-management programme (Vancouver Fibromyalgia Consensus Group 1996). It is totally inappropriate to foster dependency through encouraging repeated consultations. This is very unlikely to be in the patient's best clinical or financial interest, though it may serve the practitioner.

The practitioner should question patients about their self-management strategies, and particularly about their emergency relapse self-management

programme, if they developed one while on pain management. The focus of management is assisting the patient to implement this. Where possible, advice should be sought from the pain management programme that the patient attended, and the opportunity of joint management should be discussed. In any event, resumption of a graded exercise programme is to be encouraged early on, with appropriate attention to pacing and goal setting.

Most evidence points to the unfortunate fact that those with fibromyalgia will have it for a long time, and possibly for life. Although a greater understanding of the problem will hopefully provide better treatments in the future, currently we do not have a cure for the problem. Management of the symptoms of fibromyalgia is not the same as rehabilitation and will not solve the wider issues of incapacity associated with this condition. All practitioners have a duty to assist patients to continue an independent lifestyle as much as possible. This should also mean a life free from further ineffective investigations and treatments. We must ensure that patients remain in control of their lives and of the management of their condition.

Boxes 7.3 and 7.4, by Leon Chaitow, summarize some additional research findings concerning links between biochemistry, the mind and fibromyalgia syndrome.

Box 7.3

Biochemistry, the mind and fibromyalgia syndrome (see also Figs 4.6 and 4.9)

Leon Chaitow

In this chapter cognitive behaviour modification methods are detailed by Paul Watson, who has specialized in treating chronic pain in general and fibromyalgia in particular using these approaches. This section offers another viewpoint, that of Jay A. Goldstein, who has mapped this controversial territory from his unique perspective (Goldstein 1996). (See also Box 7.4, which summarizes other research findings.) Goldstein defines CFS/FMS as *neurosomatic* disorders, quoting Yunus (1994a) on the fact that they are 'the commonest group of illnesses for which patients consult physicians'.

- Goldstein believes that these disorders emerge from biochemical imbalances within the neural network.
- He administers multiple medications to try to exert normalizing effects, with claims of a high success rate.
- Neurosomatic disorders are illnesses which Goldstein suggests are caused by 'a complex interaction of genetic, developmental and environmental factors', often involving the possibility of early physical, sexual or psychological abuse (Fry 1993).
- Symptoms emerge as a result of 'impaired sensory information processing' by the neural network (including the brain). Goldstein clarifies this by saying, 'actually processing occurs properly, but "gating", the control of data input and output from processing centers, is dysfunctional'.
- Examples given are of light touch being painful, mild odours producing nausea, walking a short distance being exhausting, climbing stairs being like going up a mountain, reading something light causing cognitive impairment – all of which examples are true for many people with CFS/FMS.
- Some of the key biochemical aspects of this misprocessing (resulting from genetic, developmental and environmental factors, see below) include:
  a. insufficient glutamate, an excitatory amino acid, which leads to
  b. decreased levels of noradrenaline (norepinephrine) which is responsible for enhancing the processing of sensory input. When low levels of noradrenaline (norepinephrine) occur 'much sensory input will reach the cerebral cortex, some of it irrelevant', leading to misperception and distractibility in stimulus situations.
  c. When noradrenaline (norepinephrine) is low, substance P levels will be high, further lowering the threshold for 'irrelevant' stimuli reaching the brain (including pain messages).
- Goldstein is highly critical of psychological approaches to treatment of these conditions, apart from cognitive behaviour therapy (see this chapter), which he suggests 'may be more appropriate, since coping with the vicissitudes of these illnesses, which wax and wane unpredictably, is a major problem for most of those afflicted'.
- He claims that most major medical journals concerned with psychosomatic medicine rarely

Box 7.3—Cont'd

discuss neurobiology and 'apply the concept of somatization to virtually every topic between their covers'.

The four basic influences on neurosomatic illness are, Goldstein states:

1. Genetic susceptibility, which can be strong or weak. If strong, the individual will develop a neurosomatic illness almost inevitably, often in childhood. If only a weak tendency exists, other factors are needed to influence the trait (Hudson et al 1992).
2. If a child feels unsafe between birth and puberty hypervigilance may develop and interpretation of sensory input will alter. The neurochemical expression of this may lead to 'elevated levels of SP [substance P] enabling him to attend to a wide range of stimuli, as well as transiently elevated cortisol with subsequent down-regulation of the HPA [hypothalamic–pituitary–adrenal] axis. Central NE [noradrenaline (norepinephrine)] levels would also be low, contributing to disautonomia as well as abnormalities in sensory processing in the circuit between the dorsolateral prefrontal cortex, thalamus and the hippocampus.'
3. Genetically predetermined susceptibility to viral infection affecting the neurons and glia: 'Persistent CNS viral infections could alter production of transmitters as well as cellular mechanisms.'
4. Increased susceptibility to environmental stressors due to reduction in neural plasticity (resulting from all or any of the causes listed in 1, 2 and 3 above). This might include deficiency in glutamate of nitric oxide secretions which results in encoding new memory. 'Neural plasticity' capacity may be easily overtaxed in such individuals which, Goldstein suggests, is why neurosomatic patients often develop their problems after a degree of increased exposure to environmental stressors such as acute infection, sustained attention, exercise, immunization, emergence from anaesthesia, trauma, etc.

Goldstein also describes the limbic system and its dysregulation:

- The limbic system acts as a regulator (integrative processing) in the brain with effects on fatigue, pain, sleep, memory, attention, weight, appetite, libido, respiration, temperature, blood pressure, mood, immune and endocrine function.
- Limbic function dysregulation influences all or any of these functions and systems.
- Regulation of autonomic control of respiration derives from the limbic system; major abnormalities in breathing function (hyperventilation tendencies, irregularity in tidal volume, etc.) are noted in people with chronic fatigue syndrome, along with abnormal responses to exercise (including failure to find expected levels of cortisol increase, catecholamines, growth hormone and somatostatin, increased core temperature, etc.) (Gerra et al 1993, Goldstein & Daly 1993, Griep et al 1993, Munschauer et al 1991).
- Dysfunction of the limbic system can result from central or peripheral influences ('stress'). Sensory gating (the weight given to sensory inputs) has been shown to be less effectively inhibited in women than in men (Swerdlow et al 1993).
- Many biochemical imbalances are involved in limbic dysfunction and no attempt will be made in this summary to comprehensively detail these; however, Goldstein lists viral and early developmental influences as possible triggers (see discussion of allostasis in Ch. 2, Fig. 2.4C).
- The trigeminal nerve, states Goldstein, modulates limbic regulation: 'The trigeminal nerve may produce expansion of the receptive field zones of wide dynamic range neurons and nociceptive-specific neurons under certain conditions, perhaps involving increased secretion of substance P, so that a greater number of neurons will be activated by stimulation of a receptive zone, causing innocuous stimuli to be perceived as painful' (Dubner 1992).
- Goldstein reports that nitric oxide (NO), which is a primary vasodilator in the brain, has profound influences on glutamate secretion, and the neurotransmitters which influence short-term memory (Sandman et al 1993), anxiety (Jones et al 1994), dopamine release (Hanbauer et al 1992) (so affecting fatigue), descending pain inhibition processes, sleep induction, and even menstrual problems: 'Female patients with CFS/FMS usually have premenstrual exacerbations of their symptoms. Most of the symptoms of late luteal phase dysphoric disorder are similar to those of CFS, and it is likely that this disorder has a limbic aetiology similar to CFS/FMS' (Iadecola et al 1993).

Allostasis is a major feature of Goldstein's model. He reports that:

- Approximately 40% of FMS/CFS patients screened have been shown to have been physically, psychologically or sexually abused in childhood (Teicher et al 1993).
- By testing for brain electricity imbalances, using brain electricity activity mapping (BEAM)

Continued

Box 7.3—Cont'd

techniques, Goldstein has been able to demonstrate abnormalities in the left temporal area, a feature of people who have been physically, psychologically or sexually abused in childhood (as compared with non-abused controls).

- Major childhood stress, he reports, increases cortisol levels which can affect hippocampal function and structure (McEwan 1994, Sapolsky et al 1990).
- It seems that early experience and environmental stimuli interacting with undeveloped biological systems lead to altered homeostatic responses, 'for example exaggerated or insufficient HPA axis responses to defend a homeostatic state in a stressful situation could result in behavioural and neuro-immunoendocrine disorders in adulthood, particularly if stimuli that should be nonstressful were evaluated ... inappropriately by the prefrontal cortex' (Meaney et al 1994).

Sapolsky has studied this area of 'allostasis' (regulation of internal milieu through dynamic change in a number of hormonal and physical variables that are not in a steady state condition) and identifies as a primary feature a sense of lack of control. In studies of this topic, CFS/FMS patients are found to predominantly attribute their symptoms to external factors (virus, etc.) while control subjects (depressives) usually experience inward attribution (Powell et al 1990). Sapolsky also identifies a sense of lack of predictability and various other stressors which influence the HPA axis and which are less 'balanced' in individuals with CFS/FMS; all these stressors involve 'marked absence of control, predictability, or outlets for frustration'.

Allostatic load, in contrast to homeostatic mechanisms which stabilize deviations in normal variables, is 'the price the body pays for containing the effects of arousing stimuli and the expectation of negative consequences' (Schulkin et al 1994). Chronic negative expectations and subsequent arousal seem to increase allostatic load. This is characterized by anxiety and anticipation of adversity leading to elevated stress hormone levels (Sterling & Eyer 1981). Goldstein attempts to explain the immensely complex biochemical and neural interactions which are involved in this scenario, embracing areas of the brain such as the amygdala, the prefrontal cortex, the lower brainstem, and other sites, as well as myriad secretions including hormones (including glucocorticoids), neurotransmitters, substance P, dopamine and nitric oxide. Finally, he states, prefrontal cortex function can be altered by numerous triggering agents in the predisposed individual (possibly involving genetic features or early trauma) including:

- 'viral infections that alter neuronal function'
- 'immunizations that deplete biogenic amines' (Gardier et al 1994)
- 'organophosphate or hydrocarbon exposure'
- 'head injury'
- 'childbirth'
- 'electromagnetic fields'
- 'sleep deprivation'
- 'general anaesthesia'
- 'stress' e.g. 'physical' such as marathon running, or 'mental or emotional'.

What Goldstein is reporting is an altered neurohumoral response in individuals whose defence and repair systems are predisposed to this happening, either because of inherited tendencies or because of early developmental (physical or psychological) insult(s), to which additional multiple stressors have been added. His solution is a biochemical (drug) modification of the imbalances he identifies as key features of this situation.

Alternative approaches might attempt to modify behaviour (see this chapter) or to alter other aspects of the complex disturbances, possibly using nutritional approaches. Goldstein has offered us insights and his own solutions.

Not everyone will necessarily accept these solutions but the illumination of the highly complicated mechanisms involved which he offers is to be commended.

Box 7.4

The mind and fibromyalgia syndrome: additional research findings

Leon Chaitow

Box 7.3 summarized the work of Dr Jay Goldstein, which points towards major biochemical disturbances involving key brain areas, with influences capable of producing all of the symptoms of CFS/FMS. In this summary of findings by other researchers additional opinions are offered, with varying conclusions being drawn:

- Canadian research has examined the relationship between emotional factors, muscle activity, psychological stress and the occurrence of fibromyalgia and myofascial pain. The conclusion is that chronic muscular pain is not a life stress syndrome and has to be understood in terms of organic disorders which are aggravated by psychological factors. The psychological changes which occur as a *result* of severe, chronic, muscle pain, however, require appropriate psychological treatment (Merskey 1993).
- A Swedish study has evaluated the question, does a fibromyalgia personality exist? A total of 155 women with FMS completed a questionnaire which analyses personality traits. The traits that were most obviously different in FMS women were a need for order and a low need for exhibition, autonomy and aggressive non-conformance. 'FMS patients are pedantic and have great needs for order, perfectionism, planning and cleanliness. There was no evidence of a greater tendency towards developing depression' (Johannsson 1993).
- Physical exercise (cardiovascular training) as well as low level antidepressant medication have both been shown to offer benefits to people with FMS. A study conducted in Finland evaluated the benefits of combined antidepressant medication and exercise therapy in treatment of FMS. The results indicated that a combined protocol was more beneficial than either the exercise or the medication alone. 'Although low levels of amitriptyline has only minor antidepressive effects, it may improve the quality of sleep and correct aberrations of serotonin in the brain stem. This may raise spirits, as does physical training, by causing post-exercise hypoalgesia through increased endogenous opioids in the brain. It is known that physical training is able to alleviate depression and to improve the quality of sleep' (Isomeri et al 1993).
- Research in the Netherlands attempted to determine whether a combined psychological and behavioural therapy protocol (psychomotor and marital counselling) was useful in treating fibromyalgia patients (50 treated, 50 untreated as controls). There was a high drop-out rate (33%) and although many patients reported improvements in their ability to deal with their disabilities, the researchers could not confirm these reports: 'There was no significant differences compared to the non–treatment controls.' There was no reduction of pain or other physical complaints (de Voogd et al 1993).
- Don Goldenberg, professor of medicine at Tufts University School of Medicine, has reviewed the literature and concludes that: 'fibromyalgia is not a psychiatric illness. A subset of patients may have major depression and there is evidence that stress may play an important role in fibromyalgia. Depression may be a biologic marker for fibromyalgia in some families with a spectrum of "affective disorders"' (Goldenberg 1994). Among the more specific conclusions Goldenberg includes the following:
  a. Most patients with FMS do not have psychiatric illness.
  b. There is no correlation of the core FMS symptoms or treatment response with psychological factors.
  c. There may be a greater lifetime history and family history of depression in FMS compared with rheumatoid arthritis and normal controls.
  d. There may be greater levels of daily stress in FMS than in rheumatoid arthritis.
- Behaviour modification as a treatment option in FMS was evaluated at the school of medicine of the University of Missouri. The conclusion was that: 'behavioural theory can be used to understand some of the patterns associated with pain [and that] behavioural treatment suggestions and cognitive behavioural treatment programs provide options for improving the quality of life associated with fibromyalgia' (Buckelew 1994; and see this chapter).
- Mohammed Yunus, professor of medicine at the University of Illinois and a leading researcher into the care of fibromyalgia syndrome, is definite in his conclusion that: 'Presently available data indicate that FMS is not a psychiatric condition.' He notes that between 25% and 35% of FMS patients seen at rheumatology clinics have significant psychological problems but that the proportion of such patients seen in primary care settings is

Continued

Box 7.4—Cont'd

lower and that it is because of referral bias that a high number end up at specialist clinics. He is clear that psychological abnormalities are not necessary for the emergence of FMS; however, he cautions that some patients with psychological distress may be more difficult to manage in treating their pain and fatigue (Yunus 1994b).

- Researchers compared the clinical and psychological features of patients with widespread chronic musculoskeletal pain and patients with fibromyalgia (FMS). The conclusion was that the clinical and psychological features of the two groups were similar and were also similar to patients with osteoarticular diseases. The researchers believe that FMS should be considered an advanced clinical stage of a continuum of widespread musculoskeletal pain, and not a psychological condition (Moral et al 1997).
- There is much clinical support for the hypothesis that most depression and anxiety associated with FMS is a result rather than a cause of the condition (Mason et al 1991), and that both fibromyalgia and depression may be caused by a common underlying set of factors (Kate 1997).

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Chapter Eight

8

Differential diagnosis of fibromyalgia

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Since the 1990 publication of the American College of Rheumatology criteria for the classification of fibromyalgia (ACR criteria), fibromyalgia (FMS) has become a well-recognized clinical entity (Wolfe et al 1990). The World Health Organization has included the diagnosis of FMS in its *International Statistical Classification of Diseases and Related Health Problems* (World Health Organization 2007), while the US Food and Drug Administration has recognized FMS by approving pregabalin and duloxetine for its indication (Food and Drug Administration 2007). Several studies offer support for the administration of pregabalin and duloxetine to patients with FMS (Arnold et al 2008, Crofford et al 2005, 2008, Mease et al 2008, Pae et al 2009, Russell et al 2008); however, neither drug demonstrated acceptable efficacy for the majority of patients (Lawson 2008).

According to the ACR criteria, a diagnosis of FMS should be made when an individual presents with widespread pain lasting longer than 3 months and tests positive for the tender point count. Several associated conditions have been described and multiple aetiological hypotheses have been developed. Even though the ACR criteria were widely used in clinical practice, they have several significant limitations, which may explain why fewer health care providers use them in clinical practice compared to a decade ago (Clauw 2008). At the time of the development of the criteria, FMS was considered a discrete disease, which could be captured with the somewhat simplistic tender point count, even though the number of positive tender points was based on a totally arbitrary decision-making process. The tender point count remains a non-specific concept and does not differentiate FMS from other chronic widespread pain diagnoses featuring many of the same symptoms (Dommerholt 2002). Physicians who still consider the ACR criteria as the gold standard when making the diagnosis of FMS, or physicians who consider a diagnosis of FMS an endpoint rather than an opportunity to explore what may be causing the widespread pain and associated symptoms, may disregard the established medical differential diagnostic process and ignore the current thinking about FMS. This

chapter will highlight several other pain syndromes that should be considered in the differential diagnosis of FMS with special attention to the diagnosis of myofascial pain.

The ACR criteria

The ACR criteria were deliberately referred to as 'classification' criteria to distinguish them from 'diagnostic' criteria. The term 'classification' was used to represent the minimal standard for entry of subjects into research and epidemiological studies; however, the ACR criteria suggested that the criteria would be useful for clinical diagnosis as well (Wolfe et al 1990). A consensus document developed during the 1992 Second World Congress on Myofascial Pain and Fibromyalgia in Copenhagen supported using the ACR criteria as diagnostic criteria, even in the absence of the required number of tender points (Jacobsen et al 1993, Wolf et al 1993). According to the Copenhagen declaration, strict adherence to the tender point count was indicated in research protocols. However, when the ACR criteria were used as diagnostic criteria, the diagnosis of FMS could be made with less than 11 tender points, a sentiment repeatedly expressed in several other publications (Bennett 1999, Jacobsen et al 1993, Wolfe et al 1995). Following the publication of the ACR criteria and the Copenhagen declaration, physicians and other health care providers worldwide started applying the classification criteria diagnostically in their clinical practices. Compared to other medical specialists, rheumatologists most frequently made the diagnosis (White et al 2000a).

Because the ACR criteria include only two parameters, namely widespread tenderness and duration of symptoms, there are potential pitfalls clinicians should be aware of when considering the diagnosis of FMS. First, the ACR criteria associate a single non-specific clinical feature, such as tenderness, with an entire pain syndrome and fail to distinguish between cause and effect (Cohen & Quintner 1993). Although several studies have confirmed the validity and inter- and intra-observer reliability of the tender point count, there is no evidence that this validates the tool to characterize a specific syndrome (Okifuji et al 1997, Tunks et al 1988, 1995). Technically, patients with widespread burns may meet the ACR criteria for FMS; however, it is inconceivable that a physician would diagnose FMS in the presence of obvious signs of burn scars (Wolfe 1993). A recent study showed that anatomical regions of tenderness are indeed non-specific for describing patients with diffuse pain (Katz et al 2006). A Norwegian study of over 3000 subjects showed that localized musculoskeletal pain is relatively rare and that musculoskeletal pain usually coexists with pain in other body regions, which suggests that using a tender point count to establish the widespread nature of a particular pain problem may lead to many false positives (Kamaleri et al 2008a, 2008b). It has been established that a high number of tender points may depict a more general measure of distress, more somatic symptoms, more severe fatigue and low levels of self-care, but the use of the tender point count and its arbitrary 11-point cut-off remain highly subjective (Croft 2000, Jacobs et al 1996, McBeth et al 1999, Smythe 1986, Wolfe 2000).

Second, there is a substantial risk of circular reasoning. After patients have been diagnosed with FMS using the tender point count, they may still wonder why they have pain. Invariably, the clinician will answer something like: 'You have pain, because you have FMS.' This circular reasoning basically implies that patients have pain, because they have pain. By not distinguishing between cause and effect, circular reasoning is inevitable (Cohen & Quintner 1998).

Third, tenderness assessed by the tender point count does not distinguish a particular clinical entity, but may be an indication of allodynia, hyperalgesia, peripheral and central sensitization (Croft et al 1996, Graven-Nielsen et al 1999, Henriksson 2002). The current thinking considers that FMS is a diffuse disorder of central pain processing with widespread body pain (Clauw 2008). However, central sensitization is not specific to FMS and is commonly seen with other chronic pain syndromes, including myofascial pain, spinal cord injuries, burn injuries, post-herpetic neuralgia, phantom limb pain, trigeminal neuralgia, back and neck pain, endometriosis, whiplash-associated disorders, temporomandibular pain, headache, etc. (Bajaj et al 2003, Coderre et al 1993, Curatolo et al 2004, 2006, Eich et al 2000, Eide & Rabben 1998, Eide et al 1994, 1996, Fernández de las Peñas et al 2007a, Johansen et al 1999, Kavanagh et al 1991, Mense & Hoheisel 1999, Okifuji et al 1999a, O'Neill et al 2007, Sessle et al 1999, Yunus 2007a).

There is much evidence that most chronic pain states feature a combination of central and peripheral mechanisms (Cousins 2007, Curatolo et al 2006).

Neuroimaging studies of patients with various chronic pain syndromes have shown similar alterations in functional brain activity, independent of the specific diagnosis, that may contribute to allodynia, hypersensitivity, tenderness and other abnormal pain experiences (Bradley et al 2000, Bushnell et al 2002, Grachev et al 2000, Niddam et al 2007, 2008).

Although the word fibromyalgia suggests that FMS is a musculoskeletal syndrome limited to fibrous and muscular tissues, FMS is now defined as a medical condition, characterized and defined by the hallmark of chronic widespread non-articular musculoskeletal pain (Chakrabarty & Zoorob 2007). There is some evidence that people with FMS are more pressure sensitive than others with chronic widespread musculoskeletal pain (Cöster et al 2008), but in a given individual all tissues are usually equally tender (Vecchiet et al 1994). There is no evidence of any peripheral FMS-specific aberrations (Dommerholt 2000, Henriksson et al 1993, Mengshoel 1998, Nørregaard et al 1994, Schrøder et al 1993, Simms 1994, 1996, Yunus et al 1989). FMS is a diffuse central nervous system disorder with pain and dysfunctional sensory processing (Clauw 2007). Yet, patients with FMS are not a homogeneous group and it is unlikely that all non-pain symptoms such as disturbed sleep, fatigue, cold intolerance, dry eyes and dizziness can fully be explained by the sensitization model (Jones et al 2007). Yunus has argued that FMS is part of a spectrum of overlapping central sensitivity syndromes (Yunus 2007b, 2008).

Last, in cases where a treatable medical diagnosis can be identified, it is questionable if and how patients benefit from an additional diagnosis of FMS. The ACR criteria suggest that the diagnosis of FMS is 'a diagnosis by inclusion', which should be made irrespective of other diagnoses (Wolfe et al 1990). Patients were advised to avoid physicians who believe that FMS is a diagnosis by exclusion (Russell 2001). Yet, there is an inherent risk in making the diagnosis of FMS by inclusion, especially when the majority of symptoms in a particular individual can be traced back to other medical conditions that feature similar symptoms, including widespread pain, sleeplessness and fatigue (Dommerholt 2002). Schneider & Brady (2001) refer to this category of patients as 'pseudo FMS' patients, or patients who were misdiagnosed with FMS.

Clauw maintains that one of the characteristics of FMS is that no physical reason for the pain can be identified, which in his view may lead to a belief by health care providers that patients may be malingering and thus delay the diagnosis and treatment (Clauw 2008). However, there are many medical conditions that may feature widespread pain and not all health care providers will rule out all other differential diagnoses, making it questionable whether there really is no other physical reason for pain. Myofascial trigger points are just one of many conditions that can cause widespread pain and few health care providers are skilled in identifying trigger points. Patients with multiple trigger points may thus get a diagnosis of FMS, while the treatment of their trigger points likely would resolve or lessen their widespread pain (Dommerholt et al 2006a, Gerwin 2005). When a diagnosis of FMS is made by inclusion, other diagnoses may not get identified, which potentially could result in withholding appropriate treatment options from the patient. For example, any time a cardiologist prescribes or increases the dose of a cholesterol-lowering medication, the patient may develop widespread myalgia as a side-effect of the medication. All cholesterol-lowering medications in the so-called 'statin' family have widespread myalgia as a potential side-effect (Silva et al 2006, Sirvent et al 2008). The patient may not realize that the cholesterol-lowering drug may be responsible for the relatively sudden onset of widespread muscle pain and may consult a general practitioner, rheumatologist or physiatrist, instead of the cardiologist who prescribed the medication. The patient may be diagnosed with FMS if the physician is not familiar with the potential side-effects of cholesterol-lowering medications or if the physician follows the principle of a diagnosis by inclusion. It is safe to assume that the symptoms that are now ascribed to FMS will continue as long as the patient continues to take the cholesterol-lowering medication.

After much debate during the past decade, it is now abundantly clear that there is nothing special about the number of tender points. Rheumatologists have finally suggested that the ACR criteria should not be used as diagnostic criteria for clinical use (Ablin et al 2008).

Differential diagnoses

Among the diagnoses that may feature widespread pain and a positive FMS tender point count are hypothyroidism, disturbed sleep, growth hormone

Table 8.1 Differential diagnosis of fibromyalgia syndrome

Fibromyalgia
Hypothyroidism
Adult growth hormone deficiency
Metabolic insufficiencies
Myofascial pain syndrome
Myalgias secondary to medication use
Parasitic infestations
Myoadenylate deaminase deficiency
Rheumatic diseases
Psychological diagnoses
Hypermobility syndrome
Whiplash syndrome
Widespread burns

deficiency, metabolic insufficiencies, myofascial pain, myalgias secondary to medication use, parasitic infestations, myoadenylate deaminase deficiency, rheumatic and infectious diseases, psychological diagnoses, hypermobility syndrome and whiplash syndrome (Table 8.1). There is evidence that the mere diagnosis of FMS may contribute to feelings of hopelessness, depression, anger, anxiety and illness behaviour, which is one important reason why clinicians should be cautious with giving patients the diagnosis of FMS (Hadler 1996, Hellström et al 1999).

In spite of the notion that, according to the ACR criteria, a diagnosis of FMS should be made irrespective of other diagnoses, a more logical approach would dictate following the accepted medical differential diagnostic process and exclude other potential causes of widespread pain, fatigue, sleep problems and psychosocial distress. A brief review of some common causes of widespread pain and associated symptoms pertinent for the differential diagnosis follows.

Hypothyroidism

Hypothyroidism is suspected clinically when there is a complaint of coldness, dry skin or dry hair, constipation and fatigue. Several authors have suggested that FMS may be associated with hypothyroidism (Garrison & Breeding 2003, Lowe 1996). Hypothyroidism is commonly associated with widespread pain and in one study occurred in 10% of chronic myofascial pain subjects with widespread myofascial trigger points (Gerwin 1995). The thyroid-stimulating hormone (TSH) level may only be in the upper range of normal, but as shown by TRH stimulation tests, may still be abnormal for a given individual (Gerwin 2005). Patients with hypothyroidism are commonly managed with medications such as levothyroxine (Singh et al 2000, Woeber 2000). However, not all tissues are equally able to convert thyroxine to triiodothyronine, the active form of thyroid hormone. The addition of triiodothyronine to thyroxine has been shown to result in an improved sense of well-being, an improvement in cognitive function and mood, and an increase in serum levels of sex-hormone-binding globulins, a sensitive marker of thyroid hormone function (Bunevicius & Prange 2000, Bunevicius et al 1999). For more information about thyroid dysfunction, see Chapter 10 of this book, where John Lowe has provided a comprehensive review of his metabolic approach to patients with chronic widespread pain.

Since the clinical features of FMS and hypothyroidism are so similar, there is no real advantage to diagnosing patients with FMS as well, once hypothyroidism has been established.

Disturbed sleep

One of the commonly described symptoms of FMS is sleep disturbance, even though impaired sleep patterns were not part of the ACR criteria. Interestingly, disturbed sleep is an independent predictor of chronic widespread pain, as are poor health, low energy and emotional distress (Schochat & Raspe 2003). Patients diagnosed with FMS presented with significantly higher levels of dysfunctional beliefs and attitudes about sleep and perceived stress than healthy controls (Theadom & Cropley 2008). It is often thought that persons with FMS have a disturbed sleep pattern with a characteristic alpha-delta anomaly, which is also known as the alpha EEG. However, not all studies support this notion. The alpha-delta sleep anomaly was found in only one-third of persons diagnosed with FMS (Carette et al 1995).

A recent sleep study demonstrated that subjects with FMS were not different in most polysomnographic measures when compared to healthy

controls (Burns et al 2008). The only difference was that FMS patients had shorter stage 2 sleep periods, which confirmed an earlier study by Landis et al (2004). One study identified three varieties of alpha EEG sleep in subjects diagnosed with FMS, including phasic alpha sleep (50% of patients vs. 7% of healthy controls), tonic alpha sleep (20% of patients vs. 9% of controls) and low alpha sleep (30% of patients vs. 84% of controls) (Rizzi et al 2004). Alpha EEG sleep occurs not only in slow wave sleep, but is also observed in stage 2 sleep (Moldofsky 2008). Patients with phasic alpha sleep more likely had poor sleep efficiency, increased post-sleep tenderness and subjective pain (Rizzi et al 2004). Morning stiffness and diffuse pain are also common in FMS patients with phasic alpha sleep (Moldofsky 2008).

Many clinicians assume that insomnia is a consequence of pain; patients assume that they are awakened by nocturnal pain. Yet, in one study the type and degree of insomnia were equal in persons with chronic pain as in persons with primary insomnia, suggesting that nocturnal pain may not be causally related at all to a lack of delta sleep and severe fragmentation of sleep (Schneider-Helmert et al 2001). Many of the secondary symptoms of FMS, including cognitive dysfunction, fatigue and poor attention span, can be explained by insomnia, but are not specific either (Schneider-Helmert et al 2001).

Sleep disturbances or insomnia are commonly observed not only in persons diagnosed with FMS, but also in healthy subjects, in persons diagnosed with AIDS, osteoarthritis, rheumatoid arthritis, myofascial pain, depression, restless leg syndrome, obstructive sleep apnoea, irritable bowel syndrome and temporomandibular joint disorders (Hirsch et al 1994, Korszun 2000, Kubicki et al 1989, Moldofsky 2008, Moldofsky et al 1987, Schneider-Helmert et al 2001, Scudds et al 1989, Von Korff & Simon 1996).

Side-effects of medications

In patients with initial complaints of widespread pain a few weeks after they increased the dose or started taking any of the 'statin' drugs, the cholesterol-lowering medications could be responsible for the pain complaint (Silva et al 2006, Sirvent et al 2008). It is now hypothesized that the statin-induced myotoxicity is the result of multiple factors. Statin drugs appear to impair the mitochondria, resulting in a mitochondrial calcium leak and an altered regulation of the sarcoplasmic reticulum (Sirvent et al 2008). Statin drugs also block the production of farnesyl pyrophosphate, which is an intermediate in the synthesis of ubiquinone or coenzyme Q10 (CoQ10). CoQ10 is important in mitochondrial energy production. Although some have hypothesized that statin-induced CoQ10 deficiencies would be involved in the pathogenesis of statin myopathy, recent studies did not confirm the role of CoQ10 in causing myopathies (Marcoff & Thompson 2007, Young et al 2007). Irrespective of the underlying mechanism, these patients can be successfully treated by reducing the dosage of the medication or by switching to another cholesterol-lowering drug.

Alnwick reported a case of a 42-year-old female with a diagnosis of FMS, who was found to have serotonin syndrome as a result of taking citalopram (Alnwick 2008). Citalopram is a serotonin reuptake inhibitor, which may have triggered excessive stimulation of serotonergic receptors (Chan et al 1998, McDaniel 2001, Mason et al 2000). Poduri & Gibson (1995) reported a case of medication-induced lupus that was mistaken for FMS. When patients present with widespread pain after having started new medications, or after altering the dosage of current medications, a diagnosis of FMS is often not indicated. Rather, these patients should be diagnosed with side-effects of medication use.

Parasitic disease

Parasitic infestations, such as amoebiasis, fascioliasis and giardia, can cause or contribute to widespread pain. According to the World Health Organization, fascioliasis is perhaps the least known parasitic disease in this category, even though it is endemic worldwide (http://www.who.int/neglected_diseases/diseases/fascioliasis/en). Fascioliasis is a common infectious disease of domestic herbivores, such as cattle, sheep and goats, due to liver flukes (Mas-Coma 2005, Mas-Coma et al 2005, Saba et al 2004). Occasionally, humans can become a host, especially in areas where sheep and cattle are raised and where humans consume raw watercress or other aquatic vegetables, such as kjosco and water caltrop (Laird & Boray 1992, Sapunar et al 1992). De Gorgolas and colleagues reported that the most common symptoms of fascioliasis are fever (83%), abdominal pain (100%), weight loss (83%), and

generalized myalgia and joint pain (67%) (de Gorgolas et al 1992). Most parasitic infestations can be treated effectively with medications, such as triclabendazole or praziquantel, eliminating the symptoms perhaps attributed to FMS (de Gorgolas et al 1992, Jamaiah & Shekhar 1999, Mannstadt et al 2000, Qureshi et al 1997, Richter et al 1999). Similarly, chronic candida yeast infections are common contributing factors to widespread pain. Particularly in women who have been given courses of antibiotic therapy for recurrent urinary tract infections, suspected sinusitis, complaints of earache or sore throat, candida yeast infections are common (Gerwin 2005, Gerwin & Dommerholt 2002, Teachey 2004).

Myoadenylate deaminase deficiency

Myoadenylate deaminase deficiency is a syndrome of muscle enzyme deficiency that in few cases may cause widespread pain for which there are no permanent solutions. Marin & Connick published a case report of a patient who for years was treated unsuccessfully for FMS until she finally was diagnosed with myoadenylate deaminase deficiency (Marin & Connick 1997). Patients with pain resulting from myoadenylate deaminase deficiency are best managed with common pain management strategies.

Metabolic insufficiencies

In her work with pain patients, Dr Janet Travell was one of the first physicians to suggest that metabolic insufficiencies and deficiencies, including those for vitamin B_{12}, folic acid and ferritin, may cause or contribute to complaints of localized and widespread pain (Simons et al 1999). A deficiency is a value outside the normal range and is easily recognized; an insufficiency is within the normal range, but may be suboptimal, and often receives little attention. Yet, insufficiencies may cause serious problems for individual patients (Simons et al 1999). Although there are few scientific studies to support Travell's claims, clinicians familiar with her work recommend paying close attention to metabolic insufficiencies or deficiencies when patients experience only temporary improvement following physical therapy intervention (Gerwin 2005, Gerwin & Gevirtz 1995).

Vitamin D deficiency is commonly observed with chronic, non-specific musculoskeletal pain (Plotnikoff & Quigley 2003). Nearly 90% of 150 subjects with musculoskeletal pain had vitamin D levels less than 20 ng/ml and 28% had less than 8 ng/ml, where levels above 30 ng/ml are considered optimal (Plotnikoff & Quigley 2003). Vitamin D deficiency in adults is defined as serum 25(OH)D levels below 20 ng/ml and vitamin D insufficiency as 25(OH)D below 30 ng/ml (Vieth et al 2007). Vitamin D deficiencies are endemic in northern Europe and America (Gordon et al 2004, Huh & Gordon 2008, MacFarlane et al 2004), and are associated with muscle weakness, myofibrillar protein degradation, reduced muscle mass, osteoporosis and decreased functional ability (Bischoff et al 1999, 2000, 2001, Dukas et al 2005, Holick 2006, Wassner et al 1983). Although there are no randomized controlled studies examining the correlation between vitamin D deficiencies or insufficiencies and myofascial pain, empirical observations in a community pain management centre suggest that vitamin D insufficiencies are very common among individuals with myofascial pain (Gerwin 2005). In the hierarchy of evidence-based medicine, clinical evidence is a valid parameter and should be included in the review of evidence (Moore et al 1995, Pencheon 2005, Sackett et al 1996).

The assumption that vitamin D deficiencies would cause or contribute to disease processes has recently been challenged (Marshall 2008). Marshall suggests that low values of vitamin D may not be the cause, but the result of the disease process. Current biology studies support the notion that vitamin D may not even be a true vitamin, as vitamin D metabolites play an active role in the gene transcription of hundreds, if not thousands, of genes. According to Marshall, the idea that exogenous modulation of a metabolism could provide a simple clinical solution is not only naïve, but could also pose significant risks (Marshall 2008).

Vitamin B_{12} and folic acid are closely related and function not only in erythropoieses, but also in central and peripheral nerve formation. Serum levels of vitamin B_{12} below 350 pg/ml may be clinically significant and associated with a metabolic insufficiency manifested by elevated serum or urine methylmalonic acid or homocysteine (Pruthi & Tefferi 1994). Laboratories commonly indicate that the normal range for vitamin B_{12} levels is between 200 and 1200 pg/ml. Gerwin found that 16% of patients with chronic myofascial pain were either

deficient in vitamin B_{12} or had insufficient levels of vitamin B_{12}. Ten percent of those patients had low serum folate levels (Gerwin 1995, 2005).

Ferritin represents the tissue-bound non-essential iron stores in the body that supply the essential iron for oxygen transport and iron-dependent enzymes. Serum levels of 15–20 ng/ml indicate that storage sites for iron, such as muscle, liver and bone marrow, are depleted of ferritin. Many female patients with a chronic sense of coldness and chronic myofascial pain have insufficient or deficient ferritin and iron levels, either from excessive menstrual iron loss or from chronic intake of non-steroidal anti-inflammatory drugs. Iron insufficiencies in chronic myofascial pain suggest that iron-requiring enzymatic reactions like the cytochrome oxidase and NAD(H) dehydrogenase reactions may be limited, possibly resulting in a local energy crisis when muscles are exposed to excessive mechanical stress (Gerwin 2005, Gerwin & Dommerholt 2002). Serum ferritin levels below 30 ng/ml need to be corrected through iron supplementation (Gerwin 2005).

By correcting the insufficiencies and deficiencies, patients commonly experience either total elimination of their pain complaints or they are now able to respond to medical and physical therapy interventions (Simons et al 1999).

Rheumatologic and infectious diseases

Several rheumatologic and infectious diseases, including seronegative rheumatoid arthritis, ankylosing spondylitis, Sjögren's disease, polymyositis, Lyme disease, polymyalgia rheumatica and systemic lupus erythematosus, feature widespread pain and can easily be mistaken for FMS (Aloush et al 2007, Bliddal & Danneskiold-Samsoe 2007, Bonafede et al 1995, Marques 2008, Middleton et al 1994, Poduri & Gibson 1995, Reilly 1999, Reilly & Littlejohn 1992). Most rheumatic diseases are treated with medications and education, combined with physical therapy and occupational therapy interventions (Bertin 2000, Clark 2000, Ramos-Remus et al 2000, Stucki & Kroeling 2000).

Infectious diseases have been implicated in the aetiology of FMS, including Lyme disease and hepatitis C (Ablin et al 2006, 2008). Lyme disease in the United States is caused by the spirochete *Borrelia burgdorferi sensu strictu*. In Europe and Asia, three species of *Borrelia* are responsible for most human infections, including *B. burgdorferi sensu strictu*, *B. afzelli* and *B. garini*, collectively referred to as *B. burgdorferi sensu lato* (Baranton et al 1992, Tilly et al 2008). In the northeastern and midwestern United States, the *Ixodes scapularis* tick or Eastern black-legged tick is the primary transmitter of the disease, while in the western part of the country the *Ixodes pacificus* or Western black-legged tick is most common. In Europe and Asia, the *Ixodes ricinus* or European sheep tick and the *Ixodes persulcatus* or taiga tick are the primary transmitters respectively (Burgdorfer et al 1985, Marie-Angele et al 2006, Nahimana et al 2004, Piesman & Gern 2004, Postic et al 1997, Smetanova et al 2007, Uspensky et al 2006, Vorobyeva et al 2002).

Persons infected with Lyme disease can present with a wide variety of symptoms, including headaches, diffuse myalgia and arthralgia, and neuropathy, among others (Ablin et al 2006, Ogrinc et al 2008). Fortunately, only about 25–33% of patients suspected of being infected are usually found to have Lyme disease (Marques 2008, Ogrinc et al 2008). Most patients are treated successfully with antibiotics, but a small number of patients do not recover and develop chronic Lyme disease, which is a controversial term used to describe different patient populations with varying symptoms and levels of dysfunction (Marques 2008). Some of these patients are so-called slow responders, who may have symptoms for weeks or months. Others may have irreversible damage, while approximately 10–20% of patients have persistent or intermittent subjective symptoms, including fatigue, stiffness, paraesthesia, myalgias, arthralgias, synovitis, disturbed sleep, irritability, cognitive dysfunction, poor concentration and depression (Ablin & Buskila 2008, Ablin et al 2008, Marques 2008, Ogrinc et al 2008, Sigal 1990).

Proponents of the FMS diagnosis suggest that many of these patients should be diagnosed with FMS to avoid unnecessary antibiotic therapy (Ablin et al 2006). Others would recommend a diagnosis of chronic fatigue syndrome, chronic Lyme disease or post Lyme disease syndrome (Marques 2008). Concerns that patients with these symptoms may suffer from persistent infections of *B. burgdorferi* have not been confirmed, realizing that *B. burgdorferi* cultures have very low sensitivity in most body fluids (Auwaerter 2007, Halperin 2008, Marques 2008). More research is needed to explore whether Lyme disease may indeed trigger FMS. Overlapping

symptoms do not necessarily justify the conclusion that Lyme disease and FMS must be related. Again, is the diagnosis of FMS justified when the clinical history suggests an infectious disease like Lyme disease? Similar arguments have been developed about other infectious diseases and FMS.

Two Israeli studies found that 16% of persons diagnosed with hepatitis C met the ACR criteria for FMS (Buskila et al 1997a, 1998). Ablin and colleagues suggested that both hepatitis C and FMS have aberrant cytokine profiles in common, which may be involved in the symptoms of disturbed sleep and chronic fatigue (Ablin et al 2006). A more recent Spanish study did not confirm any relation between hepatitis C and FMS (Narvaez et al 2005). It seems again premature to conclude that hepatitis C may result in the development of FMS. It may be preferable to recognize that certain infectious diseases feature symptoms of diffuse widespread pain, cognitive dysfunction and depression.

Growth hormone deficiency

Growth hormone is an amino acid polypeptide hormone synthesized and secreted by the anterior pituitary. Its primary function is to promote linear growth. Growth hormone stimulates the release of somatomedin C in the liver, which is required for the maintenance of normal muscle homeostasis (Neeck & Crofford 2000). Approximately 70% of the growth hormone production occurs during stage 3 and 4 non-rapid eye movement sleep (Van Cauter & Plat 1996). Acute stress and exercise stimulate the secretion of growth hormone, but chronic stress, depression, traumatic brain injury and chronic illness blunt its release (Casanueva 1992, Casanueva et al 1984, Sachar 1976, Vigas et al 1977).

Growth hormone deficiency is a distinct clinical entity (Nilsson et al 2007). In the United States approximately 6000 new cases occur annually. Some 70 000 adults are estimated to have growth hormone deficiency. The disease can be caused by pituitary tumours, adenoma, head trauma and certain infectious diseases, such as HIV/AIDS. The symptoms of growth hormone deficiency are variable and not all patients have symptoms. Some of the more common symptoms of growth hormone deficiency include fatigue, muscle weakness, stiffness, joint pain, a reduced ability to exercise, reduced cardiovascular function, depression, social isolation, osteoporosis and a weakened immune system (Nilsson et al 2007). Several of these symptoms have been described for FMS.

Growth hormone deficiencies have been established in some subsets of patients with FMS (Bennett 1998, Bennett et al 1992, Griep et al 1994, Leal-Cerro et al 1999). Bennett found growth hormone deficiencies in approximately 30% of patients with FMS (Bennett 2002a, Bennett et al 1998). Landis et al (2001) observed decreased nocturnal levels of growth hormone in women with FMS compared to normal controls. When compared to healthy subjects, FMS patients exhibited a reduced growth hormone response to exercise, which was thought to be the result of increased levels of somatostatin (Paiva et al 2002). Somatostatin is a growth hormone inhibiting hormone that is secreted under the influence of corticotropin-releasing hormone and thyroid hormones (Sapolsky 1992). Other researchers did not find any significant growth hormone deficiencies (Dinser et al 2000, Nørregaard et al 1995).

The question remains whether the symptoms of these patients are solely due to growth hormone deficiency or due to FMS. If the symptoms are part of the symptomatology of growth hormone deficiency, would there be any benefit to adding a diagnosis of FMS? Guidelines have been developed for the management of growth hormone deficiency syndrome (Nilsson et al 2007). When patients are diagnosed with FMS instead of growth hormone deficiency, they may not receive the most appropriate treatment. The US Food and Drug Administration has approved growth hormone therapy for adults with documented pituitary disease, cachexia in HIV infection, idiopathic short stature, and with an abnormal growth hormone response to a stimulation test (Jones et al 2007). Persons with FMS usually have normal growth hormone stimulation tests. Bennett has established that administering growth hormone reduced and, in some cases, eliminated the symptoms of FMS (Bennett 2002a, Bennett et al 1998).

Psychological diagnoses

Patients with psychological diagnoses and widespread pain are appropriately treated with an interdisciplinary approach combining medications with psychological interventions, exercise and stress management techniques, emphasizing the psychosocial,

behavioural and organic aspects of chronic pain (Turk & Okifuji 1999, van Koulil et al 2007, 2008). Patients with FMS are reported to have higher rates of lifetime and current depression, notwithstanding a few studies that did not find any evidence of increased depression (Ahles et al 1991, Hudson & Pope 1996, Offenbächer et al 1998, Piergiacomi et al 1989, Yunus et al 1991). Multiple studies have shown that 30–54% of chronic pain patients suffer from severe forms of depression, which limits their mobility, increases disability and interferes with most activities (Alschuler et al 2008, Keogh et al 2006). Depression, anger, anxiety and illness behaviour have a negative impact on patients' feeling toward themselves, which is reflected in poor expectations of patients and their health professionals, and poor outcomes in physical therapy and rehabilitation (DeVellis & Blalock 1992, Jensen et al 1999, McCracken et al 1999, Okifuji et al 1999b).

Several questions remain. Can depression cause or significantly contribute to FMS? Do patients with FMS get depressed because of pain or increased pain sensitivity, allodynia and hyperalgesia? There is some evidence that depression may be secondary to pain and may completely resolve once the pain has been eliminated (Hendler 1984, Wallis et al 1997). Persons diagnosed with FMS routinely maintain that the psychological and emotional symptoms are the result of FMS and not the cause. Or are both disorders the result of a common underlying abnormality? Depression and widespread pain may be the result of an insufficient catecholaminergic or serotonergic neurotransmission or hyperactivity of corticotropin-releasing hormone (Ackenheil 1998, Hudson & Pope 1996, Neeck & Riedel 1999).

It is likely that having a diagnosis of FMS combined with constant pain, poor expectations regarding recovery, and a sense of hopelessness may also become perpetuating factors for depressive mood disorders. Fassbender and colleagues observed that patients with FMS had significantly more tender points than patients with depression (Fassbender et al 1997). Several studies have shown that patients with FMS demonstrated significantly higher lifetime prevalence rates of mood, anxiety and somatization disorders than patients with rheumatoid arthritis (Burckhardt et al 1993, Hawley & Wolfe 1993, Katz & Kravitz 1996, Walker et al 1997). Wolfe and colleagues found that persons with FMS are more than four times as likely to be divorced compared to the general population without FMS (Wolfe et al 1995).

Rather than diagnosing these patients with FMS, a diagnosis based on the criteria of the *Diagnostic and Statistical Manual of Mental Disorders* of the American Psychiatric Association seems more appropriate, and may include dysthymia, depression, or somatoform pain disorder (DSM-IV 2000). A psychiatric diagnosis of depression or somatoform pain disorder may give some patients the impression that physicians do not take their pain seriously. Yet, there is evidence that some patients with the typical fibromyalgia symptoms are so psychologically distressed that the syndrome may indeed become an excuse not to deal with their difficult life circumstances (Ford 1997, Hellström et al 1999).

Myofascial pain and myofascial trigger points

A survey of members of the American Pain Society showed general agreement with the concept that myofascial pain exists as an entity distinct from FMS (Harden et al 2000). Myofascial pain is often thought of as a localized problem, yet nearly half the patients with myofascial pain in a chronic pain management centre featured pain in three or four body quadrants (Gerwin 1998). These patients may meet the ACR criteria and erroneously be diagnosed with FMS. Even though both diagnoses may represent central sensitization (Fernández de las Peñas et al 2007a), there are distinct advantages of a diagnosis of myofascial pain over a diagnosis of FMS. In most cases, myofascial pain can be treated effectively as part of a comprehensive treatment regimen (Dommerholt et al 2006a, Gerwin & Dommerholt 2006, Issa & Huijbregts 2006). The rheumatology literature suggests that currently there is no effective treatment for FMS.

The FMS tender points do not represent any anatomical abnormality. Therefore, treatments to resolve the tenderness at these points are doomed to fail. On the other hand, myofascial trigger points function as peripheral nociceptors that can initiate, accentuate and maintain the process of central sensitization (Borg-Stein & Simons 2002, Fernández de las Peñas et al 2007a). As a source of peripheral nociceptive input, myofascial trigger points are capable of unmasking sleeping receptors in the dorsal horn, which may result in spatial summation and the appearance of new receptive fields. Input from previously ineffective regions can now

stimulate the neurons (Hoheisel et al 1993, Mense 1997). Patients with chronic widespread pain or FMS not only experience pain at the tender point sites, but also throughout their entire bodies (Vecchiet et al 1994).

Hypermobility syndrome

Joint hypermobility syndrome or hypermobility syndrome has been classified as a hereditary connective tissue disorder, and is synonymous with Ehlers–Danlos hypermobility type (Simmonds & Keer 2007). The prevalence in adults ranges from 5% in the USA to 43% in the Noruba tribe in Nigeria (Birrell et al 1994, Jessee et al 1980). In rheumatology clinics or outpatient rehabilitation centres, the prevalence can be as high as 58% in one sample of non-Caucasian female patients (Simmonds & Keer 2007).

Somewhat surprisingly, subjects with hypermobility syndrome do not always have pain problems. However, widespread myalgia is the predominant complaint, presumably because of muscle imbalances and constant compensation of muscles in an effort to stabilize unstable joints (Russek 1999, Simmonds & Keer 2007). Hypermobile patients with widespread myalgia commonly meet the ACR criteria (Acasuso-Díaz & Collantes-Estévez 1998, Gedalia et al 1993), but there are no compelling reasons to make the diagnosis of FMS in addition to the diagnosis of hypermobility syndrome.

Persons with hypermobility syndrome are often challenging to treat. A comprehensive treatment programme emphasizing patient education, activity modification and a progressive strengthening regime can decrease the associated symptoms and improve functional abilities (Russek 1999, 2000, Simmonds & Keer 2008).

Whiplash-associated disorders

In 1997, Buskila and colleagues suggested that FMS is common following motor vehicle accidents (Buskila et al 1997b). Other researchers have also suggested a relationship between trauma and FMS. In spite of the now commonly held belief that motor vehicle accidents frequently result in FMS, in subsequent publications Buskila and colleagues, as well as White and colleagues, have concluded that there really is no scientific evidence of a causal relationship between trauma and FMS (Buskila & Neumann 2000, 2002, White et al 2000b). In a German study of nearly 1100 subjects involved in low-velocity collisions, 80% were found to have muscle pain (Schuller et al 2000). Persons with chronic whiplash pain developed more widespread hypersensitivity to mechanical pressure and thermal stimuli than subjects with chronic idiopathic neck pain (Scott et al 2005). Reduced cold tolerance has been confirmed in patients with chronic whiplash symptoms (Kasch et al 2005).

There is no question that involvement in motor vehicle accidents may result in central sensitization, hypersensitivity and widespread pain (Banic et al 2004, Curatolo et al 2001, 2004, Herren-Gerber et al 2004, Johansen et al 1999, Kosek & Januszewska 2008, Munglani 2000, Sterling et al 2002, 2003), but there is no benefit to the additional diagnosis of FMS (Dommerholt 2005). In a retrospective review, Gerwin & Dommerholt (1998) found that all patients with chronic pain complaints following a motor vehicle accident had myofascial pain and myofascial trigger points, which were not considered in Buskila's studies. However, even if trigger points would have been considered by applying the inclusive ACR criteria, the diagnosis of FMS would still have been made.

Some persons involved in whiplash injuries may suffer from post-traumatic stress disorder, which can also feature many of the symptoms of FMS (Sherman et al 2000). Furthermore, it is conceivable that in some whiplash patients the thyroid gland may be injured. This may contribute to the development of post-traumatic hypothyroidism with widespread pain, fatigue and other symptoms commonly attributed to FMS (Sehnert & Croft 1996).

Summary – differential diagnoses

There are no studies that indicate how frequently the diagnosis of FMS is made in the presence of other diagnoses. However, it is very likely that published research studies on FMS include subjects with other clinical diagnoses responsible for the pain, sleep disorder and fatigue. This could contribute to the poor results of long-term outcome studies, which frequently show that patients diagnosed with FMS do not improve (Wolfe et al 1997). Could it be that after making the diagnosis of FMS, physicians and patients may not consider any

other causes of chronic widespread pain? In these cases, would that make FMS an iatrogenic syndrome, as the appropriate diagnosis and effective treatment options would not be entertained or implemented? Or is it appropriate to diagnose FMS and other diagnoses responsible for widespread pain simultaneously?

The question remains how an additional diagnosis of FMS improves the medical management, particularly when the rheumatology literature suggests that currently there are very limited treatment options for FMS (Bennett 1999, Russell 2001). If that's true, then why are patients labelled with this diagnosis in the presence of another diagnosis that provides a mechanism for the reported symptoms and for which effective treatment options are available? While it is known that the diagnosis of FMS initially offers patients a meaningful confirmation of their pain syndromes, most of the other diagnoses that can cause similar symptoms accomplish the same. How does a diagnosis by inclusion influence the thinking about FMS if these patients are included in research studies but do not receive the appropriate medical intervention for the possible underlying cause of pain and dysfunction?

Physicians that are willing to consider the common principles of differential diagnoses and accept that at best the diagnosis of FMS is a diagnosis by exclusion may not diagnose patients so rapidly with FMS syndrome and avoid risking illness behaviour and feelings of hopelessness, depression, anxiety, fear and poor expectations (Dommerholt 2002, Gerwin 1999). From an epidemiological perspective, FMS does not meet the basic criteria to be considered a distinct clinical entity (Makela 1999). Persons diagnosed with FMS are a rather heterogeneous group (Russell 2002). More research is needed to determine whether there really are several subgroups of FMS or whether patients should be diagnosed with other medical diagnoses that also feature widespread pain.

Myofascial pain syndrome

Schneider & Brady (2001) suggested that 'pseudo FMS' can be categorized into three categories, namely organic diseases (e.g. Lyme disease and hypothyroidism), functional disorders (e.g. nutritional deficiencies and intestinal dysbiosis) and musculoskeletal disorders (e.g. myofascial pain and undiagnosed disc and facet lesions). After excluding organic diseases and functional disorders, the diagnosis of myofascial pain offers a valuable approach to reduce or eliminate pain and other associated symptoms, and to restore function. Myofascial pain should be considered in the differential diagnosis not only of FMS, but also of radiculopathies, angina, joint dysfunction, craniomandibular dysfunction, migraines, tension headaches, complex regional pain syndrome, carpal tunnel syndrome, repetitive strain injuries, whiplash injuries and most other pain syndromes (Dommerholt et al 2006a).

Trigger points have also been associated with visceral dysfunction, including endometriosis, interstitial cystitis, irritable bowel syndrome, urinary/renal and gall bladder calculosis, dysmenorrhea and prostadynia (Anderson 2002, Anderson et al 2005, 2006, Doggweiler-Wiygul 2004, Gerwin 2002, Giamberardino et al 1999, Jarrell 2004, Jarrell et al 2005, Weiss 2001, Zermann et al 1999). Trigger points have been reported as the most common diagnosis responsible for chronic pain and disability, but are frequently overlooked (Fricton 1990, Hendler & Kozikowski 1993, Rosomoff et al 1989, Skootsky et al 1989). They are common in all age groups, except infants (Alfven 1993, Cimbiz et al 2006, Kao et al 2007, Vecchiet 2002, Zapata et al 2006). There is no evidence that myofascial pain develops into FMS, although this is frequently suggested in the literature (Meyer 2002, Russell 2001, Yunus 2008).

Trigger points are divided into active and latent trigger points. An active trigger point produces symptoms, including local tenderness and pain, referral of pain or other paraesthesia to a distant site, and peripheral and central sensitization. A latent trigger point is only painful when stimulated. Trigger points have characteristic motor, sensory and autonomic features. Motor phenomena associated with trigger points include disturbed motor function, muscle weakness as a result of motor inhibition, muscle stiffness and restricted range of motion. Nociceptive input can perpetuate altered motor control strategies and lead to muscle overload or disuse (Falla & Farina 2007, 2008). In a study of the influence of trigger points on muscle activation patterns, Lucas et al (2004) demonstrated that subjects with latent trigger points in several shoulder muscles featured altered shoulder abduction patterns when compared to healthy subjects. Autonomic aspects may include, among others, vasoconstriction, vasodilation, lacrimation and piloerection (Ge et al 2006).

During the last few decades, myofascial pain has received much attention in the scientific and clinical literature. Already during the early 1940s, Dr Janet Travell (1901–1997) realized the importance of myofascial pain and its hallmark feature, the myofascial trigger point. Recent insights into the nature, aetiology and neurophysiology of trigger points and their associated symptoms have propelled interest in the diagnosis and treatment of persons with myofascial pain worldwide (Bennett 2002b, Dommerholt et al 2006a).

Historically, pain from muscles has been described by multiple terms, including fibrositis, myofasciitis, muscular rheumatism, rheumatic myositis, muscle hardening, myogelosis, myofascial pain and myalgia (Simons 1975). The phenomenon of myofascial trigger points was already described in 1816 by the British physician Balfour as 'nodular tumours and thickenings which were painful to the touch, and from which pains shot to neighbouring parts'. These nodules were considered a result of inflammation in the fibrous connective tissue in muscle (Stockman 1904). The term 'trigger point' was coined by the American physician Steindler in 1940 (Steindler 1940).

Over the last 60 years several assessment and treatment approaches have emerged independently of each other both in Europe and in the United States, including myofascial trigger point therapy (USA), neuromuscular technique or NMT (UK), neuromuscular therapy, also abbreviated as NMT (USA), and manual trigger point therapy (Switzerland). It is intriguing that these approaches share many similarities and have common goals and objectives. The various schools of thought have more in common than they are different. Some techniques are slightly different and there is some disagreement about terminology and methodology. The terminology and definitions formulated by Simons, Travell and Simons are most widely accepted and will be applied in this chapter: 'myofascial pain syndrome can be described as the sensory, motor, and autonomic symptoms caused by myofascial trigger points' (Simons et al 1999). A myofascial trigger point is clinically defined as 'a hyperirritable spot in skeletal muscle that is associated with a hypersensitive palpable nodule in a taut band. The spot is painful on compression and can give rise to characteristic referred pain, referred tenderness, motor dysfunction, and autonomic phenomena' (Simons et al 1999).

There are no laboratory or imaging studies available for the diagnosis of myofascial pain or myofascial trigger points. To make a diagnosis of myofascial pain requires a systematic palpation of pertinent muscles across the direction of the fibres. Only by palpating perpendicularly to the fibre direction will a clinician be able to locate the taut band. A taut band feels like a rope or string of contracted fibres that may extend from one end of the muscle to the other, depending on the specific muscle architecture. Recent elastography studies have been able to visualize the taut band, but these techniques are not yet available in clinical practice (Chen et al 2007, 2008). Taut bands are stiffer than relaxed muscle fibres, and the degree of stiffness can be assessed by phase-contrast analysis of vibration-induced cyclic shear waves (Chen et al 2007, 2008).

Microscopic and electrodiagnostic research of muscles has revealed that many muscle bellies are divided into compartments of one or more fibrous bands or inscriptions. Each compartment has its own nerve supply and motor endplates. The number of inscriptions and compartments varies per muscle. For example, the biceps femoris and gracilis each have two compartments, the semitendinosus has three and the sartorius has four. Because of these inscriptions, the longest human muscle fibres are approximately 12 cm, which corresponds to 55 000 sarcomeres (McComas 1996). When palpating for taut bands, clinicians must be aware of these inscriptions, as different taut bands can be found throughout the muscle belly of one particular muscle. Palpation along a taut band may reveal a nodule that is exquisitely tender and that with firm pressure stimulation may produce referred pain sensations in typical patterns for each muscle. These painful spots are known as trigger points. Patients often recognize the localized or referred pain as 'their pain', and this recognition of pain is now considered one of the diagnostic criteria for active myofascial trigger points in addition to the presence of a taut band and the trigger point itself (Gerwin et al 1997, Simons et al 1999). Taut bands and trigger points are found in asymptomatic individuals and are only considered clinically relevant when the patient recognizes the elicited pain or when the functional limitations imposed by the taut band contribute to mechanical dysfunction secondary to muscle shortening (Gerwin & Dommerholt 2002, Scudds et al 1995).

The minimum criteria that must be satisfied in order to distinguish a trigger point from any other tender area in muscle are a taut band and a tender

point in that taut band. The presence of a local twitch response, referred pain or reproduction of the person's symptomatic pain increases the certainty and specificity of the diagnosis of myofascial pain syndrome (Gerwin et al 1997). The taut band, trigger point and local twitch response are objective criteria, identified solely by palpation, that do not require a verbal response from the patient. A local twitch response is an indication of the presence of an active trigger point. It is a brief involuntary contraction of the taut band that can be recorded electromyographically, can be felt with the needle during trigger point injection or dry needling, or observed visually on diagnostic ultrasound. It is mediated primarily through the spinal cord without supraspinal influence (Hong 1994a, 1999). High resolution sonography is not yet sensitive enough to visualize the actual trigger point, but allowed researchers to visualize the twitch response of the taut band following stimulation of the trigger point by insertion of a hypodermic needle (Gerwin & Duranleau 1997, Lewis & Tehan 1999). The patient's body type, the skill level and experience of the clinician, and the nature of the muscle determine the ease of soliciting a local twitch response.

Several studies have considered the inter-rater reliability of the trigger point examination; however, this was only recently established by the groups of Bron, Gerwin and Sciotti and other researchers (Bron et al 2007, Gerwin et al 1997, Lew et al 1997, Nice et al 1992, Njoo & Van der Does 1994, Sciotti et al 2001, Wolfe et al 1992). In Gerwin's study, a team of recognized experts could initially not agree. Only after developing consensus regarding the criteria did the experts agree, which indicates that training is essential for the identification of myofascial trigger points (Gerwin et al 1997). Bron and colleagues confirmed that well-trained physical therapists can agree on the identification of myofascial trigger points in three different shoulder muscles (Bron et al 2007).

The integrated trigger point hypothesis

Combining all available supporting evidence of the existence of myofascial trigger points, Simons has developed the 'integrated trigger point hypothesis' (Simons et al 1999). The integrated trigger point hypothesis has evolved through several steps of progress since its first introduction as the 'energy crisis hypothesis' in 1981 (Simons & Travell 1981). The energy crisis hypothesis postulated that direct trauma and subsequent damage to the sarcoplasmic reticulum or the muscle cell membrane would lead to an increase of the calcium (Ca^{2+}) concentration, an activation of actin and myosin, a relative shortage of adenosine triphosphate, and an impaired calcium pump, which in turn would increase the intracellular calcium concentration even more, completing the cycle. Calcium is a prerequisite for muscle contractions. Muscle contractions occur after actin and troponin are activated by Ca^{2+}, allowing tropomyosin to shift its position and expose myosin-binding sites on actin, thus regulating the cross-bridge interactions between actin and myosin (Clark et al 2002). Under normal physiological conditions, the calcium pump is responsible for returning intracellular Ca^{2+} to the sarcoplasmic reticulum against a concentration gradient, which requires a functional energy supply.

The integrated trigger point hypothesis builds on the finding that excessively released acetylcholine from the motor nerve terminal causes miniature motor endplate potentials that produce the endplate noise observed with needle EMG of trigger points (Couppé et al 2001, Macgregor & Graf von Schweinitz 2006, Simons et al 2002). Endplate noise occurs more frequently in trigger points than in the same endplate zone away from the trigger point, but is not unique to trigger points. The excessively released acetylcholine maintains a sustained depolarization of the post-junctional membrane, which in turn stimulates voltage-gated sodium channels of the sarcoplasmic reticulum and triggers an excessive release of calcium (Simons et al 2002). This results in ongoing activation of nebulin, troponin and tropomyosin, and may cause persistent muscle contractures consistent with myofascial trigger points. Shenoi & Nagler (1996) confirmed that an impaired reuptake of calcium into the sarcoplasmic reticulum induced by calcium channel blockers may cause myofascial trigger points.

The original energy crisis hypothesis assumed that the excessive release of calcium was due to some traumatic event, such as a mechanical rupture of the sarcoplasmic reticulum or of the muscle cell membrane. Now it is known that any muscle trauma that triggers the excessive acetylcholine release is sufficient to initiate the vicious cycle. The presence of excessive acetylcholine can be the result of acetylcholinesterase insufficiency, an acidic pH, hypoxia, a lack of adenosine triphosphate, certain genetic

mutations, drugs and particular chemicals, such as calcitonin gene-related peptide, di-isopropylfluorophosphate, or organophosphate pesticides, and increased sensitivity of the nicotinic acetylcholine receptors (Bukharaeva et al 2005, Gerwin et al 2004, McPartland & Simons 2006). Myofascial tension or muscle hypertonicity, as seen in trigger points, may also enhance the excessive release of acetylcholine (Chen & Grinnell 1997, Grinnell et al 2003).

There are many possible vicious cycles capable of maintaining the resulting contractures and trigger points. For example, one study has shown that the oxygen saturation in the centre of a trigger point is far below normal values (Brückle et al 1990). Hypoxia leads to an acidic milieu, muscle damage and an excessive local release of multiple nociceptive substances, including calcitonin gene-related peptide, bradykinin and substance P, and may even trigger an immediate increased acetylcholine release at the motor endplate (Bukharaeva et al 2005, Graven-Nielsen & Arendt-Nielsen 2003). An acidic pH enhances the release of calcitonin gene-related peptide and downregulates acetylcholinesterase and causes hyperalgesia (Gerwin et al 2004, Sluka et al 2001, 2003). Calcitonin gene-related peptide stimulates the release of acetylcholine from the motor endplate, decreases the effectiveness of acetylcholinesterase and upregulates the nicotinic acetylcholine receptors. Bradykinin is known to activate and sensitize muscle nociceptors, which leads to inflammatory hyperalgesia, an activation of high threshold nociceptors associated with C fibres and an increased production of bradykinin. Furthermore, bradykinin stimulates the release of tumour necrosis factor alpha (TNFα), which activates the production of the interleukins IL-1β, IL-6 and IL-8. IL-8 in particular can cause hyperalgesia that is independent from prostaglandin mechanisms. Via a positive feedback loop, IL-1β can also induce the release of bradykinin (Poole et al 1999).

Researchers at the US National Institutes of Health have developed a clinical protocol to assess the local biochemical milieu of myofascial trigger points by fabricating a 30-gauge microdialysis needle capable of the in vivo collection of minute volumes of solutes from muscle tissue (Shah et al 2005, 2008). In the immediate proximity of active myofascial trigger points, they found consistently higher concentrations of substance P, calcitonin gene-related peptide, bradykinin, serotonin, norepinephrine, TNFα and interleukin IL-1β, but not in latent trigger points or normal muscle tissue (Shah et al 2005). A second study confirmed and expanded these findings and included sampling of analyte levels from the biochemical milieu of a remote uninvolved site in the upper medial gastrocnemius muscle. They found that the analyte concentrations of the tested biochemical substances in the gastrocnemius were almost always lower than concentrations in the trapezius. The second study also revealed that substances associated with pain and inflammation are not limited to local areas of trigger points or a single anatomical locus, as subjects with an active trigger point in the upper trapezius had relatively elevated levels of these analytes in a remote, uninvolved muscle compared to gastrocnemius levels in latent and normal subjects (Shah et al 2008).

Stimulation of the autonomic system has been shown to increase the endplate potentials. For example, an increase in psychological arousal resulted in an immediate increase of endplate spike rates (Lewis et al 1994, McNulty et al 1994). Autogenic relaxation and the administration of the sympathetic blocking agents phentolamine and phenoxybenzamine inhibited the autonomic activation (Banks et al 1998, Chen et al 1998a, Hubbard 1996). Induced autonomic nerve activity could explain the observed autonomic phenomena and further contribute to the abnormal release of acetylcholine, possibly by increasing the permeability of calcium channels in the cell membrane of the nerve terminal (Chen et al 1998b, Hou et al 2002a). A study examined the effects of trigger point massage therapy on the cardiac autonomic tone in healthy subjects. The researchers observed that following trigger point therapy, there was a significant decrease in heart rate, and systolic and diastolic blood pressure, indicating a significant increase in parasympathetic activity (Delaney et al 2002).

The integrated trigger point hypothesis is summarized in Figure 8.1. The hypothesis is a 'work in progress' that is beginning to be subjected to rigorous scientific review and verification. If this hypothesis is basically correct, myofascial trigger points are primarily a muscle disease with secondary but important sensory, motor and autonomic phenomena (Borg-Stein & Simons 2002, Dommerholt et al 2006a).

Clinical assessment

Any time a patient presents with a diagnosis of FMS or with any of its symptoms, a diagnosis of myofascial pain should be suspected. As Schneider & Brady

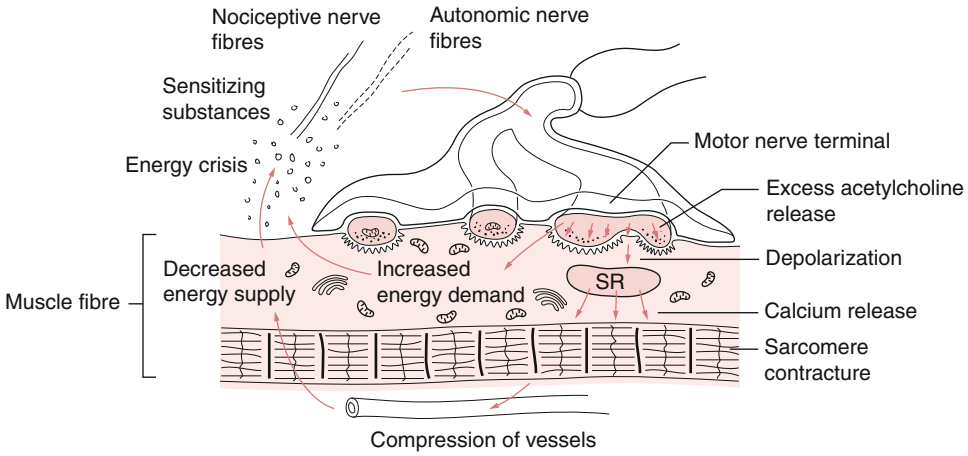

Figure 8.1 • Integrated trigger point hypothesis (after Simons et al 1999; reproduced with permission from Chaitow & DeLany 2000, p 68).

(2001) have outlined, a thorough differential diagnosis is critical and should include an assessment of the presence of organic diseases, functional disorders and musculoskeletal disorders. The initial task of a clinician in evaluating a patient is to obtain information regarding differential diagnostic characteristics, the supposed cause of the problem, the patient's local tissue and global stress adaptability, and the expected prognosis. Clinicians must strive for completeness in their observations. A thorough examination requires a detailed patient history, observation, functional evaluation and palpation, and drawing relevant conclusions (Materson & Dommerholt 1996). Following the initial assessment and formulation of diagnostic hypotheses, new data must be collected at each encounter. The initial hypotheses may need to be modified to facilitate the most efficient and effective management of patients with myofascial pain. A diagnosis of myofascial pain does not exclude other diagnoses, such as joint dysfunction, a metabolic insufficiency or visceral pathology.

Jarrell found that the presence or absence of a trigger point in the abdominal wall helps to determine whether there is evidence of current or previously treated visceral disease. The presence of an abdominal wall trigger point predicted evidence of visceral disease in 90% of subjects. However, the absence of a trigger point was associated with no visceral disease in 64% of the subjects (Jarrell 2004, Jarrell & Robert 2003). A Spanish study showed that trigger points in the upper trapezius were correlated with cervical spine dysfunction at the C3 and C4 segmental levels, although a cause-and-effect relationship was not established (Fernández de las Peñas et al 2005). A single spinal manipulation did induce changes in pressure pain sensitivity in latent trigger points in the upper trapezius muscle (Ruiz-Saez et al 2007). At all times, the diagnostic process must consider all possible contributing factors to the pain syndrome.

Of particular importance in the evaluation of patients with chronic pain is the psychosocial assessment. A patient's psychosocial history can provide insights into possible cultural influences of the pain experience, the patient's family background and interpersonal dynamics. The patient's coping skills, perceived self-efficacy and the presence of fear-avoidance behaviour are examples of interpersonal dynamics that should be recognized (Bandura et al 1987, 1988, Bates 1996, Bennett 2002c, Vlaeyen & Linton 2000). The chronicity of a pain problem may also be related to certain stressful work conditions, the work environment and physical demand, and participation in leisure activities (Berg Rice 1995, Khalil et al 1994).

A sudden onset or a clear remembrance of the onset of pain may indicate an acute activation of trigger points due to mechanical stress or trauma, but it may also indicate a sudden change in the patient's environment or habits. Mechanical stress or trauma may be the result of sudden or abrupt movements, motor vehicle accidents, falls, fractures, joint sprains or dislocations, a direct blow to a muscle or joint, excessive exercise or activity, or performing new or unaccustomed activities. When

the sudden onset of widespread pain occurs in close relation to a change in medication intake, the clinician should suspect that the change in medication intake may have triggered the pain response. In other cases the onset of pain may follow an illness, metabolic deficiencies or exposure to certain parasites.

A gradual or insidious onset is usually the result of chronic overloading of tissue, but may also be due to metabolic insufficiencies and parasitic infestations. Typical overload causes include postural imbalances, poor body mechanics, repetitive movements, and tension as a consequence of psychological or emotional stress. The symptoms of certain parasitic infestations, such as fascioliasis, may develop insidiously over a period of weeks, months and sometimes even years.

Questioning the patient regarding the nature of their pain and functional limitations will give insight into which structures may be responsible. Myofascial pain caused by trigger points tends to be dull, poorly localized and deep, similar to visceral referred pain and in contrast to the precise location of cutaneous pain (Gerwin 2002). It can present as a constant or intermittent deep ache, but rarely as throbbing or burning. Occasionally, patients describe pain from myofascial trigger points as a sharp or stabbing pain. The term 'referred pain' not only encompasses pain, but may also include other paraesthesias and dysaesthesias. Referred sensations of trigger points need to be distinguished from peripheral nerve entrapment and nerve root irritation. Functional limitations due to trigger points include muscle weakness, poor coordination of movement, fatigue with activity, decreased work tolerance, lack of endurance, and joint stiffness. Finally, limitations in active and passive range of motion may be due to myofascial hypertonicity that occurs as a result of trigger points.

Once the possible cause has been identified, it is useful to gain a better understanding of the course of the symptoms, prior diagnostic tests and previous treatments. Are there recurrent exacerbations and remissions, and if so, what are their triggers? Characteristically, myofascial pain is aggravated by strenuous use of the muscles, rigorous stretching of the muscles harbouring trigger points, repeated trigger point compression, overloading and overcompensation of muscles during assumed prolonged postures, repetitive contractions of the involved muscle, cold and damp weather, viral infections, and periods of increased stress, anxiety and tension. Pain symptoms caused by trigger points may be alleviated with periods of rest, gentle stretching, massage, use of ice or heat, positional supports, and activities that may induce relaxation, including breathing re-education and yoga.

What previous treatments were administered and what were the outcomes of those treatments? Often times, acute problems develop into chronic problems due to poor insight and unawareness by the individual, inadequate management by medical professionals, and their inability to recognize myofascial trigger points as the source of the problem or as a significant contributing factor. Due to the chronicity of the problem, muscle guarding and abnormal movement patterns persist, other muscles become involved, and latent trigger points may become active. Peripheral and central sensitization leads to other complications, including depression, anxiety and anger, and other musculoskeletal problems. Clinicians who routinely consider myofascial trigger points as part of the clinical picture are often the last resort for patients who have been given endless diagnoses that do not explain or address their pain and/or associated dysfunctions (Hendler & Kozikowski 1993). Patients often appear relieved when the practitioner can literally put the finger on the source of the pain, which usually results in instant rapport between patient and clinician.

Physical examination

The physical examination starts with a general impression of the patient's physical expression, body type, static and dynamic posture, and movement patterns. The patient's breathing pattern may reveal potential overuse of accessory respiratory muscles, such as the scalene muscles, and indicate possible higher levels of stress (Chaitow 2004). Structural abnormalities and asymmetries, which result from a congenital or acquired movement impairment, will invariably lead to persistent musculoskeletal pain and dysfunction with the inclusion of trigger points. Pelvic obliquity, scoliosis, forward head posture, leg length discrepancy, small hemipelvis, short upper arm syndrome, long metatarsal syndrome and scapular abnormalities are a few of the most common structural variations that can lead to myofascial pain (Simons et al 1999).

Leg length discrepancies are divided into structural and functional leg length discrepancies. Structural discrepancies are due to true anatomical

differences in length of the femur or tibia, while functional discrepancies can be caused by hip adductor contractures, trigger points in the quadratus lumborum muscles, hip capsule tightness, or by unilateral innominate pelvic rotations. Leg length discrepancies and pelvic asymmetries may produce muscle imbalances and postural adjustments that result in the development of trigger points (Janda 1994). Leg length discrepancies may be due to congenital, developmental, traumatic or pathological changes in one of the osseous links of the lower extremity kinetic chain.

Identifying the specific posture type from a thorough structural spine assessment in sitting and standing will indicate the muscle imbalances that are present. The upper and lower crossed syndromes, described by the late Dr Vladimir Janda, recognize muscle imbalances on the basis of muscle fibre type and its inherent characteristics. Janda distinguished 'tonic' or 'postural' muscles from 'phasic' or 'dynamic' muscles. Tonic and phasic muscles are physiologically different in their oxidative ability and their ability to contract over a specified time period. Tonic muscles are slow twitch, slow oxidative and fatigue resistant posture (type I) muscles. Phasic muscles are divided into fast twitch, oxidative-glycolytic and fatigue resistant movement (type II-a) muscles, fast twitch, glycolytic and easily fatigued movement (type II-b) muscles, and superfast (type II-m) muscles found primarily in the jaw muscles. Myofascial trigger points can develop in both tonic and phasic muscles. Tonic muscles include the hamstring muscles, rectus femoris, iliopsoas, quadratus lumborum, the paraspinals, the pectorals, the sternocleidomastoid, upper trapezius and levator scapulae (Fig. 8.2). Phasic muscles include the rectus abdominus, serratus anterior, rhomboids, the middle and lower trapezius, the deep neck flexors, suprahyoid, and mylohyoid (Janda 1983, 1993). Tonic muscles have a tendency to tighten in response to abnormal stress or dysfunction, while phasic muscles have a tendency to become weak. These typical response patterns will result in the upper and lower crossed syndromes (Figs 8.3 and 8.4). The upper crossed syndrome or forward head posture is the most common postural

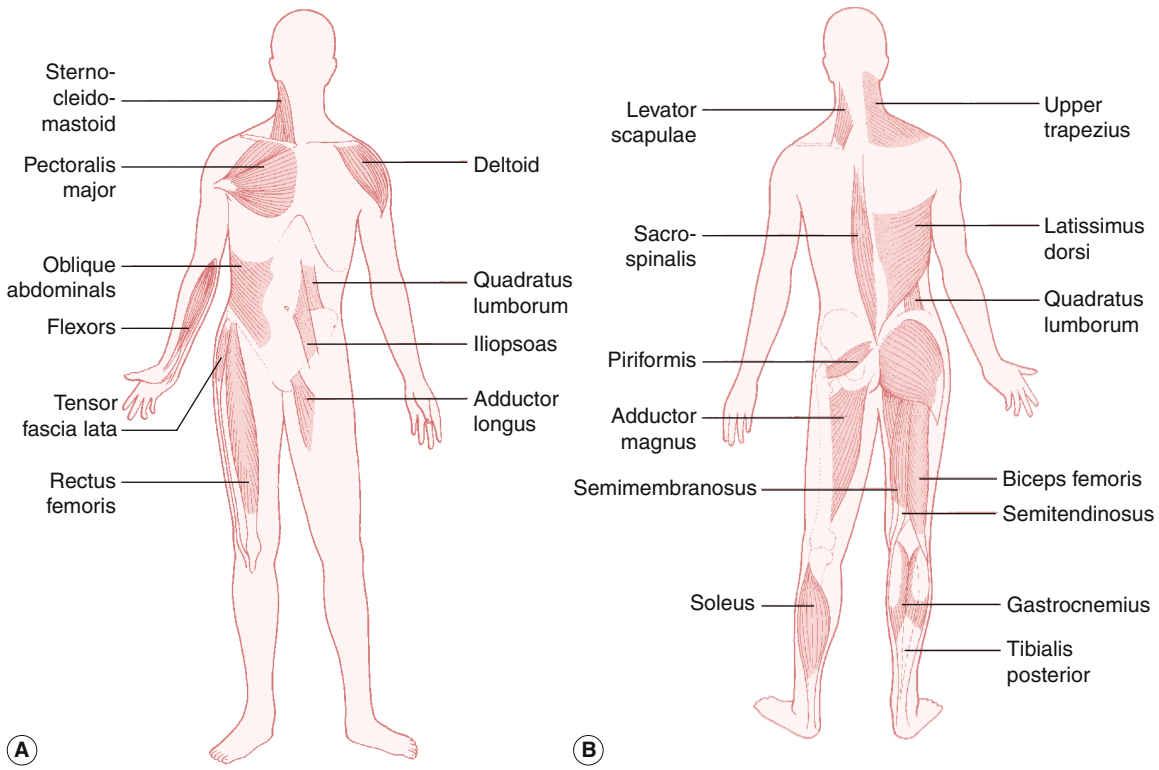

Figure 8.2 • Major postural muscles **A** Anterior. **B** Posterior. (Reproduced with permission from Chaitow & DeLany 2000, p 23.)

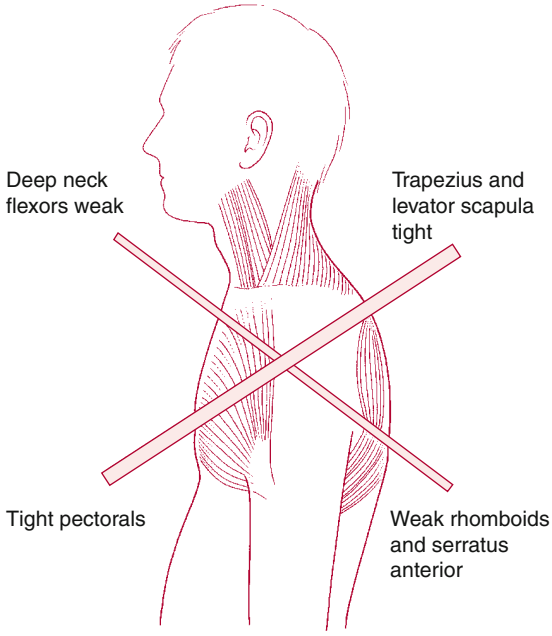

Figure 8.3 • Upper crossed syndrome (after Janda). (Reproduced with permission from Chaitow & DeLany 2000, p 56.)

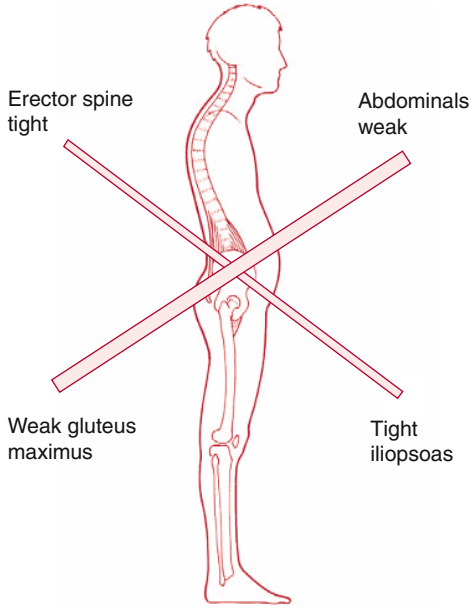

Figure 8.4 • Lower crossed syndrome (after Janda). (Reproduced with permission from Chaitow & DeLany 2000, p 56.)

deviation in patients with myofascial pain (Fricton et al 1985, Janda 1994).

Forward head posture is usually associated with a posterior rotation of the cranium, flattening of the cervical spine and a protracted shoulder girdle (Rocabado 2001). Myofascial restrictions and trigger points related to forward head posture are commonly seen in the suboccipital muscles, cervical paraspinals, splenius capitis and cervicis, levator scapulae, upper trapezius, anterior and medial scalenes, sternocleidomastoid, and pectoralis minor and major muscles (Simons et al 1999). Myofascial dysfunction also needs to be evaluated in the weak phasic musculature found in muscle imbalances. Trigger points will arise in any muscle that is functioning in a lengthened position or in a compromised manner as a result of muscle imbalances and structural abnormalities. Fernández de las Peñas and colleagues demonstrated an association between active trigger points in the suboccipital muscles and forward head posture in chronic tension-type headache subjects. Chronic tension-type headache subjects with active suboccipital trigger points described a greater headache intensity, duration and frequency compared to those with latent trigger points (Fernández de las Peñas et al 2006a).

Observing structural alignment and abnormal neuromuscular movement patterns during functional activities will also identify specific muscles or regions with myofascial restrictions. Much information can be gathered by watching how someone bends over and picks up an object from the floor, or how an individual walks down the hall, or balances on one leg. Someone with complaints of sciatica exacerbated by walking may exhibit instabilities in hip rotation during single leg stance due to poor neuromuscular control of the hip external and internal rotation muscles. Myofascial trigger points in the piriformis, gluteus medius and minimus, and adductor muscles are likely.

As part of the physical examination, the clinician should include a thorough evaluation of myofascial trigger points relevant to the patient's current pain presentation. The patient's current area(s) of pain can be visualized through patient pain drawings. Myofascial trigger points of each muscle have their own specific pain pattern. While patients communicate their pain patterns, the clinician can begin identifying those muscles and active trigger points most likely involved in the pain problem. The localization of pain is not always the source of pain, hence the importance of a thorough differential diagnosis.

Sources of referred pain are well known and include trigger points, facet joints, intervertebral discs, nerve roots, peripheral nerve entrapments, viscera and sclera (Bogduk & Simons 1993, Giamberardino et al 1999, Simons et al 1999). Referred pain from myofascial trigger points has been mistaken for pain from angina, radiculopathy, trigeminal neuralgia and thoracic outlet syndrome, among others. A study showed good inter-rater reliability among four physicians considered experts in the field for the identification of five characteristics: tenderness, presence of a taut band, referred pain, local twitch response and reproduction of the patient's pain; a global assessment was made regarding the presence of a trigger point (Gerwin et al 1997).

In addition to considering the pain component, the mechanical aspects of myofascial trigger points provide further insights. Both active and latent trigger points may be associated with restricted range of motion and functional limitations. During the assessment, the sensory, motor and autonomic aspects of trigger points must be considered. For example, in a patient with complaints of headaches, the pain complaint may direct the clinician to the sternocleidomastoid, upper trapezius, temporalis and inferior oblique capitis muscles (Calandre et al 2006, Fernández de las Peñas 2006a, 2006b, 2006c, 2007a, 2007b, 2007c, Giamberardino et al 2007). The patient's head posture in slight side bending and rotation may implicate the scalene muscles. The referred pain pattern from myofascial trigger points in the scalene muscles may include the head region (Dejung et al 2003). If in addition the patient presents with a paradoxical breathing pattern, it will be necessary to examine and treat the accessory breathing muscles as well, including the pectoralis minor, scalenes, sternocleidomastoid and upper trapezius musculature, that may be overloaded due to increased demands. Teaching the patient a normal diaphragmatic breathing pattern and fostering awareness of relaxation techniques for the upper chest and neck region will aid in the long-term management of the headaches (Chaitow 2004).

In the context of FMS, it is easy to understand how clinicians would conclude that a patient has a positive FMS tender point count when the pain is due to either localized or referred pain from myofascial trigger points. A quick FMS tender point count will not reveal the cause of the increased sensitivity as the corresponding trigger points frequently are not identified. Yet, the specificity of the diagnosis would increase dramatically and the prognosis would be far superior. The most common myofascial trigger points and their referred pain patterns that may be responsible for the tenderness at the FMS tender point locations are summarized in Table 8.2. It is recommended that when a positive FMS tender point is identified, the clinician evaluates the patient for the presence of trigger points that could cause the increased sensitivity at the FMS tender point location. Myofascial trigger points that correspond to the FMS tender points at the occiput, gluteal muscle, lateral epicondyle and knee are summarized in Figure 8.5A–D. When a clinician identifies a positive FMS tender point, an examination of these trigger points may direct the clinician to the cause of the pain and result in the initiation of an effective treatment approach. For the other FMS tender point locations, corresponding muscles should be examined for trigger points (see Table 8.2).

The treatment of a patient with myofascial pain falls beyond the context of this chapter. Myofascial pain can be approached from many perspectives; however, the therapy must address the various components of dysfunction. The local contraction knot or trigger point must be released either manually, by dry needling, or by trigger point injections to improve the local circulation and to decrease pain in order to restore range of motion and facilitate functional movement patterns (Dommerholt 2004, Dommerholt et al 2006a, 2006b, Issa & Huijbregts 2006). There are many different manual techniques, including myofascial release techniques, ischaemic compression, trigger point compression combined with active contractions of the involved muscle, post-isometric relaxation, connective tissue stretches and general massage therapy (Gröbli & Dejung 2003, Gröbli & Dommerholt 1997). Massage therapy has been found to be effective in the treatment of low back pain for patients with myofascial trigger points (Chatchawan et al 2005). Several studies have explored different compression techniques, including ischaemic compression technique, transverse friction massage and trigger point pressure release of active and latent trigger points, and found that all techniques showed significant improvement in pressure pain threshold and significant difference in visual analogue scale scores (Fernández-de-las-Peñas et al 2006d, Gemmell et al 2008). No significant differences were found comparing the various techniques. Manual pressure release of latent trigger points in the upper trapezius

Table 8.2 Fibromyalgia tender point locations and overlapping myofascial trigger point areas and referred pain patterns

FMS TPs	Location of FMS TPs	Common overlapping MTrPs and referred pain patterns
Occiput	At the suboccipital muscle insertion	Suboccipitals, upper trapezius, splenius capitis, sternocleidomastoid, semispinalis cervicis, multifidi
Low cervical	At the anterior aspect of the intertransverse space at C5–C7	Upper trapezius, splenius cervicis, levator scapulae, multifidi, sternocleidomastoid
Trapezius	At the midpoint of the upper border	Upper trapezius, scalenes, levator scapulae supraspinatus, multifidi
Supraspinatus	At origin above the scapula spine near the medial border	Supraspinatus, levator scapulae, upper trapezius, middle trapezius, iliocostalis, thoracis
Second rib	At the second costochondral junction, just lateral to the junction on upper surface	Pectoralis major, pectoralis minor, sternalis
Lateral epicondyle	2 cm distal to the epicondyle	Subscapularis, triceps, subclavius, scalenes, serratus posterior superior, supraspinatus, infraspinatus, brachioradialis, supinator, anconeus, extensor carpi radialis longus, extensor digitorum
Gluteal	In upper outer quadrant of the buttock in anterior fold of muscle	Quadratus lumborum, gluteus maximus, gluteus medius, gluteus minimus, piriformis, iliocostalis lumborum
Greater trochanter	Posterior to the trochanteric prominence	Quadratus lumborum, gluteus maximus, gluteus minimus, piriformis, iliocostalis lumborum, vastus lateralis
Knee	At the medial fat pad proximal to the joint line	Vastus medialis, rectus femoris, sartorius, adductors longus and brevis

has shown a reduction in perceived pain and a significant increase pressure tolerance (Fryer & Hodgson 2005).

Needling techniques include superficial and deep dry needling, and trigger point injections. A Cochrane Review endorsed that dry needling might be useful in combination with other therapies in the treatment of chronic low back pain (Furlan et al 2005). A systematic review of 23 randomized controlled trials of needling therapies in the treatment of myofascial pain found that direct needling of trigger points is an effective treatment in decreasing symptoms, but efficacy compared to placebo could not be proven or disproved (Cummings & White 2001). Several studies suggested that deep needling of myofascial trigger points may be more effective than traditional acupuncture or superficial needling (Ceccherelli et al 2002, Itoh et al 2004, 2007). A study comparing lidocaine injections, botulinum toxin injections and dry needling of trigger points found a decrease in pain pressure thresholds and pain scores in all three groups (Kamanli et al 2005). Another study that looked at lidocaine injection versus dry needling of trigger points in the upper trapezius showed significant improvement in pain intensity, pain threshold and cervical range of motion in both groups; the lidocaine injection resulted in less post-treatment soreness (Hong 1994b). The authors concluded that the elicitation of local twitch responses was essential in obtaining a therapeutic benefit (Hong 1994a). It should be noted that in the last two studies, the dry needling procedures were administered with syringes and not with solid filament needles, which are more commonly used in clinical practice (Dommerholt et al 2006b). In a more recent study, trigger point injections were compared with dry needling using solid filament needles and both techniques were found to be equally effective (Ga et al 2007). More research is needed (Tough et al 2009).

Various modalities have been suggested as being clinically relevant in the treatment of myofascial trigger points, including electrical stimulation, ultrasound and laser therapy (Rickards 2006). Hsueh

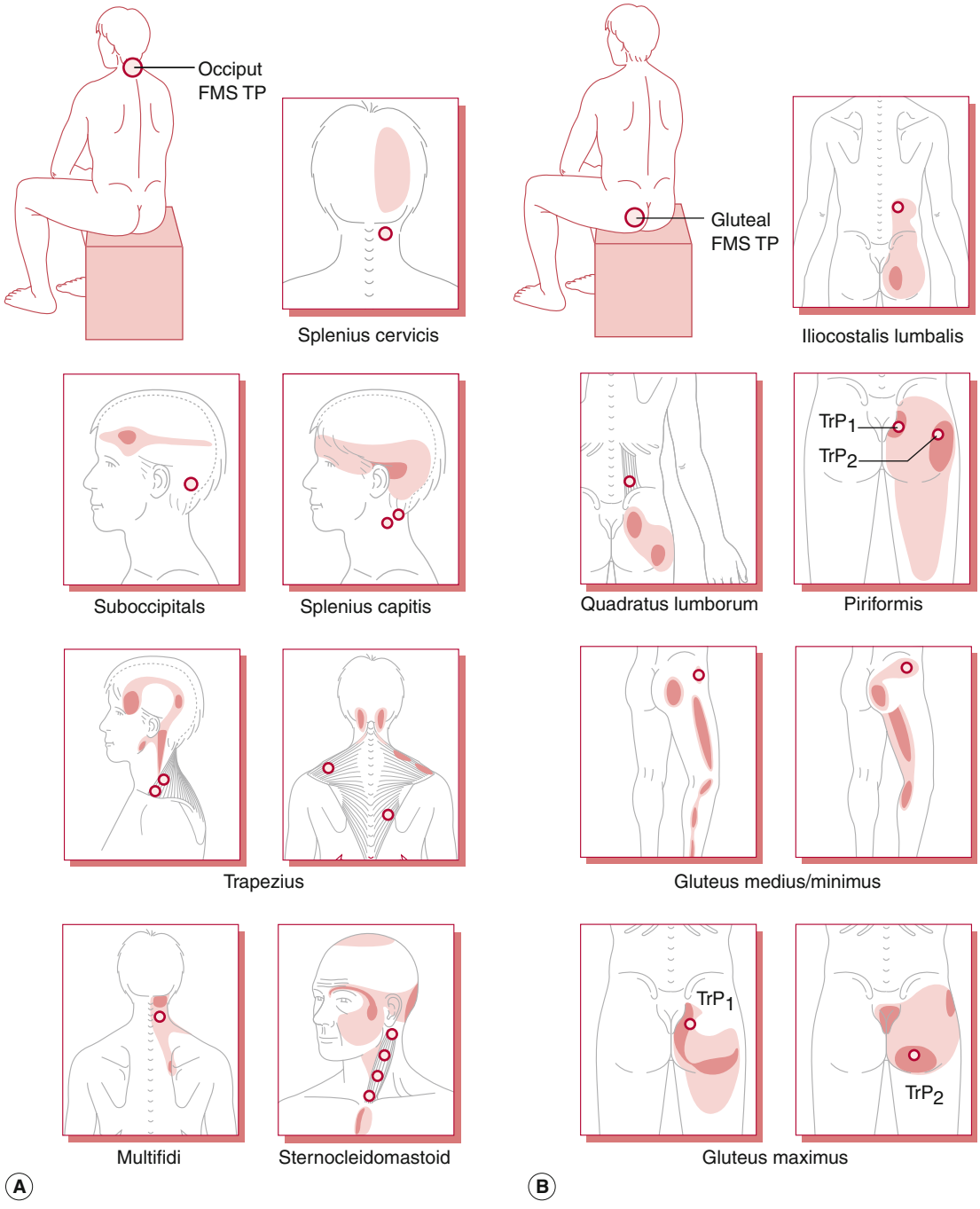

Figure 8.5 • **A** Occiput FMS tender point and MTrPs. **B** Gluteal FMS tender point and MTrPs.

(Continued)

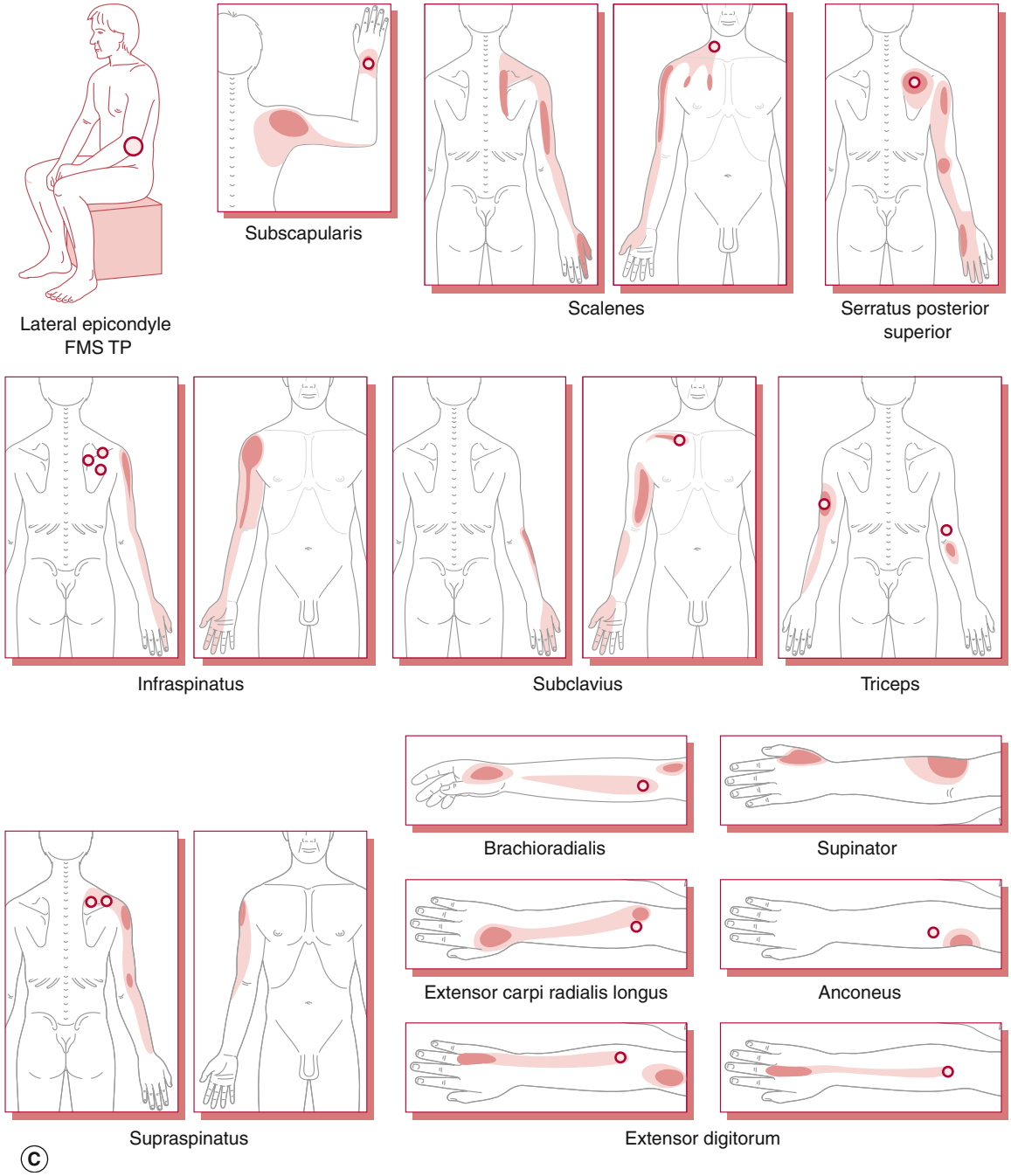

Figure 8.5—cont'd. **C** Lateral epicondylitis FMS tender point and MTrPs.

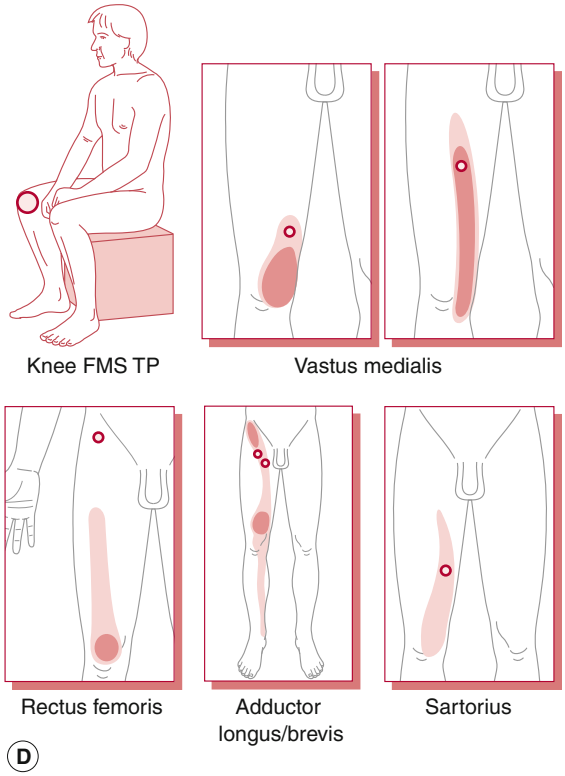

Figure 8.5—cont'd. **D** Knee FMS tender point and MTrPs.

and colleagues studied the immediate effectiveness of electrical stimulation on myofascial trigger points in the upper trapezius and found that transcutaneous electrical nerve stimulation (TENS) was significantly more effective in reducing subjective pain intensity and pressure pain thresholds than placebo (Hsueh et al 1997). Electrical muscle stimulation was significantly more effective in improving range of motion than placebo and the TENS groups (Hsueh et al 1997). Graff-Radford and colleagues reported that high frequency/high intensity TENS of 100 Hz with 250 µs stimulation was the most effective of four tested TENS combinations in reducing myofascial pain, but it had no effect on the sensitivity of myofascial trigger points (Graff-Radford et al 1989). This was also found by Smania and colleagues who demonstrated that TENS had an immediate effect on pain, but not on the sensitivity of the trigger point by algometric measurement (Smania et al 2005). Hou and colleagues claimed that TENS or interferential currents, when combined with other listed treatments (manual or physical therapies), was more effective in attenuation of trigger point pain (Hou et al 2002b).

Frequency-specific microcurrent therapy has shown positive empirical findings in the treatment of chronic low back pain of myofascial origin (McMakin 2004, McMakin et al 2005). Ultrasound trials for trigger points yielded conflicting results. In a randomized controlled trial, Majlesi & Ünalan (2004) found that a high-power, pain-threshold, static ultrasound technique was more effective in the reduction of pain and significantly decreased overall treatment duration as compared to a conventional ultrasound technique. Gam and colleagues concluded that ultrasound offered no pain reduction to patients with shoulder and neck pain (Gam et al 1998), which was also found by Lee and colleagues (Lee et al 1997). In contrast, Esenyel and colleagues reported that ultrasound improved pain intensity, the trigger point pressure threshold and cervical range of motion (Esenyel et al 2000). Srbely & Dickey confirmed that ultrasound can reduce the short-term sensitivity of trigger points (Srbely & Dickey 2007, Srbely et al 2008). Laser therapy is demonstrating favourable results in pain reduction (Ceccherelli et al 1989, Hakguder et al 2003, Simunovic 1996, Simunovic et al 1998), improved algometry thresholds (Hakguder et al 2003, Ilbuldu et al 2004), improved thermography (Hakguder et al 2003) and improved functional recovery (Ilbuldu et al 2004, Simunovic 1996).

Hou and colleagues used a randomized controlled trial to evaluate six different therapeutic combinations on cervical myofascial pain, trigger point sensitivity and cervical range of motion in 119 subjects. The most effective combinations in decreasing pain and improving range of motion were: hot pack plus active range of motion and stretch with vapocoolant spray; hot pack plus active range of motion and stretch with spray as well as transcutaneous electrical stimulation; and hot pack plus active range of motion and interferential current as well as myofascial release technique (Hou et al 2002b). This suggests that effective treatment strategies of trigger points may involve the combination of various treatment techniques and modalities, which is most likely indicative of true clinical practice.

The therapeutic programme must address the various perpetuating factors, including metabolic insufficiencies, mechanical discrepancies and psychosocial factors. The patient with chronic myofascial pain may benefit from an interdisciplinary approach to include medical pharmacological management, psychosocial therapy, physical therapy, chiropractic care, osteopathy, massage therapy or

more specific neuromuscular therapy. Patients with more acute myofascial pain may only require treatment by a physician and either a physical therapist or neuromuscular therapist.

The patient and the clinician need to identify appropriate goals and develop the means to reach them through therapy. Inactivation of myofascial trigger points is a means to achieve pain relief and improved biomechanical function, and thus to improve the ability of the patient to better perform whatever desired tasks have been selected as goals. Relief of pain or increased range of motion, both of which can be the result of trigger point inactivation, are not in themselves the final goals of treatment. For some individuals, an initial goal may be to simply sleep through the night. For another patient, it may be walking the dog or fastening a bra behind the back. For yet another, it may be regaining sexual ability, returning to work or participating in a recreational activity. Reasonable goals that can be achieved and measured as being reached or not, are more important to focus on than simply the inactivation of a trigger point or an increase in the range of a particular movement (Gerwin 2000).

Summary

Many arguments can be made to consider the normal differential diagnostic process in the diagnosis of individuals with widespread chronic pain. The notion that the diagnosis of FMS should be made irrespective of other diagnoses seems to be too simplistic and may actually deprive patients of required treatments. Clinicians and patients may not consider other possible causes of widespread chronic pain once the diagnosis of FMS has been established. Empirically, the diagnosis of myofascial pain appears to be a reasonable alternative, especially when myofascial trigger points are identified that mimic the patient's pain complaint. Other diagnoses, including organic diseases and functional disorders, must be ruled out.

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Chapter Nine

9

Microcurrent therapy in the treatment of fibromyalgia

Carolyn McMakin

CHAPTER CONTENTS

Introduction

The author has been using microamperage current modulated by specific frequencies to treat both myofascial pain and fibromyalgia since 1996. This new treatment technique makes these conditions much more responsive to treatment and has allowed some patients to recover. In this context, recovery means the patient no longer meets the diagnostic criteria for fibromyalgia, is sleeping well without medication and has less than 11/18 tender points when tested using the American College of Rheumatology (ACR) protocol. The patient might still need treatment for specific joint or muscle problems that would be normal for someone else of the same age with the same history of trauma but the overall fibromyalgia complaints of fatigue, sleep disturbance and generalized aching are gone, often permanently. This chapter will present the history and theory behind frequency-specific microcurrent and describe the treatment techniques that allow us to treat myofascial pain, neuropathic pain and fibromyalgia with some measure of success.

Microcurrent

Microamperage current was introduced in the United States in the early 1970s (Rowley et al 1974). Microcurrent provides current to the patient in a physiological range of microamperes or millionths of amperes. An ampere (amp) is a measure of the strength of electric current and measures the rate of flow of charge in a conducting medium. One micro amp (μA) equals 1/1000th of a milliamp (mA). By comparison, interferential, TENS and high-volt pulsed galvanic stimulators deliver currents in the milliamp range, causing muscle contraction, pulsing and tingling sensations. With microcurrent, the patient cannot feel the current since there is not enough current to stimulate sensory nerve fibres (Mercola & Kirsch 1995).

Microcurrent has typically been used to increase the rate of healing in injured athletes, control pain, increase the rate of fracture repair, and treat myofascial pain and dysfunction (Manley Tehan 1994, Morgareidge & Chipman 1990, Rowley et al 1974).

In a study conducted in rat skin by Ngok Cheng MD, electrostimulation of the tissues with microcurrent resulted in remarkably increased ATP concentrations, protein synthesis and membrane transport. With currents from 50 A to 100 μA, the ATP levels were increased threefold to fivefold. With currents between 100 A and 500 μA, the stimulatory effects were similar. With currents exceeding 1000 μA, the ATP concentration levelled, and with 5000 μA they were even reduced slightly as compared with the non-treated controls. Similar effects were noted in regard to protein synthesis. At about 500 μA, there is a tremendous enhancement of protein synthesis; however, when the current rose over 5000 μA, the trend reversed into suppression (Cheng et al 1982).

Normal membrane bioelectric activity includes the flow of electrons through the electron cascade in the cell wall to produce ATP. The first step in oxidative phosphorylation in the mitochondria involves the ionization of the hydrogen atoms that have been removed from food substrates. The hydrogen atoms are removed in pairs; one immediately becomes H^+ and one combines with NAD^+ to form NADH. The electrons that are removed from the hydrogen atoms to cause ionization immediately enter the electron transport chain in the inner mitochondrial membrane. Transport of these electrons through the electron transport chain releases energy that is used to synthesize ATP. For each two electrons that pass through the entire electron transport chain, up to three ATP molecules are synthesized. The large electrical potential difference between the inner and outer mitochondrial membrane causes the hydrogen ions to flow into the mitochondrial matrix through the ATPase molecule. The greater the electron flow, the greater this electrical potential difference and the greater the creation of ATP. Microcurrent could increase the production of ATP by both of these mechanisms (Guyton 1986) (Fig. 9.1).

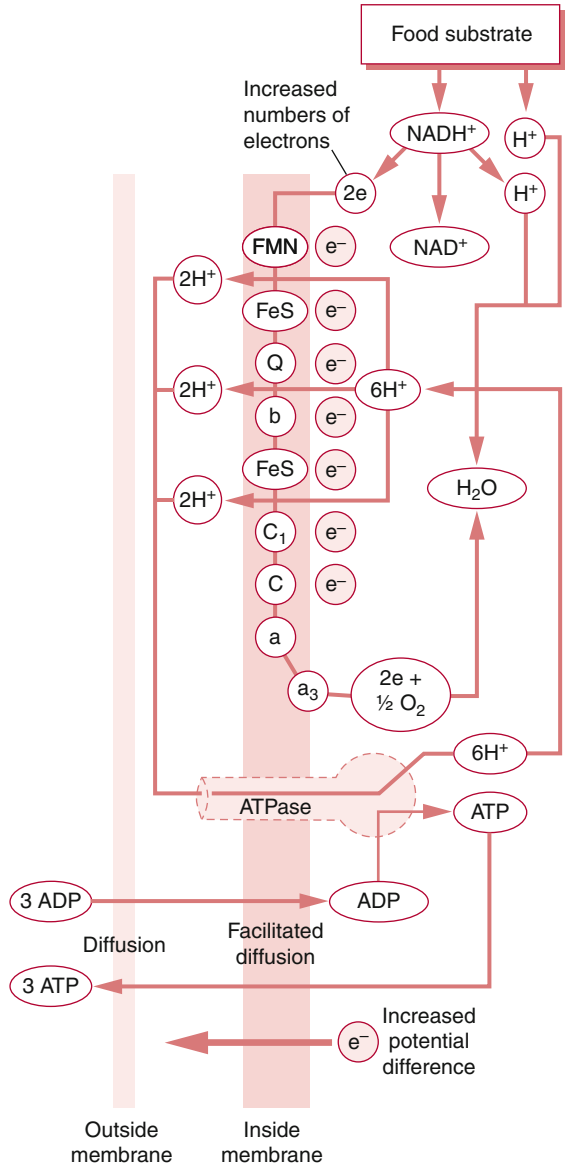

Figure 9.1 • The illustration shows membrane electron transport and two possible mechanisms by which microcurrent could produce the 500% increase in ATP production described by Cheng in 1987.

A standard battery-operated microcurrent instrument made by Precision Microcurrent Inc. (Fig. 9.2) is used in patient treatments. This unit has two channels that can each be set to a different frequency between 0.1 Hz and 999 Hz. Previous models had two-digit frequency specificity with a three-place multiplier, so the digits 2 and 8 could become 2.8 Hz, 28 Hz or 280 Hz depending on the multiplier. The frequencies used require three-digit specificity and in the present models the frequencies are accurate to three places. Thus the frequency 284 Hz can be set with less than 1% error in output and can become 28.4 Hz by changing the multiplier. Each channel generates current in a ramped square wave form from 10 to 600 μA. The circuitry modifies the voltage so that the current remains constant regardless of tissue resistance. The circuitry also modifies the DC battery current so that it can alternate or be polarized.

Figure 9.2 • The photograph shows the battery operated, two-channel microcurrent instrument (manufactured by Precision Microcurrent) used in treatment. The controls from left to right along the upper portion of the instrument are: the buttons to set the frequencies for channel A, the threshold adjustment (not used in the treatments described in this chapter), the switch that changes the polarity from alternating (for myofascial treatment) to positive (for nerve and spinal cord treatments) and, last, on the right, the buttons to set the frequencies for channel B. The controls in the lower row (from left to right) are: to select the current for channel A, the current for channel B, to set the timer for either continuous or timed segments, and to select the wave slope from sharp (for sedating nerves) to gentle (for treating new injuries and fresh wounds). LED lights above each current selection knob indicate the activity of each channel. The meter on the right shows what percentage of the current output is reaching the patient. There are two leads for each channel colour coded red and black for positive and negative polarity.

This feature is important because most treatments are done with alternating current but in the author's experience nerve tissue is most effectively treated with current polarized positive centrally and negative distally. Any microamperage current generator could be used as long as it has these characteristics.

Using specific frequencies

The early microcurrent instruments provided current modulated by only a few frequencies: 0.3 Hz was used to stimulate healing, 30 Hz or 40 Hz was found useful to reduce pain, and 300 Hz was used clinically for lymphoedema (Greenlee & Wing 1986, Manley Tehan 1994). The frequencies employed by the author were those used by a retired osteopathic physician, Harry Van Gelder, ND DO, who found them in a manual that came with a 1920s electromagnetic therapy device that he acquired when he bought a practice in Canada in 1946. Using this ancient machine, he used one frequency to neutralize a pathology or support a function in a tissue, and a second frequency to address a particular tissue or organ. Van Gelder had a reputation for helping people to recover from various difficult conditions. When he died and the machine became defunct, two Oregon chiropractors, who had trained with him, saved the frequencies for historical interest. In 1994, one of these chiropractors provided the frequencies and guided the author in using Van Gelder's treatment protocols on a two-channel microcurrent instrument. Later, frequencies taken from the work of Albert Abrams, a medical physician who practised in San Francisco in the early 1900s (Abrams 1934), were

added to treatment protocols, and several additional frequencies were developed through trial and error.

Of all the millions of permutations and combinations of frequencies that could possibly have an effect on biological tissue, why do these certain frequencies seem to work in a microcurrent system? We can't know with certainty how the original practitioners arrived at these frequencies. In clinical applications certain frequencies either work or they don't; if they don't work, they don't have any obvious negative effects. As a result, clinical outcomes and treatment response have been the criteria that determine efficacy. It is rather like the use of willow bark and then aspirin for hundreds of years before the chemistry of prostaglandin inhibition was understood. Medicine doesn't always have to understand the mechanism and the precise origin of the therapy to make use of it.

The frequencies are rarely used as a single frequency. A process of trial and error has shown that using one frequency thought to address or neutralize a condition on channel A and one thought to be targeting a specific tissue on channel B produces an optimal effect.

The combination of the two frequencies seems to be important since changing either frequency changes the clinical response. The frequencies are applied in an interferential pattern so that they intersect in the area to be treated. The interferential effect creates a complex of frequencies in the treatment field that includes each frequency by itself, the sum of the two frequencies and their difference. The microcurrent instrument creates a ramped square wave with a 2.5-second pulse to carry the frequency. Trials with microcurrent devices using sine waves were not as successful and it was determined that the square wave was more effective. Square waves are produced by high frequency spikes that rise and drop off sharply. At this point there is no way of knowing what portion of this complex is necessary to create the observed therapeutic effects but it is clear in a clinical setting that changes in either the frequency or the wave shape change the therapeutic effect.

History and theoretical model for use of specific frequencies

The microcurrent instrument acquired by the author in 1994 was the first one available that had the ability to provide an independent specific frequency on each of two channels. In 1996 the clinic acquired a different microcurrent instrument intended to be used for anti-ageing skin treatments. This unit came with a pair of graphite gloves designed to be worn by the practitioner to conduct the current from the instrument to the patient (Fig. 9.3). These lightweight graphite gloves have micro-jacks cemented to the dorsal surface and are designed to conduct current and provide good tactile perception. The gloves seemed ideal to conduct current into injured muscles and in January 1996 the gloves, the two-channel microcurrent instrument and the frequencies to neutralize 'mineral deposits' from Van Gelder's list were combined in order to treat a patient with resistant myofascial pain in the muscles of his neck. The fibrotic tender tissue softened within seconds and became pain free in minutes after being unresponsive to weeks of manual trigger point therapy.

The author began experimenting with the treatment of chronic myofascial pain in 1996. After successful outcomes in the first 150 patients treated it was clear that the results were consistent and the response was very frequency specific (McMakin 1998). Patients responded and recovered who had been symptomatic for years despite skilled and appropriate treatment from a variety of practitioners. When certain frequencies were applied the tissue would soften dramatically in seconds, accompanied by a reduction in pain. Not all frequencies, or frequency combinations, produced this response. An 'inappropriate' or ineffective frequency produced no change in tissue no matter how long the frequency was used and changing to a 'correct' frequency produced the characteristic softening of the tissue in seconds.

How could specific frequencies produce specific effects in different tissues in the ways observed? Biophysics provided an intellectually satisfying foundation for the observed effects. The explanation for the effects of specific frequencies on specific tissues and conditions starts with a quantum view of physical tissue instead of a Newtonian or mechanical view. Physical tissue looks solid but, in reality, physical tissue is a collection of biochemicals formed, folded and aligned in particular configurations to create a biological/biochemical/bioelectric system that is the cell. The molecules and atoms that create these biochemicals are held together by electromagnetic bonds in an energetic relationship. In fact, the atomic and subatomic particles that form the atoms are not matter at all but rather bits of energy that may behave as particles or as waves.

Figure 9.3 • The lightweight graphite conducting gloves have both red leads attached to one glove and both black leads attached to the other glove through double pin-jacks cemented on the back of the glove.

There is more space between the particles than there are particles and the simple laws of physics dictate that the particles, atoms and molecules create an electromagnetic field in this space. This field must then be able to be influenced by other electromagnetic fields and may then have an effect on the tissue that creates it (Oschmann 1994, 1997, 2000).

On a macromolecular level the cell is no longer seen to be an unstructured bag of membranes filled with organelles processing reactions through simple diffusion. All of the intracellular organelles are suspended and interconnected by the microtrabecular lattice that forms the ground substance within the cell. Glycoproteins extend across the cell surface from the interior to the exterior and create a filamentous tissue network. This network is a crystalline gel lined by water molecules and functions like a semiconductor. Biophysicist Albert Szent-Gyorgyi suggested that virtually all of the molecules forming the living matrix are semiconductors. He said: 'Molecules do not have to touch each other to interact. Energy can flow through the electromagnetic field... The electromagnetic field, along with water, forms the matrix of life. Water can form structures that transmit energy' (Oschman 2000) (Fig. 9.4).

Hart has proposed that electric fields of physiological strength (approximately 100 V/m) are transduced by the mechanical torque they exert on glycoproteins in the cell walls. The resulting mechanical signal is then transmitted to the cytoskeleton and propagated throughout the cell interior. This mechanical coupling was analysed for transmembrane glycoproteins, such as integrins and the glycocalyx, and for glycoproteins in the extracellular matrix of cartilage. The paper concluded that the resulting vibrational system represented a damped, driven harmonic oscillator. This process may operate in concert with other transduction mechanisms, such as the opening of voltage-gated channels and electrodiffusion for DC fields to produce changes in cellular function (Hart 2008).

Lipton (2005) reported that the cell can operate perfectly without the nucleus until such time as it needs to reproduce, suggesting that cellular functions are performed by the membrane proteins embedded in the cell wall. He described experiments that demonstrated the sensitivity of cell membrane proteins to vibrational information in the form of emotions or electromagnetic signalling.

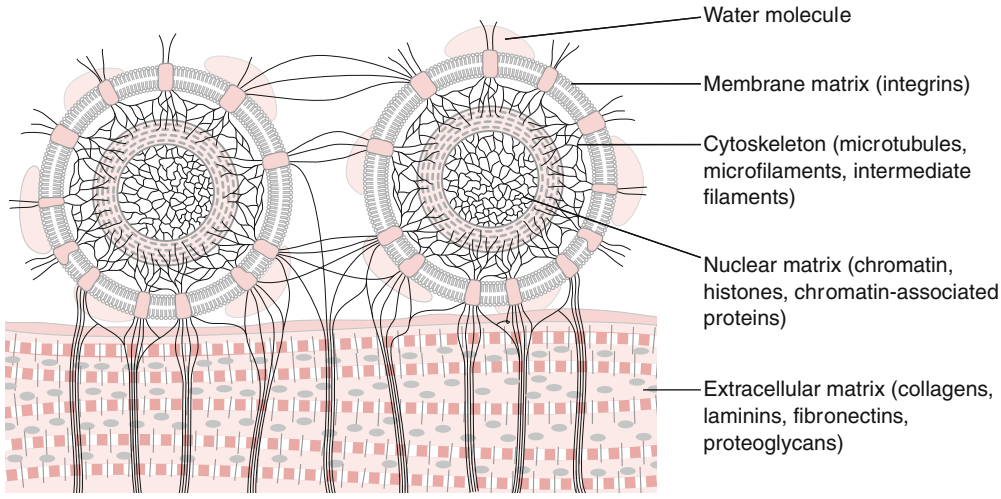

Figure 9.4 • The membrane structure that allows tissue to act as a semiconductor. (Reproduced with permission from Oschman 1997.)

The semiconductor tissue conveys and stores current, charge and vibrational information (Oschman 1997). The membrane proteins may change their configuration and their function in response to the electromagnetic information conveyed throughout the body by the fascia and perineurium. The concept of a continuum between the brain and the rest of the body through the perineurium or fascia, combined with cell membrane protein response to signalling, may explain how information is 'stored' in physical tissue and affects physiology. It would explain, for example, how the effects of physical injury, emotional trauma or toxicity exposure can influence function long after the tissue should have healed.

It also explains how electromagnetic patterns applied as frequencies could be conducted through the body, and resonate with specific tissues and their membrane proteins to neutralize the patterns created by different conditions. The effect would be similar to the use of an electronic door opener instead of a mechanical key to change the lock configuration.

Frequency-specific microcurrent, as the treatment method came to be called, was first taught in 1997 to determine whether students could reproduce the results. By 1998 it was clear that the results were indeed reproducible. The results of microcurrent treatment using specific frequencies to treat 73 cases of chronic neck and low back pain were presented at the American Back Society in 1997. Successful treatment of 50 cases of resistant myofascial pain in the head, neck and face were published in 1998 (McMakin 1998) and 23 cases of chronic low back pain were published in 2004 (McMakin 2004). Since that time thousands of cases of traumatic injury, chronic myofascial pain and nerve pain have been treated by trained microcurrent practitioners with similar results. In 1999 treatment protocols were developed that allowed successful treatment of neuropathic pain and the full body pain from fibromyalgia associated with cervical trauma.

The frequencies and treatment protocols were established by observing clinical response and refined by clinical experience and practitioner and patient feedback. They are taught in a 24-hour introductory course and 14-hour advanced course for physicians and therapists licensed to use electrotherapies. Practitioners are trained and can achieve certification in the US, Ireland and Australia after 6 months' practice, submission of 10 written cases and successful completion of a written examination. Frequency-specific microcurrent is so new that no controlled trials have been done as yet but they are planned as more research-oriented physicians become interested because of the clinical outcomes.

Treating fibromyalgia associated with spine trauma

In the author's fibromyalgia clinic it has been observed that fibromyalgia patients seem to divide into seven fairly clear although often overlapping

aetiologies. These are clinical distinctions based on patient history and response to treatment developed during 10 years of treating hundreds of fibromyalgia and myofascial pain patients.

1. *Stress*: One type of fibromyalgia seems to be associated with prolonged emotional or physical stress and the subsequent adrenal depletion and physiological sequelae of prolonged elevated cortisol and other stress hormones.
2. *IgG allergies*: One type is associated with 'leaky gut' and IgG food or environmental allergies. Mast cell overload from elevated IgG complexes causes the release of histamine, which stimulates class C pain fibres.
3. *Toxicity*: This type is associated with one time acute or long-term chronic exposure to organic chemicals, heavy metals or pesticides.
4. *Genetic*: This type has a genetic link, seems to run in families and may be associated with food sensitivities, especially gluten, or may represent an increased need for enzyme substrate in the liver detoxification pathways or serotonin pathways.
5. *Viral*: This type occurs after immunizations or viral illness.
6. *Vestibular injuries*: This type is associated with sleep disturbances and cognitive difficulties resulting from a vestibular injury or brain trauma.
7. *Spine trauma*: This type of fibromyalgia occurs after whiplash injuries, cervical or thoracic spine trauma, or after surgery, and can be caused by any trauma that involves spinal flexion/rotation, compression or ballistic segmental movement. The post-surgical cases are thought to occur when the neck is hyperextended during intubation and constitutes a cervical injury.

All fibromyalgia patients, regardless of the aetiology of their condition, have the same neuroendocrine and central sensitization features described in the fibromyalgia research but they each respond to different treatment strategies (Bennett 1999, Crawford 1998, Neeck & Riedel 1999). The model for these aetiologies has come from successful resolution of fibromyalgia when the treatment strategies address the specific cause of the pain or dysfunction.

It is the author's contention that fibromyalgia associated with spinal trauma (cervical trauma fibromyalgia or CTF) represents a distinct aetiology from fibromyalgia associated with other causes. The fully referenced theoretical model for the causative link between cervical trauma and fibromyalgia is presented elsewhere in this chapter. In short, it is proposed that spinal trauma cracks the disc annulus and exposes the spinal cord to the nucleus pulposus and neurotoxic concentrations of phospholipase A_2 (PLA_2) present in the disc nucleus. PLA_2 is known to reduce the firing of nerves and may damage the anterolateral pathways, which are directly adjacent to the portion of the disc most commonly found to be injured in trauma. If the function of the anterolateral pathways was sufficiently slowed it could constitute a chemical lesion, or functional deafferentation, in the nociceptive system, creating what is essentially central or thalamic pain. The pain descriptors for central pain and its affective quality are strikingly similar to the descriptors and affective quality seen with CTF (Kandel & Schwartz 1985).

This hypothesis (Box 9.1) was developed when it was found that the full body pain of post-traumatic fibromyalgia could be eliminated *only* by treating with the frequencies from Van Gelder's list to 'reduce inflammation' in the 'spinal cord', and a literature search revealed a model for how inflammation in the spinal cord could create full body pain.

In the author's experience, patients with fibromyalgia associated with spine trauma localize their pain in the neck, arms, hands, midscapular and paraspinal area, gluteals, legs and feet. As a group, they are the only fibromyalgia patients who describe burning or aching pain in the hands and feet. The pain is more severe than that of non-fibromyalgia patients and is usually rated subjectively on a visual analogue scale (VAS) between a 6 and a 9/10. The pain is not alleviated by narcotic or opioid medication, suggesting that it is neuropathic in origin. Spine trauma fibromyalgia patients use different pain descriptors from other fibromyalgia patients. They use words like burning, stabbing, sharp and shooting to describe their pain instead of describing the dull diffuse aching described by other fibromyalgia patients (Fig. 9.5). In general, they tend to have a higher incidence and greater severity of headaches and there is a characteristic affective quality to the pain that is reminiscent of central pain (Kandel & Schwartz 1985). The pain is not only moderate but also emotionally bothersome and irritating, and is quite different from the pain described in fibromyalgia not associated with spine trauma.

Box 9.1

Full hypothesis of the link between cervical trauma and fibromyalgia

We know that cervical trauma causes cracks in the annulus and fractures in the endplates that expose the nucleus pulposus to the spinal fluid, either directly or via the spinal vasculature. In their 1993 paper on disc injuries in cervical trauma, Taylor & Twomey describe the pathological changes in the cervical discs created by trauma. They did a comparative study of the cervical spines from 16 subjects who died of major trauma and 16 subjects who died of natural causes. Fifteen of the 16 trauma subjects showed clefts in the cartilaginous endplates. The cartilaginous endplates are important because they are vascularized, whereas the disc itself is avascular. The vasculature extends from the endplate into the epidural space (Netter 1991). Age-related changes in the discs are found extending from the uncovertebral joints medially toward the centre of the disc and do not involve the endplates. Posterior disc herniations and facet haemarthroses were also observed in the trauma group and absent in the control group (Taylor & Twomey 1993).

> *The outer annulus of cervical discs is innervated and cervical discs may be more extensively innervated than lumbar discs (Bogduk 1988, Mendel & Wink 1989). . . . The rim lesions described by Taylor and Twomey usually involve the outer part of the annulus. The delayed healing and predisposition to premature degeneration after the experimental production of rim lesions in the intervertebral discs of sheep, with the tendency to vascularization of these lesions, suggest that something similar may be responsible for chronic pain associated with soft-tissue injuries to the cervical spine. This study and the study of Davis et al (1991) show that neck extension sprain, with posterior disc herniation, may be associated with injury to the spinal cord such as localized petechial hemorrhage in the anterior columns or vascular damage to the anterior spinal or radicular arteries.*

In the cases studied by Taylor & Twomey, X-rays taken before microscopic examination did not show fractures, dislocations or subluxations. 'Clinical studies show that rim lesions and traumatic herniations are demonstrable in survivors of motor vehicle trauma in the absence of vertebral fractures.'

Patients with chronic residual cervical pain following trauma have symptoms that persist for years after soft tissue injuries should have healed. The damage to the cartilaginous endplates and discs provides a model for that persistence. Rim lesions produced surgically to a depth of 5 mm in the discs of sheep do not heal when followed for a period of 18 months. Only the outer third of the annulus shows the capacity to heal. These disc and rim lesions extend inward to at least that depth with deformation of the annular lamellae and degeneration of the nucleus pulposus. This phenomenon helps to explain the persistence of the injury (Taylor & Twomey 1993).

Nucleus pulposus as a neurotoxic agent

It has been established that the nucleus pulposus causes an inflammatory response in nerve tissue (Olmarker et al 1995). Nucleus pulposus material was implanted in the epidural space in pigs near the cauda equina. Implantation of retroperitoneal fat was used as a control. Nerve fibre degeneration, axonal swelling, increased axoplasmic density and marked attenuation and splitting of the myelin sheaths were noted in the animals exposed to nucleus pulposus material. Nerve root conduction velocity was significantly lower in the nucleus pulposus exposed nerve roots than in the control nerve roots. This study was the first time it had been demonstrated that the nucleus pulposus could produce reduction in nerve conduction velocity and nerve fibre degeneration without a mechanical compression of the nerve root (Olmarker et al 1993).

Nerve conduction velocity	Day 1	Day 3	Day 7
Control	84 ± 2	83 ± 4	76 ± 11
Nucleus pulposus	63 ± 9	45 ± 16	45 ± 19

It is known that the nucleus pulposus elicits an inflammatory response as indicated by leukotaxis and an increase in vascular permeability. The exact mechanism of the inflammatory response has not been verified. It is not clear whether the inflammatory reaction is induced by the nucleus itself or from substances being liberated from other

Box 9.1—Cont'd

tissues as a response to the interaction with the components of the nucleus. Glycoproteins, immunoglobulin G, phospholipase A_2 (PLA_2) and hydrogen ions have been proposed as possible mediators of this inflammatory damage (Olmarker 1993).

Marshall proposed a 'chemical radiculitis' in which the annulus fibrosis is weakened by degeneration and finally ruptures under the stress of a traumatic episode. The nuclear fluid, which may be highly irritating to nerve tissue, is then ejected into the peridiscal tissue (Marshall et al 1977). The inflammatory properties of the nucleus pulposus have been demonstrated in hogs (Olmarker et al 1995), dogs (McCarron et al 1987) and rabbits (Cavanaugh et al 1997). Macrophages predominate in an area of tissue injury within a few days and secrete the by-products of phagocytosis, including hydrogen peroxide, lactic acid and PLA_2. PLA_2 is an important lipolytic enzyme in the arachidonic acid cascade. This process intensifies and prolongs the inflammatory responses. Proinflammatory substances such as interleukin-1 and other cytokines may also activate PLA_2 and other proteolytic enzymes that are found in disc tissue. Phospholipase A_2 is present in high concentrations in herniated and painful discs (Ozaktay et al 1998).

> *It is concluded that immediate neural response is a direct effect of PLA_2, based on its chemical composition. . . . In a long term PLA_2 study 3 days after the application [of PLA_2] breakdown of myelin sheaths, unclear axonal margins and vacuolar degeneration were observed . . . The PLA_2 found in the herniated human disc may be neurotoxic around the immediate exposed tissues . . . The evidence for neurotoxicity included loss of spontaneous nerve discharge after PLA_2 application and absence of response to mechanical stimulation in previously responsive units.'(Ozaktay et al 1995)*
> *Central processing of pain may arise from the neurotoxicity or recruitment of silent units. Long-term consequences of this neurotoxicity could include neurodegeneration, neural regeneration, neuroma formation and ectopic nerve impulses all of which can be sources of pain (Bennett 1994, Chen et al 1997). Peripheral nerve lesions can produce spinal cord changes that may contribute to deafferentation pain. These changes include sprouting of myelinated fibers into lamina 2 of the spinal cord and increased discharge of dorsal horn neurons. (Marshall et al 1977, Ozaktay et al 1998)*

Fibromyalgia and pain processing

Robert Bennett (1999) has described the central sensitization of pain perception in fibromyalgia patients in wonderful detail. Proinflammatory cytokines (interleukin-1, interleukin-6 and tumour necrosis factor) sensitize second order dorsal horn neurons (lamina V slow C multimodal pain neurons) through an NMDA–substance P–nitric oxide cascade. Mountz et al (1995) used SPECT scanning to demonstrate reduced blood flow to the thalamus and caudate nucleus where pain stimuli are processed in fibromyalgia patients as compared to normal controls. In acute pain, blood flow is increased in these areas. Bennett also points out that lesions of the lateral thalamus often result in a pain syndrome characterized by affective distress, and aching, burning and tingling pain that is exacerbated by normally innocuous stimuli such as light touch. This phenomenon is known as allodynia.

Chronic pain and cervical trauma

All of these pieces come together in the spinal cords of patients who have had cervical trauma. We hypothesize that the exposure of the nucleus pulposus material to the spinal fluid, via the cracks in the annulus created by cervical trauma, causes an inflammatory response in the spinal fluid. This inflammatory response may be mediated by PLA_2 and its associated cytokines.

Nerve destruction such as that shown in dogs, pigs and rabbits would be created by these neurotoxic inflammatory chemicals in the spinal cord in response to exposure to the nucleus pulposus. Phospholipase A_2 has been shown to be so neurotoxic that it is capable of damaging the pathways in the anterolateral system. This inflammatory response is dose related (Ozaktay et al 1995, 1998). We hypothesize that this nerve destruction creates a chemical lesion in the paleospinothalamic tracts. These tracts carry pain information up the spine to the thalamus, caudate nucleus and the cortex, and ascend the cord in the anterolateral portion of the lateral column. The paleospinothalamic tract is the outermost of the two tracts and carries diffuse deep chronic pain sensation (Bennett 1994, Netter 1991).

The anatomical proximity of the cracks in the discs and endplates could expose this system to high levels of these inflammatory chemicals. This tract is immediately adjacent to the site of the disc herniations demonstrated by Taylor & Twomey in their study of cervical trauma cases (Kandel & Schwartz 1985, Taylor & Twomey 1993).

Continued

Box 9.1—Cont'd

The inflammatory damage to the anterolateral columns could operate in one of two ways. If the damage was minor and simply reduced the firing threshold of the axons, pain traffic up the cord would be facilitated and enhanced, creating the profuse allodynia seen in fibromyalgia patients. If the inflammatory damage progressed to nerve destruction of the paleospinothalamic nerves, it would effectively create a chemical deafferentation. We have seen how inflammatory chemicals reduce the firing of the nerves and slow nerve conduction. The trauma-induced physical damage to the anterolateral pathways and the cord seen by Taylor & Twomey add another possible aetiology for the deafferentation phenomenon. Deafferentation, whether caused by chemical disruption or physical trauma, and damage in the ascending pain pathways would produce what is essentially a thalamic pain pattern. The author finds this mechanism the more likely of the two proposed.

In their chapter on pain Kandel & Swartz (1985) state that:

> *Central pain can arise not only from pathologic lesions in the thalamus but also from neurosurgical lesions placed anywhere along the nociceptive pathway from the spinal cord and brain stem to the thalamus and cortex. . . . The sensations are unpleasant and abnormal, often unlike anything the patients had ever felt before: spontaneous aching and shooting pain, numbness, cold, heaviness, burning and other unsettling sensations that even the most articulate patients find difficult to describe. Central pain is particularly distressing emotionally.*

Fibromyalgia and central pain

Fibromyalgia patients with a cervical trauma aetiology have been describing this type of pain to the author for more than 10 years. The description of the pain sensations associated with central or thalamic pain is precisely, word for word, what has been described in patient histories in more than 40 of our patients. Deafferentation in the anterolateral pathways is capable of creating the tract lesions that produce the thalamic pain symptoms we see in fibromyalgia patients. Patients with fibromyalgia not caused by cervical trauma do not have the same quality of pain that cervical trauma patients describe. Their pain is diffuse and achy but it lacks the disturbing affective neuropathic intensity seen in the cervical trauma mediated fibromyalgia patients. This affective intensity is characteristic of thalamic or central pain. The similarities between centrally mediated pain and the pain described by this group of fibromyalgia patients, and the differences between treatments effective in this group of fibromyalgia patients and other types of fibromyalgia patients, led to the development of this hypothesis.

The clinical picture suggests that the chronic central nerve pain facilitates the sympathetic nervous system, causing a chronic fight or flight response, especially when the disc is damaged at the C5–6 level causing stimulation/facilitation of the C5 sympathetic ganglion. The sympathetic response is characteristic. The body's repair systems are put on hold, circulation to the digestive system is reduced, myofascial circulation is altered, immune system function is compromised, the adrenals produce elevated levels of endogenous cortisol and are constantly taxed to keep up, and the system gradually experiences more and more dysfunction. When the gut is compromised in this fashion for a year or more it is more prone to dysfunction, including 'leaky gut' and the resultant food and systemic allergy reactions. Elevated endogenous cortisol levels cause thinning of the gut wall and may impair transport of the branched chain amino acids. The branched chain amino acids are necessary precursors of neurotransmitters, including serotonin, epinephrine, norepinephrine, oxytocin and dopamine, and are essential cofactors in phase one and phase two liver detoxification pathway function. Branched chain amino acid levels are reduced in fibromyalgia patients (Juhl 1998).

Adrenal fatigue follows inevitably after years of sympathetic upregulation and increased adrenal demand. By the time the patient has been in this condition for 1–2 years, the symptoms have generalized into the classic neuroendocrine chaos we call 'fibromyalgia'.

This would all be interesting as an academic exercise but it becomes compelling when one is able to treat and reverse these effects.

The neurological examination findings for patients whose fibromyalgia is associated with spinal trauma are different from fibromyalgia patients with a non-traumatic onset. Every trauma-onset patient had slight to moderate hyper-reflexia of the patellar reflexes, many had crossed adductor response and some also had hyperactive triceps, biceps or abdominal reflexes. Normal patellar

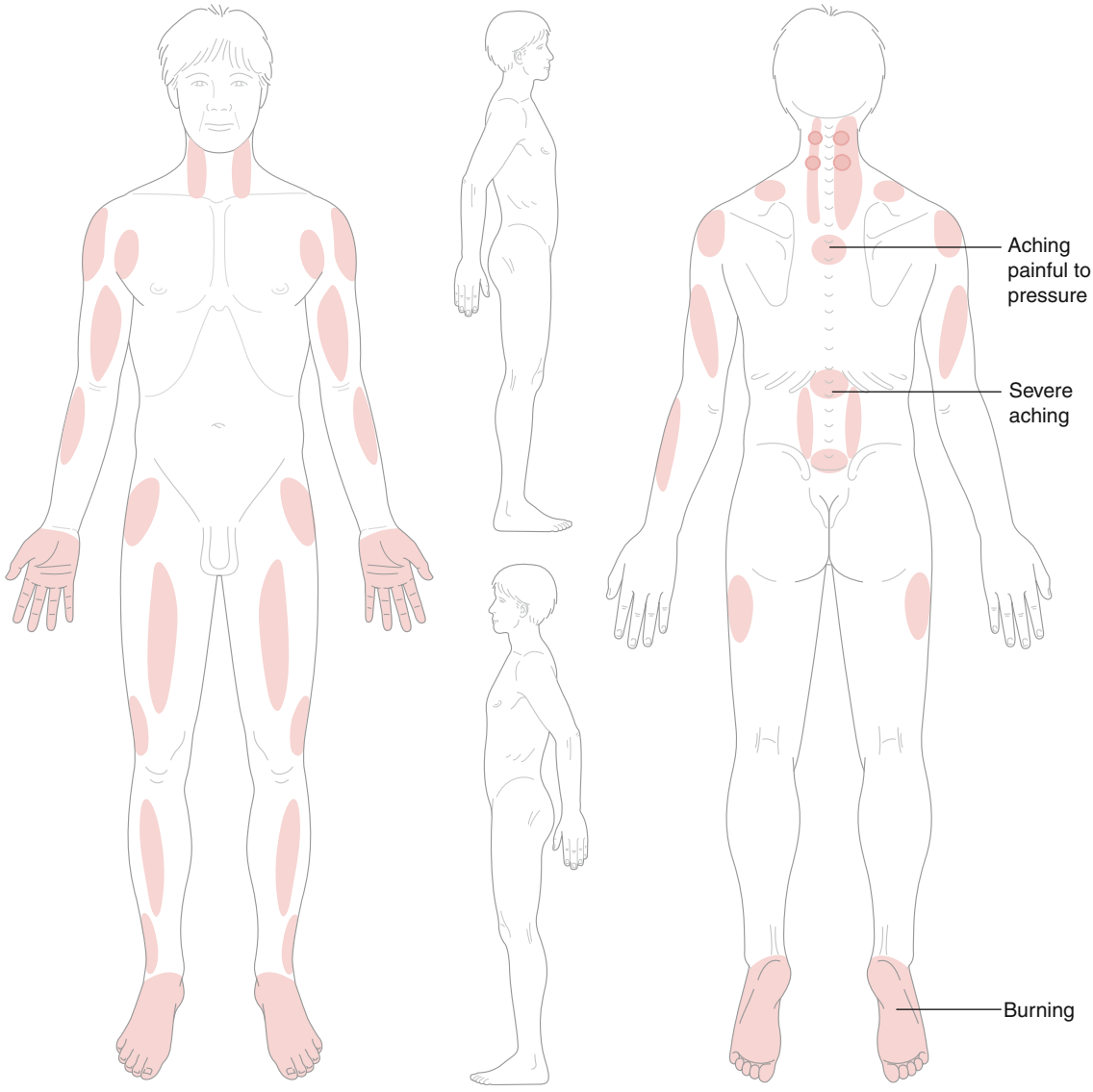

Figure 9.5 • Pain diagram typical of cervical trauma-induced fibromyalgia. As a group these are the only fibromyalgia patients to describe burning or aching pain in the hands and feet.

reflexes depend on descending inhibitory impulses coming down the spinal cord from the brain to dampen the reflex response at the L3 reflex arc. If the spinal cord is inflamed above the level of L3, the inflammation slows conductivity in the cord, slows the descending inhibitory impulses and allows the patellar reflex to become hyperactive. Crossed adductor response indicates an additional degree of cord inflammation that activates spinal interneurons and initiates contraction of the contralateral adductors. Hyper-reflexia at any tested deep tendon reflex segment indicates spinal cord inflammation above the tested segment. Patellar hyper-reflexia is the one predictive, consistent, objective diagnostic finding indicating that the fibromyalgia is due to spinal trauma.

The sensory examination with Wartenberg's pinwheel consistently showed dermatomal hyperaesthesia, usually at the dermatomes adjacent to the traumatized disc. If the cervical spine was traumatized, the C3, C4, C5 and C6 dermatomes were most commonly affected (Fig. 9.6). In the case of patients with thoracic spine

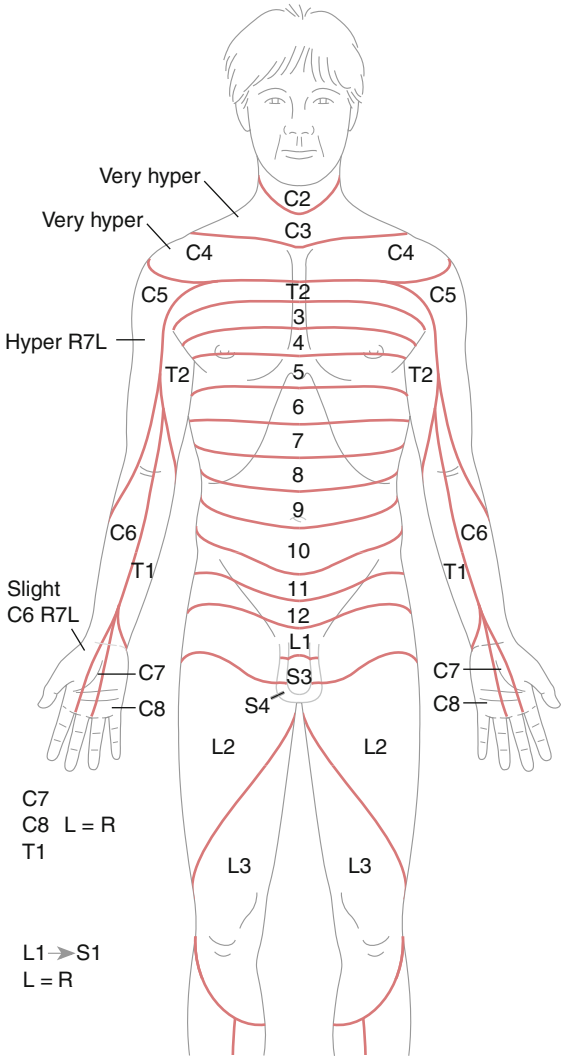

Figure 9.6 • Sensory diagram typical of cervical trauma-induced fibromyalgia. These patients have specific dermatomal hyperaesthesia in addition to the allodynia common to all fibromyalgia patients.

trauma the thoracic dermatomes adjacent to the injured disc could be hyperaesthetic or numb. Normal pinwheel sensation is described as simply sharp or prickly; hyperaesthesia is perceived as unpleasant, sharper and bothersome, and indicates nerve inflammation and sensitization. Numbness is described when the patient can feel the pressure but not the sharpness of the pinwheel and represents loss of neural sensory function. The dermatomal hyperaesthesia was distinct from and in addition to the allodynia characteristic of fibromyalgia regardless of aetiology. The neurological examination suggests a degree of spinal cord and nerve root irritability not seen in other types of fibromyalgia.

Based on the physical examination findings, fibromyalgia from spine trauma is clearly neuropathic pain, somehow associated with spinal cord irritability and inflammation.

In February 1999 a way of treating patients with this symptom profile was developed in the clinic. Through a process of trial and error the frequency combination of 40 Hz on channel A and 10 Hz on channel B to 'reduce inflammation' in the 'spinal cord' was found to relieve severe muscle tightness and intense local neck pain within minutes for a patient who had a known cervical disc bulge. Several days later a patient came in whose neck felt similarly tight but whose pain extended to the full body. It seemed reasonable to apply the same frequency combination to the full body from neck to feet and to polarize the current positive to match the normal body polarity described by Robert Becker in *The Body Electric* (Becker & Seldon 1985). The patient reported immediate pain reduction which continued until the pain was completely gone and immediate softening in the cervical muscles. The new technique eliminated pain in this patient after months of treatment for myofascial pain had failed. By the end of 1999, 25 of these patients had been treated, by April of 2001 an additional 29 had been treated and between April 2001 and January 2008 an additional 103 were seen – a total of 157 patients. Average chronicity in this group was 10 years with a range of 1–50 years.

These patients were unresponsive to previous medical treatments, to physical therapy, to functional medicine and natural medicine approaches, and to microcurrent treatment of myofascial tissue. Indeed, in some cases the pain was worsened by microcurrent myofascial treatment. The pain is not easily managed even with narcotic medication. One patient had been treated for over a year in our clinic and had had cervical disc surgery, lumbar disc surgery and a shoulder repair following a motor vehicle accident. Her case is one that illustrates and supports the deafferentation hypothesis. Repairing the cervical disc did not change her full body pain. She moved away from Portland in 1998 and returned for one treatment in October 1999 after this treatment protocol had been developed. She left the treatment room pain-free for the first time in 2 years. She had some arthritis pain but the debilitating neuropathic pain was gone following this specific treatment protocol.

This patient was treated several times and the pain improvement persisted and became permanent. It is reasonable to hypothesize that the damage to the anterolateral pathways created by the disc injury perpetuated her pain and persisted despite surgical repair of the disc. It is also reasonable to hypothesize that the microcurrent and the frequencies somehow changed the conductivity and function of the injured areas of the cord and in some way restored proper function.

A standard two-channel microcurrent instrument with three digit frequency settings and a two-place multiplier is used. Frequencies of 40 Hz on channel A, thought to reduce inflammation, and 10 Hz on channel B, thought to address the spinal cord, were found to reduce the pain if the current was polarized positive. Subsequent refinements in the treatment protocol include treating with the frequencies thought to address 'chronic inflammation' in the 'cord' and 'fibrosis' in the 'cord'. When the pain disappears at the end of 60–90 minutes, patients routinely look bewildered and report feeling as if the pain should still be present even though it was pleasant to have it gone. This phenomenon was presumed to be a manifestation of central sensitization and central pain amplification. Treatment with the frequency to 'reduce inflammation' in the 'midbrain' seems to resolve the dissonance between central pain amplification and zero pain. The tissues and conditions are in quotes because it is not certain that a particular tissue is being treated or a particular condition is being resolved until more basic research has been undertaken to document these effects. Clinically, the patient responds as if upregulation in the thalamus is being dampened.

The addition of these new frequencies improved outcomes in patients treated between 2002 and 2008. Based on current clinical experience, it seems that the polarized current must be applied with the positive leads at the upper cervical spine and negative leads at the feet. The cervical contact wraps around the neck to the exiting nerve roots. For convenience the graphite conducting glove is wrapped in a small warm wet towel that is wrapped around the neck to provide current distribution through the spinal cord. Any current distribution method that encircles the cord would presumably be as effective. The graphite glove with the negative leads is wrapped in a small wet hand towel that is wrapped around the feet to complete the circuit (Fig. 9.7).

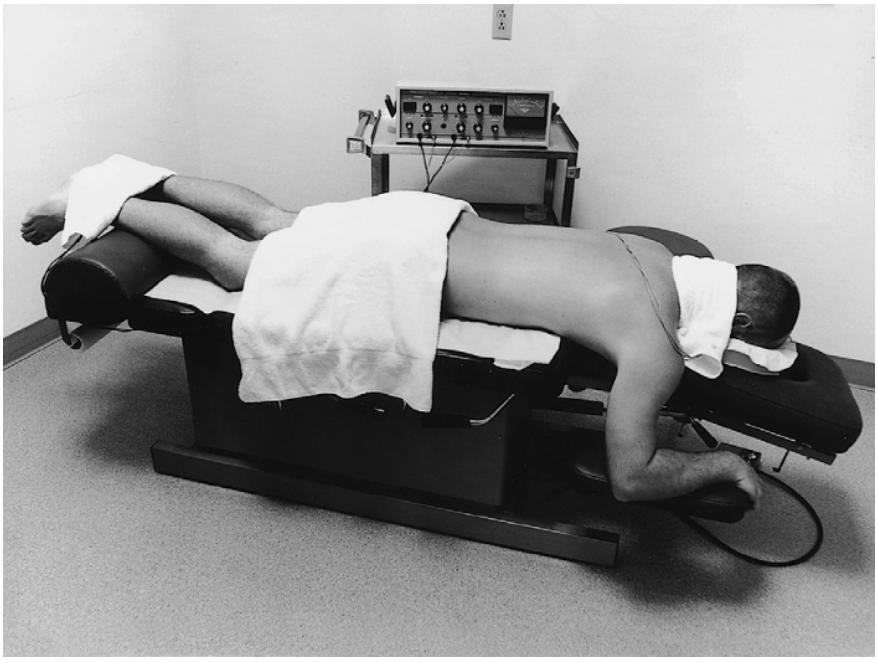

Figure 9.7 • The patient is usually treated prone but may be treated supine if that is more comfortable. The graphite glove from the channel polarized positive is wrapped in a warm wet towel wrapped around the neck. The graphite glove from the channel polarized negatively is wrapped in a warm wet towel wrapped around the feet.

The treatment starts to reduce the subjective pain within 10 minutes, beginning with the feet and moving cephalad until just the arm and hand pain remain. The arm and hand pain resolves more quickly if the patient places the hands on the skin of the trunk to ensure current flow in the arms. The time required to reduce the pain from incoming average of 7.3 (range 5–10/10) to the ending average of 1.3 (range 0–4/10) is about 90 minutes on the first treatment and about 60 minutes on subsequent treatments. In general, the time required to eliminate the pain becomes shorter at each subsequent treatment session.

All patients with 'simple' fibromyalgia associated with cervical or spinal trauma, regardless of chronicity, experience relief with these frequency combinations. No other frequency combinations were effective. As this frequency combination is not effective in any other type of pain, patient selection is important. Patients were chosen on the basis of their symptom description, pain diagram, physical examination findings and a history of spine trauma as the mechanism of onset of chronic pain. The cervical injuries were from motor vehicle accidents, falls, lifting injuries and following surgery, the last presumably due to hyperextension of the neck during intubation for anaesthesia. Thoracic spine injuries were due to martial arts trauma and falls. True central pain from stroke or head injury only responds to the frequency for 'reducing inflammation' in the 'midbrain', even though the pain diagram and physical examination may be similar. As such, the mechanism of injury becomes important in patient selection for treatment.

Clinical controls

These treatments have been carried out in an active clinical practice funded by patients and their insurance companies and blinded, placebo-controlled trials are not possible in this setting. However, efforts were made to ensure that the clinical effects were produced by the treatment and not some other factor. The patients were always positioned so they could not see the instrument. During the first few years after the treatment was developed, sham treatments with the machine turned off were performed in about one quarter of the cases, at first by accident and later as an intentional control during the first portion of the treatment to evaluate placebo effect. The sham treatment is easy to do because the current is subsensory. Sham treatment did not produce pain reduction or tissue softening in any patient. The patients were always blinded to the frequency used and to the current polarization. The treatments were done with the gloves wrapped around the neck and feet in a warm wet towel to remove any effect of the operator's field or personal contact with the patient. In most cases the clinician left the room during the treatment to minimize the effect of practitioner intention and attentiveness and placebo. The results demonstrated a consistent treatment effect in the spite of all measures taken to minimize the placebo effect.

Complete treatment protocol

Patients were treated in the clinic twice a week for 4–6 weeks with microcurrent. Massage and manipulation were used as needed. When treatment in the clinic was effective in reducing the patient's pain, the patient was sent home with a small pocket-sized microcurrent unit, formerly made by Rehabilicare (New Brighton, Minnesota) and available until 2003. This unit had the capacity to provide polarized current on two different channels and four different frequencies, including 40 Hz and 10 Hz on each channel. In 2003, Precision Distributing Inc. (Vancouver, Washington) developed and Bio-Therapeutics (Seattle, Washington) manufactured a small pocket-sized unit (Fig. 9.8) that delivers the particular frequency protocols useful in recovery from fibromyalgia, including those for the full body pain, dermatomal nerve pain, discogenic and facet pain, adrenal and digestive rehabilitation and improved sleep. When the patients use a home microcurrent unit they use either graphite gloves wrapped around the neck and feet as in the in-office treatment or they can use adhesive electrode pads applied to the hands and feet so that the positive lead from channel A is applied to one hand and the opposite foot, and channel B to the remaining hand and its opposite foot (Fig. 9.9). Most patients use the home unit once a day; many use it at night so they can sleep pain-free or as needed during the day. The programme to reduce the full body pain takes 76 minutes. The unit, called the 'HomeCare', was designed with the same parameters as the in-office unit and patients receive the same relief at home as they do in the office. Patients are instructed to wear the unit daily or as needed to keep their pain below a 3–4/10. The practitioner can assign

Figure 9.8 • This small unit makes the same sequences of frequencies used in the clinic available to patients for home use. The protocols provided in the unit include those for the full body pain of fibromyalgia, plus those for dermatomal nerve pain, myofascial pain, facet- and disc-generated pain, digestion and sleep, among others.

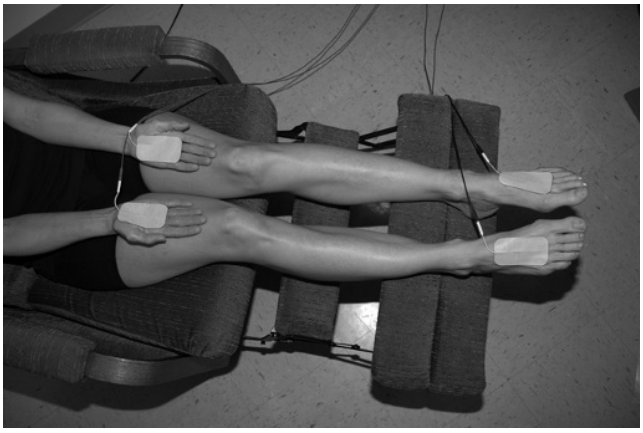

Figure 9.9 • The adhesive electrode pads may be placed on the hands and feet as an alternative to wrapping the contacts around the neck. The positive lead is placed on the hand and the negative lead from each channel is placed on the opposite foot. While slightly less effective, it is so much more convenient that it is often preferred for home use.

particular protocols to be used that are helpful for each individual patient's symptom constellation.

The wearing time for the home unit was usually reduced to once or twice a week in most patients after 2 months of use. Most patients continue occasional use of the home unit but a few patients have been able to discontinue its use altogether.

Reducing or eliminating the pain has proved to be surprisingly easy but returning the patient to full health is a more challenging multidisciplinary effort involving exercises to stabilize the spine, treatment of myofascial pain, microcurrent treatment or injections for cervical or lumbar facet-generated pain or persistent nerve root pain, medication withdrawal, nutritional and psychological support, and neuroendocrine and physical rehabilitation.

Patients are referred to their medical provider for medication management and withdrawal from

narcotics and antidepressants. When they are physically ready, they are referred to a physical therapy clinic that specializes in spinal stabilization and exercise rehabilitation and, if necessary, to a medical physiatrist certified in spinal injection procedures. Our clinic directed, monitored and coordinated care, and provided treatment for nerve pain, cord-mediated pain, myofascial pain and the recovery of various systems impacted by fibromyalgia such as digestion and adrenal function using microcurrent, non-prescription therapeutics and nutritional support. We also recommended the common-sense lifestyle changes (e.g. increasing water consumption, dietary modification, good sleep hygiene and gentle aerobic exercise) common to most effective fibromyalgia treatment protocols.

Fibromyalgia pain is only part of the diagnostic and symptom picture. The neuroendocrine dysfunction in fibromyalgia patients is almost as disabling as the pain and it may be associated with alterations in central hormone responses, primarily corticotropin-releasing hormone or corticotropin-releasing factor (CRH or CRF). Neeck & Riedel (1999) proposed – and it seems a reasonable hypothesis – that the pain itself serves as a chronic stressor, elevating CRH in the hypothalamus. CRH in turn modifies levels of luteinizing hormone-releasing hormone (LHRH), thyroid-stimulating hormone (TSH) and growth hormone-releasing hormone (GHRH) centrally, contributing to disruptions in gonadal hormones, particularly progesterone, thyroid hormone and thyroid receptor sensitivity and growth hormone levels. Chronic moderate neuropathic pain would be sufficient to cause the elevations in CRH found in fibromyalgia and the alterations in central pain processing common to fibromyalgia patients (Bennett 1999). By the time the patient has been in pain for 1–2 years, the symptoms seem to generalize into the classic neuroendocrine abnormalities seen in fibromyalgia caused by any aetiology (Crawford 1998, Neeck & Riedel 1999). Understanding the neuroendocrine changes was important when sorting out the fibromyalgia diagnosis but became most important in helping the patient to understand their condition and to recover from it.

The key problematic central neuroendocrine hormone in fibromyalgia is CRH or CRF. The stress response has its own evolutionary survival logic. When the body comes under attack, it does not respond differently if the level 8/10 pain is caused by a tiger dragging you into the woods or by a disc bulge causing full body neuropathic pain. Certain stress responses go into effect, mediated primarily by CRH/CRF and cortisol to keep the body alive until the attack is over. CRH stimulates the adrenals to increase cortisol levels and it acts centrally to modulate central regulatory hormones. All repair systems and long-term physiological processes are put 'on hold' until the threat either kills you or resolves. This creates problems when the stress persists in the form of moderate to severe pain lasting for years.

CRH suppresses thyroid-stimulating hormone (TSH) centrally. Primitive survival logic dictates that the stress hormones are stimulating enough and additional thyroid hormone would be hyperstimulatory. Elevated cortisol from the adrenal glands suppresses the peripheral conversion of the T_4 storage form of thyroid hormone into the T_3 active form of the hormone. Many fibromyalgia patients present as if they are clinically hypothyroid, complaining of weight gain, constipation, dry skin, hair loss, fatigue and feeling cold. The patient becomes functionally hypothyroid but TSH is almost always found to be in the normal range when tested. TSH cannot rise in response to the peripheral insufficiency because it is suppressed centrally by CRH.

CRH suppresses follicle-stimulating hormone (FSH) and luteinizing hormone (LH) centrally. The long-term processes of ovulation, sperm production, copulation and pregnancy are put on hold until the threat is gone. In women, FSH and LH promote maturation of the corpus luteum and its increased production of progesterone to balance the oestrogen produced by the ovaries during the post-ovulatory stage of the menstrual cycle. If production of progesterone by the corpus luteum is insufficient to balance oestrogen, the patient experiences the symptoms of premenstrual syndrome (PMS) caused by oestrogen dominance. The patient complains of fatigue, irritability, water retention, sleep problems and emotional lability. These complaints are common to fibromyalgia patients.

CRH suppresses growth hormone-releasing factor (GHRH) centrally, interfering with growth hormone secretion. In an adult, growth hormone facilitates amino acid transport across the cell membrane to enhance tissue repair. Growth hormone in an adult is released during stage 4 sleep and in a burst about 1 hour after vigorous exercise. Fibromyalgia patients do not experience stage 4 sleep and they do not have the normal burst following exercise due to CRH suppression. Without adequate levels of growth hormone, the normal exercises

and activities of life and the minor tissue damage that follows are not easily repaired. This explains why fibromyalgia patients experience days or weeks of muscle pain after simple exercise or exertion.

CRH acts as a neurotransmitter and modifies cognitive processing to interfere with short-term memory and modulate long-term memory. In acute stress the only short-term information processing required is the answer to: 'How do I get away from this tiger?' which leads the brain to focus on: 'How did I get away from the tiger the last time?' Fibromyalgia patients complain of problems with short-term memory, processing details and sequencing of activities and information.

Cortisol, chronic stress and sympathetic upregulation interfere with digestion. Digestive enzymes and stomach acid secretions are suppressed. Digesting meals is one of the short-term projects put on hold until the threat passes. Food can be digested tomorrow, if there is a tomorrow, but digestion is not as important as escape when the threat is present. If stomach acid secretions are suppressed, the stomach does not empty efficiently, leading to reflux of the semi-digested food. When it does empty, the contents may not be quite as acid as required for optimal digestion and absorption of minerals and protein. If the digestive enzymes of the pancreas are insufficient, food may not be adequately digested or absorbed. Large undigested food particles may putrefy in the gut, creating the allergic responses and inflammation characteristic of irritable bowel syndrome commonly seen in fibromyalgia patients. Elevated cortisol levels cause thinning of the gut wall and can contribute to the loss of gut membrane integrity, sometimes called 'leaky gut'. Large food molecules could leak across the membrane and encounter the immune system, contributing to the food sensitivities commonly seen in fibromyalgia patients (Sapolsky 1994).

Once the pain has been eliminated or markedly reduced, the neuroendocrine system seems to right itself and the neurohormonal and digestive disturbances common to fibromyalgia begin to improve within several weeks and usually resolve within 4 months. Other than providing adrenal support with microcurrent, nutritional supplements and herbs, and removing the pain as a perpetuating factor, no direct treatment for neuroendocrine disruption was provided.

Nutritional support included a low dose mixed antioxidant combination product (see Box 9.2) that provided not only antioxidants but also the nutritional substrates necessary for liver detoxification pathway function in every patient. Aside from this constant, the treatment protocols were customized for each patient's particular symptom constellation. Irritable bowel syndrome was treated with avoidance of potentially allergenic foods such as wheat and milk, nutritional supplements such as L-glutamine, herbs in combinations thought to be useful for intestinal repair and support, and products that provided adequate doses of appropriate gut bacteria and nutrients to support their proliferation. Many of these patients were adrenal depleted and adrenal support products containing nutrients such as pantothenic acid, B_6 and vitamin C and various herbs supplied in proprietary blends helped with energy and adrenal recovery.

There are microcurrent frequencies thought to address various organs and tissues in the body. Microcurrent was used with these frequencies to supply electrons at physiological amperage. It is presumed that this increases ATP production in these organs and supplies whatever support the frequencies might have for the tissues treated. Although research data are not available regarding specific effects when treating the adrenals, liver or intestines, the clinical response has been consistently positive: patients appear to recover more quickly with the use of microcurrent than without it. Improvements in intestinal palpatory pain, skin tone, affect and energy level are commonly observed, often by the end of a 30-minute treatment. Residual benefits vary and microcurrent is seldom sufficient to produce lasting improvement

Box 9.2

Ingredients in a combination low dose mixed antioxidant nutritional supplement

Vitamin A (as mixed carotenoids)	7500 IU
Vitamin C (ascorbic acid)	300 mg
Vitamin E (d-alpha tocopherol acetate and mixed tocopherols)	90 IU
Zinc (zinc gluconate)	15 mg
Selenium	75 mcg
Coenzyme Q10	3 mg
Potassium sorbate	15 mg
Glutathione	30 mg
L-Methionine	105 mg
Taurine	105 mg
N-acetyl-cysteine	105 mg
Superoxide dismutase	90 mcg
Catalase	90 mcg

without the use of nutritional support and lifestyle changes. However, in many cases, nutritional support and lifestyle changes, without the use of microcurrent, have failed to produce improvement or have resulted in only modest degrees of improvement. The combination of nutritional support and microcurrent appears to produce noticeable improvement in function, usually within 2–4 weeks. Such a rapid rate of improvement helps to create a positive expectation in the patient and contributes to both compliance and recovery.

Eliminating the deep bothersome nerve pain is the major feature of the treatment and recovery process. One patient, who developed fibromyalgia 7 years previously, following surgery for Crohn's disease, had been treated for 18 months by a medical internist skilled in functional medicine nutritional treatment. She told him that she felt better but her pain was unchanged. He referred her for treatment and her pain was eliminated at the first visit. She was treated twice in our clinic, used the home unit for 1 month and saw a physical therapist for cervical stabilization exercises. She was pain free and fully recovered in 6 weeks and remains so 1 year later. It seems highly probable that neither approach would have worked by itself as quickly as the combination of both treatments.

Side-effects and adverse reactions

The treatment is generally well tolerated. Some patients used the current, in the fashion described above, daily for 12 months, with no ill effects. Skin irritation from the continuous use of microcurrent adhesive electrode pads was the major side-effect in the early patients. Some early patients got small skin sores from the constant flow of polarized current at the negative electrode on the sacrum from the gel conductive pad. The sores have not been a problem when the pads are placed on the hands and feet instead of on the neck and sacrum. There have no reports of skin irritation when using graphite gloves to provide current distribution. One patient had headaches following treatment and treatment was abandoned.

Some patients did not tolerate treatment. In the early stages of the development of this treatment protocol, approximately 10% of patients (5 out of the first 54) had an increase in midscapular pain, followed by a headache, within 3 minutes of the application of microcurrent polarized from neck to feet. Treatment was terminated and the pain returned to pre-treatment levels within 24 hours. When this side-effect was analysed it became clear that all of the patients who did not tolerate treatment had some degree of cord compression or frank stenosis, and had very hyperactive reflexes. The increase in midscapular pain follows the discogenic pain pattern described by Cloward (1959). It is hypothesized that the polarized current increases spinal fluid flow – which in turn creates increased pressure on the disc annulus causing the midscapular discogenic referral– and the restricted flow of spinal fluid eventually causes a headache. Improvement in the treatment technique has reduced this reaction to less than 5% of new patients, but these patients remain very challenging. Some patients eventually required surgery for the stenosis. Changing the current from polarized to alternating and moving the contacts slightly below the neck onto the upper thoracic spine was found to alleviate this side-effect and allow successful treatment.

Some patients become anxious or develop a shivering response approximately 30–40 minutes into the treatment session. This reaction may be caused by the rapid and dramatic increases in the measured neurochemicals shown in the section below. The dramatic elevations in cortisol or endorphins are most likely to be involved. Trial and error proved that this side-effect can be terminated in 30–60 seconds by switching to the frequency thought to 'reduce inflammation' in the 'sympathetic nervous system'. This side-effect is most likely to occur in the first four treatments and has never been reported by a patient using home treatment.

Of the first 54 patients treated, 31 recovered from fibromyalgia after approximately 4 months of treatment. Two patients relapsed when they discontinued use of the home unit. The patients were considered to have recovered when their pain level was consistently below 3/10 or they had less than 11/18 tender points, tender to less than 4 lb/in^2, or when they discontinued care and self-reported that they had recovered. This recovery percentage has been maintained in the subsequent patients treated with this programme.

Treatment failures

The treatment, while 100% successful in eliminating pain, is by no means 100% successful in producing recovery from fibromyalgia. The greatest

challenge for recovery seems to be the psychological leap from the position of chronic pain to pain free at the end of one 90-minute treatment. Of the first 49 patients treated, 18 discontinued treatment in spite of their ability to become pain free. The patients who discontinued treatment experienced a decrease in pain from an average of 7.5 to 1.3 by the end of the first treatment, which was not significantly different from the group that recovered, with an almost identical drop in pain in the two groups.

The vast majority of patients who discontinued treatment did so very early, claiming financial hardship or the inability to find the time to be treated. As a group they usually dropped out within the first 3–6 weeks, most after one to three treatments, precluding any significant chance of full recovery. The psychological considerations involved in their decisions to withdraw from treatment cannot be underestimated. Many patients come to identify themselves with their pain and with their diagnosis. The early patients treated with these protocols were offered very little help with finding the answer to the question: 'Who am I if I am not in pain?' Patients treated more recently have this issue addressed in the first or second treatment session and it seems to help them persist into recovery. People who have been molested or abused as children seem to have more resistance to recovery, perhaps because of the upregulated central stress response known to be present in such patients (Sapolsky 1994).

Those patients on high doses of narcotics, especially the long-lasting narcotics administered by an adhesive patch, have difficulty reaching resolution of their fibromyalgia. Physical and psychological addiction is the obvious but not the only challenge with these patients. When opiate narcotics block pain they do it by blocking pain receptors in the brain and nervous system. The pain receptors respond by proliferating in number and increasing in sensitivity which leads to the requirement for ever increasing doses in addicted patients. Patients on narcotics still present for treatment with pain levels approaching 7/10 but the medication makes them not 'mind' the pain. When the microcurrent treatment reduces the pain from 7/10 to 0–1/10 the patient is immediately overmedicated but the process of medication withdrawal is much more prolonged. The home microcurrent treatment will always reduce the pain but it has no effect on withdrawal symptoms of nausea, malaise, chills and depression. If the motivated patient independently stops narcotic medication without medical supervision, they face 3 days or more of these symptoms. Although supervised gradual withdrawal is safer and has fewer side-effects, there are predictable bouts of increased pain as the still-proliferated receptors are liberated from their opiate blockade, and while the microcurrent treatment reduces the pain, it does little to ease the pain of psychological withdrawal. It is during this process that the physician and patient discover the subtle power of legal medical addiction.

Recovery has been accomplished often enough in this group to know that it can be done successfully. One patient who was injured in the line of duty as a police officer 3 years prior to presenting for treatment was on high levels of narcotic medication, several antidepressants and medication for sleep and digestion. His initial pain level was 6–7/10 and his pain pattern and physical examination were typical of the spinal trauma fibromyalgia patient. He was pain free at the end of the first treatment. He returned 5 days later with his pain at a 2/10 VAS and left once again pain free. When he called to cancel his third appointment, there was concern expressed by the staff that he may be having trouble with medication withdrawal. He called after a month had passed to reschedule and returned to the clinic for a follow-up visit. His pain level was 1/10 and he reported that he had spent the month withdrawing himself from all of his medication. He said he did not need treatment but just came in to express his thanks. His is the exception that holds out hope for each practitioner and patient who face this challenging clinical situation.

Antidepressant medications are widely used in chronic pain patients, primarily because serotonin modulates central pain perception and also because elevated pain and the stress response interferes with the production and utilization of serotonin in the brain, leading to depression. The antidepressant medications are helpful and also subtly addicting. The patients fear return to the dark days of their early pain and cling to their medication as a defence against relapse. However, once the pain and stress are reduced by treatment, the medication can produce side-effects such as anxiety and digestive difficulties because it is no longer needed or the dose is now excessive. And although patients on high doses of one antidepressant or moderate doses of several antidepressant medications combined do not feel very depressed, they don't feel much of anything, including joy. The medication blunts affect and

makes the patient feel somewhat removed from life. Not all patients find the return to emotion and life's unfiltered experiences easy and withdrawal from antidepressant medication can be challenging. Patients with a history of depression prior to the onset of their pain should of course work with their mental health provider to determine the best product and dosage for optimal comfort. Patients whose 'depression' started with their pain should be encouraged to work with their provider to determine if it is possible to withdraw from these medications once the pain and other fibromyalgia symptoms have been eliminated.

Reversing the widely held belief that fibromyalgia is incurable and that the individual must learn to 'live with the pain' has proven to be the final challenging aspect of treatment. The most delicate period of adjustment occurs during the first 4 weeks when the patients must reverse their self-image as a dependent chronic pain patient, and move ahead into the unknown territory of recovery. Those with determination, a strong ego sense and good personal support systems seem to be the most successful in making this transition.

Case report

Recovery has been achieved in enough cases to provide hope and therapeutic direction for this difficult condition. The typical patient with an optimal response was a 49-year-old woman, referred to our clinic by her pain management group, who had had fibromyalgia for 18 years following a motor vehicle accident. Her presenting symptoms included burning, aching, stabbing and shooting pains in the neck and midscapular area, arms, back, legs and gluteals, hands and feet, rated as 7–8/10 while on narcotics and varying between a 4/10 and 8/10. She also had asthma, allergies, acne, irritable bowel syndrome and required medication for sleep. She had a great attitude, good self-esteem, a strong healthy support system at home and insurance coverage for the treatment programme.

The patient had 20 treatment sessions between 8 December 1999 and 15 March 2000. She had the typical treatment including the in-office microcurrent protocol described above, daily use of the home unit, massage at each visit, microcurrent trigger point therapy (described later in this chapter), manipulation as needed, an epidural at C5 and facet injections in the lumbar and cervical spine, physical therapy exercises to stabilize the neck and low back, and exercise such as swimming for general reconditioning. She took nutritional supplements, including mixed low dose antioxidants, magnesium and malic acid, oil-based vitamin A to help with her acne and night vision, and a herbal, fibre-rich, probiotic supplement for the irritable bowel. Once she was off antidepressants, she took 5-hydroxytryptophan (5-HTP), a serotonin precursor, at 100 mg twice a day for 4 weeks to increase serotonin levels and help her sleep.

On the first day of treatment the patient had 14/18 tender points, tender to pressure of less than 4 lb/in^2. On 12 January 2000 she had 11/18 tender points, and on 8 February 2000 she had 7/18 tender points. By 12 May 2000 she had 4/18 tender points. She was off narcotics and muscle relaxants but still took some mild pain medication occasionally. She was sleeping well with no sleep medication or 5-HTP. Cervical range of motion increased by 40%, and lumbar range of motion was full and pain free. The irritable bowel syndrome and acne had resolved and the asthma was not active. She recovered fully in 5 months, was followed for an additional 2 months before she moved out of the area and at a 1-year follow-up she was still doing well. Recent follow-up revealed that she remained recovered for 6 years and relapsed only when she was intubated during a 2007 hospitalization for ulcerative colitis caused by antibiotic use. She described her conviction that since she had recovered once she would recover again using the same principles.

Documenting objective changes

As more patients were treated and the rapid pain reductions and apparently successful outcomes were observed, a method by which to measure objective changes in serum chemistry, occurring during treatment, became available. It was hoped that this might explain the rapid reductions in subjective pain. Terry Phillips, PhD, an immunochemist in Bethesda, Maryland, offered to do sample analysis on finger stick blood samples to identify and quantify changes of the inflammatory cytokines interleukin-1, -6 and -8, tumour necrosis factor alpha and cortisol, and the neuropeptides substance P, neuropeptide Y, beta endorphins and serotonin. Over the next year samples were taken on six patients. The following patient and her serum data are representative of that group.

The patient was a 29-year-old woman who had a lifting injury at work in 1992, 6 years prior to treatment in our clinic for myofascial pain in the neck, arms and hands in 1998. The myofascial pain was eventually found to be secondary to disc injuries at C5–6 and C6–7 and she had a cervical discectomy and fusion at these levels in 1999. Following the surgery the pain generalized to the lower extremity. By the time she was seen in our clinic for treatment of fibromyalgia on 11 March 2000 she rated her pain as 7/10, varying between a 4 and an 8/10, and described aching and burning in the neck, arms, shoulders, hands and feet, with burning pain up the legs into the gluteals. She had 14 of 18 tender points, tender to less than 4 lb/in^2 pressure and required medication to sleep. She was taking prescribed anti-inflammatory and antidepressant medication. She was treated with the protocols described above and her pain was reduced to 0/10 in the first 90-minute treatment. The response was similar in the two subsequent treatments. Her pain was reduced from an average of 7/10 to 0/10 at the first visit. The pain remained reduced for up to 24 hours following treatment.

The residual pain relief from a single treatment varied from patient to patient, lasting from 4 hours up to 4 days, with some improvements lasting as long as 2 weeks.

Finger stick blood samples were taken before, during and at the end of each treatment, air dried overnight and sent to Dr Phillips at his Bethesda laboratory. The first sample was taken before treatment and the subsequent samples were taken as the pain dropped, or frequencies were changed. On each treatment date 90 minutes elapsed between the first and final sample. The changes in serum chemistry at the three treatments are noted in Table 9.1. The changes for the cytokines, substance P, endorphins and cortisol are linear and correlate directly with pain score reduction.

The dramatic elevations in cortisol deserve some explanation. Cortisol is released by the adrenals in response to stimulation by ACTH from the brain. When endorphins are produced pro-

Table 9.1 Serum sample data from a cervical trauma patient

Sample	Date	IL-1	IL-6	IL-8	TNFα	IFNγ	SP	VIP	β-End	Cortisol	Serotonin
M1	5/11/00	392.8	204.3	59.9	299.1	97.2	132.6	8.5	5.2	15.5	285.6
M2	5/11/00	288.5	200.8	47.6	265.7	99.8	127.5	10.2	7.1	12.6	309.2
M3	5/11/00	103.2	121.7	21.3	96.5	73.7	82.4	32.9	21.4	33.7	202.1
M4	5/11/00	52.6	33.9	11.4	43.4	32.6	38.2	48.4	69.1	78.3	169.5
M5	5/11/00	21.4	15.6	4.8	20.6	11.4	10.5	69.9	88.3	169.9	289.6
M1	5/14/00	218.7	165.9	45.7	205.6	75.9	99.6	4.9	9.4	12.9	250.0
M2	5/14/00	113.2	87.3	21.6	151.8	44.7	102.5	26.3	36.7	61.8	203.7
M3	5/14/00	45.6	40.7	5.8	33.3	26.5	41.7	39.1	89.5	149.3	366.2
M1	5/17/00	145.9	100.5	42.6	114.2	80.6	144.6	12.5	11.6	11.8	322.4
M2	5/17/00	61.5	47.2	10.4	71.9	39.3	55.7	28.4	88.6	78.9	259.3
M3	5/17/00	10.6	11.6	5.1	22.1	5.9	9.4	71.8	115.9	182.6	410.6
Normal range		0–25 pg/ml	0–25 pg/ml	0–25 pg/ml	0–25 pg/ml	0–25 pg/ml	0–30 pg/ml	0–20 pg/ml	0–35 pg/ml	5–25 μg/ml	100–300 ng/ml

IL-1, interleukin-1; IL-6, interleukin-6; IL-8, interleukin-8; TNFα, tumour necrosis factor alpha; INFγ, interferon gamma; SP, substance P; VIP, vasoactive intestinal peptide; β-End, beta endorphin.

Table 9.2 Myofascial pain patient

Sample	Date (2000)	IL-1	IL-6	IL-8	TNFα	IFNγ	SP	VIP	β-Endorphin	Cortisol	Serotonin
J 1	27 June	61.8	55.7	32.6	75.8	27.3	44.9	18.5	11.6	39.9	42.6
J 2	27 June	66.4	51.7	40.3	71.8	30.3	41.6	16.4	19.5	44.7	31.8

opiomelanocortin is cleaved into ACTH and β-lipotropin, and β-lipotropin is cleaved into γ-lipotropin and β-endorphin. Neuropeptide Y decreases during treatment and generally follows the stress response, which suggests that the elevations in cortisol are not stress related but are rather related to the rapid increases in β-endorphin.

The serotonin response is intriguing and follows a different pattern from that of the other variables. Serotonin dropped while the pain was coming down and continued to drop until the pain reached 0/10. When the pain became 0/10, treatment was changed to two frequencies thought to reduce 'nervous tension' and 'emotional tension'. When these frequencies were used the patients reported feeling very relaxed and experienced an almost hypnotic euphoric state. This was a very different effect from the profound relaxation engendered during the pain relief phase that is presumably produced by the increases in endorphins and cortisol. In every case where measurements are available, serotonin reversed its downward trend and rose, in this case by 71%, when these frequencies were used. In one case serotonin increased from 155 to 315 – an increase of 103%. These frequencies produce this relaxation effect routinely and no other frequencies have the same effect, even when both the patient and the provider are blinded to the frequency being used. The effect is more profound when the levels of emotional tension and nervous tension are high and more subtle when they are low. The effect lasts for approximately 1 hour, although patients report feeling relaxed for up to 24 hours. No hypothesis has been developed to explain how or why the effect occurs, or why serotonin increases with the use of these frequencies, but the effect is consistent and suggests an area ripe for further research.

As it happens this cervical trauma patient did not persist in treatment beyond the first five sessions due to financial constraints, did not acquire a home unit, would not allow herself to be treated at no cost and she has not recovered as far as we know.

It is apparent that the inflammatory cytokines were significantly elevated in this patient and they were similarly elevated in the five patients sampled who had fibromyalgia associated with cervical trauma whose data are not shown (McMakin et al 2005).

One patient who presented with a diagnosis of fibromyalgia but who actually had simple upper extremity and lumbar myofascial pain had no elevations in cytokines and her levels are shown in Table 9.2. She did not respond to the fibromyalgia treatment protocol but her pain was eliminated with the treatment protocol for myofascial pain and trigger points (see below.). Her blood samples were taken before and at the end of treatment. Her pain was 0/10 at the end of this treatment and she recovered from her myofascial pain after six treatments, use of a magnesium malate supplement and reconditioning. This patient served as the control in the published paper (McMakin et al 2005).

Treatment of myofascial pain from trigger points

Most fibromyalgia patients have myofascial pain or trigger points, but patients with myofascial pain syndrome do not necessarily have the full neuroendocrine profile seen in fibromyalgia. Successful resolution of myofascial pain is essential to the recovery of the fibromyalgia patients discussed above. It has been suggested that patients with simple myofascial pain may progress to fibromyalgia if left untreated. There are multiple theories as to the aetiology, physiology, pathology and perpetuating factors associated with myofascial pain syndrome and trigger points. Microcurrent treatment with specific frequencies did not evolve from any of the theoretical resources; it was a purely clinical development. Different frequency combinations were used clinically, and, purely by trial and error, treatment sequences of frequencies were developed that seemed effective. It was only later that a literature review supported the rationale for the choice and use of the frequencies for nerve inflammation and tissue induration found to be effective.

Unlike traditional trigger point therapy which requires injections, or firm and often painful pressure (Travell & Simons 1983), application of microcurrent to the tissue reduces the pain and tenderness and causes the tissue to soften with minimal to no pressure. The current is used in an alternating mode with gloves placed so that the current flows through the involved muscle and its biomechanical antagonists. In order for the treatment to be effective, the current must pass through the tissue to be treated. This can be done by having the practitioner wear the graphite gloves on their hands or by wrapping the gloves in warm wet towels applied at the spine and distally so the current runs through the tissue to be treated in three dimensions. Pressure is applied as needed to palpate the changes in the tissue as it softens. The muscles can be moved passively through a range of motion during treatment to facilitate resolution of myofibrosis and this seems to speed the process of resolution.

When the frequency is 'correct', the tissue relaxes under the therapist's fingers until that frequency has finished its portion of the work. When the changes stop, further use of that frequency during that session is usually not productive and different frequencies must be used to produce results. Each time the correct frequency is chosen and applied there is a feeling of the tissue softening under the operator's fingers and the patient generally feels a sensation of warmth, tissue softening and pain reduction.

The sequence of frequencies used is individualized depending on the condition of the muscles, the patient's history and physical examination, and the operator's perception of the patient's response to treatment. The treatment protocol for myofascial pain starts with frequencies to reduce 'inflammation' in the 'nerve' using polarized current and it is now believed that virtually all myofascial trigger points have a component of neural upregulation (Gerwin 2007). This is followed by frequencies used for removing 'fibrosis', 'mineral deposits' and 'histamine' in the 'fascia', 'muscle belly' and 'nerve'. It is interesting that the frequencies found to be most effective clinically were described as treating conditions such as nerve inflammation, fibrosis, tissue induration and histamine release by mast cells, which coordinate with the mechanisms for myofascial dysfunction proposed by Travell and others.

There are frequencies thought to be specific for conditions such as fibrosis, scar tissue, mineral deposits, allergy reaction, chronic inflammation, toxicity and viral infection to be combined with frequencies for specific tissues such as fascia, muscles, tendons, connective tissue, arteries and nerves. There are approximately 20 combinations of frequencies used on a regular basis. The effects of the frequencies have been observed, measured and palpated, but short of dissection or biopsy, there is no way to know with certainty exactly what they are doing to any specific tissue or condition.

The response is clearly frequency specific. Time spent using an 'inappropriate' or ineffective frequency produces no change in tissue no matter how long the frequency is used. Changing to a 'correct' frequency produces the characteristic softening of the tissue in seconds. This response occurs even when the operator is unaware of the frequency being used. The patient is always blinded and trials were performed with the operator blinded to the frequencies and the tissue response was consistent, independent of the operator's expectation or knowledge.

Treatment technique

The treatment technique made possible by use of the graphite/vinyl gloves is a real advantage in treating the sensitive musculature of the head, jaw and neck. In order to be effective, the current must simply pass through the dysfunctional tissue in three dimensions. Compression or stretching is not essential to the process. This makes it possible, for example, to treat the suboccipital muscles by inserting one glove into the buccal area at the back of the mouth and placing the other on the suboccipital area. This intra-oral technique can also be used to treat the pterygoids, digastric, omohyoid and scalenus muscles and the cervical paraspinals. The current travels from the intra-oral glove through the muscles to the external glove wherever it is placed (Fig. 9.10).

Unlike injections or ischaemic compression, which can only treat small areas, this method allows treatment of entire muscles and synergist/antagonistic muscle groups at the same time during the same visit, allowing a smooth return of normal biomechanical function to the painful dysfunctional region. For example, when the upper back, shoulder and posterior neck are treated, it is possible to simultaneously treat the serratus anterior, the subscapularis, the levator and trapezius, the cervical paraspinals, mutifidi and scalenes in one treatment session. This seems to provide a distinct advantage in the recovery of biomechanical function as well as providing pain relief (Figs 9.11–9.13).

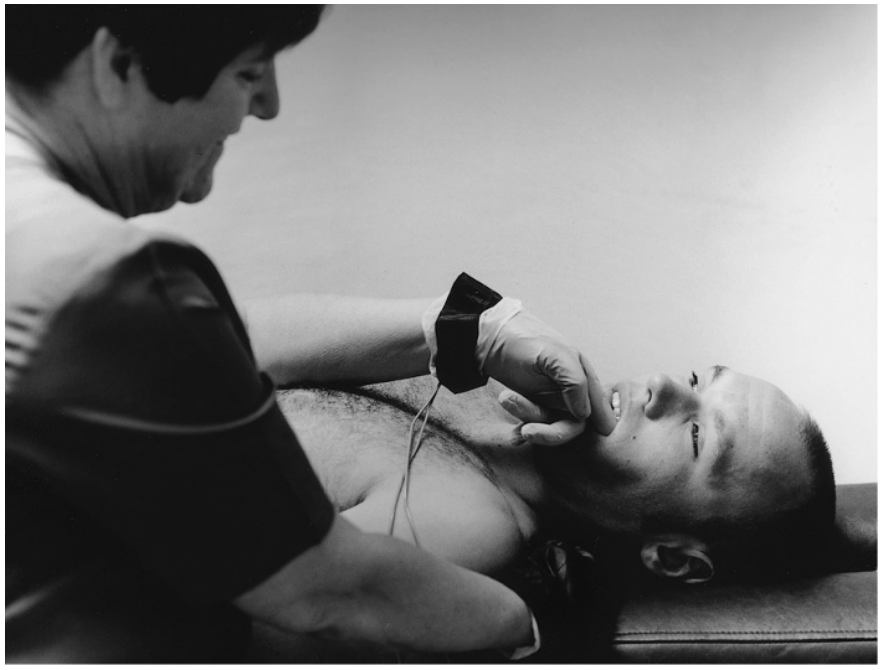

Figure 9.10 • The patient is positioned comfortably and the gloves used in such a way that the practitioner can treat the symptomatic jaw and cervical muscles and their antagonists simultaneously.

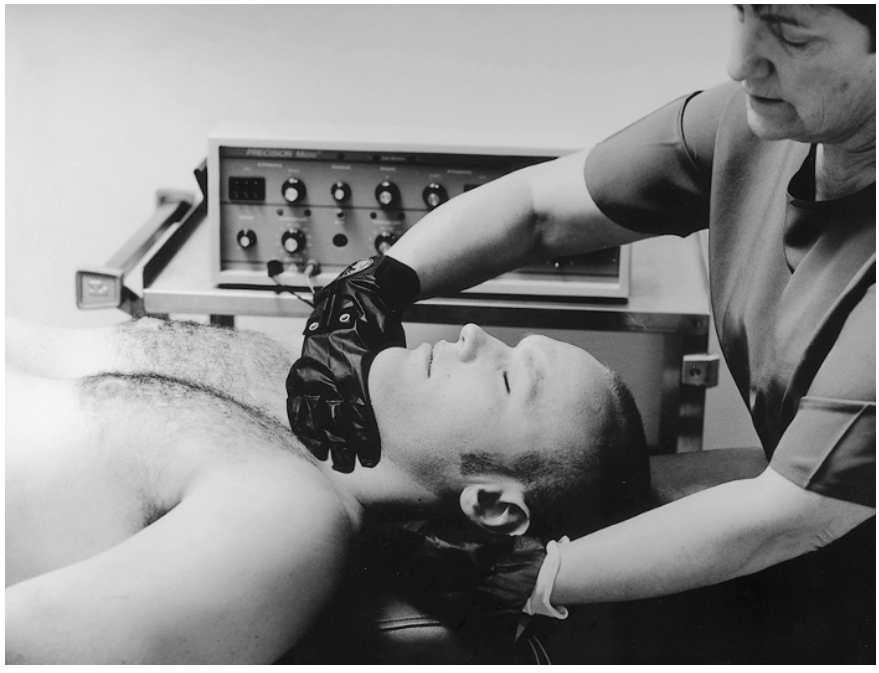

Figure 9.11 • Supine treatment focuses on the scalenes and cervical paraspinal muscles.

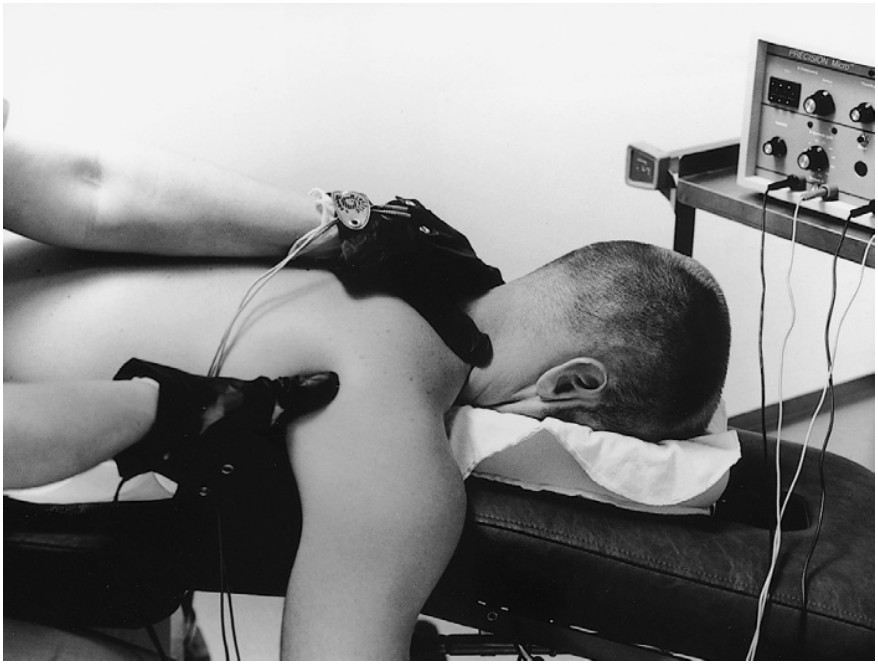

Figure 9.12 • Prone cervical myofascial treatment focuses on the cervical paraspinals, the levator and trapezius, the serratus anterior and subscapularis.

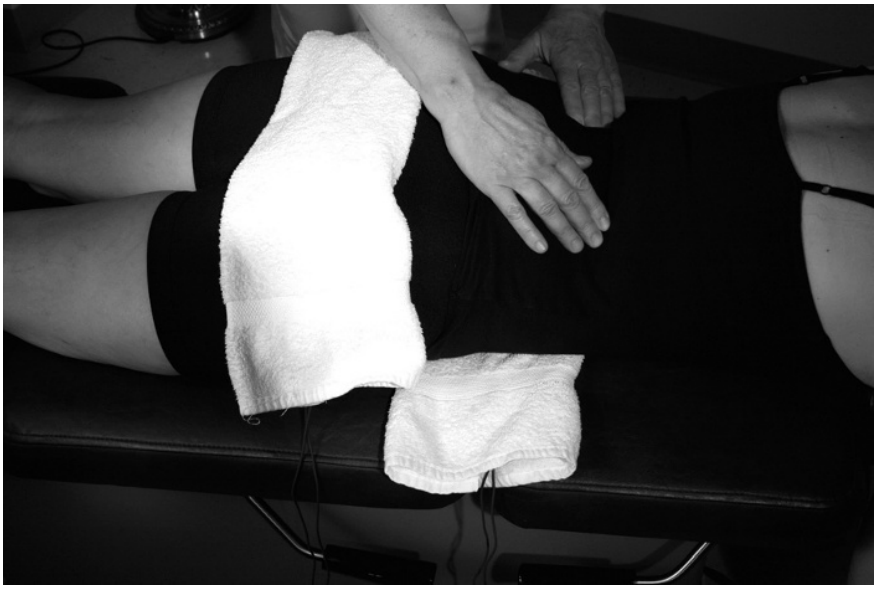

Figure 9.13 • It is more convenient and in most cases more effective to wrap the graphite glove in a warm wet towel and place the positive lead contact around the neck at the exiting nerve roots and the negative lead contact at the distal end of the nerve and the muscles to be treated. This leaves the practitioner's hands free to mobilize the muscles and change frequencies.

When treating low back pain and the psoas, iliacus, quadratus lumborum and lumbar paraspinals the same principles apply. The psoas is treated during the first treatment while the patient is supine with the knees and hips flexed by treating the nerve then the fibrosis and induration in the muscle belly, fascia and tendon. The gloves are positioned with the operator's gloved hand just inside the iliac crest anteriorly and the other glove, without the operator's hand, under the patient's back. This allows the current to pass through the psoas and posterior muscles simultaneously and leaves the operator one free hand to change frequencies. If there is referred pain down the thigh from the psoas (Travell & Simons 1992), the current can be polarized with the positively charged glove used on the active trigger point in the psoas and the negatively polarized glove placed on the referral area (Fig. 9.14).

The second low back treatment is done with the patient prone (Fig. 9.15). The gloves may be placed on the lumbar paraspinal muscles bilaterally or one glove contact can be placed under the abdomen to treat the muscles from anterior to posterior as long as the current flows through the tissue in three dimensions. The patient is usually much improved after the first treatment, which focuses primarily on the psoas. The second treatment seems to alleviate much of the remaining posterior pain. The subsequent treatments usually address trigger points in the gluteals, tensor fascia lata, pectineus or piriformis and maintain the tissue improvement while the patient begins reconditioning.

Unlike spray and stretch, which can be awkward to use in certain areas, microcurrent is simple and direct and allows easy access to complex muscle couples. There are no known environmental hazards associated with the use of microcurrent. Unlike dry needling of trigger points which can only treat one or two muscles at a session and which can be painful and hazardous, microcurrent is subsensory and very low risk.

Home stretches and exercises are prescribed within the first 2 weeks. Conditioning is gradual and gentle and designed to increase muscle oxygenation and mobility before increasing strength.

If the facet joint is the primary pain generator and the myofascial trigger points are thought to be secondary to or compensatory for the facet irritation, manipulation of the joint and specific microcurrent protocols for facet syndrome are used; if necessary, facet injections are ordered. The

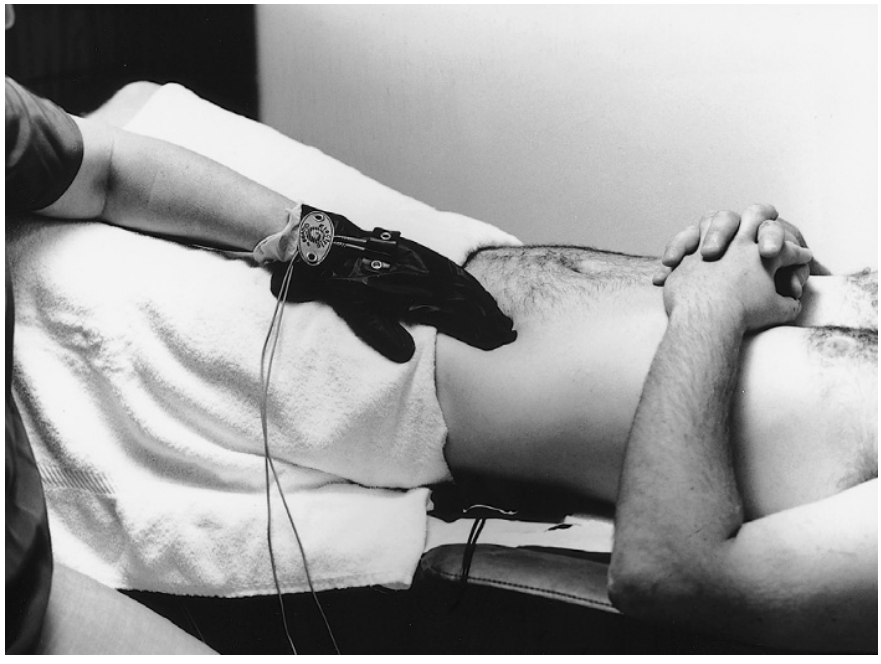

Figure 9.14 • Supine lumbar myofascial treatment focuses on the psoas. The glove behind the patient's back can be wrapped in a warm wet towel instead of being worn on the practitioner's hand. The wet towel allows for better conductivity of higher current levels.

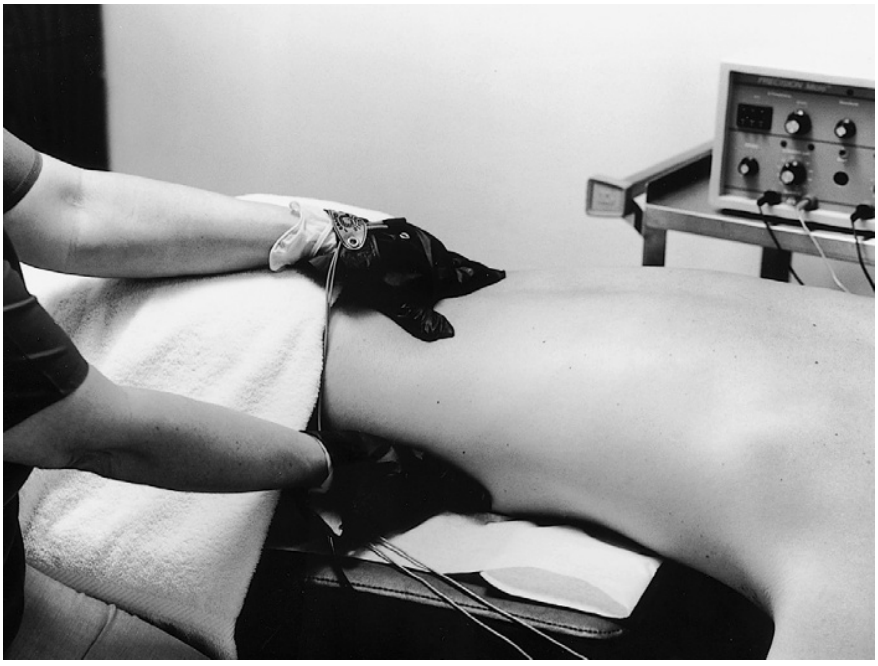

Figure 9.15 • Prone lumbar myofascial treatment focuses on the lumbar multifidi, paraspinals and gluteals. The glove under the patient's abdomen can be wrapped in a warm wet towel instead of being worn on the practitioner's hand.

prescribed exercises focus on strengthening the muscles while the facet is gapped and in traction by having the patient flex the lumbar spine and perform small movements in extension or side bending.

If an injured or degenerated disc is a primary pain generator and serves as the perpetuating factor for myofascial trigger points, then manipulation, exercises and microcurrent protocols specific for disc inflammation must be used in order to resolve the pain. If conservative measures are not successful, epidural steroid injections may be ordered to aggressively address disc and nerve inflammation. Exercises and postural recommendations are prescribed to keep the lumbar spine in extension while the lumbar paraspinal muscles and the abdominal muscles are strengthened.

Patients are given a supplement containing magnesium glycinate 150 mg, malic acid 600 mg, manganese glycinate 5 mg, vitamin B_6 50 mg and thiamine 50 mg to help improve muscle function and provide enhanced nutrients for muscle metabolism. Any supplement containing magnesium and malic acid should be effective. The supplement is continued during treatment and for 2 weeks after treatment is completed. If the myofascial pain begins to recur at some future time the patient is instructed to begin taking the supplement immediately and to return for treatment if the pain does not recede within 5 days. The low dose antioxidant described above is also recommended to enhance antioxidant status and help the patient detoxify or process muscle metabolites released during treatment.

Side-effects and adverse reactions

The most common side-effect of myofascial treatment is a post-treatment reaction starting approximately 90 minutes after treatment and lasting 6–24 hours. This is presumed to be a detoxification reaction, similar to that seen after massage, only magnified. Symptoms include slight to moderate nausea, flu-like aching and sometimes a slight increase in pain. This reaction can usually be avoided by consumption of 2 quarts of water in the first 3 hours after treatment and use of the antioxidant supplement mentioned above that provides phase one and phase two liver detoxification pathway substrates. The reaction is less pronounced after the third or fourth visit,

presumably because liver detoxification pathway enzymes increased with the increased demand.

Most patients treated for myofascial pain are observed to have a significant increase in range of motion following treatment. Some patients with a significant amount of joint degeneration, especially in the cervical spine, may also experience a temporary occurrence of radicular pain following treatment, presumed to be due to the movement of the degenerative spurs into the nerve space. This reaction can be treated with the microcurrent protocols for radicular pain. The neuropathic pain stops when the range of motion returns to normal and we hypothesize that the bone spurs are no longer moving into the nerve space. Once this reaction is gone the myofascial pain remains quiet, usually for 4–6 months. The joint degeneration perpetuates the myofascial pain, and supplements and occasional microcurrent treatments must be continued to keep these patients pain free long term.

Pain that is thought to be myofascial, but which is in fact due to nerve or cord compression or irritation, can actually increase when treated with the myofascial protocols. When this pain increase occurs we have found that switching immediately to the protocols for neuropathic pain reduces the pain and will eventually relieve the myofascial pain as well (Fig. 9.16).

In addition to these precautions specific to our uses of microcurrent, the general precautions and contraindications for microcurrent are observed. It is not to be used through a pregnant uterus or on patients with demand-type pacemakers.

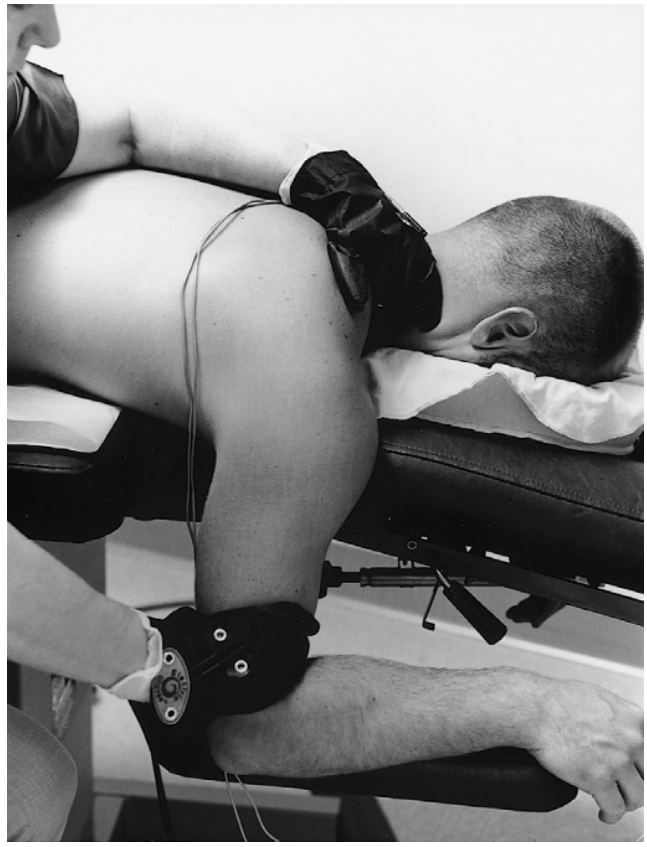

Figure 9.16 • Cervical nerve pain can be treated effectively using the frequencies thought to reduce inflammation and the frequencies thought to address the peripheral nerves. The current is polarized positively at the neck and negatively at the end of the dermatome being treated. The graphite gloves can be wrapped in warm wet towels and applied as described in Figure 9.13.

Myofascial results in clinical practice

In 1996 the results in 137 cases of 'simple' chronic myofascial pain in various body regions – uncomplicated by disc injury, neuropathy or severe arthritides, most due to prior trauma or chronic overuse – were examined. Symptom duration ranged from 8 months to 22 years. The majority of patients had been treated by one or more prior therapies, including prescription drugs, physical therapy, surgery, chiropractic, acupuncture, trigger point therapy and massage. Of those 137 patients, 128 completed treatment. Pain was reduced in 126 of those 128 from an average 5–8/10 to a 0–2/10. Two patients had pain reduced from the 5–8/10 range to 3–4/10 range. Treatment duration varied depending on the severity, complexity and chronicity of the case. Patients were told to return if the pain recurred or motion became limited. Random follow-up contacts suggest that the results have been long lasting and possibly permanent.

Further refinements in treatment techniques and frequencies resulted in improved patient response and reduced the number of treatments required to achieve resolution of the patient's symptoms. Data were retrieved from the charts of 73 patients with head, neck, face or low back pain resulting from chronic myofascial complaints seen between January and June 1997. We defined chronic as pain lasting longer than 90 days after the precipitating trauma. Most of the patients were referred to the clinic by a medical physician, chiropractor, naturopathic physician or another patient.

Table 9.3 shows the outcomes of treatment of these patients. The results since this early data sample have remained consistent, and have even improved as both assessment and treatment techniques have been refined. Simple myofascial pain, regardless of chronicity, resolves quickly and usually permanently with myofascial treatment using frequency-specific microcurrent, nutritional support and gentle specific rehabilitation exercising. Patients who do not respond in the expected fashion within 4 weeks are now treated with protocols for neuropathic pain and discogenic, facet-generated or metabolic perpetuating factors developed in recent years. Referrals for spinal stabilization exercises, epidural and facet injections are made within 6 weeks if myofascial treatment does not produce lasting improvement. This shift in treatment programme has improved patient outcomes. Similar outcomes are reported anecdotally by students using this technique in clinics in the US, Canada, Ireland, Europe and Australia. Formal data collection and outcomes assessment are planned for the future to evaluate the effectiveness in a more scientific fashion.

Conclusion

Microcurrent therapy has improved outcomes in the treatment of myofascial pain and fibromyalgia, leading to successful and complete resolution

Table 9.3 Outcomes in the early treatment of myofascial pain (Treatment of chronic myofascial pain presented at the American Back Society Annual Meeting in San Francisco, 1997)

Simple myofascial pain: averaged outcomes in 50 cases of head, neck and face pain						
Patients	**Chronicity**	**Failed other TX**	**No. treatments**	**No. weeks**	**VAS start**	**VAS end**
50	4.7 years, range (1–28)	88%	11.2	7.9	6.8/10	1.5/10

Simple myofascial pain: averaged outcomes in 23 cases of chronic low back pain						
Patients	**Chronicity**	**Other TX**	**No. treatments**	**No. weeks**	**VAS start**	**VAS end**
23	8.4 years, range (1–20)	87%	5.7	5.7	6.8/10	1.6/10

The cervical myofascial pain cases were published in *Topics in Clinical Chiropractic* (McMakin 1998) and the lumbar myofascial pain cases were published in the *Journal of Bodywork and Movement Therapies* (McMakin 2004).

of symptoms in many cases. Microcurrent is not sufficient to produce these effects by itself but rather forms a necessary adjunct to other therapies and strategies, which by themselves are helpful but not sufficient to produce resolution in most cases. Even though complete permanent resolution cannot be achieved in every case, these outcomes in the treatment of fibromyalgia suggest that the condition is indeed curable in many patients.

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Chapter Ten

10

The metabolic rehabilitation of fibromyalgia patients

John C. Lowe

CHAPTER CONTENTS

Recent evidence indicates that fibromyalgia (FMS) is a manifestation of impaired metabolism and other effects of inadequate thyroid hormone regulation of cell function. The inadequate regulation may result from a thyroid hormone deficiency or from cellular resistance to normal levels of thyroid hormone. The measurable features of FMS can be improved or relieved in most patients through therapy that is best termed 'metabolic rehabilitation'. The four components of my protocol is nutritional supplements, thyroid hormone, exercise to tolerance, possibly physiological cortisol and/or bioidentical sex hormone therapies, elimination of chemical contaminants and physical treatment. For most patients who undergo metabolic rehabilitation, FMS pain scores normalize only after soft tissue treatment and spinal manipulation. These physical treatments appear to control or eliminate noxious neural input from the musculoskeletal system to the central nervous system. Treatment decisions are data-driven. During a patient's treatment, FMS status is assessed at 1- to 2-week intervals using five measures. Treatment outcome is most often successful when these scores are posted to line graphs that provide a visual depiction of changes in the patient's status (see Figs 10.1–10.5). The patient's treatment is altered as necessary to cause the lines in the graphs to move over time in directions indicating improved status.

Introduction

Recent studies of patients with FMS provide strong evidence for three conclusions:

1. FMS is a condition of metabolic insufficiency in select tissues.
2. In most cases, the insufficiency is a result of primary or central hypothyroidism or cellular resistance to thyroid hormone.
3. Treatments that cause or encourage a sustained increase in metabolism are effective in improving or relieving most FMS patients' symptoms (see also Box 10.1).

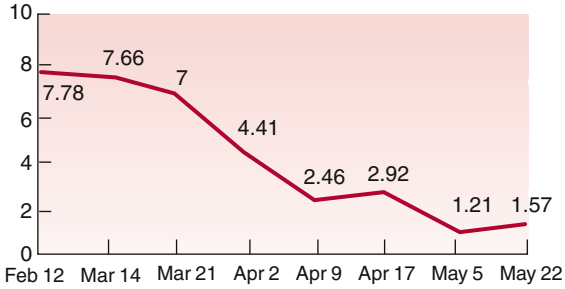

Figure 10.1 • The mean intensity of 14 FMS symptoms, determined by the 0–10 visual analogue scales of the FibroQuest form. At each evaluation, the mean intensity is calculated and posted to the line graph.

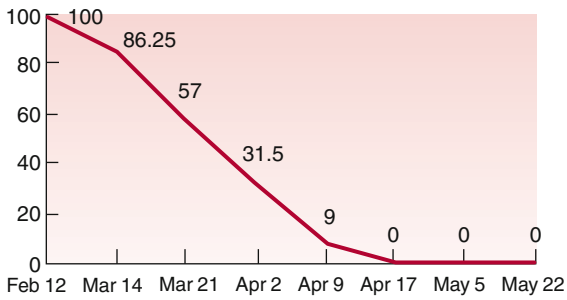

Figure 10.2 • Pain distribution. Scores show the percentage of 36 body divisions containing pain at each evaluation (determined by the patient's pain drawing). At each evaluation, the percentage was posted to the graph.

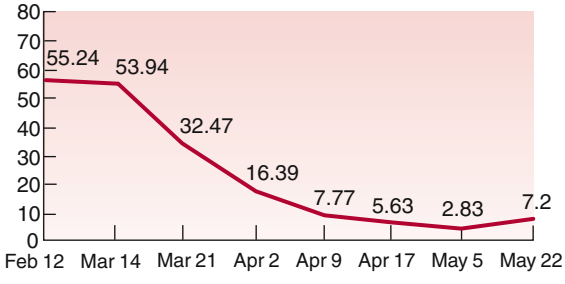

Figure 10.3 • Fibromyalgia Impact Questionnaire (FIQ). Scores indicate the patient's level of impaired function. At each evaluation, the total score for the FIQ was posted to the graph. The line shows the trend of changing scores.

In view of these conclusions, does the bodyworker doing soft tissue treatment have a role to play in the care of FMS patients? Definitely. For most patients, soft tissue treatment provides palliative relief during the process of metabolic rehabilitation. More importantly, the use of soft tissue

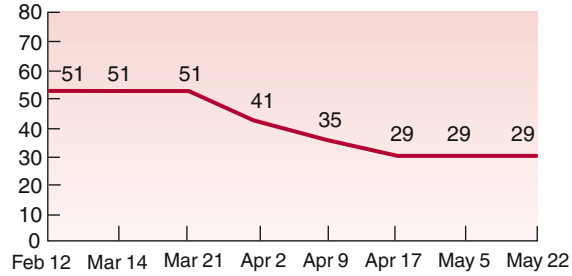

Figure 10.4 • Zung's Self-Rating Depression Scale. At each evaluation, the score for Zung's was posted to the graph. Key: ≥70, severe depression; 60–69, moderate depression; 50–59, mild depression; <50, normal.

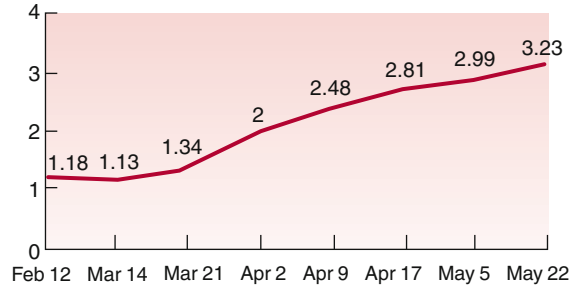

Figure 10.5 • Tender point sensitivity. At each evaluation, the mean of the pressure/pain thresholds of the 18 FMS tender points (measured with an algometer) was calculated and posted to the graph.

treatment is necessary in many cases if patients are to fully recover from the most distinguishing symptom of FMS: chronic widespread pain. I describe the modifications in manual technique that are advisable for treating most FMS patients.

FMS as a manifestation of hypothyroidism or cellular resistance to thyroid hormone

The clinical features of FMS and hypothyroidism are virtually the same (E Awad, personal communication 1990, Beetham 1979, Bland & Frymoyer 1970, Delamere et al 1982, Fessel 1968, Golding 1970, Hochberg et al 1976, Lowe 1995, Sonkin 1985, Wilke et al 1981, Wilson & Walton 1959). The 13 most common FMS symptoms (pain, fatigue, stiffness, headaches, sleep disturbance, bowel disturbance, depression, poor memory and

Box 10.1

The hypometabolism hypothesis of fibromyalgia

Scientific studies and years of related clinical experiences have led to several conclusions about the pathogenesis of FMS and its treatment:

- In most cases, FMS is caused by, or related to, inadequate thyroid hormone regulation of cell function. The inadequate regulation results from one of two phenomena: (1) thyroid hormone deficiency, or (2) partial cellular resistance to the hormone.
- Other factors may also induce and sustain symptoms that lead to a diagnosis of FMS if those factors impede the metabolism of the tissues from which FMS symptoms and signs arise. Such factors include B complex vitamin deficiencies, the use of beta-receptor blocking drugs, and deconditioning. Whereas one such factor may not be enough to induce FMS symptoms, combinations of factors may be sufficient (Lowe 1998, 1999).
- The metabolism-impeding factors responsible for FMS must be controlled or eliminated before a patient can significantly improve. When FMS results from inadequate thyroid hormone regulation, thyroid hormone is indispensable if the patient is to improve or recover.
- For most patients, nutritional supplements are also essential. They synergistically interact with thyroid hormone to cause a sustained increase in metabolism (Lowe 1997b). As thyroid hormone accelerates metabolism, the body's requirement for nutrients – especially B complex vitamins – increases. Not taking vitamin supplements may result in vitamin deficiency or cardiomyopathy (Travell & Simons 1983). Taking supplements can avert such adverse effects and facilitate a thyroid hormone-induced increase in metabolism.
- For all patients, exercise to tolerance is necessary. Exercise enables patients to capitalize on the increased metabolic capacity provided by thyroid hormone and nutritional supplements (Lowe 1997b). Resistance exercises contribute to the increase in metabolism by increasing lean tissue mass, which has a higher metabolic rate than fat tissue (Pratley et al 1994). Aerobic exercise contributes by increasing the metabolic rate of the lean tissues (Shinkai et al 1994).

concentration, anxiety, cold intolerance, numbness and tingling, dry tissues and difficulty exercising) are also common symptoms of hypothyroidism. Moreover, some 40 objectively verified abnormalities in FMS are plausibly explained by inadequate thyroid hormone regulation of cell function (Lowe 1998, 1999). These include the low serotonin (Russell et al 1992) and high substance P (Vaerøy et al 1988) levels that may mediate the chronic widespread pain and pressure sensitivity of FMS patients. Inadequate thyroid hormone regulation can plausibly explain both low serotonin secretion and high substance P levels (Frankhyzen & Muller 1983, Yellin 1997). Moreover, two studies have shown that FMS patients, compared to matched healthy controls, had abnormally low resting metabolic rates and basal body temperatures (Lowe et al 2006a, 2006b). I discuss these abnormalities in detail below.

Hypothyroidism in FMS

Hypothyroidism in adults results most frequently from autoimmune thyroiditis. It often occurs, however, following radiation exposure, surgical removal of part of the thyroid gland or pituitary failure (Oertel & LiVolsi 1991).

There is an extraordinarily high incidence of hypothyroidism in FMS patients. The incidence of primary hypothyroidism (thyroid hormone deficiency due to impaired thyroid gland function) in the general US population is about 1% (Hershman 1980). The incidence of primary hypothyroidism among FMS patients has been reported as 10% (Eisinger et al 1992, Gerwin 1995), 10.5% (Lowe 1997a), 12% (Shiroky et al 1993) and 13.0% (Lowe et al 1998b). The incidence of central hypothyroidism (thyroid hormone deficiency due to hypothalamic or pituitary dysfunction) in the population at large is about 0.00021% (Hershman 1980). We found an incidence among FMS patients of 52.6% (Lowe 1997a) and 43.5% (Lowe et al 1998b). Ferraccioli and colleagues (1990) and Neeck & Riedel (1992) reported similarly high incidences of central hypothyroidism among FMS patients. Thus, the incidence of primary hypothyroidism among FMS patients may be some 10 times higher than in the population at large, and the incidence of central hypothyroidism some 250 000 times higher. FMS patients also have a significantly higher incidence of autoimmune thyroiditis than in the general population (Ribeiro & Proietti 2004, Törüner 2004).

Euthyroid hypometabolism in FMS (partial cellular resistance to thyroid hormone)

We found that 36.8% (Lowe 1997a) and 43.5% (Lowe et al 1998b) of FMS patients were euthyroid (had normal laboratory thyroid function test results). What could cause hypothyroid-like symptoms in these patients? Any factor that impedes the same metabolic pathways as those impeded by thyroid hormone deficiency. Examples of such factors are folic acid deficiency and beta-adrenergic blocking drugs. But our studies and clinical experiences indicate that euthyroid FMS is most often a result of cellular resistance to thyroid hormone. Symptoms and objective abnormalities resulting from cellular resistance are virtually the same as those resulting from thyroid hormone deficiency.

Mutations in the c-*erb*Aβb gene on chromosome 3 were the first documented cause of resistance (Refetoff et al 1993). More mechanisms of resistance have since been identified. These include antibodies, calorie deprivation, selenium deficiency, toxins (dioxins and PCBs), drug metabolites, body metabolites (uraemic compounds) and carnitine inhibition of the nuclear uptake of T_3, the metabolically active thyroid hormone (Tjørve et al 2007). It is possible that such mechanisms underlie the hypothyroid-like symptoms and objective findings in euthyroid FMS patients (Lowe et al 1997d).

Possibly the most common mechanism of thyroid hormone resistance, including that in a subset of FMS patients, is contamination with dioxins, PCBs, organophosphates and other man-made chemical contaminants. These environmental contaminants are nearly ubiquitous in our environment and are abundantly present in human breast milk, fat and blood (McKinney & Pedersen 1987). The contaminants cause the liver to eliminate thyroid hormone at an abnormally rapid rate (Van den Berg et al 1988). They also displace thyroid hormone from the protein (transthyretin) that transports it into the brain, possibly reducing the concentration of the hormone in the brain (Lans et al 1993). PCBs and dioxins also appear to interfere with the binding of thyroid hormone to its receptors on genes. This interference alters transcription patterns and produces hypothyroid-like effects (McKinney & Pedersen 1987).

At this time, we conclude that a patient has cellular resistance to thyroid hormone when several conditions are met. When the patient:

1. is euthyroid before beginning to use thyroid hormone
2. recovers from hypothyroid-like FMS symptoms and signs with 'supraphysiologic' (higher than normal) dosages of T_3
3. after beginning treatment, has an 'abnormally' high blood free T_3 level
4. has no tissue overstimulation (thyrotoxicosis) due to the high T_3 levels, according to the results of ECGs, and laboratory and bone density tests.

We find this pattern in virtually all our euthyroid patients who benefit from metabolic rehabilitation. And according to these criteria, we have documented the presence of thyroid hormone resistance in FMS patients in several double-blind, placebo-controlled, crossover studies (Lowe et al 1997a, 1997b, 1997c). It appears, then, that the hypothyroid-like FMS symptoms and signs of many euthyroid FMS patients – perhaps most, according to some of my colleagues (Garrison & Breeding 2003) – are a result of cellular resistance to thyroid hormone (Lowe 1998, 1999).

That FMS in most patients is a result of inadequate thyroid hormone regulation is further supported by an important study completed in 1998 (Lowe et al 1998a). Its results are the first to demonstrate long-term effectiveness of an FMS treatment. The study was a 1- to 5-year follow-up comparing patients treated with metabolic therapy to untreated patients. Twenty FMS patients who underwent metabolic treatment were matched with 20 FMS patients who did not. Patients were matched by sex, thyroid status and the time since their initial evaluations. All patients were initially evaluated 1–5 years before the follow-up study began. In each group, 10 patients (50%) had been classified as euthyroid, six (30%) as primary hypothyroid, and four (20%) as central hypothyroid. Before 20 of the patients began treatment, there was no statistical difference on any measure between them and the 20 patients who were to have no treatment. At follow-up, analyses showed that treated patients had decreased their use of antidepressants and NSAIDs; untreated patients had increased their intake of antidepressants and anxiolytics. Comparison of baseline measures with follow-up measures for each group showed that treated patients improved on all FMS measures; untreated patients improved on none. The conclusion is that, at 1- to 5-year follow-up, the FMS

status of euthyroid and hypothyroid patients who underwent metabolic therapy significantly improved compared to matched, untreated FMS patients. The continuation of improved FMS status in treated patients for 1–5 years effectively rules out two possible mechanisms of improvement: a placebo effect, and a tendency to improve over time (regression toward the mean).

The available evidence therefore indicates that the most likely mechanism of FMS is inadequate thyroid hormone regulation of cell function. This is caused by a deficiency of thyroid hormone or by partial cellular resistance to thyroid hormone (Lowe 1999, Lowe & Yellin 2008).

Assessment

Below, I describe the steps we take to diagnose FMS, monitor for changing status, and treat patients. Our initial assessment of a patient includes measurement of resting metabolic rate, basal body temperature and pulse rate, paper and pencil tests, a history, physical examination, measurement of the voltage of the R-wave in the QRS complex of the electrocardiogram (ECG), and thyroid function tests. We use a modified tender point examination and assessment of pain distribution and symptoms that provide greater precision and quantification than the 1990 American College of Rheumatology (ACR) method (Box 10.2). Also, the modifications enable us to make decisions in patient care that are more evidence-based (Lowe 1999).

Box 10.2

Five fibromyalgia measures

1. **Pain distribution** is quantified by the percentage of the patient's body in pain according to a pain drawing the patient completes at each visit.
2. **Symptom intensity** (0–10 visual analogue scale). One VAS for each of the associated symptoms is marked by the patient. A 14th VAS is for the patient's estimate of pain intensity. The average of the 14 scores is posted to a graph.
3. **Tender point sensitivity** (the pressure/pain threshold) at each of the 18 tender points is measured with an algometer (calibrated force gauge). The average for the points is calculated.
4. Functional capacity is assessed through the **Fibromyalgia Impact Questionnaire.**
5. Depression is quantified with the **Zung's Self-Rating Depression Scale,** which grades the presence and degree of depression.

Paper and pencil tests

Our patients complete several forms at their initial visit and at subsequent evaluations, as described below.

FibroQuest Questionnaire

This provides us with historical and current information about the patient. We use the responses as a jumping off point for discussion of the patient's complaints. The questionnaire contains visual analogue scales (VAS) for the most common FMS symptoms (pain, fatigue, stiffness, headaches, disturbed sleep, depression, disturbed bowel function, cognitive disturbance, anxiety, paraesthesias, coldness, dry mucous membranes, exercise intolerance and dysmenorrhoea). We total the ratings of symptom severity, divide by 14, and post the mean score on a graph similar to that in Figure 10.1.

At subsequent evaluations, the patient completes the FibroQuest Symptoms Survey. This survey form contains only visual analogue scales for the 14 FMS symptoms. The patient estimates the severity of each symptom by marking the appropriate scale. We calculate the mean severity of the 14 symptoms and again post it to graph 1. This running graph provides a visual depiction of changes in symptom intensity. We use the information from this graph and the other four graphs we mention below to make decisions about the patient's management, such as dosage adjustments (see Figs 10.1–10.5).

Pain distribution body form

This form contains drawings that show the front, back and both sides of the body. The patient shades in any areas of aching, pain, soreness, tenderness or paraesthesias experienced since the last evaluation. The patient must be precise in depicting the distribution of the pain. To score these forms, we place a transparent template that divides the body into 36 areas over the patient's drawing. The pain distribution is the percentage of the 36 body divisions

that contain pain. The percentage is placed on a graph similar to that in Figure 10.2.

Fibromyalgia Impact Questionnaire

The patient completes this form which measures the impact the patient's condition is having on his or her functional abilities (Fig. 10.3).

Zung's Depression Inventory

This form allows the clinician to classify the patient according to the presence and severity of depression (Fig. 10.4). Patients fill out all four forms at each re-evaluation. The single score from each and the mean of the pressure/pain thresholds of the 18 tender points (see below) are posted to separate line graphs. Figures 10.1–10.5 show line graphs for the five measures. The graphs show the changes in FMS measures during metabolic rehabilitation of a euthyroid FMS patient reported by Honeyman (1997). We typically do re-evaluations at 1- to 2-week intervals. The graphed data allow us to assess the patient's status in relation to previous evaluations. (Usually, all measures change together in a direction of 'improvement', 'no improvement' or 'worse'.) This permits us to make data-based decisions about changes in the patient's treatment regimen. Through working with the patient and his or her treatment regimen, we manipulate the trend of the lines in the graphs until they reach and stay within the normal range. The patient's subjective status usually corresponds closely to what the trend lines indicate.

Examination

We perform the following each time a patient visits.

Algometer (pressure/pain gauge) examination of tender points

We examine the 18 tender points. We use the same form the patient has shaded to record at each point the pressure in kg/cm^2 at which the algometer tip induces discomfort (an algometer is a calibrated force gauge). We teach patients to distinguish the threshold at which the slowly increasing pressure takes on the slightest noxious quality. We post the mean of the algometer measurements of the 18 points to a graph similar to that in Figure 10.5.

Achilles reflex

The relaxation phase of the Achilles reflex is abnormally slow in most FMS patients before they begin taking thyroid hormone. The speed of the relaxation phase is a measure of the status of muscle energy metabolism in the calf muscles. When energy metabolism is low in the calf muscles, they take longer to muster enough energy to fuel separation of the actin and myosin filaments so that the muscle fibres can lengthen. When subnormal muscle energy metabolism is corrected with thyroid hormone, the contraction and relaxation phases of the reflex occur at an equal, brisk speed. Progressive changes in the reflex are a convenient barometer of increasing muscle metabolism in the FMS patient taking thyroid hormone.

Pulse rate and blood pressure

Most FMS patients have low blood pressure, and their pulse rates are usually slow in view of their level of cardiovascular conditioning. Recently, some researchers have come to refer to low blood pressure in FMS patients by terms such as 'neurogenic hypotension'. Our model accounts for this, in that the failure of thyroid hormone to regulate transcription allows an increased α-adrenergic receptor count in cells that regulate blood pressure adjustments. This appears to reduce cardiac contractility sufficiently to result in low peripheral blood pressure. Thyroid hormone therapy virtually always normalizes the heart rate and contractility, and usually normalizes the blood pressure.

Resting metabolic rate

We measure each patient's resting metabolic rate (RMR) using indirect calorimetry. The patient is carefully prepared so that he or she is in as close to a vegetative state as possible. We then measure the patient's VO_2 and use the value to calculate his or her calorie consumption at rest for a 24-hour period. Except when a patient is taking a medication that increases the metabolic rate, such as a noradrenaline (norepinephrine) reuptake inhibitor, FMS patients have low RMRs (Lowe et al 2006a, 2006b). These increase, typically into the normal range, during metabolic rehabilitation that includes the use of thyroid hormone.

Basal body temperature

Before beginning metabolic rehabilitation, most FMS patients have basal body temperatures (BBTs) that are well below the reference range of 97.8–98.2 (Lowe et al 2006a, 2006b). During treatment, the BBT usually rises close to or within the reference range.

ECG

We do a baseline ECG and repeat the test at intervals. The heart is particularly sensitive to exogenous thyroid hormone. For some patients, changes in the ECG are sensitive signs of treatment response. For example, some patients initially have low voltage ECGs. The PR, QRS or QT interval may be of maximum normal width or greater. As the thyroid hormone dosage reaches an amount that increases the beta-adrenergic receptor density on heart muscle cell membranes, the intervals usually shorten. The amplitude of the deflections also increases. Most FMS patients, just as most hypothyroid patients, have low voltage R waves in either or both of the limbs and precordial leads.

Treatment with thyroid hormone usually increases the voltage into the normal reference range. The most common change, however, is an increase in heart rate, which does not require an ECG to assess. If there is any question whether the patient is having an adverse cardiac effect from exogenous thyroid hormone, we perform another ECG. In an occasional patient, increased heart rate and contractility may amplify underlying cardiac abnormalities. If this occurs, we adjust the patient's thyroid hormone dosage to ensure safety. We also have the patient consult a cardiologist for an evaluation.

Thyroid function testing

Before beginning a treatment, we determine the patient's thyroid status. Primary hypothyroidism (thyroid hormone deficiency due to thyroid gland dysfunction) in most patients can be determined with a standard thyroid profile containing a T_4, T_3 uptake, free T_4 index, and TSH. In untreated primary hypothyroidism, the TSH is elevated. (TSH is the pituitary hormone that stimulates the thyroid gland to release thyroid hormone.) This diagnosis is tentative unless the patient has had a thyroidectomy, antithyroid drug therapy or evidence of antithyroid antibodies. Even in the absence of these in FMS patients, however, a trial of thyroid hormone therapy is warranted.

Euthyroidism (normal function of the hypothalamic–pituitary–thyroid gland axis) and central hypothyroidism (thyroid hormone deficiency due to pituitary or hypothalamic dysfunction) can be identified most conveniently with a TRH stimulation test. (TRH is the hypothalamic hormone that stimulates the pituitary gland to release TSH.) In this test, a blood sample is taken to measure the basal TSH level. TRH is injected and 30 minutes later another blood sample is taken to measure the TSH level again. The clinician subtracts the baseline TSH level from the 30-minute level to derive the TSH response to TRH. A result between 8.5 and 20.0 mU/ml is consistent with normal thyroid function. A result below 8.5 mU/ml is consistent with pituitary hypothyroidism. A result above 20.0 mU/ml is consistent with central hypothyroidism (an exaggerated TSH response to TRH does not distinguish between pituitary and hypothalamic hypothyroidism). The diagnosis is tentative unless there is evidence of other pituitary or hypothalamic hormone abnormalities (from assays), pituitary or hypothalamic structural abnormalities (from imaging) or mutations of the TRH or TSH gene (from nucleotide sequencing).

Because thyroid hormone dosage should be adjusted based on tissue responses, such as increases in the RMR and BBT, there is no value in reordering the standard thyroid profile after the initial one. The two assumptions that the basal serum TSH level correlates with tissue metabolic status and can be used to predict tissue thyrotoxicity cannot be justified scientifically, and the test should not be ordered for this purpose (Lowe 1999, Lowe 2006).

Treatment

Our treatment protocol primarily involves four components: the use of nutritional supplements, thyroid hormone, exercise to tolerance, and physical treatment. Many patients, however, also have subnormal cortisol levels and these most be corrected with physiological cortisol therapy.

Nutritional supplementation

Box 10.3 lists the minimum nutritional supplements we require patients to take. We explicitly instruct patients not to depend on nutritional products that contain only the recommended daily amounts, which provide only 50% more of each nutrient than the amount calculated to prevent abject deficiency disease. Dosages that increase the chances of optimal health are considerably greater.

Amounts of the B complex vitamins in products are usually in proper ratio to one another. This makes it convenient to use vitamin B_1 as a guide to dosage. The product would best contain at least 50 mg of vitamin B_1 per tablet, and the patient should take one tablet twice per day. It is important that the patient spread vitamin C intake through the day, taking 1000–3000 mg a minimum of twice daily, but ideally more often. The patient may have to develop tolerance to higher dosages of vitamin C by working up from smaller dosages.

In addition to the antioxidants vitamin C, beta carotene and vitamin E, the patient should make sure that the mineral formulation contains the antioxidant selenium. The mineral formulation should also contain as wide an array as possible of mineral and trace elements.

Thyroid hormone

Use of supplemental thyroid hormone is central to our treatment regimen. We base the choice of desiccated thyroid or T_3 on the outcome of thyroid function testing, and we adjust patient dosages according to specific indications of tissue response at each dosage. As part of their treatment regimen, patients must make lifestyle changes. The changes enable them to maximize the benefits of their increased metabolic capacity. This is essential to the protocol, and they must make the changes as early as possible. Failing to do so is likely to compromise their level of improvement.

Effective treatment of FMS for most patients critically depends on three steps:

1. selecting the proper form of thyroid hormone
2. properly titrating the dosage
3. inducing patients to engage in activities or lifestyle changes that capitalize on the increased metabolic capacity the thyroid hormone gives them.

Box 10.3

Minimum recommended nutritional supplements

Supplement	Dosage per day
B complex	50–100 mg of most
Vitamin C	2000–10 000 mg
Calcium	2000 mg
Magnesium	1000 mg
Multiminerals*	
Vitamin E complex	800 IU
Beta carotene	30–90 mg

* Not possible to give a general recommendation here.

Proper form of thyroid hormone

The euthyroid patient begins treatment with T_3 (usually Cytomel tablets). As a general rule, the patient with either primary or central hypothyroidism begins treatment with desiccated thyroid. If there is no response to desiccated thyroid after a fair trial (a small percentage do not), the patient switches to T_3. The prescribing physician also provides each patient with 20 mg propranolol tablets (which block the effects of thyroid hormone mediated by beta-adrenergic receptors) to use only in case of overstimulation that is bothersome or threatening.

Properly titrating dosage

With most FMS patients, 75 micrograms of T_3 or 60 mg of desiccated thyroid is a good starting point. We increase patient dosages at 1- to 2-week intervals with T_3 and 3- to 4-week intervals with desiccated thyroid. Dosage increases at these intervals are 12.5–25 micrograms of T_3 and 30–60 mg of desiccated thyroid. We can increase patient dosages of T_3 more aggressively than dosages of desiccated thyroid. This is because the effects of T_3 have a faster onset (with increased dosages) and offset (with decreased dosages). Finding the effective desiccated thyroid dosage usually requires more patience, as the effects of an increase may not be apparent for a couple of weeks. For some patients it may take a month or longer. Cookbook guidance is of limited help in properly adjusting dosages. Only experience

with patients will teach the clinician how to properly adjust a patient's dosage.

An ECG before each dosage adjustment can ensure patient safety in terms of cardiac function. This is of foremost concern. Most patients experience overstimulation as tremors, rapid heart rate or excess body heat. These effects do not usually signal dangerous overstimulation, although some patients may be bothered by them. If a rapid or 'pounding' heart with minimal exertion is the predominant symptom indicating overstimulation, the patient should have an ECG. The clinician should make sure that the sinus rhythm is normal, that the ST segment is not elevated and that the QT interval is not abnormally short.

Middle-aged and elderly patients who are severely deconditioned should begin thyroid hormone at a very low dosage and increase it very gradually at greater intervals than recommended above. At the same time, they must engage in cardiovascular conditioning activities to tolerance, progressively increasing the intensity. They should also take nutrients scientifically shown to protect the human cardiovascular system.

There are four important considerations in adjusting the patient's dosage of thyroid hormone.

1. Patients with compromised cardiac function. If the patient has compromised heart function, the initial dosage should be low enough to avoid aggravating the heart condition. The starting dose may be 12.5 micrograms of T_3 or 15 mg of desiccated thyroid. If the patient tolerates this dosage well, the dosage can in most cases be increased by 12.5 micrograms of T_3 every 2–3 weeks, or by 0.0125 mg of desiccated thyroid once per month.

Before allowing these patients to increase their dosages, an ECG should be performed to confirm that no adverse cardiac effects have occurred from the previous increase. If adverse effects have occurred, the patient should reduce the dosage sufficiently to assure safety. It may be advisable for the patient to take 20–60 mg of propranolol (for 24–48 hours with T_3 and 1–2 weeks with desiccated thyroid). These patients should also have a thorough cardiac evaluation.

2. Osteoporosis. If a patient has osteoporosis, we order a baseline bone density study and repeat the study at intervals. The patient should also use mineral supplements (including 1–2 g calcium), 'bone-jerking' types of exercises calibrated to tolerance, and possibly female sex hormone replacement if post-menopausal. We have found that, in general, the bone mineral density of female patients who have improved or recovered with metabolic rehabilitation increases somewhat over time. This probably results from their increased levels of physical activity.

New studies show that, for most women, taking thyroid hormone does not significantly reduce bone density as long as the dosage is not excessive for them (and this may have nothing to do with the TSH level). Those at greatest risk are reported to be post-menopausal women not taking sex hormone supplements (Lowe 1999). Testing has shown that most of our FMS patients have not had adverse effects from the use of exogenous thyroid hormone.

3. Dosage adjustments made on the basis of peripheral measures. It is critical that the patient's thyroid hormone dosage not be adjusted based on an 'ideal' mid-range TSH level. Doing so almost guarantees a failed therapeutic outcome. Many clinicians mistakenly believe that the TSH level correlates with tissue metabolic rate. The TSH level and metabolic rate are out of synchrony in many, and perhaps most, patients. We have found no studies documenting a reliable correlation between the two.

Fibromyalgia patients improve when their dosage is adjusted based on 'peripheral' or 'indirect' measures of metabolic status. These measures, such as the RMR, BBT, Achilles reflex, serum cholesterol and increased voltage of the ECG, are more directly related to tissue metabolic status than is the TSH level. Also, we have spent considerable time discerning whether an FMS patient's subjective recovery and increased functional abilities correlate with improvement on the five FMS measures. They typically do, although not in all cases. Certainly, though, these measures are a better guide than the TSH level in making dosage adjustments.

We adjust dosage based on changes in the pencil and paper test results and the outcome of the examination findings at the re-evaluations following the last dosage change. If these measures do not indicate that metabolism has increased sufficiently, the patient's dosage is increased. How much the dosage should be increased depends on the patient. For the patient with compromised cardiac function or osteoporosis, the precautions mentioned in the previous two sections should be observed. It may be necessary to increase a patient's dosage only after

safety testing. Increases should be small enough and at intervals wide enough to ensure patient safety.

4. Objective of dosage adjustments. The objective of dosage adjustments is maximum improvement on all measures of FMS status. Typically, improvement in the measures corresponds to the patient subjectively feeling improved. There may be a lag, however, between objective and subjective improvement, either one preceding the other in some cases. A minority of patients improve solely through the use of thyroid hormone. But complete recovery usually requires that a patient make lifestyle and medication changes as well. We detail these in the section below.

Lifestyle and medication changes

Most FMS patients who improve only minimally, or not at all, with metabolic rehabilitation have failed to make lifestyle changes that are necessary parts of the regimen. Most often, these patients fail to engage in regular toning and aerobic exercise to tolerance or to take nutritional supplements. These components of the regimen are indispensable to a favourable outcome. Because of this, we refer patients who find it difficult to make these changes to a physical trainer and/or a nutritionist. Patients who find it difficult to swallow tablets and capsules can take nutritional supplements in liquid form or as wafers that dissolve in the mouth.

Fortunately, many long-suffering FMS patients, in their quest for relief, have already acquired a high quality, wholesome diet supplemented by almost every vitamin, mineral and trace element. Many have also adopted other measures considered to induce and sustain health. In our experience, these patients have the highest probability of therapeutic success.

Some patients are not able to muster the drive to exercise because of their use of muscle relaxing, sedative or narcotic medications. These drugs may have previously made life tolerable. However, for virtually all patients, use of these drugs during participation in metabolic rehabilitation sabotages the patient's improvement or recovery. This occurs mainly by the drugs' decreasing the patient's wherewithal for taking part in exercise to tolerance.

Other medications that may interfere with metabolic rehabilitation are tricyclic antidepressants (such as amitriptyline and cyclobenzaprine). These alone may cause tachycardia and ischaemic heart disease. Thyroid hormone typically increases the heart rate as it increases the density of beta-adrenergic receptors on cardiac muscle. In some patients, the use of both thyroid hormone and tricyclic antidepressants causes a greater increase in heart rate than either medication alone. Patients should therefore stop tricyclic drugs before or soon after beginning to take thyroid hormone.

Patients must also stop beta-blocking medications. Beta-blocking drugs nullify the adrenergic effects of thyroid hormone, and it is these effects that mediate most of the metabolism acceleration from thyroid hormone.

Physical treatment

For most FMS patients as they undergo metabolic rehabilitation, pain scores improve to some degree even without physical treatment. But for many patients, pain measures will indicate maximum pain relief only after the patients undergo effective soft tissue treatment and spinal manipulation. In most cases, the soft tissue treatment must loosen hypertonic muscle and fascial adhesions, and it must desensitize myofascial trigger points. Less often, soft tissue treatment, manipulation or physiotherapy is needed to resolve chronic musculoskeletal conditions that are sources of noxious neural input to the CNS. Among the most common of such conditions are chronic shoulder and spinal joint dysfunction. When soft tissue treatment is effective, the FMS patient's pain scores usually proceed further towards normal.

Soft tissue treatment

Some patients who respond well to metabolic therapy but who do not have physical treatment are left with regional musculoskeletal pain they may misinterpret as persisting FMS. Patients may continue to calculate this regional pain into their visual analogue scales in the FibroQuest Symptom Survey. As a result, when they shade in parts of the body drawing where they have pain, the percentage of their body containing pain may not accurately reflect the benefit they have derived from the metabolic therapy.

Also, inadequate thyroid hormone regulation can cause an energy deficit in muscles. This can mediate energy deficiency contractures that sustain trigger point activity (Box 10.4). The cycle of reduced blood

Box 10.4

Hypometabolism as a factor in the perpetuation of myofascial trigger points

Travell & Simons (1983) wrote of hypometabolism as an endocrine factor that can perpetuate myofascial trigger points (TPs). And in fact they stated that, in some patients, the irritability of TPs is a sensitive indicator of inadequate thyroid function. According to Travell & Simons, clinicians often mention patients with myofascial pain syndrome who also have untreated low thyroid function. In general, these patients are not treated with thyroid hormone for two reasons:

1. their hypothyroid symptoms are mild
2. their thyroid hormone blood levels are only low normal or borderline low.

Travell & Simons wrote that hypometabolic patients are more susceptible to myofascial TPs. Specific myofascial therapy usually provides the patients with only temporary relief. But the increased irritability of their muscles and their resistance to physical treatment are improved when they begin using supplemental thyroid hormone, especially T_3. Travell & Simons noted that, in contrast to the hypometabolic patient, the hyperthyroid patient (who is, of course, hypermetabolic) rarely has active myofascial trigger points. This observation is consistent with our clinical experiences.

According to Travell & Simons, some hypometabolic patients with normal circulating thyroid hormone levels may still have irritable myofascial TPs. It appears that in these patients thyroid hormone fails to exert a normal effect on metabolism at the level of the patient's muscle cells. Simons contacted me in 1994 after he read a paper (Lowe et al 1994) in which, with colleagues, I reported the cases of four patients with TPs and FMS. The patients all improved or recovered with high dosages of T_3, combined with nutritional supplements and exercise to tolerance (D G Simons, personal communication, 1994). We proposed in the paper that the patients required high dosages of T_3 because their cells were partially resistant to thyroid hormone. As a possible mechanism of the resistance, we cited the discovery some 6 years before of mutations in the c-*erb*Aβ gene (Refetoff et al 1993). This gene codes for the most common type of thyroid hormone receptor, and mutations in the gene cause mutant T_3 receptors that bind poorly to the hormone. After reading of the discovery, Simons told me that some 10 years before, he had made observations similar to those that we reported in the paper. He had observed that patients with treatment-resistant TPs were responsive to treatment after their hypometabolism was relieved by T_3. At the time, he had searched the published medical literature for a possible mechanism for the patients' improvement. Failing to find relevant studies, he complied with the wishes of some conventional endocrinologists that he abandon the use of T_3 therapy. Now, based on the new research findings, we have some justification for the discriminative use of thyroid hormone therapy for apparently hypometabolic patients. These patients have normal thyroid hormone levels but are resistant to appropriately applied physical treatment methods for myofascial TPs. We have confirmed our clinical observations in a small number of studies. Our need now is to build on these studies so that we learn more about using this hormone approach with hypometabolic patients who are resistant to the physical treatment of TPs.

flow and low threshold nerve endings in the taut bands of muscle housing the trigger points may persist even after a patient's general metabolism becomes normal. Soft tissue techniques may be necessary to inactivate these trigger points and help return the involved muscle to a normal state. Inactivating the trigger points usually results in improvement in FMS measures, especially pain measures.

It is important that soft tissue treatment be strategically used so as not to exacerbate the patient's pain (Box 10.5). The most important considerations are that the FMS patient's fascial mechanoreceptors may be hyper-responsive and central nervous system pain-modulating system impaired. The practitioner should apply soft tissue techniques gently. The goal is to increase circulation through the involved muscle regions while being careful not to increase noxious signal output from the mechanoreceptors.

As the FMS patient progresses through metabolic rehabilitation, more forceful techniques may be applied without adverse effects. Until then, however, the practitioner should keep one qualification in mind:

CAUTION: Except for cross-frictioning, the FMS patient is likely to benefit from any soft tissue technique the practitioner customarily uses with patients who do not have FMS. But with most FMS patients, the practitioner must use less mechanical force than

Box 10.5

Pointers on bodywork techniques for treating patients with fibromyalgia

- Be flexible in positioning for maximum patient comfort.
- Your FMS patient's CNS is impaired in its ability to modulate down incoming sensory signals from mechanoreceptor afferents. Therefore, temper technique and pressure so that the patient's threshold for pain is not exceeded.
- Do not use pressure sufficient to induce a catecholamine release (instead of cross-frictioning, for example, it would be best to use stretching and ultrasound).
- Aim to relieve the patient's pain. Understand, however, that until the patient's metabolic status is improved, manual therapies may be capable of providing only slight, and perhaps brief, pain relief.

with non-FMS patients. How much the force should be reduced depends upon how excessively sensitive to pressure the individual patient is. A useful method is to instruct the patient to verbally indicate how much discomfort the pressure is causing, on a scale from 0–10. With the typical FMS patient, post-treatment discomfort can be avoided by keeping the discomfort level during treatment between 1 and 5 (Lowe & Honeyman-Lowe 1998).

Spinal manipulation

Most patients benefit from spinal manipulation much as they do from soft tissue treatment. Manipulation relieves segmental facilitation. Facilitation lowers resistance to transmission of nociceptive signals from the periphery into the brainstem and brain through the spinothalamic tracts. It also lowers the threshold for activation of preganglionic sympathetic neurons and alpha motor neurons of an involved segment, possibly inducing peripheral vasoconstriction and shortening muscle fibres of the motor unit. Two controlled studies have shown that spinal manipulation (combined with paraspinal soft tissue manipulation) increased the 'global well-being' of FMS patients (Backstrom & Rubin 1992).

Ancillary therapies

As described above, the core therapies of metabolic rehabilitation include thyroid hormone, nutritional supplementation, wholesome diet, exercise to tolerance and abstention from metabolism-impairing drugs. These are all that some fibromyalgia patients require to markedly improve or fully recover. A variety of disorders, however, impede other patients' improvement, and must be diagnosed and effectively treated before these patients can significantly improve. The most common impeding disorders are several mechanisms of impaired energy metabolism, adrenocortical hypofunction, sex hormone imbalances and candida overgrowth. Diagnosing and treating these disorders have modestly increased the success rate of metabolic rehabilitation used with fibromyalgia patients.

Impaired energy metabolism

Inadequate thyroid hormone regulation is a major source of impaired energy metabolism. Other sources, however, often must be diagnosed and properly treated before some patients benefit fully from metabolic rehabilitation. The other sources that we most commonly encounter are hypoglycaemia, hyperglycaemia and insulin resistance.

Hypoglycaemia

A common clinical observation is that mild hypoglycaemia related to high sugar consumption or failing to eat for prolonged periods becomes more severe when the patient begins thyroid hormone therapy. The basis for this observation may be several effects of thyroid hormone on the body's handling of glucose. In studies, thyroid hormone increased the rate of glucose absorption from the gastrointestinal tract, possibly causing an earlier peak blood sugar level (Marks et al 1960); increased glucose uptake by peripheral tissue cells independent of insulin or insulin receptors (Sandler et al 1983) increased the affinity of plasma membrane insulin receptors for insulin and increased insulin secretion (Dimitriadis et al 1985, Mackowiak et al 1999) and accelerated the intracellular use of glucose for ATP production (Baquer et al 1976, Gregory & Berry 1995, Mirsky & Broh-Kahn 1936).

Symptoms of hypoglycaemia often closely resemble those of overstimulation with thyroid hormone. Distinguishing the source of the symptoms may be difficult for both patient and clinician, but teaching patients how to distinguish the symptoms of each condition often helps them to determine whether hypoglycaemia or excess thyroid hormone is the cause of their symptoms. Important distinguishing factors are that hypoglycaemia symptoms are usually more episodic than those of thyroid hormone overstimulation, and hypoglycaemia symptoms often occur at fairly set intervals after ingestion of sugary foods and after failing to eat for prolonged periods.

With most patients who have hypoglycaemia-type symptoms, a glucose tolerance test is not necessary for effective management of the symptoms. A history, symptom list and description of diet are sufficient to alert the clinician that the patient should make the necessary dietary changes. The most telling part of the history is that the patient becomes dizzy, shaky, faint or has headaches when he or she does not eat regularly, and that these symptoms are quickly relieved upon eating. Most patients' hypoglycaemia symptoms can be relieved within a week or two with appropriate dietary changes (Honeyman-Lowe & Lowe 2002). (See also the notes on hypoglycaemia in Ch. 15.)

Hyperglycaemia

Diabetic patients undergoing metabolic rehabilitation must carefully monitor their blood glucose levels. Their use of thyroid hormone may increase absorption of glucose from the intestinal tract. The hormone may also increase intracellular glucose use. Low insulin secretion in the type 1 diabetic and low density insulin receptors on cells in the type 2 diabetic may reduce the intake of glucose into their cells (Loeb 1991). Poor passage of glucose from the blood to cells, combined with increased intracellular use of glucose, may result in hyperglycaemia and an intracellular energy crisis. If so, patients may have to increase their use of medications that facilitate the entry of glucose into cells.

Insulin resistance

Progestins in birth control pills and hormone replacement therapy induce insulin resistance in some women. Clinical effects of insulin resistance include elevated blood fats, arterial hypertension and obesity (Gaspard & Lefebvre 1990, Gossain et al 1983, Panay & Studd 1997, Ramamoorthy et al 1989, Skouby et al 1987, Spellacy et al 1975). In the author's experience, some women who use progestins have treatment-resistant myofascial pain syndromes, probably due to an intramuscular energy deficiency, that cease to occur only when they discontinue the use of progestins (Lowe 1991, 1992, 2000).

The increased intracellular glucose use induced by thyroid hormone, simultaneous with progestin-induced insulin resistance, can generate symptoms that mimic thyroid hormone overstimulation. For some women to use effective dosages of thyroid hormone during metabolic rehabilitation, they must cease to use progestins.

Adrenocortical hypofunction

Some patients with hypofunction of the adrenal cortices have frank adrenal insufficiency and others have decreased adrenocortical reserve. In either case, symptoms of insufficient cellular cortisol, such as muscle weakness, may be induced by the use of thyroid hormone. The symptoms develop because taking thyroid hormone increases the cellular use of cortisol and clearance of cortisol from the body through the liver. If the production of cortisol by the patient's adrenal cortices is abnormally low, the increased cellular demand and hepatic clearance is likely to induce symptoms of cortisol deficiency (Lowe 2000). However, severe adrenocortical crisis is so extremely rare in these cases that in 17 years of research and clinical experience with thyroid hormone therapy, we have never observed it once.

In decreased adrenocortical reserve, the patient's adrenal cortices produce a normal amount of cortisol under non-stressful conditions. When the patient is stressed, however, the adrenal cortices are not able to increase cortisol secretion sufficiently to meet the stress-induced increased cellular need (Jefferies 1996).

In some patients, low cortisol secretion or decreased adrenocortical reserve is due to inadequate thyroid hormone regulation of adrenal cortical cells. The use of the appropriate form and dosage of thyroid hormone corrects this cause of low cortisol secretion. If, however, adrenocortical cell function is impaired by some other factor that is, at least for the time being, uncollectable, the patient may have to take a physiological dose of cortisol in order to use thyroid hormone without cortisol deficiency symptoms (Jefferies 1996).

Sex hormone imbalances

Female sex hormone imbalances can generate symptoms that overlap those of fibromyalgia. Often, sex hormone imbalances complicate fibromyalgia caused mainly by inadequate thyroid hormone regulation. Effective therapy for both conditions is necessary for the patient to fully recover.

We believe it is extremely important to measure sex hormone levels before a patient begins the use of oestrogen, progesterone, pregnenolone, cortisol or DHEA. The purpose of the testing is to avoid potentially complicating an already existing hormonal abnormality.

Candida infection

Many fibromyalgia patients have candida overgrowth. The most common factors responsible for the overgrowth among our patients are the use of corticosteroids, a high refined carbohydrate diet and the use of broad-spectrum antibiotics. Symptoms of candida overgrowth can resemble those of fibromyalgia, and often patients concurrently have fibromyalgia and candida infection. Treatment of both conditions is essential to patients' recovery (Crook 1998).

Clinicians can use serum and faecal testing to confirm candida overgrowth, but except for verification of overgrowth, testing may not be necessary for effective management. The patient's history is often sufficient to justify anti-candida therapy. A course of antifungal medication may be necessary, but many patients eliminate their candida symptoms merely through diet changes and avoidance of corticosteroids and antibiotics. The diet changes required to eliminate candida overgrowth are similar to those needed to correct hypoglycaemia. (See Ch. 15 for an anti-candida protocol.)

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Chapter Eleven

11

Fibromyalgia and the endocannabinoid system

John M. McPartland

CHAPTER CONTENTS

Introduction

Fibromyalgia has been characterized as an 'endocannabinoid (eCB) deficiency syndrome', along with other refractory maladies such as irritable bowel syndrome, migraine, premenstrual syndrome and other pain-processing disorders (Russo 2004). This syndrome may arise from diminished receptor expression, inadequate ligand biosynthesis or gain-of-function mutations in ligand-catabolizing enzymes. Helping you to understand these basic science concepts (and applying them) will be the goal of this chapter. Our trawl through basic science begins with definitions:

- Ligands are natural or synthetic compounds that bind to receptors.
- Ligands may activate receptors ('agonists') or deactivate receptors ('inverse agonists').
- Endogenous ligands (ligands produced by our own bodies) are synthesized by anabolic enzymes.
- To serve in self-regulatory roles, ligands must be broken down by catabolic enzymes.

Clinicians with a biomechanical or structural orientation may better understand the chemical concepts underlying eCB research by realizing that *chemistry is structure* (Ingber 1998). For example, the pharmacological principle of structure–activity relationships (SAR) is analogous to the anatomical concept of structure–function relationships.

On a molecular level, the eCB system resembles the better-known endorphin system. The endorphin system was indirectly discovered in 1801, when morphine was isolated from opium. The mechanism of action of morphine remained a mystery until the μ-opioid receptor was discovered by Candice Pert in 1973. That discovery begged the question: Why do humans have a receptor for an opium plant compound? Shortly thereafter, scientists discovered the enkephalins and endorphins, endogenous compounds that are mimicked by the plant compound (reviewed by Pert 1997).

According to Dr Andrew Taylor Still, the founder of osteopathic medicine, 'Man should study and use the drugs compounded in his own body' (Still 1897). Still hypothesized that osteopathic manipulative treatment (OMT) stimulated the production of endogenous compounds that promoted homeostasis and healing. Soon after enkephalins and endorphins were discovered, researchers at schools of osteopathy, chiropractic, physical therapy, massage therapy and acupuncture carried out endorphin research. The initial wave of enthusiasm dampened after studies produced conflicting evidence. In fact, endorphins and enkephalins may not be modulated by OMT, chiropractic manipulation, massage therapy, acupuncture or even 'runner's high' (reviewed in Dietrick & McDaniel

2004, Harbach et al 2007, McPartland et al 2005, Schultz et al 2000). In the past few years, research has swung from endorphins to the eCB system. In 1992, the year eCBs were discovered, an internet query using the PubMed search engine (http://www.ncbi.nlm.nih.gov/entrez/query.fcgi) with the term 'endorphin' returned 596 hits, and 'endocannabinoid' returned only two hits. In a search limited to 2008, 'endorphin' returned 141 hits whereas 'endocannabinoid' returned 565 hits.

The eCB system embodies our holistic concept that the body possesses self-regulatory mechanisms that are self-healing in nature. The eCB system has emerged as an important regulator of mind–body structure and function. This self-regulatory capacity can be rephrased as the maintenance of homeostasis. The eCB system's capacity to maintain homeostasis will be cited many times in this chapter. As Dr Still emphasized: 'To find health should be the object of the doctor. Anyone can find disease' (Still 1897).

Cannabis and cannabinoid receptors

Discovery of the μ-opioid receptor in 1973 launched a search for cannabinoid receptors, which are named after the *Cannabis* plant, the source of cannabis (marijuana, hashish). Cannabis has long been recognized for its anti-inflammatory, analgesic (pain-relieving) and muscle relaxant qualities. Over 4000 years ago the Chinese physician Shen Nung recommended cannabis for rheumatic pains (cited in Mechoulam 1986). Nearly a century ago, Sir William Osler considered cannabis the 'most satisfactory remedy' for migraine headache (Osler & McCrae 1915). At that time, cannabis was dispensed as an orally administered fluid extract, sold by all the leading pharmaceutical companies. Unfortunately, orally administered cannabis is erratically absorbed by the gut. This factor, coupled with variable product potency, unreliable sources of supply and poor storage stability, led to fluid extracts falling out of favour (McPartland 2008a). The decline in popularity was hastened by new synthetic medicines, such as aspirin. Concern with 'reefer madness' led to cannabis prohibition, despite vigorous opposition to prohibition by the American Medical Association that continues today (Fishbein 1937, Okie 2005).

The primary psychoactive ingredient in cannabis, Δ^9-tetrahydrocannabinol (THC), was discovered in 1964. Over 70 C_{21} terpenophenols unique to cannabis, collectively called the cannabinoids, have been identified by Raphael Mechoulam, Roger Pertwee and others (reviewed in Mechoulam 1986, Pertwee 2005). Synthetic THC (dronabinol, Marinol) was approved as a schedule II drug in 1986, and moved to schedule III in 1999. Its medical indications include nausea and vomiting associated with cancer chemotherapy, and appetite loss and weight loss in people with acquired immunodeficiency syndrome (AIDS). Nabilone (Cesamet), a synthetic analogue of THC, was also approved by the US Food and Drug Administration (FDA), with the same indications.

The search for a cannabinoid receptor was stymied by THC's poor performance as a molecular probe (THC is lipophilic and sticks to everything), so receptor discovery awaited development of a synthetic, water-soluble THC analogue. This was accomplished in 1988 when researchers showed that [^{3}H]CP55,940 bound specifically to a cannabinoid receptor located in neuron cell membranes. Two years later the gene for the receptor was cloned (reviewed in Howlett et al 2002). The gene translates into a chain of 472 amino acids that weave back and forth across the cell membrane seven times – the structure of a G-protein coupled receptor (GPCR). GPCRs are named for their G-proteins (short for guanine-nucleotide-binding proteins), which function as intracellular 'molecular switches'. Each GPCR possesses a unique binding pocket with affinity for specific ligands, like a lock-and-key mechanism. A short list of GPCRs includes opioid receptors, dopamine receptors, some serotonin receptors, some GABA receptors and beta-adrenergic receptors.

GPCRs are tensegrity structures that span the cell membrane. A ligand that loads the receptor's *extracellular* surface will distort the shape of its *transmembrane* weave of amino acids, thereby altering the *intracellular* side of the receptor and its interface with the G-protein. Cannabinoid receptors associate with several subtypes of G-proteins, such as Gi, Gs and Go subtypes. The 'i' and 's' abbreviate 'inhibitor' and 'stimulator', which describes the oppositional effects these G-proteins have on their targets. Importantly, research has shown that different cannabinoid agonists preferentially activate different G-proteins subtypes. This 'agonist trafficking' of G-proteins lysergically alters

the classic key-in-lock metaphor; instead, different keys (different cannabinoid agonists) fit the same lock (the CB receptor), but open the door into three different rooms (Gi, Go or Gs). This may explain why different strains of cannabis produce different psychoactive effects. For example, afghani strains seem to preferentially activate Gi and cause an inhibitory, stony, narcotic-like effect, whereas plants from Thailand seem to preferentially activate Gs and cause a speedy, buzzy high.

A second cannabinoid receptor was discovered in 1993, so the receptors were renamed CB_1 and CB_2. The two receptors express slightly different structures, and therefore express slightly different functions: CB_1 principally functions in the nervous system, whereas CB_2 is primarily associated with cells governing immune function, such as white blood cells. Taken together, CB_1 and CB_2 span the field of psychoneuroimmunology and represent a microcosm of mind–body medicine.

CB_1 is the most common GPCR in the human brain. Its uneven distribution in the brain reflects the well-known effects of cannabis upon humans and other animals. Highest densities of CB_1 are found in the hippocampus (affecting short-term memory) and parts of the basal ganglia – for example, substantia nigra, globus pallidus and striatum (caudate and putamen). CB_1 in these nuclei coordinate motor function and movement, as does CB_1 in the cerebellum. High densities in the cerebral cortex, amygdala and dorsal horn of the spinal cord affect cognition, mood and emotion, and pain perception. The brainstem nuclei that govern 'cardiorespiratory drive' express very few CB_1 receptors, which probably accounts for the lack of lethal effects from cannabis overdose (reviewed in Howlett et al 2002).

The genes for CB_1 (termed *CNR1*) and CB_2 (*CNR2*) are paralogues (genes separated by a gene duplication event), and their orthologues (genes separated by a speciation event) have been identified in all vertebrate species. A cannabinoid receptor gene tree within a species tree is illustrated in Figure 11.1. The species tree was constructed from 8 species whose entire genomes have been sequenced, specifically chosen to obtain a balanced species divergence within the evolutionary 'tree of life'. The human, mouse and puffer fish genomes all express *CNR1* and *CNR2* genes, whereas the sea squirt genome expressed only one gene, which we called the ancestral *CBR* gene (McPartland et al 2006). No cannabinoid genes were found in

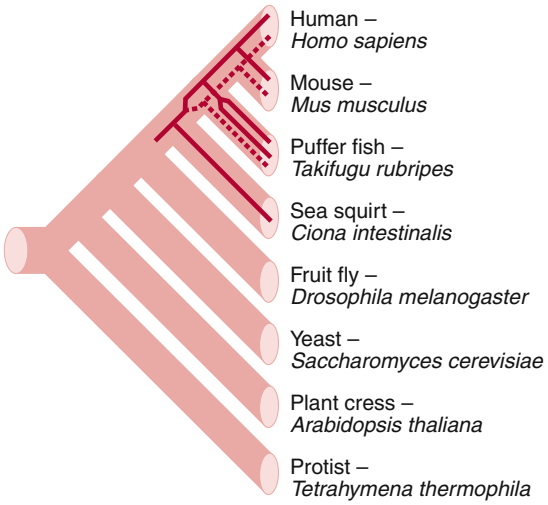

Figure 11.1 • The cannabinoid receptor gene tree within a species tree. The species tree is represented by thin tubular lines, with the gene tree represented by thicker lines, either solid (representing ancestral CBR gene orthologues and CB_1 gene orthologues after the gene duplication event) or dashed lines (representing CB_2 gene orthologues). (Reproduced with permission from McPartland 2008a.)

the 'lower' organisms with deeper evolutionary roots. These findings suggest that the gene duplication event that gave rise to *CNR1* and *CNR2* occurred in the ancestor of vertebrates. The ancestral *CBR* gene that preceded the duplication event may have evolved in the ancestor of sea squirts, about *600 million years ago* (McPartland et al 2007). Several lines of evidence suggest the solitary ancestral *CBR* receptor probably functioned more like CB_1 than CB_2 (McPartland & Glass 2003, Matias et al 2005). Duplicated genes often show asymmetric rates of evolution, with one paralogue retaining its ancestral function and preserving its gene sequence, while the other paralogue undergoes neofunctionalization accompanied by a burst of sequence evolution. Consistent with this, the cannabinoid gene duplication event gave rise to one paralogue that continued its CB_1-like function, whilst the second paralogue diverged to take up new functions. *CNR1* has become stabilized, whilst *CNR2* reflects neofunctionalization and its mutation rate is four-fold greater than *CNR1* (McPartland et al 2007).

Mutant CB_1 (–/–) knockout mice have been created that lack CB_1 receptors. Surprisingly, the transgenic CB_1 (–/–) mice survive gestation, but they suffer increased morbidity and premature

mortality compared to wild-type mice (Zimmer et al 1999). Young CB_1 (–/–) mice perform as well as wild-type mice, or often better, in a number of learning and memory paradigms. But mature CB_1 (–/–) mice perform much worse, suggesting that age-related cognitive decline is accelerated in the absence of CB_1 (Bilkei-Gorzo et al 2005). CB_1 (–/–) mice show greater aggression, epilepsy, age-related neuron loss, anxiogenic-like behaviour, depressive-like behaviour, anhedonia and fear of newness (Martin et al 2002). Their very survival speaks volumes regarding the resiliency of life, and probably depends on the recruitment of vestigial receptor systems.

Endocannabinoids and their enzymes

Humans did not evolve cannabinoid receptors for a *Cannabis* compound. The cannabinoid receptor definitely evolved long before *Cannabis*, which is not more than 34 million years old (McPartland & Guy 2004). The best-known endogenous cannabinoid, anandamide (AEA), was discovered by Mechoulam in 1992 (28 years after he discovered THC), followed by 2-arachidonoylglycerol (2-AG). AEA and 2-AG are metabolites of arachidonic acid. Their structures do not resemble the THC structure, but all three compounds nonetheless fit the CB_1 and CB_2 binding pockets. Thus the effects of THC, AEA and 2-AG substantially overlap, because they activate the same receptors (reviewed in Mechoulam et al 1998).

AEA and 2-AG are not stored in vesicles like classic neurotransmitters. Instead they are synthesized 'on demand' from precursor phospholipids within the lipid cell membrane, and released when needed. The biosynthesis of AEA may follow several pathways and involve several enzymes. Its precursor phospholipid (abbreviated NAPE) can be cleaved by a NAPE-selective phospholipase D enzyme (NAPE-PLD) to directly release AEA. NAPE also serves as a substrate for the abhydrolase domain-containing protein (ABHD4) enzyme, giving rise to phosphoglycerol-AEA which is cleaved by a phosphodiesterase into AEA. NAPE can be hydrolysed via a PLC pathway into phospho-AEA before being further hydrolysed to AEA by the protein tyrosine phosphatase, non-receptor type 22 enzyme (PTPN22). Lastly, a pathway involving a secretory phospholipase 2 enzyme followed by a lysophospholipase D enzyme may convert NAPE to AEA (reviewed by McPartland et al 2007). For AEA to work in a homeostatic fashion, it must be catabolized (broken down) after it activates a cannabinoid receptor. The best-known catabolic enzymes of AEA are fatty acid amide hydrolase (FAAH), fatty acid amide hydrolase 2 (FAAH2) and *N*-acylethanolamine acid amidase (NAAA).

The 'life-cycle' of 2-AG appears to be more straightforward. 2-AG is biosynthesized by two diacylglycerol lipases, DAGLα and DAGLβ, and 2-AG is catabolized by monoacylglycerol lipase (MAGL) and by cyclooxygenase 2 (COX-2, prostaglandin-endoperoxide synthase). Recently, an FAAH-blocking agent was described, which prolonged AEA activity in the synapse, analogous to a serotonin uptake inhibitor. Pharmacologists are racing to find inhibitors of the other eCB enzymes as well (Pertwee 2005).

The eCBs, their enzymes and the cannabinoid receptors collectively regulate many aspects of homeostasis, including embryological development (and adult neurogenesis via the same mechanisms), neuroprotection and neural plasticity, autonomic function with links to immunity and inflammation, apoptosis and carcinogenesis, hunger and feeding, biological oscillators and pacemakers cells, and perhaps most importantly for the purposes of this book, nociception, pain and emotional memory (suffering).

Nociception and pain

The effects of eCBs upon nociception and pain will focus on four areas: 1) the peripheral terminals of nociceptors; 2) the dorsal horn in the spinal cord; 3) the descending pain inhibitory pathway; and 4) supratentorial sites.

Pain begins in peripheral tissues as nociception, transmitted by A-δ and C-fibre afferent sensory neurons (nociceptors). *Polymodal* nociceptors contain receptors for mechanical pressure, thermal stimuli and many chemicals: potassium ions, protons and free O_2 radicals (by-products of muscle metabolism and tissue injury), histamine (released from mast cells), serotonin (released from platelets after exposure to platelet-activating factor released from mast cells) and bradykinin (cleaved from serum proteins). All of these chemical 'activators' bind to receptors in the nociceptor and initiate an action

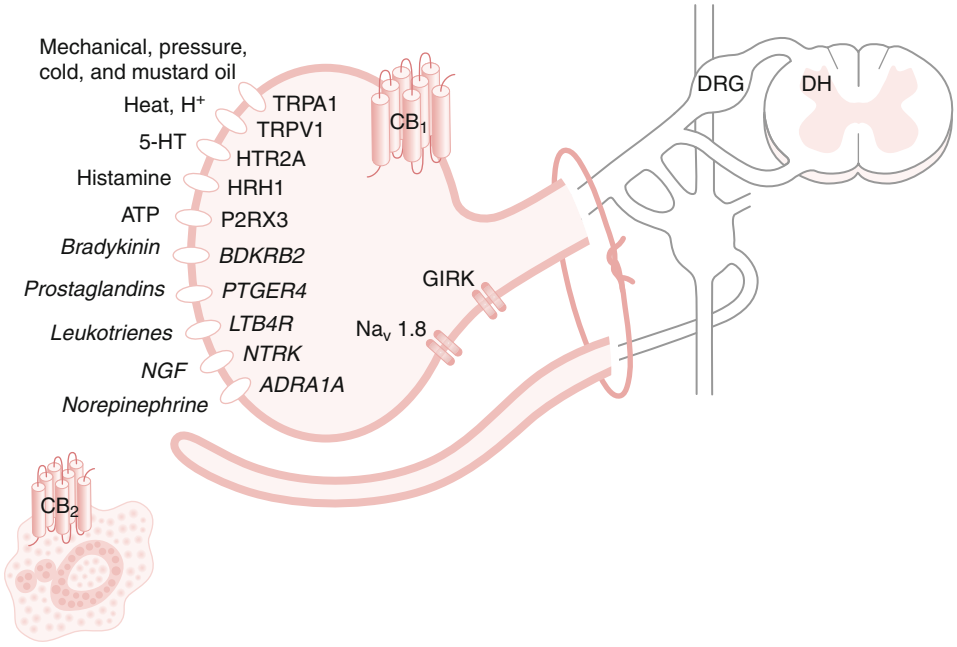

Figure 11.2 • Schematic illustration of a polymodal C-fibre nociceptor, with an enlarged view of its distal terminal, its cell body in the dorsal root ganglion (DRG) and central terminal in the dorsal horn (DH). A suture loop separates the enlarged view from the rest of the nociceptor. A sympathetic postganglionic neuron and a lymphocyte expressing CB_2 are illustrated below the distal terminal. Within the distal terminal are five receptors for activators (regular font) and five receptors for sensitizers (italic font), named by their gene symbols. Also embedded in the distal terminal are two ion channels (GIRK and Na_v 1.8) and CB_1. (Reproduced with permission from McPartland 2008a.)

potential (Fig. 11.2). 'Sensitizers' are also released from damaged tissue (e.g. prostaglandins and leukotrienes), neighbouring autonomic nerves (noradrenaline/norepinephrine) and from the nociceptor itself (substance P and calcitonin gene-related peptide). Sensitizers decrease the activation threshold of a neuron, so that the nociceptor fires with less activation (Fig. 11.2).

Activators and sensitizers cause *peripheral sensitization* – a phenomenon known to people with fibromyalgia as *hyperalgesia* (abnormally increased sensation of pain) and *allodynia* (pain from normally non-painful stimuli). Peripheral sensitization elicits a homeostatic response by the eCB system: CB_1 activation causes a decrease in the release of activators and sensitizers around the site of tissue injury, and CB_1 opens K^+ channels in the nociceptor cell membrane, so the nerve becomes hyperpolarized and less likely to fire. CB_2 signalling decreases the release of activators and sensitizers by neighbouring mast cells and macrophages (reviewed by Walker & Hohmann 2005). Functioning of the eCB system at the peripheral terminal of the nociceptor provides the 'first line of defence against pain' (Agarwal et al 2007).

In the dorsal horn (the gateway to the central nervous system or CNS) the nociceptor synapses with a sensory neuron that ascends to the brain. Normally a nociceptor action potential arrives at the dorsal horn, causes a release of glutamate and substance P into the *synaptic cleft*, and these neurotransmitters bind to their respective receptors in the *postsynaptic* cell. Activation of the postsynaptic cell initiates another action potential, which ascends to the brain (Fig. 11.3). Abnormal persistent activation of a nociceptor causes excessive glutamate release in the dorsal horn synapse. This maladaptively upregulates glutamate receptors in the postsynaptic cell and causes an influx of Ca^{2+} in the postsynaptic cell, which leads to central sensitization, 'wind-up' or 'dorsal horn memory'. The sensitized dorsal horn becomes a 'neurologic lens'. It consolidates other nociceptive signals that converge upon the same segment of the spinal cord, including nociceptive signals from other somatic dysfunctions and visceral dysfunctions. As a result, postsynaptic

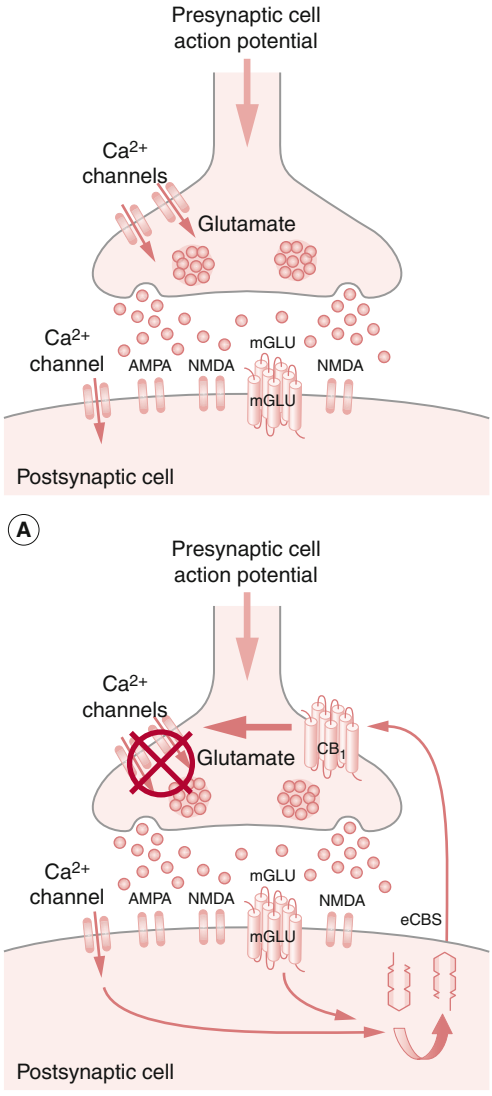

Figure 11.3 • The eCB system dampens excessive nociception at the dorsal horn. **A** Persistent firing of a C-fibre nociceptor opens voltage-gated calcium channels (VgCCs) in the presynaptic axon terminal. Calcium influx causes presynaptic vesicles of glutamate to release into the synaptic cleft. Excessive activation and upregulation of glutamate receptors in the postsynaptic cell causes the opening of calcium channels. **B** Open calcium channels in the postsynaptic cell stimulate DAGLα enzymes to synthesize 2-AG, which is released into the synapse and activates CB_1 in the presynaptic cell. The G-proteins from activated CB_1 close GCCs, thereby halting release of presynaptic glutamate vesicles. (Reproduced with permission from McPartland 2008a.)

spinal neurons have *decreased* activation thresholds, and *increased* response magnitudes. They fire with increased frequency or fire spontaneously (Simons et al 1999).

Again, the eCB system may come to the rescue: Ca^{2+} influx into the postsynaptic cell causes DAGLα enzymes located in that cell to synthesize 2-AG. The 2-AG moves *retrograde* across the synapse (opposite the direction of glutamate) to CB_1 located on the presynaptic neuron (see Fig. 11.3). Activated CB_1 closes presynaptic Ca^{2+} channels, which halts glutamate vesicle release. This newly discovered *retrograde transmission* is called 'depolarization-induced suppression of excitation' (DSE; Mátyás et al 2007). The eCB system induces 'dorsal horn memory loss' and short circuits central sensitization (Morisset & Urban 2001), requiring neuroscientists to rewrite textbooks that describe the synapse as a 'one-way street'. Retrograde signalling enables the postsynaptic cell to control its own incoming synaptic traffic. The eCB system also employs the same negative feedback mechanism to temporarily halt the synaptic release of gamma-aminobutyric acid (GABA). GABA is an inhibitory neurotransmitter, so this mechanism is termed depolarization-induced suppression of inhibition (DSI, Straiker & Mackie 2006). DSI is a ubiquitous phenomenon and modulates neurotransmission in the hippocampus, cerebellum, basal ganglia, cerebral cortex and amygdala.

The 'descending pain inhibitory pathway' is activated by the perception of pain in the brain. The pathway descends from the cerebral cortex and thalamus through the periaqueductal grey (PAG) and periventricular grey (PVG) in the midbrain, to the nucleus raphe magnus (NRM) in the rostroventral medulla, and down to the dorsal horn of the spinal cord. Endorphins, eCBs, serotonin, noradrenaline (norepinephrine) and adenosine play important roles in the pathway. CB_1 and eCBs are found in high concentration in the PAG, PVG, NRM and dorsal horn, where they suppress GABA-releasing interneurons that inhibit neurons in the descending pathway (reviewed by Walker & Hohmann 2005). The coordinated release of eCBs in this pathway mediates 'stress-induced analgesia' (Suplita et al 2007), the well-known phenomenon in which people are less responsive to pain following an environmental stressor (i.e. soldiers wounded in battle or athletes injured in sports events may not feel pain during the battle or game). The eCB and endorphin systems co-localize within the pathway circuitry. This is how THC and eCBs work synergistically with morphine, and

provide a 'morphine-sparing effect' (Walker & Hohmann 2005). A rodent study also showed that activated CB_2 receptors stimulate the release of beta-endorphins (Ibrahim et al 2005).

'Supratentorial sites' (a cranial osteopathic term for parts of the brain lying above the tentorium cerebelli) control the acquisition and storage of aversive memories. Painful memories, fear and anxiety are factors that turn *chronic pain* into *chronic suffering*. The eCB system facilitates the extinction of aversive memories ('active forgetting') through selective inhibitory effects on local inhibitory networks in the limbic system (especially the amygdala), and also squelches hippocampus-dependent fear conditioning. Thus the eCB system may benefit hospice patients and people unable to extinguish painful memory (e.g. post-traumatic stress disorder; Lafenetre et al 2007). Fear of pain and fear of movement are significant concerns for people with fibromyalgia, and elevated fear correlates with greater pain severity, depressed mood and disability (Turk et al 2004).

Around the edges of fibromyalgia

CB_1 receptors in nociceptors are synthesized in the dorsal root ganglion and carried by axoplasmic flow to insertion sites in the distal terminal of the nerve (see Fig. 11.2). In a rodent study of the sciatic nerve (Hohmann & Herkenham 1999), it was shown that a mechanical barrier (a loop of suture) that restricted axoplasmic flow actually prevented CB_1 receptors from reaching the distal terminal. The ligation loop in Figure 11.2 represents myofascial dysfunctions seen in people with fibromyalgia – thoracic outlet restriction, piriformis syndrome, carpal tunnel syndrome, etc. Thus myofascial dysfunction may diabolically exacerbate eCB system dysfunction in a positive-feedback loop.

The pathophysiology of fibromyalgia involves the autonomic nervous system, stress hormones, the immune system, the sleep cycle, tender points and trigger points, and connective tissue in general. The eCB system affects autonomic outflow through the peripheral and central nervous systems. Sympathetic nerve terminals contain CB_1, and the activation of these receptors inhibits noradrenaline (norepinephrine) release and dampens sympathetically mediated pain (Pacher et al 2006). The sympathetic nervous system drives the hypothalamic–pituitary–adrenal (HPA) axis and the hypothalamic–locus coeruleus–noradrenaline (norepinephrine) (HLN) axis. Psychological stress activates the HPA axis and results in corticosteroid release, whereas stress-induced activation of the HLN axis results in noradrenaline (norepinephrine) release. These stress responses are opposed by the eCB system (Pacher et al 2006).

Activation of the HPA axis hinders the immune response. Cannabinoids oppose the HPA, and therefore act as immuno*modulators*, and not simply immuno*suppressors* as characterized in the 1970s (Ashton 2007). Cannabinoids do indeed suppress production of Th1 (T-helper 1, cellular immunity) cytokines such as interleukin (IL)-2 and interferon gamma (INFγ), as well as tumour necrosis factor alpha (TNFα). On the other hand, cannabinoids *increase* the secretion of Th2 (T-helper 2, humoral immunity) cytokines such as IL-4, IL-5 and IL-10. The alkylamide ligands produced by *Echinacea* potently stimulate CB_2, and stimulate phagocytosis by white blood cells (Ashton et al 2008). Lack of psychoactivity by *Echinacea* can be attributed to its CB_2-specific selectivity and the relative lack of CB_2 in the brain.

The eCB system alters every biological oscillator or pacemaker cell investigated to date, including cells that govern the sleep cycle (reviewed in McPartland 2008a). The pineal gland produces melatonin as well as 2-AG in a circadian rhythm driven by the suprachiasmatic nucleus, regulated in part by CB_2. The eCB may also be involved in sleep induction (Mechoulam et al 1997), an important consideration in people with fibromyalgia.

The major diagnostic criterion of fibromyalgia – the presence of tender points – may be a symptom of eCB deficiency. During the menstrual cycle, AEA decreases during the luteal phase (*c.* day 21) and rises during the follicular phase (*c.* day 10) due to the progesterone-induced upregulation of FAAH (enzyme that breaks down AEA) in the luteal phase. In a study of healthy women with normal menstrual cycles, the decrease in AEA corresponded with hypersensitivity to algometer-induced pressure pain during the luteal phase. Several subjects 'changed' fibromyalgia diagnosis during the course of a menstrual cycle, fulfilling the tender point criterion (tenderness $\leq$4 kg at $\geq$11 points) during the AEA-deficient luteal phase or menstrual phase, but never during the AEA-rich follicular phase (Dunnett et al 2007).

The differences between myofascial tender points and myofascial trigger points (MTrPs) are

described elsewhere in this book. The eCB system modulates both. Travell & Simons implicated dysfunction at the motor endplate (i.e. the neuromuscular junction) as the cause of MTrPs. At the motor endplate, an α-motor neuron terminates upon its target muscle. The nerve terminates in multiple swellings (termed presynaptic boutons) that contain acetylcholine (ACh) vesicles, with voltage-sensitive calcium channels (VsCCs, specifically *P/Q-type* VsCCs) clustered nearby (Fig. 11.4). Normally an α-motor neuron action potential arrives at the bouton and opens VsCCs, leading to an influx of Ca^{2+} into the bouton, which causes a release of ACh. ACh diffuses across the synaptic cleft and binds to nicotinic ACh receptors (nAChs) embedded in the cell membrane of the postsynaptic muscle fibre (see Fig. 11.4). This mechanism is analogous to the dorsal horn (see Fig. 11.3), but uses ACh instead of glutamate. Activation of postsynaptic nAChs depolarizes the postsynaptic cell, forming a miniature endplate potential (MEPP). A sufficient number of MEPPs activate postsynaptic VsCCs (specifically *L-type* VsCCs), which subsequently trigger the ryanodine receptor. Activation of the ryanodine receptor releases Ca^{2+} from the sarcoplasmic reticulum into the cytoplasm of the muscle cell. This triggers the interaction between actin and myosin, and the muscle contracts (Simons et al 1999).

MTrPs may be evoked by the abnormal depolarization of motor endplates, caused by presynaptic, synaptic and postsynaptic mechanisms (McPartland & Simons 2007). Presynaptic dysfunction may arise from excessive release of ACh, synaptic dysfunction may be a defect of acetylcholinesterase (the enzyme responsible for ACh breakdown) and postsynaptic dysfunction may be caused by an upregulation of nAChs. McPartland & Simons hypothesized that CB_1 in motor endplates dampens ACh release, and perhaps plays a role in preventing or treating MTrPs. This hypothesis has been supported by two new animal studies showing that CB_1 activation in motor endplates dampens ACh release (Newman et al 2007, Sánchez-Pastor et al 2007).

Fascia and connective tissues are also modulated by the eCB system. A recent study revealed that fibroblasts, myofibroblasts, chondrocytes and synoviocytes expressed CB_1, CB_2, and eCB ligand-metabolizing enzymes (McPartland 2008b). Fibroblast CB_1 levels became upregulated after exposure to inflammatory cytokines, and after mechanical stretching of fibroblasts. Within the cell membrane, CB_1 is localized to scaffolding microdomains known as 'lipid rafts' (Rimmerman et al 2007). Lipid rafts in fibroblast cells anchor *integrins*, which are transmembrane receptors that link ligands in the extracellular matrix (such as collagen and fibronectin) to the intracellular cytoskeleton. Integrin receptors transmit signal via intracellular enzymes (e.g. FAK, Rac and Rho), and these in turn regulate the actin–microtubule–cytoskeleton system. The integrin-centred cluster of signalling proteins is known as a 'focal adhesion' and it regulates fibroblast growth, remodelling and migration. It is easy to speculate that focal adhesions are modulated by a mechanism that is CB_1-dependent (Aguado et al 2007).

Inflammatory degradation of connective tissues may be dampened by CB_1. Fibroblast-like synovial cells exposed to inflammatory TNFα secrete metalloproteinase enzymes, which facilitate articular cartilage destruction (Johnson et al 2007). Johnson and colleagues experimentally decreased metalloproteinase secretion by treating fibroblast cells with a synthetic cannabinoid, ajulemic acid (AjA). Related research has shown that articular cartilage destruction (*and* nitric oxide-induced proteoglycan degradation *and* collagen breakdown) are all decreased by AEA (Mbvundula et al 2005).

Enhancing the eCB system

Obviously, enhancing the eCB system would benefit people with fibromyalgia. Clinicians who use bodywork (i.e. osteopathy, chiropractic, physical therapy, massage therapy, Rolfing, etc.) induce psychological changes in their patients, such as anxiolysis, easement of suffering, an increased sense of well-being and even euphoria. These supratentorial effects have been dubbed 'cannabimimetic' because they are evoked by the administration of cannabis. Perhaps bodywork evokes cannabimimetic effects by augmenting the production of eCBs in our patients. We conducted a randomized, blinded, controlled clinical trial (McPartland et al 2005) that measured serum AEA levels twice in subjects, pre- and post-osteopathic manipulative treatment (OMT). The OMT intervention consisted of myofascial release, muscle energy techniques and thrust techniques. Subjects receiving OMT experienced cannabimimetic effects such as 'high, happy, lightheaded and hungry' (measured with a visual analogue-type questionnaire). The increase in

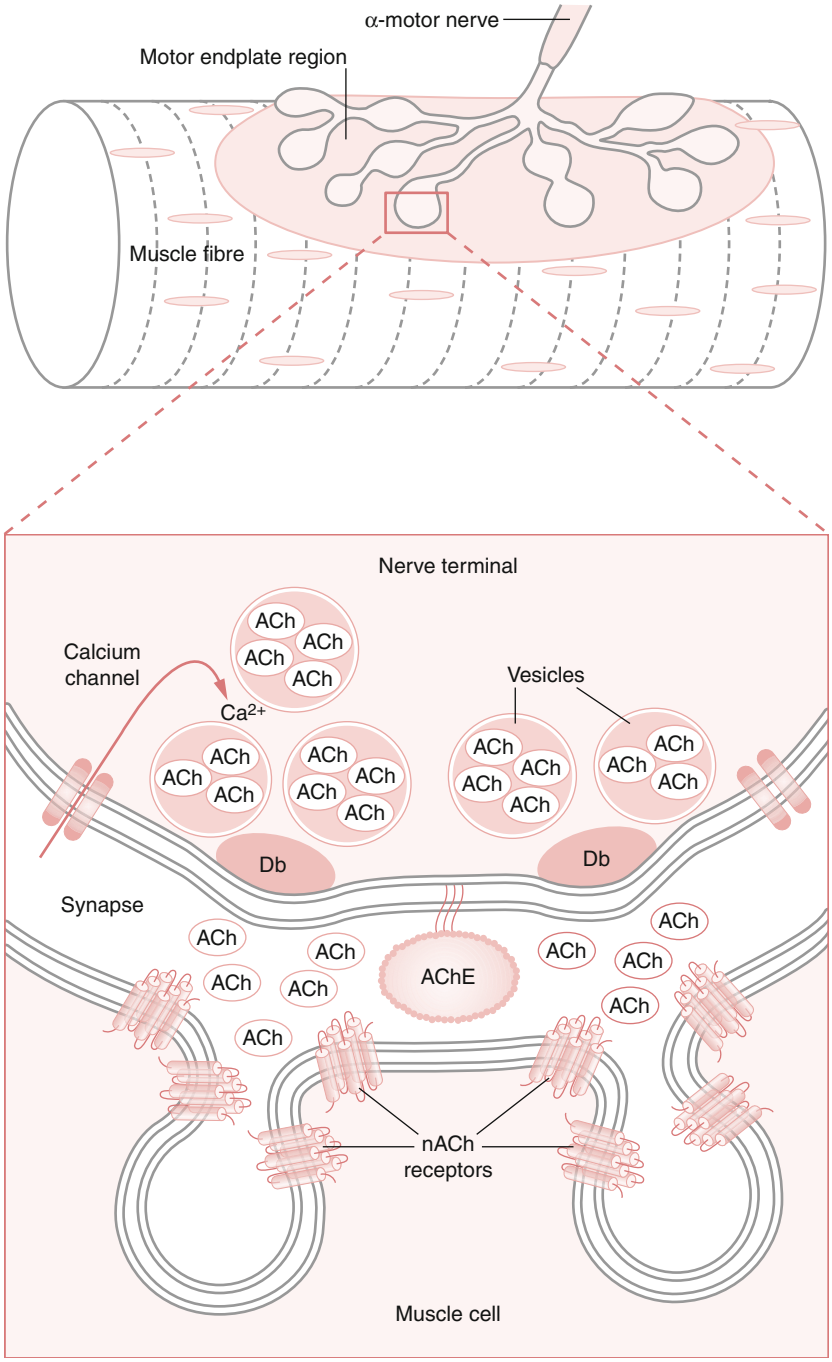

Figure 11.4 • The motor endplate – proposed site of trigger point dysfunction. Top: The junction between the α-motor neuron and the muscle fibre. Bottom: Presynaptic boutons are separated from the postsynaptic muscle cell by the synaptic cleft. Within each bouton are many vesicles containing ACh, clustered around dense bars (Db). Also clustered around the Db are calcium channels. The Db is the site of ACh release into the synaptic cleft. Across the synaptic cleft from the Db, the postsynaptic muscle cell membrane forms junctional folds that are lined with nicotinic ACh receptors (nACh). ACh released into the synaptic cleft activates nACh receptors, then is inactivated by the acetylcholinesterase enzyme (AChE). (Reproduced with permission from McPartland & Simons 2007.)

cannabimimetic effects correlated with an elevation in post-OMT serum AEA levels (more than double pre-OMT levels). Neither cannabimimetic effects nor changes in AEA levels occurred in control subjects. A second smaller clinical trial that investigated the effects of OMT upon eCB levels reported little change in AEA levels, but showed significant post-OMT augmentation of *N*-palmitoylethanolamine (PEA), a short-chain analogue of AEA (Degenhardt et al 2007). The lack of change in AEA levels may have been from differences in measuring AEA, but may have been due to the fact that the OMT intervention in the Degenhardt study did not include myofascial release. Myofascial release imparts strong and prolonged mechanical shearing forces upon the skin. Previous researchers have hypothesized that eCB release in the skin may be the source of 'runner's high' – the cannabimimetic emotions evoked by feet repetitively 'pounding the pavement' (Dietrick & McDaniel 2004).

As noted in the previous section describing thoracic outlet restriction and piriformis syndrome, myofascial dysfunction may recursively loop into eCB system dysfunction. Myofascial barriers can restrict axoplasmic flow and prevent CB_1 from reaching peripheral sites. Thus bodywork that reduces or eliminates myofascial barriers will restore axoplasmic flow and facilitate CB_1 transport to peripheral sites of action.

The cellular mechanisms underlying OMT have been modelled by in vitro stretching of fibroblasts in a Flexercell apparatus (Dodd et al 2006). Unfortunately these researchers did not investigate the effects of stretching upon eCB ligands or CB_1 activation. We reported a doubling of CB_1 *expression* in fibroblasts following stretching in a Flexercell apparatus, but expression is not the same as activation (McPartland 2008b). Speculatively, stretching may activate CB_1 in the *absence* of an eCB agonist. Recall that an agonist works by reshaping its receptor into an 'active conformation', thereby activating a G-protein. Similar reshaping occurs when hydrostatic pressure stretches the angiotensin 1 receptor into an active conformation (Zou et al 2004). This makes sense, because the angiotensin 1 receptor occurs in smooth muscle cells in blood vessel walls and modulates blood pressure. Receptor activation of G-protein in the absence of ligand is termed 'constitutive activity'. Constitutive activity may arise spontaneously in CB_1, but the causes of CB_1 constitutive activity remain unknown (reviewed in Howlett et al 2002).

We speculated a hydrostatic mechanism might stretch CB_1 into an active conformation during a cranial osteopathic 'CV-4' treatment (McPartland 2008b). CV-4 (compression of the fourth cerebral ventricle) transiently increases hydrostatic pressure in the cerebral ventricular system (Adams et al 1992), and cells that line the cerebral ventricles are enriched with CB_1 (Curtis et al 2006). However, cells lining the cerebral ventricles also express enzymes for AEA (Ashton et al 2004), so we have also speculated that the CV-4 technique may trigger a release of eCBs (McPartland & Skinner 2005). Activation of the eCB system may explain many CV-4 effects, such as relaxation and drowsiness, decreased sleep latency and decreased sympathetic nerve activity (Cutler et al 2005). This is not a particularly original thought – Pert (2000) previously hypothesized that energy therapists heal patients by inducing a vibrational tone that shifts neuroreceptors into active conformations, or the vibrational tone triggers release of endorphins that active the neuroreceptors. Oschman (2000) described crystalline materials within biological structures that generate piezoelectric fields when compressed or stretched. Examples of crystalline materials applicable to fibromyalgia include the phospholipids that surround CB_1 within cell membranes, and collagen in the ECM that surrounds fibroblasts.

The eCB system modulates at least three cranial phenomena: the motility of neurons and glial cells (Harkany et al 2007), the rate and amplitude of CSF production (Mancall et al 1985), and restraint of suture ossification (Ofek et al 2006). Lastly, OMT may stimulate nitric oxide and improve cardiovascular circulation, perhaps via eCB release (Stefano & Salamon 2006). Improved cardiovascular circulation is one mechanism by which OMT improves health: 'the rule of the artery is supreme' (Still 1897).

Other approaches

Clinicians wield other tools for augmenting eCB activity in people with fibromyalgia. These include lifestyle modifications (exercise, stress reduction, dietary supplements, drug and alcohol restraint) and pharmaceutical approaches (acetaminophen, NSAIDs, antidepressants, exogenous cannabinoids).

Fibroblasts react to acupuncture needle rotation, a response modulated by Rho and Rac signalling (Langevin et al 2006). Recall that Rho and Rac

signalling are part of 'focal adhesions' and the eCB system works through Rho and Rac (e.g. Berghuis et al 2007, He & Song 2007). Indeed, acupuncture may work through the eCB system (Li et al 2007), rather than the endorphin system as previously assumed (Harbach et al 2007). Similarly, the eCB system rather than the endorphin system may be responsible for 'runner's high' – exercising on a treadmill or stationary bicycle raises serum AEA levels (Dietrich & McDaniel 2004, Sparling et al 2003). Encouraging patients to exercise is a key part of *stress reduction*. Chronic stress downregulates CB_1 expression (Hill et al 2005), so any form of stress reduction may enhance the eCB system.

Studies have shown that acute ethanol ingestion decreased AEA and 2-AG in most brain regions (Gonzales et al 2002) and chronic ethanol downregulated CB_1 expression (Ortiz et al 2004). Dietary inclusion of fish oils containing DHA (docosahexaenoate) and other omega-3 polyunsaturated fatty acids increased AEA and 2-AG levels in the brain (Berger et al 2001, Watanabe et al 2003). Oral administration of *Lactobacillus* upregulated CB_2 in intestinal epithelial cells and relieved symptoms of irritable bowel syndrome (Rousseaux et al 2007).

Pharmaceuticals may augment the eCB system. Acetaminophen (paracetamol) is converted into *N*-arachidonoylphenolamine by the liver, a compound that activates CB_1 (Hogestatt et al 2005). Ibuprofen and other non-steroidal anti-inflammatory drugs (NSAIDs) inhibit COX-2, an enzyme that breaks down 2-AG, so NSAIDs may prolong 2-AG activity. NSAIDs also inhibit FAAH and therefore enhance AEA activity (Fowler 2004). In animal models, the coadministration of NSAIDs with eCBs acted synergistically (Guindon et al 2006). This may explain why NSAIDs sometimes cause sedation and other unexpected psychotropic effects in our patients. Dexamethasone potently upregulated CB_1 in rodents (Wang et al 2007) and may account for the strange 'steroid-induced euphoria' seen in patients on high doses of these drugs. Diazepam and eCBs produce synergistic anxiolytic effects in mice, leading researchers to propose that enhancement of eCB function increases the effectiveness of diazepam (Naderi et al 2008). The tricyclic antidepressant desipramine increased CB_1 levels in the brain (Hill et al 2006), whilst fluoxetine decreased CB_1 expression (Oliva et al 2005). This may be why people with fibromyalgia often respond to low doses of tricyclic antidepressants, whereas SSRIs yield mixed results.

What about drugs that directly activate CB_1 and CB_2? Adelmidrol, a synthetic analogue of PEA, has been topically applied to improve lateral epicondylitis (Sioutis et al 2004). At least three clinical studies are currently testing THC or nabilone (a synthetic THC analogue) for the treatment of fibromyalgia (see http://www.clinicaltrials.gov). Two other studies have been completed. Subjects given nabilone reported significant improvements in visual analogue scales (VAS) for pain and anxiety, and in the Fibromyalgia Impact Questionnaire (a functional improvement scale) (Skrabek et al 2008). The drug was well tolerated, although the nabilone group experienced more side-effects than the placebo group. A previous pilot study of synthetic THC (Schley et al 2006) reported improvement in some fibromyalgia patients, but over half the subjects withdrew due to adverse side-effects.

Adverse side-effects are the primary reason why many patients prefer cannabis to synthetic THC (McPartland & Pruitt 1999). Cannabis is more than THC. Other ingredients provide additional benefits, as well as mitigate the side-effects of THC. Cannabidiol (CBD), for example, reduces symptoms of dysphoria and anxiety provoked by THC, while contributing its own anxiolytic, antipsychotic, analgesic, anticarcinogenic, antioxidant and neuroprotective effects (Russo & Guy 2006). Sativex, a botanical extract standardized to contain a 50:50 mix of THC and CBD, has been approved for Phase III trials in the USA. The product is sprayed under the tongue, where it is absorbed into the bloodstream. Sativex is licensed in Europe and Canada for multiple sclerosis, neuropathic pain and cancer-related pain. Extension studies have shown that Sativex retains efficacy for at least 4 years, without drug tolerance or dose escalation, and with no evidence of dependency or abuse (Russo 2007).

Myofascial pain is a common reason why patients self-medicate with cannabis (Ware et al 2005). Cannabis is mostly illegal, although it is being reinstated as a controlled pharmaceutical drug by an increasing number of countries (in Europe, Canada and elsewhere, and in a dozen states in the USA). Suboptimal routes of administration continue to hamper its use. The oral administration of cannabis shares drawbacks with THC or nabilone capsules – they all suffer from erratic gut bioavailability and poor dose titration. THC taken by mouth is converted to an 11-hydroxy-THC metabolite with two to four times more psychoactivity, which is why people get whacked by 'pot brownies' (McPartland & Pruitt 1997).

Smoking cannabis is a health hazard due to polyaromatic hydrocarbons (PAHs) formed during combustion. Vaporization of cannabis provides an alternative to smoking, recently described and illustrated in the *New England Journal of Medicine* (Okie 2005). THC vaporizes at a temperature *below* the ignition point of combustible plant material, so few PAHs appear in the vapour.

THC and CBD may widen their own therapeutic windows by increasing AEA levels, and THC surprisingly upregulated CB_1 expression when administered acutely (reviewed in McPartland & Guy 2004). Low doses of THC (subtherapeutic doses) markedly potentiate pain relief imparted by endogenous cannabinoids (Suplita et al 2007). Chronic high doses of THC, however, cause downregulation and desensitization of cannabinoid receptors (they involute from the cell surface), resulting in the development of drug tolerance (Breivogel et al 2003). Tolerance develops at varying rates and magnitudes in different brain regions – for example, it occurs faster and greater in the hippocampus compared to the basal ganglia (Breivogel et al 2003). This may explain why frequent users of cannabis develop tolerance to its effects upon memory loss but not to its euphoric effects, which are believed to be mediated by the hippocampus and basal ganglia, respectively (D'Souza et al 2008).

Although controversial, the eCB system has been associated with psychotic disorders. Individuals with schizophrenia have elevated levels of AEA in their cerebrospinal fluid, but the elevated levels are negatively correlated with psychotic symptoms (Giuffrida et al 2004). This suggests that abnormal activation of postsynaptic D_2 receptors triggers release of AEA and retrograde signalling via CB_1, thus homeostatically attenuating dopamine release. High doses of THC may therefore provoke psychiatric illness in susceptible individuals, by downregulating and desensitizing CB_1 receptors and diminishing retrograde signalling (Giuffrida et al 2004). On the other hand, CBD shows promise as an antipsychotic agent (Zuardi et al 2006).

Conclusions

The eCB system is a key regulator of psychoneuroimmunological function. As fibromyalgia may represent an eCB deficiency syndrome, enhancing eCB function provides a new approach for treating fibromyalgia. The strategies described in this chapter should be added to existing regimens, because fibromyalgia is a complex condition that requires a multifactorial approach to management.

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Chapter Twelve

12

Therapeutic Touch in the treatment of fibromyalgia

Pat Winstead-Fry and Rebecca Good

CHAPTER CONTENTS

Therapeutic Touch (TT) has been used to treat fibromyalgia for many years. Before fibromyalgia was identified as a distinct disease, persons with pain would present themselves to TT practitioners. Because TT works well in alleviating pain and reducing anxiety, regardless of the cause, the person with fibromyalgia experienced relief after a treatment. As TT practitioners learned more about the disease and treatment, the anxiety, depression and pain associated with the disease were treated even more successfully. This chapter presents the history of Therapeutic Touch, the theory underlying the treatment, research related to fibromyalgia symptoms, two case studies and an interview with Dr Dolores Krieger, co-founder of Therapeutic Touch.

Introduction to Therapeutic Touch

Therapeutic Touch is a contemporary interpretation of several ancient healing practices. Therapeutic Touch is defined as an intentionally directed process of energy exchange during which the practitioner uses the hands to facilitate – it is hypothesized - the rebalancing of another's energy field in support of healing. Therapeutic Touch is a complementary integrative therapy that works effectively with a wide variety of patient conditions. It is a holistic process that aims to bring balance to the individual in body, mind, emotions and spirit.

Therapeutic Touch is practised by nurses, occupational therapists, physical therapists and other professionals in diverse health care settings. Therapeutic Touch has been shown to be effective in eliciting a relaxation response, reducing anxiety, decreasing pain, increasing a sense of well-being, and accelerating the body's ability to heal from wounds and surgery (Blankfield et al 2001, Denison 2004, Lin & Gill 1999). Evidence suggests that Therapeutic Touch is valuable across the age spectrum, from neonates to the elderly (Aucott et al 2002, Ireland 1998, Woods & Diamond 2002). As such, it is an important addition to nursing interventions, as it meets the National Institute of Nursing's mandate to reduce the burden of illness

by developing and implementing interventions that are non-invasive, inexpensive and easily learned. It is suggested that Therapeutic Touch helps restore balance and order in all aspects of the individual: body, mind, emotion and spirit.

History

Dr Dolores Krieger and Mrs Dora Kunz developed the contemporary form of TT from the ancient practice of 'laying on of hands'. Mrs Kunz was born with the ability to see subtle energies around living organisms. She was able to develop her gift, and by the 1960s was asked by physicians to evaluate acknowledged healers (Karagulla 1967). About the same time, Mrs Kunz invited Dr Krieger to observe with her and take notes. Most of the healing took place using the laying on of hands. Despite doubts as to whether what was conceived as being a gift could be learned, Dora Kunz began to teach Dr Krieger. With practice, Dr Krieger became able to feel what was believed to be energy field imbalances, and developed the skill to rebalance it. In the early 1970s she and Dora Kunz began to teach what is now called Therapeutic Touch. They began with graduate nursing students at New York University.

In 1974, Dr Krieger developed the first complementary medicine curriculum in a university, which was a nursing course on Therapeutic Touch entitled 'Frontiers in Nursing' that was approved by the New York University School of Education curriculum committee.

'Frontiers' was taught for the first time in 1975. It has been taught every semester since then. As 'Frontiers' is a graduate level course, the nurses who enrol in it are practising nurses. These nurses were able to implement what they learned into their clinical care of patients.

Currently, the North American Nursing Diagnosis Association (NANDA) recognizes Therapeutic Touch as a nursing intervention under the NANDA diagnosis 'disturbed energy field' (NANDA International 2006). Other professional organizations such as the American Nurses Association (ANA) and the National League for Nursing (NLN) support TT as a nursing intervention based on its extensive research as presented below. The National Institute of Health's National Center Office for Complementary and Alternative Medicine (NIHCAM) recognizes TT worthy of receiving funding for further research, as does the US Department of Defense (Turner et al 1998), White House Commission on Complementary and Alternative Medicine Policy (2002).

Theoretical basis

There are several assumptions upon which Therapeutic Touch is based. One that draws upon the work of nursing theorist Martha Rogers states that each person is a localized concentration of energy within a larger field that connects all living organisms (Rogers 1990). In this model each individual is conceived as being an open system, interconnected to others, allowing life energy to be directed from one person to another. TT practitioners become skilled at sensing blockages, distortions and lack of energy in the patient, and the practitioner then uses her hands in a knowledgeable way to balance and increase the energy of the patient.

Another assumption is that there is a universal healing field upon which each TT therapist draws to make this energy available to patients. The idea of a universal energy field is becoming more understood by Westerners. However, it has been an assumption of Eastern Indian philosophy and medicine for thousands of years. In Ayurvedic tradition the energy is called *prana* and is used in breathing exercises designed to increase energy balance (Lerner 1994).

Prana, or the life energy, is conceptualized as being basic to life, organizing cellular and nutritive functions of the body. Prana is thought to be more basic than oxygen or food to the life process. It is related to the energy centres, termed chakras, and different aspects of prana are mediated by the various chakras. For example, the heart chakra is conceived as guiding nervous impulses (including pain and anxiety) to the brain where they are interpreted. The life force (prana) is viewed as being distributed throughout the body as a subtle energy. These concepts are difficult for some Westerners as they do not fit the reductionist and materialistic basis of Western medicine which seeks to find genetic, cellular or other causes of disease, and then to treat them. An imbalance of prana is thought to be capable of manifesting itself in many ways, depending upon the inborn tendencies of the person and the chakras involved.

TT practitioners are taught how to incorporate working with the chakras and prana when doing TT. They attempt to sense the prana and energetic differences of the chakras as they move over them with their hands during a TT session. They assess and assist in rebalancing the pranic flows in a consciously directed and knowledgeable way (Kunz & Krieger 2004).

An assumption shared by many cultures, and healing systems such as Ayurveda, is that symptoms of

illness are actually indications of energy imbalance (Lerner 1994). When symptoms of illness occur, they are believed to indicate energy imbalance or blockage. To those who accept concepts involving an energy basis of life, symptoms are associated with excesses or deficiencies of normal energy flow. The physical body is seen to be one aspect of the total person, with the body requiring unrestricted flow of vital energy. Blockages and imbalances of energy, and the consequent health problems that result, are thought to occur on physical, mental, emotional or spiritual levels (Eisenberg & Wright 1987, Gerber 1988).

Another assumption is that all healing is ultimately self-healing (Krieger 1993). This is a difficult concept because it can be misunderstood. For example, if a person does not recover health it may be thought that the individual is somehow sabotaging the self-regulating healing process. For the holistic healer, death may be a healing. Depending upon the individual's particular life course, Therapeutic Touch may result in something as wonderful as a spontaneous remission, or less pain and decreased symptomatology, or it may assist in supporting transition during death. The needs of the inner or higher self – that aspect of consciousness that is our true self and is characterized by peace and calm – are what appear to govern outcomes of an intervention. Although some people are remarkably well tuned into their higher selves, others are not; however, it is suggested that the higher self will create the desired outcomes (Kunz & Krieger 2004).

Krieger and Kunz assumed that the ability to facilitate healing in another person is an innate human potential which could be developed through training and practice. Over 35 years of teaching TT and practice have validated this assumption.

Fibromyalgia

The characteristics, differential diagnosis, hypothetical aetiological models and associated conditions of fibromyalgia (FMS) have been covered in depth in earlier chapters (see Chs 1, 3, 4 and 5). The various classifications and subtypes of FMS have been defined and discussed in Chapter 2. Regardless of the classification or aetiology, generalized pain and stiffness characterize the syndrome. For the patient with FMS, each day may be different, varying from minor levels of stiffness to severe radiating pain that is so extreme the person cannot carry out simple activities of daily living. The uncertainty associated with the disease makes living with it very stressful. Patients need a variety of management approaches, including nutrition, exercise, lifestyle changes, and complementary and alternative therapies (CAM) as fully discussed in Chapters 6 to 17 inclusive.

Research on the use of CAM by FMS patients demonstrates that 2.5 more FMS patients will seek alternative treatment than patients without FMS (56% compared to 21%), if covered by health insurance. The patients who used CAM were sicker (more disease burden), but their costs were not higher because CAM treatments are not as expensive as an office visit to a traditional medical practitioner (Lind et al 2007). Sarac & Gur (2006) point out that much of the research on CAM and FMS has not been replicated, but those studies that have been conducted show that patients feel better.

Research findings

Research into TT falls into several categories. For the purposes of this chapter, the following categories that are related to, and are also at work with TT to help the major symptoms of FMS, will be used. These are: stress and anxiety, and pain and discomfort.

Stress and anxiety

Stress is endemic in modern life. It is thought to decrease immune function, which – in turn – can increase disease. Over the years, a great deal of research has sought to develop the link between immunosuppression and disease onset or increased severity of established illness. Students who are facing predicable stressors, such as board examinations, have demonstrated that these otherwise healthy people show immune function changes such as a decrease in the helper T lymphocytes, a decrease in the number of natural killer cells and decreased mitogenic response (Glasser et al 1986, Olson et al 1997).

Although the mechanism by which TT achieves its effects is not known, it is theorized to be in some way related to the relaxation response. Most practitioners and patients note a state of relaxation within a few minutes of beginning a TT treatment. Dora Kunz taught that the importance of eliciting the relaxation response is that a person is more open to the healing of Therapeutic Touch when relaxed. One of the first studies by Krieger et al (1979)

demonstrated patient relaxation response to TT by means of electroencephalogram, electrocardiogram and palmar galvanic skin response, as well as patient self-reports confirming a state of relaxation. In a critical care setting, seriously ill patients' self-reports agreed they were relaxed (Cox & Hayes 1999).

Other studies supported similar findings with different patient groups, including hurricane survivors, hospitalized children and HIV-positive persons (Aucott et al 2002, Cox & Hayes 1997, Fedoruk 1984, Gagne & Toye 1994, Kramer 1990, Olson et al 1992, 1997). These studies demonstrate that TT alone, or TT in conjunction with other supportive activities, decreases stress. Many of these studies used Spielberger's State/Trait Anxiety Inventory as the measure of stress-related anxiety. Over the years, the studies became more sophisticated. When the effects were measured by peripheral skin temperature, pulse and galvanic skin response assessed by a biofeedback instrument (Kramer 1990), T-lymphocyte function and immunoglobulin levels (Olson et al 1997), and cortisol levels (Woods & Diamond 2002), the efficacy of TT in stress reduction was affirmed at statistically significant levels.

Studies have demonstrated that TT effectively and significantly decreases anxiety in diverse samples, including HIV-positive children, hospitalized adults, burn patients and the elderly (Hale 1986, Heidt 1981, Ireland 1998, Lin & Gill 1999, Parkes 1986, Quinn 1982, Shuzman 1993, Simington & Laing 1993, Turner et al 1998). Many of these studies have included participants who are in general hospitals, cardiovascular units, burn units and institutions for the elderly, all stressful environments. Some of these studies explored pain as well as anxiety (Lin & Gill 1999, Turner et al 1998). The pain aspect will be considered below.

Pain or discomfort

The studies in this category involved reducing pain or discomfort. Studies demonstrate the effectiveness of TT in reducing pain from differing sources (Blankfield et al 2001, Denison 2004, Gordon et al 1998, Peck 1997, 1998, Philcox et al 2002, Smith et al 2002, 2003). Studies included patients with carpal tunnel syndrome, osteoarthritis of the knee, degenerative arthritis, phantom limb and stump pain, and bone marrow transplant. Denison's study (2004) addressed FMS patients specifically. She found that FMS patients who received TT experienced a statistically significant decrease in pain from pre-treatment to post-treatment, and that quality of life improved over the six treatments. In two studies (Gordon et al 1998, Peck 1998), TT increased the functional ability in patients with osteoarthritis. Meehan (1993) found no statistically significant differences in patients treated with morphine versus TT after surgery. However, the TT group was able to delay the need for analgesics for a longer period of time than the control group.

With regard to comfort, Smith et al (2003) used TT with patients undergoing bone marrow transplant. These patients reported that TT provided comfort. Therapeutic Touch increased the well-being of patients with terminal cancer (Smith et al 2003). In another study with cancer patients, Lafreniere et al (1999) showed that TT reduced the distressing symptoms of tension, confusion and anxiety in patients undergoing chemotherapy. Side-effects of chemotherapy are similar to FMS symptomatology – for example, anxiety, fatigue, joint pain, headaches, neuralgia and connective tissue pain. The TT patients also showed a significant increase in energy. Similarly, Giasson & Bouchard (1998) found that TT decreased pain, nausea, depression, anxiety and shortness of breath, while increasing activity, appetite, relaxation and inner peace in patients with terminal cancer. These studies suggest that TT, which is non-invasive, may be valuable for a range of discomfort in cancer patients.

In a case study of a patient who had undergone a Whipple procedure, TT decreased pain and anxiety and increased comfort. An unexpected finding was that the patient healed faster than expected and was discharged early, thus decreasing the cost of the hospitalization (Smythe 2001).

Other developments in research

To date, there have been four meta-analyses of alternative healing modalities. Two of them refer to 'healing' and to 'distant healing' (Abbot 2000, Astin et al 2000). These analyses include TT and other modalities. Astin et al (2000) examined 11 studies of 'distant healing' (including TT) that had true randomization and placebo control. They concluded that a major weakness in TT research is the use of single-blind, rather than double-blind control.

However, Astin and his colleagues point out that this cannot be overcome in TT research because practitioners have to know they are delivering TT. To offset this inevitable weakness in TT research, they recommend using larger sample sizes so that more sophisticated statistical designs can be used. They also recommend performing TT more frequently during the study, thus increasing the likelihood of TT having a more pronounced effect.

Peters (1999) and Winstead-Fry & Kijek (1999) conducted meta-analyses of the TT research and came to very similar conclusions. They found that studies which used healthy participants did not support hypotheses relating to TT; this is not surprising as TT is a therapeutic modality. There was tremendous diversity in how TT was explained, which made comparisons of the results difficult. Some TT treatments lasted only 5 minutes, whereas practitioners generally treat for about 20 minutes. All four meta-analyses found a moderate benefit to the use of TT and recommend further study.

Continuous quality improvement study

In 1999, a Department of Holistic Care Services was created at St John's Riverdale Hospital in New York (Newshan & Schuller-Civitella 2003). The Department uses the Krieger–Kunz method of Therapeutic Touch. Inpatients are treated at no cost as TT is part of their usual nursing care. Patients may be referred by health care providers, family or friends, or by themselves.

Evaluation of TT was part of the continuous quality improvement (CQI) initiative within the hospital. In order to do the evaluation, a standardized tool had to be created. The tool has two parts: a patient satisfaction survey (PSS) and a TT performance improvement tool (TTPIT). The PSS consists of six questions and a space for patients to write comments. All patients who received two TT treatments were asked to answer the PSS anonymously and send it by pre-addressed envelope. The TTPIT is completed by the TT practitioner at the end of a TT treatment. Among other things, it notes changes in patient discomfort, calmness, nausea, pain, falling asleep and comments by the patient about the treatment.

By August 2000, 605 patients had received TT. Most had one treatment (373 patients). Others had as many as five or more treatments. Decrease in pain was reported by 48% of the 259 patients who had pain; 90% rated TT as very helpful or helpful. Comments were generally favourable.

Clinical applications

Therapeutic Touch – the dynamic process

The four phases of Therapeutic Touch are learned as a sequence of distinct steps or phases, which typically evolve into a synchronized process as the therapist continues to practise.

The TT process is always individualized and can be performed with the person sitting in a chair or lying down, whichever is more comfortable. It is not necessary for the client to disrobe. The practitioner will generally pass the hands over the person's body from head to toe, over the front and back of the body, holding the hands 2–6 inches (5–15 cm) from the skin. The practitioner will assess and then use rhythmical sweeping motions with the hands as explained below. The practitioner may or may not physically touch the person.

Throughout the session the therapist holds the intention of the client/patient's wholeness. Compassion and intentionality are two guiding principles in the TT process.

The four phases of Therapeutic Touch

The Therapeutic Touch process is dynamic, not linear. In the beginning, however, it is easier to understand when explained in phases or steps.

Centering

The therapist begins by *centering* her or himself, i.e. bringing body, mind and emotions to a quiet, focused state of consciousness. Characteristics of this state may include:

- finding an inner sense of equilibrium, a personal reference of physical, emotional and intellectual stability
- quieting the body, mind and emotions
- connecting with one's inner core of wholeness and stillness
- feeling integrated
- being non-judgemental.

The therapist continues through the entire TT interaction in a state of 'sustained' centeredness.

Assessment

The second phase or step is also referred to as 'scanning'. In the *assessment*, the hands are used to determine the nature of the dynamic energy field of the patient. The therapist holds the hands 2–6 inches (5–15 cm) away from the patient's body, while moving from the head to the feet in a rhythmic, symmetrical manner. The intent is to observe the nature of the flow of energy throughout the patient's field, based upon the assumption that in health the flow is generally open and balanced. The therapist senses carefully for any differences in this flow. The sensory cues, which are received intuitively, cognitively and energetically, vary for each practitioner, but may include sensations of tingling, pulsation or temperature changes.

Intervention/rebalancing

The third phase or step, *intervention*, is also referred to as *balancing* or *rebalancing*. The intention of the therapist is to facilitate the symmetrical and rhythmic flow of energy through the patient's field by using the techniques of unruffling/clearing, directing and modulating energy based on the cues perceived in the assessment, thereby helping re-establish the symmetrical balance, rhythm and flow in the field. In using unruffling/clearing, the therapist again moves the hands through the patient's field with the intention of facilitating the flow, allowing the field to clear itself of congestion or disruption and return to a more balanced flow. This is thought to help to free non-flowing energy and allows access to underlying imbalances.

In choosing to 'direct' and 'modulate', the therapist consciously evokes the intention to bring energy through her or himself into the field of the patient to bring balance to areas of imbalance. Energy may be directed through specific areas of the body based on assessment and re-assessment.

While directing energy, the therapist uses modulation to adjust the flow of energy during the TT intervention. While maintaining the state of sustained centering, the therapist does not push, force or constrict the flow, but with gentle awareness allows the patient's field to draw the needed energy. The therapist also recognizes the need to modulate the flow of energy based upon the patient's sensitivity to the interaction. Sensitive individuals such as the very ill, the elderly and the very young, or those with psychological disturbances, appear to require an especially light, gentle flow of energy during modulation.

Evaluation or closure

In the final phase or step, *evaluation* or *closure*, the therapist uses professional, informed and intuitive judgement to determine when the session has come to a close. Reassessment is an ongoing process. When evaluation reveals the balanced, symmetrical and rhythmical order within the system, as though the biofield has absorbed all it can during the session, the practitioner ends the session. It is helpful if the patient can rest for a short period.

The frequency and duration of a TT session varies according to the practitioner's assessment, but is usually no longer than 20–25 minutes. Depending on the age and condition of the recipient it may be shorter – for example, neonates, children and pregnant women, as well as the elderly and debilitated, are more sensitive.

Adverse effects/precautions: There have been no recorded adverse effects, but it is important for the practitioner to be knowledgeable and skilled in the TT process.

Qualifications for a Therapeutic Touch teacher and/or practitioner

Therapeutic Touch has standards and scope of practice, policy and procedure for the practice of TT, as well as ethics and a credentialling programme for practitioners and teachers. Dr Dolores Krieger and a group of TT practitioners and teachers formed Nurse Healers-Professional Associates International (NH-PAI), the official organization of Therapeutic Touch® in the late 1970s. NH-PAI sets the standards, policies and procedures and the credentialling standards for the teaching and practice of Therapeutic Touch. Credentials are maintained by satisfying specific requirements as set forth by the NH-PAI. For more information, go to http://www.therapeutic-touch.org.

Case reports

Review of the research demonstrates that TT decreases pain, anxiety and stress, and increases quality of life. TT works at the autonomic system

level by eliciting a relaxation response and calming the fight or flight reactions to anxiety and stress. With FMS, a person is constantly on alert. If they are not having a painful day, they are in fear of when the pain might come back to immobilize them again. Thus, the initial response to TT of eliciting a relaxation response begins the process of reaching all aspects of the person's being – body, mind emotion and spirit.

Once the practitioner has elicited a relaxation response, areas of imbalance or congestion are targeted. Pain, for example, will be envisaged by a practitioner as generalized or localized congestion. Using intentionality and knowledgeable direction of the energy, the practitioner facilitates the balancing and rebalancing of areas of congestion. Deficits of energy in the field, as noted from the assessment or scanning of the energy field, are also addressed using intention and knowledgeable modulation of the energy. Of note are the adrenals. These are more often than not depleted. The practitioner sends healing energy to the adrenals to replace the energy FMS exhausts, as the individual attempts to deal with the pain, anxiety and other stressors of FMS. While doing TT, the person is seen as whole and the practitioner is filled with compassion that is used to flood the patient's being to help them feel that they are not alone and that they are unconditionally accepted and loved.

As a practitioner working with many FMS patients for the past 15 years, co-author Rebecca Good has found TT to be very helpful. TT is cumulative and patients have reported sleeping better, feeling much more relaxed, feeling little or no pain, lasting for longer and longer periods post each session, and have reported a sense of increased well-being. Patients frequently say that they feel they have hope for the first time in a long time.

Therapeutic Touch is individualized according to the cues in the person's bioenergy field. When we work with a person's biofield in TT we are aware that we are working with the whole person. We realize that we are the field as we extend beyond the skin. Therefore, we are assessing cues from all aspects of the field – from body, mind, emotion and spirit. From these cues, we develop and follow an energetic plan of care. We work from a deep level, connecting with our inner or higher self. We connect with the patients' inner or higher self and work with the chakras and pranic flows at their deepest levels.

A TT practitioner comes to know the difference in the feel of the biofield of a person with FMS as compared to the field of a person receiving chemotherapy for example. There are characteristics of which Dr Krieger speaks in her interview and some approaches she uses in treating the person which go beyond the imbalanced cues. Rebecca Good practises in much the same manner.

We who practise TT regularly on FMS patients have realized for a number of years that FMS can have genetic origins, causing a person to be symptomatic from birth, and it can also be precipitated by a traumatic incident to the body, such as a motor vehicle accident (the whiplash aetiology is discussed in Ch. 3).

Case report 1

A 55-year-old woman, Mrs S, was diagnosed with FMS following a traumatic event to her body. She had quadruple bypass surgery and also experienced cardiac arrest several days after the surgery and was resuscitated. Mrs S came to me about a year after the open heart surgery, having recently been diagnosed with FMS. There was no explanation as to the sudden onset of FMS which began shortly after the open heart surgery and cardiac arrest. She was on antidepressant and anti-anxiety medications which were prescribed by a psychiatrist as she also suffered post-traumatic shock and was in fear of going into further cardiac arrest and dying. She was very sensitive to medication and had to be very cautious with the few medications she was using.

I did a Therapeutic Touch session with her, after which she said she felt more relaxed than she had in long time and her pain and anxiety were relieved. She took my suggestion and also began a gluten-free diet. She had eliminated milk a few months previously as she noted she felt worse after having milk products. Mrs S came weekly for 4 weeks for Therapeutic Touch and, with each subsequent session, she reported sleeping better and having relief from the pain and anxiety for longer and longer periods between sessions. She began coming biweekly for another 10 sessions, after which she reported not needing pain medication anymore. She had her psychiatrist cut back on her antidepressant and anti-anxiety medication. Mrs S returned for Therapeutic Touch about every 1–2 months whenever she experienced any slight pain in fear of her symptoms returning to full-blown FMS again. This continued for several years.

Four years after her last Therapeutic Touch session, I was contacted by Mrs S who reported that she was feeling good. Between her diet and the other suggested relaxation exercises she was still able to control her symptoms. She wanted to learn Therapeutic Touch so she could share this wonderful therapy with others. She took a TT class and after 6 months of practice with family and friends she expressed feeling that the practice of TT is also beneficial to her. As with other TT practitioners, she gets secondary benefits from sustained centering and allowing the universal healing energy to flow through her and not from her, as she had been taught.

Case report 2

Mr M came to me for Therapeutic Touch in 1987 when he was a teenager. He reported having had symptoms of FMS all of his life and was told by his medical practitioner that he was born with the syndrome. There was a history of his mother and grandfather also having similar symptoms all of their lives. Mr M was formally diagnosed with FMS at the age of 17 by a medical practitioner who was a holistic practitioner. His mother reported that he had had a sleep disorder since infancy which was still an issue. She said that he 'ruminated' all around his crib at night and was rarely still. He still has trouble getting to sleep and wakes up frequently. Mr M reported that he does not feel rested upon awakening and that he is stiff and achy in the morning. The medical practitioner prescribed amitriptyline to help him get a more restful sleep; he also recommended vitamin supplements and advised him to follow a gluten-free diet. Mr M had already eliminated milk due to lactose intolerance identified when he was a baby. Mr M reported that he has had muscle and joint aches ever since he could remember. However, they worsened when he began to play high school football and the long and intense workouts triggered severe pain in his muscles. Massage made his symptoms worse, so he was directed to me for Therapeutic Touch as it is a gentle therapy.

Therapeutic Touch was administered weekly for six sessions and then biweekly for 6 months. After his first session, he reported feeling more relaxed. It took two sessions before Mr M reported reduced discomfort in his muscles. He also reported sleeping better, but was not sure if it was the medication or the Therapeutic Touch. Mr M has returned for Therapeutic Touch off an on over the years as he feels it is the one therapy that does help him relax and it relieves his pain. He is a pilot now and his schedule does not allow him to come as often as he would like.

Interview with Dr Dolores Krieger

Excerpts of the interview

Question: What is the biggest challenge when treating FMS?
Krieger: The biggest challenge is the accompanying depression. It sets the tone for the rest of their behaviour. Ordinarily you wouldn't consider them a depressed person, but over a long period of time having all that pain and not a definitive answer and it not being a fantasy could be depressing. Where it is affected from a Therapeutic Touch process point of view, is that in order for healing to work a person needs to be willing to change.
Question: What is at work during a TT session beyond the relaxation response?
Krieger: There are adrenal, hypothalamus, pituitary axis and chakra connections that need to be strengthened. Of most importance is the chakra complex. The most important thing Dora [Kunz, co-developer of TT] taught was that the chakras are related to each other. No matter who you go to, they say this chakra does this and that chakra does that, but the truth about chakras is they do not work singly, but act as a 'whole', not alone.

I would be doing 'Deep Dee', in other words keeping in constant contact with my inner self to a whole different level of my perception – a shift in my perception that is very deep within the self.

Another thing that has to be said, the person with FMS has to be able to accept the healing. I do not mean psychologically accept it. The body needs to absorb in order for it to happen. With pain there is a tendency to put up natural barriers. One of the things I would also be doing is supporting them – by them, I mean their own chakra complex. I am trying to set up a balance and resonance between their chakra complex and mine. This is where we are to bring them into balance. Their energy field is so 'holey' because of the pain – the fine net of subtle energies is so 'ragged'. That is what pain does to you. This is what you're

supporting. You are supporting the intrinsic factor of the person's own finer structure in order that the energy you are sending is coming through you and so that the healee's [FM patient] complex can contain it. Otherwise, it will leak right through. That is what I mean by supporting.

From my way of looking at it, what is dysfunctional somehow is the chronic flow of prana. At least one of the five systems of the subsystems of prana is the base of the problem. When you look at it that way, then all this business of the physiological and neurological systems goes out the window because you are talking another language now. If I'm doing TT, I'm really talking prana. It is really from those flows with which I am working. Talk prana to me and it makes sense. It would be good to look at the symptoms because that is what prana plays through and try to begin to understand what the pool of encroaching factors are.

Question: When working with the symptom of pain, how would you work with your prana and with their prana to help the person?

Krieger: I think the most interesting thing in the past 10 years has been the inclusion of pain as one of the vital signs. Something I would take into consideration is [that] the vital energy field doesn't only have flow, does not only respond to what we call colour. Very importantly, it has an intrinsic rhythmicity with pain. Pain is one thing, then there is another thing with pain and that is the system has somehow clamped down on itself. I am talking about the pranic system [clamping down]. You have to figure out a way to open that flow.

The main idea in the Therapeutic Touch process to opening the pranic flow is to let your own ability not only be coordinator, but also to be coherent to that flow. In this way, begin to work out the systematic pathway for that patient as you are working. I would also give the patient homework. We would mention this as we are doing the TT session and talk about whatever visualizations occur as we are continuing.

Very importantly, from the beginning I would not only be putting energy in making connections, etc., I would be sure energy is being dissipated. Because of the pain, part of the problem is you've got a closed circuit there, so to speak, and that just intensifies and that is what we feel as pain. But if you allow it free flow and give it access to go on its way, that's very helpful.

Conclusions

Therapeutic Touch is a non-invasive treatment modality that is successful in treating the major symptoms of fibromyalgia, pain, anxiety and depression. It also reduces stress. Therapeutic Touch has a cumulative effect in reducing the symptoms of FMS. Along with changes in diet and stress management, it can effectively reduce the symptoms of FMS and increase the comfort of the patient. If it is necessary to use analgesic drugs for treatment, TT can decrease the amount of drug required or increase the amount of time between using the drugs.

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Chapter Thirteen

13

Naturopathic hydrotherapy in the treatment of fibromyalgia

Eric Blake

CHAPTER CONTENTS

The modern field of hydrotherapy is sometimes referred to as medical hydrology; balneology or balneotherapy is a branch of the science that studies baths and their therapeutic uses; and crenology or crenotherapy is the science and use of waters from mineral springs (Boyle & Saine 1988). Today, we use the terms hydrotherapy and medical hydrology interchangeably, with medical hydrotherapy indicating all uses of water therapeutically (Bender 2006). Naturopathic medical hydrotherapy is the application of water in any form, either externally or internally, for the treatment of disease and the maintenance of health, and is applied in accordance with the principles and practice of the naturopathic sciences.

History

Medical hydrology has a rich history. Water was used for healing in biblical records and by the ancient Greeks and Romans. Hippocrates (460 BCE), the father of systematic medicine, who practised much as a 19th century naturopath would, applied water for healing, along with diet, exercise, manipulation and herbs. In his tract on the use of fluids he laid down rules for the treatment of acute and chronic diseases by water, which were followed by the hydropaths in the 19th century and which, together with subsequent developments, place hydrotherapy among orthodox and scientific methods of treatment. Galen (129 CE), Celsus (25 BCE) and Asclepiades (100 BCE) also used water therapeutically (Baruch 1892).

Vincent Priessnitz, a Silesian peasant, did more to popularize hydropathy than any other person.

He is recognized as the progenitor of the 19th century nature cure movement and modern naturopathic profession. His success was great and he was known as a careful observer and a good judge of human nature, and his mechanical skill enabled him to invent various technical modifications of hydrotherapy, many of which are still in use today (Priessnitz 1843). The work of Priessnitz set the foundation for the work of the famous Bavarian priest Sebastian Kneipp. Father Kneipp expanded on Priessnitz's work and had a tremendous influence in popularizing hydrotherapy internationally (nature doctors).

Lastly, O. G. Carroll ND SP developed the system of constitutional hydrotherapy in the first half of the 20th century. He systematically combined various physical therapy and electrotherapy treatments with a refined approach to hydrotherapy. Dr Carroll was treated and then taught by Dr Ledoux in New Orleans, Louisiana. Dr Ledoux was a hydrotherapy disciple of Father Kneipp. Carroll also collaborated with Dr Lindlahr when living in the Chicago area. Carroll combined electrophysiotherapy with the Kneipp understanding of hydrotherapy and a new clinical approach to hydrophysiotherapy evolved – constitutional hydrotherapy. Constitutional hydrotherapy will be described in more detail later in this chapter as a representative example of the evolution of a modern clinical naturopathic approach relevant for the treatment of fibromyalgia.

Historical descriptions of hydrotherapy for rheumatism

Kneipp details several cases of various forms of rheumatism, both local and general, in his widely read *My Water Cure* (Kneipp 1896, pp 370–377). His approach involved manual rubbing and counter-irritation and a variety of vapour baths for various parts of the body. The part of the body treated in some cases was indirect to the region of the body that was afflicted – for example, treating the feet when the head and neck were chiefly affected (Kneipp 1896, p 372).

The treatments Kneipp described included a variety of applications. For example, in one case of rheumatism affecting the whole body, sensations of suffocation and great anxiety, the applications included gushing water to the upper body and upper thighs daily, a Spanish Mantle (dripping sheet pack) on the second day, a half bath to replace the upper gush after the fourth day, and a head steam bath once weekly. In 10 days the patient was pain free (Kneipp 1896, p 373). Multiple cases are described, most of them including generalized rheumatic pains, fatigue, anxiety and confusion. Similar but individuated treatment protocols are described.

Water Cure in America: Over Three Hundred Cases of Various Diseases (Wesselhoeft et al) was published in 1856 and reflects the Priessnitz methods popular at the time. One case in particular stands out because the symptom pattern described would likely qualify for a contemporary diagnosis of fibromyalgia. A 51-year-old washerwoman, an African–American slave, describes pain throughout the body, excruciating headaches, abdominal pain and constipation. Some of the rheumatic pains were remnants of beatings at the hands of slave owners. A crude application of various Priessnitz bandages to the torso and limbs, along with cold sitz baths and a simple diet were prescribed. (The Priessnitz bandage is a cotton material wetted with cold water, applied to the skin in varying degree of wetness and number of thicknesses, and then covered with a insulating layer or layers, commonly wool. The application would commonly be removed when the cotton material became body temperature. The bandages were rewetted throughout the day and a tepid bath was taken morning and night with significant rubbing of the whole body.) After 3 weeks she was pain free, and several weeks later dispensed with the cane that she had used for over 25 years. At 2-year follow-up she was still well (Wesselhoeft et al 1856). Shew likewise describes similar crude treatments of the Priessnitz type with descriptions of positive outcome (1851), as does Trall in *The Hydropathic Encyclopedia* (1857).

The therapeutic approach in all of these early hydropathic approaches recommended not only hydrotherapy, but also simple diet. The hydrotherapy prescriptions were applied in a constitutional or holistic manner whose stated goal was to 'dissolve morbid matter' or, in contemporary terms, to detoxify the system, improve circulation generally and locally, improve thermoregulatory capabilities, and aid in the elimination of waste matters through kidney, skin and bowel.

Clinical research summaries of hydrotherapy, balneotherapy and spa therapy

Laboratory and clinical research on hydrotherapy has been ongoing for well over 150 years. Awareness of the current terminology for the terms hydrotherapy,

balneotherapy and spa therapy are useful for proper interpretation of the literature.

- Hydrotherapy generally refers to plumbed water applied at various temperatures, aquatic therapy and therapeutic rehabilitation methods.
- Balneotherapy is the therapeutic use of bathing agents such as mineral and thermal waters, muds and gases.
- Spa therapy combines hydrotherapy, balneotherapy and drinking cures in an inpatient setting.

The naturopathic professional literature of the 20th century has utilized a slightly different classification:

- Hydrotherapy is the use of water in all its forms.
- Baths and mud packs are considered one of the branches of hydrotherapy.
- Sanatorium care describes comprehensive inpatient care that would include various hydrotherapy methods and is analogous to the modern use of medical spas in Europe.

Hydrotherapy and fibromyalgia

A Brazilian study (Vitorino 2006) compared the treatment effects of hydrotherapy versus physiotherapy on fibromyalgia (FMS). Fifty female outpatients were divided into two groups. After 3 weeks of treatment, the hydrotherapy group improved total sleep time and decreased total nap time as compared to the subjects receiving physiotherapy. There was no difference reported in quality of life (both improved). *Note*: the form of hydrotherapy is not known.

Aquatic therapy and fibromyalgia

Swedish research evaluated the effects on FMS of 6 months of pool exercise (temperate temperature) combined with six sessions of education (Mannerkorpi et al 2000). Fifty-eight individuals were randomized to a treatment and a control group. The treatment group were advised to 'match the pool exercise to their threshold of pain and fatigue'. The educational component comprised discussion of coping strategies and encouragement to physical activity. The outcome was that significant differences were observed and noted on the Fibromyalgia Impact Questionnaire and the 6-minute walk test (see above). There were also improvements in the treatment group, to a significant degree, in physical function, grip strength, pain severity, social functioning, psychological distress and quality of life.

A follow-up study was carried out at 24 months. Symptom severity, physical and social function parameters were still improved at 24 months.

Balneotherapy and chronic low back pain

A meta-analysis (Pittler et al 2006) of randomized trials of the use of spa and balneotherapy in the treatment of low back pain has shown favourable, if not conclusive, results:

> *The data for spa therapy, assessed on a 100 mm visual analogue scale (VAS), suggest significant beneficial effects compared with waiting list control groups (weighted mean difference 26.6 mm, 95% confidence interval 20.4–32.8, n = 442) for patients with chronic low back pain. For balneotherapy the data, assessed on a 100 mm VAS, also suggest beneficial effects compared with control groups.*
>
> *Conclusions: Even though the data are scarce, there is encouraging evidence suggesting that spa therapy and balneotherapy may be effective for treating patients with low back pain. These data are not compelling but warrant rigorous large-scale trials.*

Batsialou (2002) describes the elements that might be involved in balneotherapy when treating chronic back pain:

> *Balneotherapy represents a therapy by various hot or warm baths in natural mineral waters of specific physical and chemical characteristics. When used externally, they have mechanical, chemical and thermic effects. Balneotherapy of lumbar syndrome includes: individual baths, swimming in the pool, hydrokinesitherapy, underwater massage, underwater extension, mud therapy, mud baths.*

Balneotherapy research and fibromyalgia

Although most balneotherapy trials involving rheumatic conditions such as fibromyalgia report positive findings, many studies have been assessed

as being methodologically flawed. Therefore, the reported 'positive findings' should be interpreted with caution (Verhagen et al 2003). Improved studies are needed.

Israeli research was conducted to evaluate the effectiveness of balneotherapy on patients with FMS in the Dead Sea (Buskila et al 2001). Forty-eight patients with FMS were randomly assigned to either a treatment group receiving sulphur baths or a control group. All participants stayed for 10 days at a Dead Sea spa. Physical functioning, FMS-related symptoms and tenderness measurements were assessed prior to arrival at the Dead Sea, after 10 days of treatment, and 1 and 3 months after leaving the spa. Physical functioning and tenderness moderately improved in both groups. With the exception of tenderness threshold, the improvement was especially notable in the treatment group and it persisted even 3 months after leaving the spa. Relief in the severity of FMS-related symptoms (pain, fatigue, stiffness and anxiety) and reduced frequency of symptoms (headache, sleep problems and subjective joint swelling) were reported in both groups, but lasted longer in the treatment group. The conclusion was that balneotherapy treatment of FMS is effective and safe.

A study was conducted to assess the effectiveness of balneotherapy in the Dead Sea area (Sukenik et al 2001) in the treatment of 28 patients suffering from both fibromyalgia and psoriatic arthritis. Clinical indices were assessed and the results showed that the number of active joints was reduced, as were the number of tender points. A significant improvement was found in dolorimetric threshold readings after the treatment period in women. The conclusion was that balneotherapy appears to produce a statistically significant, substantial improvement in the number of active joints and tender points in both male and female patients.

Evcik et al (2002) report a Turkish study in which 42 primary fibromyalgia patients, diagnosed according to American College of Rheumatology criteria, ages ranging between 30 and 55 years, were randomly assigned to two groups. Group 1 ($n = 22$) received 20 minutes of bathing once a day, five times per week. Patients participated in the study for 3 weeks (total of 15 sessions). Group 2 ($n = 20$) was accepted as the control group. Patients were evaluated by the number of tender points, visual analogue scale for pain, Beck's Depression Index and Fibromyalgia Impact Questionnaire for functional capacity. Measurements were assessed initially after the therapy, and at the end of the sixth month. In group 1, there were statistically significant differences in the number of tender points, visual analogue scores, Beck's Depression Index and Fibromyalgia Impact Questionnaire scores after the therapy programme ($P<0.001$). Six months later, in group 1, there was still an improvement in the number of tender points ($P<0.001$), visual analogue scores and Fibromyalgia Impact Questionnaire ($P<0.005$). However, there was no statistical difference in Beck's Depression Index scores compared to the control group ($P>0.05$). 'Patients with FMS mostly complain about pain, anxiety, and the difficulty in daily living activities. This study shows that balneotherapy is effective and may be an alternative method in treating fibromyalgia patients.'

Pool-based Watsu (WATer shiatSU) (Dull 1997), in which the patient floats in warm water sourced from hot springs (35°C) while having the moves and stretches of Zen Shiatsu applied, has been shown to be a highly effective intervention for FMS (Faul 2005).

Spa therapy

Spa therapy is typically practised in a health resort; therefore, it is sometimes called health resort medicine. Spa therapy combines hydrotherapy, balneotherapy, patient education, nutrition and physical therapy as the main modalities used. In combination, spa therapy has been shown to be clinically beneficial for a variety of common health conditions. Studies (Van Tubergen et al 2002) show that spa therapy is cost-effective as compared to standard treatment alone – for example, in treatment of osteoarthritis of the knee.

Spa therapy and fibromyalgia

In a Turkish study (Cimbiz et al 2005), 470 patients with fibromyalgia and other conditions received spa therapy twice a day (with underwater exercise in the spa pool), 20 minutes total duration per day in the first week and 30 minutes in the following weeks. Results showed a significant decrease in pain and high blood pressure without haemodynamic risk. The conclusion was that a combined spa and physical therapy programme may help to decrease pain and improve haemodynamic response in patients with irreversible pathologies.

Spa therapy and depression

There is a modest degree of support for the value of spa therapy in the treatment of moderate depression. The majority of spas do not accept individuals with serious behavioural problems or those who are at risk of suicide (Dubois 1973, Dubois & Arnaud 1983, Guillard 1990). While spas may not accept patients with serious behavioural problems, it is important to consider chronic pain or other medical conditions as a cause for depression or thoughts of suicide. The evaluation of the depressed patient and determination of a positive treatment outcome is based on the cause of depression. Given that chronic pain and other medical conditions may seriously affect the activities of daily living, it is plausible that hydrotherapy, balneotherapy or spa therapy may improve these medical conditions, thereby diminishing depression.

Flotation tank treatment (restricted environmental stimulation technique – REST)

REST has been shown to reduce anxiety and depression in patients with chronic pain treated in this way (Kjellgren et al 2001). Treatment comprised a procedure in which the individual is immersed in a tank filled with water of an extremely high salt concentration. Thirty-seven patients (14 men and 23 women) suffering from chronic pain participated in the study. They were randomly assigned to either a control group (17 participants) or an experimental group (20 participants). The experimental group received nine flotation-REST treatments over a 3-week period. The results indicated that the most severe perceived pain intensity was significantly reduced, whereas low perceived pain intensity was not influenced. Flotation-REST treatment elevated the participants' optimism, reduced the degree of anxiety or depression, and improved the sleep pattern.

Physiological responses to hydrotherapy application

Water is universally required for life and health. Water also has unique physical properties that render it a valuable therapeutic agent. Understanding water and its physical characteristics is necessary to understand its therapeutic impact and to effectively apply it as an agent of healing.

Water has unique properties by which it can beneficially affect the body and aid in the prevention and recovery of disease. These unique properties are:

- the ability of water to communicate and absorb large quantities of heat by contact (specific heat and latent heat)
- the intensity of temperature impressions obtained by the use of water
- the fluidity of water, rendering it efficient in applying mechanical stimuli
- its properties as a solvent and its use in nutritive changes such as improved assimilation and elimination (Abbott 1915).

It is generally conceded that it is the action of the thermic impression of water that principally produces the therapeutic effect when it is applied to the body. Water has great heat-conveying properties and, when used in accordance with naturopathic principles, definite and specific results are to be obtained from it (Boyle & Saine 1988).

Thermic impressions

Whenever a substance whose temperature differs from that of the skin comes into contact with the skin, in the presence of normally functioning temperature receptors in the skin, the impressions of heat or cold are perceived and adapted to rapidly (Moor et al 1964). Nerve transmission impulse is controlled by the sympathetic vasoconstrictor nerve fibres that secrete noradrenaline (norepinephrine), with sensitivity due in part to spinal cord reflexes (Prentice 1998), or the sympathetic constriction influences are mediated chemically through neural transmitters, with both noradrenaline (norepinephrine) and adrenaline (epinephrine) involved (Guyton 1991). Water seems hotter or colder than other substances because it stores so much heat and gives it off readily (Giancoli 2005, p 404). This makes water a most valuable means of applying thermic stimuli to the body (Giancoli 2005, p 412).

Heat is transferred to the body superficially in hydrotherapy, primarily by conduction and convection.

- *Conduction* occurs when two or more adjacent bodies (objects) of different temperature are placed in contact and a state of energy exchange

affects portions of each. Heat is transferred from the warmer to the cooler body by the process of conduction. The rate of heat exchange depends upon the different properties in heat conductivity of each medium, the difference in temperature of the adjacent bodies, and the length of time the process is allowed to continue. Hot packs, wet packs, compresses and fomentations are examples of conductive heating modalities.

- *Convection* involves the exchange of heat between a surface and a fluid (can be liquid or gas, e.g. sauna) moving over that surface. Mineral baths, whirlpool baths, saunas and Hubbard tanks are examples of hydrotherapeutic applications of convection heat (Krusen 1971).

Physical effects of heating

Heat causes a rise in temperature (hyperthermia) in the tissues to which it is applied. The effects of this thermal effect vary in proportion to the degree of heat, the duration the heat is applied, the speed in which the thermal effects are dispersed, and the type or source of heat.

Care should always be taken in the application of heat to the body. Heat should never be applied above patient tolerance or in situations where the patient does not have the ability to identify or communicate the amount of heat applied, such as with peripheral neuropathy in diabetes or the inability to communicate. It takes time for heat applied via hydrotherapy to penetrate into the body. It takes approximately 30 minutes for the skin temperature to rise from 90°F to 110°F (32–43°C), approximately 40 minutes for subcutaneous tissue to rise from 94.2°F to 105.5°F (34.5–40.8°C), and approximately 50 minutes for intramuscular temperature to rise from 94.2°F to 99.6°F (34.6–37.6°C) (Schafer 1982). A common therapeutic range for heat modalities is from 100°F to 115°F, depending on the patient's tolerance level. The maximum safe exposure time for applying heat at 113°F (45°C) at close contact is 30 minutes, although temperatures as low as 107.6°F (42°C) left on for several hours can cause thermal damage (Krusen 1971).

The application of heat initiates a transient vasoconstriction in the circulatory system that is followed by a secondary and sustained hyperaemia through vasodilation. Heat will increase the blood flow to and from the area being treated, and initially increases metabolism within the treated area. Heat applied for longer than 7 minutes exhausts the vasoconstrictor reflex and leads to vasostasis. This may lead to oedema, local congestion and reduced metabolism (Guyton 1996).

Local heat promotes activity of the sweat glands, which may help to promote elimination of toxic wastes. Local heat may also increase the threshold of cutaneous sensory receptors, through enkephalin production, although it is a minor pain control method. Heat also relaxes some patients and the psychological effect can also be noted. Care should be taken to avoid this since it can lead to increased oedema and congestion (Jaskoviak & Schaefer 1993).

Physical effects of cold application

Cold application initially causes skin vasoconstriction, and if a cold compress covers a large area of the body, a significant amount of blood will be driven into the internal organs. Prolonged cold causes a secondary hydrostatic effect after 3–5 minutes, inducing vasodilation of the surface skin blood vessels. *This secondary effect, referred to as a reaction, is of significant therapeutic importance in naturopathic hydrotherapy.* The reaction, or dynamic circulatory response in response to physiological stress, is analogous to the adaptive response of the body to physical exercise. It is a culmination of neurological vasomotor activity mediated via the smooth muscles embedded within the circulatory system. The method of cold water application in naturopathic hydrotherapy, particularly the cold wet pack, exercises this neuromuscular response over time with a constitutional benefit to the organism (Boyle 1988).

Hydrostatic effect on circulation

The hydrostatic effect in hydrotherapy is the shifting of fluid from one part of the body to another. The hydrostatic effect can be used clinically in the treatment of conditions in which it is suspected that there is a locally congested area that is giving rise to symptoms, such as congestive headache, nasal congestion, sinusitis and pulmonary congestion. Derivation, or dilation of the blood vessels of the skin at some area distal and inferior to the area affected, can be effective in relieving congested tissues. This happens because, when a

large area of the body is exposed to heat, vasodilation of the skin takes place, which is the body's method of eliminating heat. This process causes a quantity of blood to shift from the interior of the body to the superficial.

Principles of thermic impression

Thermic applications and their influence on circulation and metabolism have been categorized in the following way by naturopaths:

- *Short Hot* <5 minutes: local vasodilation mediated via vasomotors, resulting in increased local circulation and local tissue metabolism.
- *Long Hot* >5 minutes: vasodilation becomes vasostasis (due to vasomotor decompensation) and local circulation is decreased while local metabolism continues to increase.
- *Short Cold* <5 minutes: vasoconstriction followed by active, pulsating dilation, increasing local circulation and local metabolism. Note the similar tissue effects of short heat.
- *Long Cold* >5 minutes: vasoconstriction as a protective adaptive effect and depression of metabolism and circulation.

	Circulation	Metabolism
Short Hot	↑	↑
Long Hot	↓	↑
Short Cold	↑	↑
Long Cold	↓	↓

These times apply to continuous applications and *do not take into account convection or conduction*. For example, a bath applied for more than 5 minutes, where the temperature of the water for all purposes remains the same, would be considered a long hot or cold depending upon the bath temperature. The application of a wet pack (Priessnitz/Kneipp/Lindlahr/Carroll method) beyond 5 minutes does not become a long cold application because of the conductive transfer of heat as evidenced in the warming of the cotton towel (Boyle 1988). The wet pack is therefore considered a short cold application. Combination of short hot and short cold (such as contrast hydrotherapy or the towel portion of the constitutional hydrotherapy method) has beneficial additive effects. See Figures 13.1 and 13.2 (Abbot 1945).

Haematological composition and hydrotherapy

The composition of the blood is also affected by hydrotherapy. There is a significant increase in all blood cells in the peripheral circulation following a variety of cold hydrotherapy procedures associated with mechanical stimulation (friction) and after hot applications when followed by cold applications. There is often an increase in peripheral circulation of red blood cells from 20% to 35% and in white blood cells from 200% to 300%. Haemoglobin also shows an increase of 10% or more (Blake 2006).

Local effects of contrast hydrotherapy

Contrast hydrotherapy, or local alternating hot and cold, produces marked stimulation of local circulation. Cold needs to be only long enough to produce vasoconstriction, which has been shown to occur in as little as 20 seconds. Contrasting hydrotherapy is an extremely clinically useful hydrotherapy procedure because of its marked stimulation of local blood flow (Boyle 1988).

Temperature classifications

Temperature classifications can be made according to the following useful categories:

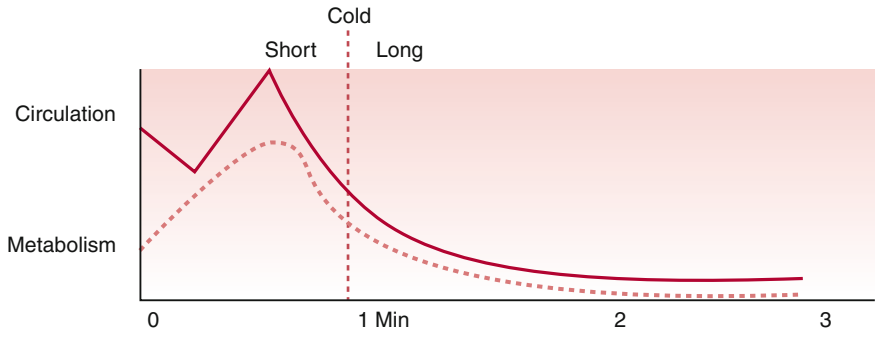
- *Hot*: above 104°F (40°C)
- *Warm*: 99–104°F (37.2–40°C)
- *Neutral*: 93–99°F (33.9–37.2°C)
- *Tepid*: 70–93°F (21.1–33.9°C)
- *Cold*: 40–70°F (4.4–21.1°C).

Alternating or *revulsive* is the application of alternating temperature combinations.

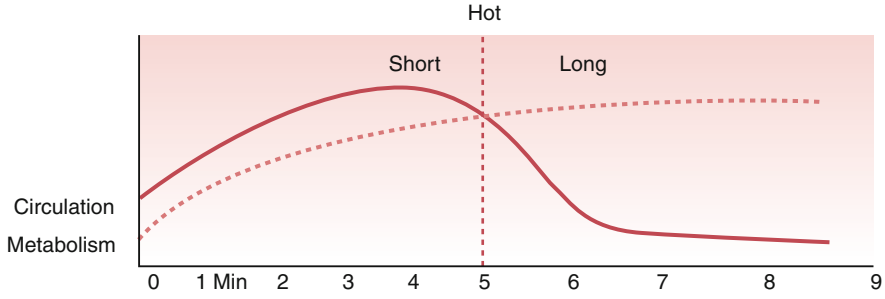
Practical effects of hydrotherapeutic applications

There are two general classes of effects produced by hydrotherapeutic applications: 1) tonic and stimulant, and 2) depressant and sedative (Scott 1990):

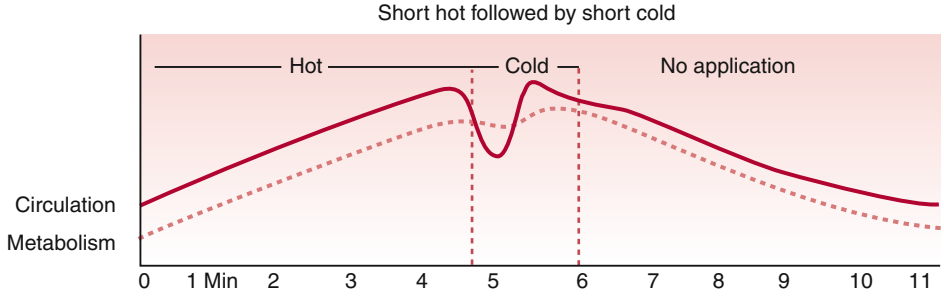
- *Tonic* and *stimulant* effects yield a strengthening (tonic) or increase (stimulant) of vital activity and metabolism. They are similar, but differ in



Short cold stimulates and long cold depresses both the circulation and metabolism as reflected by the basically parallel curves in the above graph



A short hot application stimulates the circulation and metabolism similarly, but if the heat is prolonged, the circulation is depressed to a point which may not be able to adequately support the increased metabolism



Short hot followed by short cold yields no significant depressive phase for either the circulation or the metabolism. Note the heightened metabolism and circulation is maintained well after such a treatment is terminated

Figure 13.1 • Time and temperature influence on metabolism and circulation. (Redrawn from Boyle & Saine 1988.)

degree. The intensity of the effect will be greater or lesser according to the intensity of the hydrotherapy application. A very brief intense application stimulates, while one less intense and of longer duration may produce tonic effects *if a reaction is obtained.*

- *Depressant* and *sedative* effects are due to a decrease of vital activity. They also differ as to the extent of the decrease, with a depressant effect being more intense than a sedative one.

Not only does hydrotherapy change the cellular composition of the blood, it also changes the

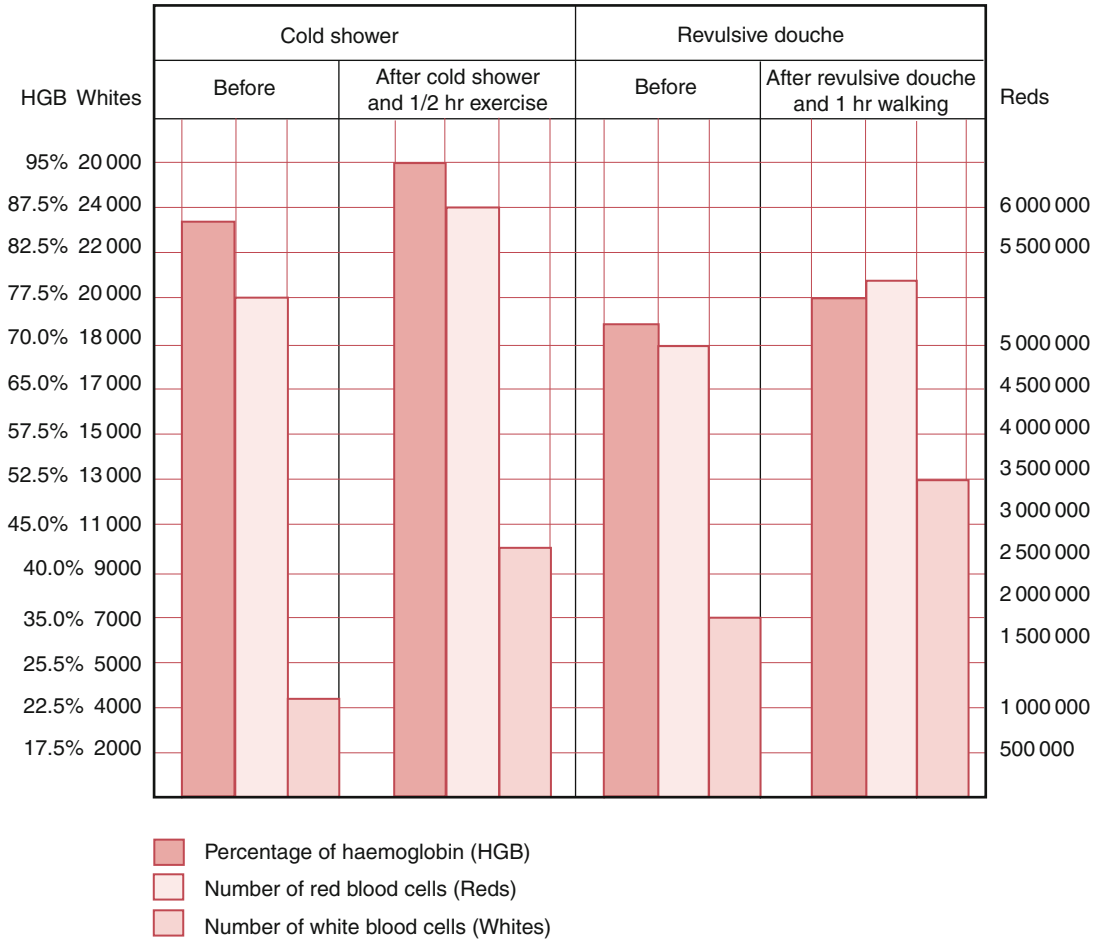


Figure 13.2 • Peripheral blood values after a short hot followed by a short cold application. (Redrawn from Abbott et al 1945.)

chemical reaction of the blood. Although blood is normally alkaline, during diseases, infections, fevers, etc. this alkalinity is decreased (though the blood never becomes acid) due to the accumulation of acid waste products that partially neutralize the normal alkalinity. The reaction obtained through cold applications increases the alkalinity of the blood, restoring it to normal by oxidation of waste products.

Tonics and stimulants

Stimulant treatments bring forth energy that the body may be unable to replace, while a tonic makes the body better able to perform its usual work. An analogous relationship is found in phytotherapy in the comparison of stimulants (such as coffee) and adaptogens (such as *Eleuthrococcus senticosus*).

Hydrotherapeutic tonics are mild in action and heighten body functions within normal limits. Their after-effects cause an increase in the building up processes of the body. Tonic effects are derived mainly from cold applications or alternate hot and cold applications. Tonic hydrotherapy techniques increase the speed and force of circulation, increase muscular activity, heighten nerve sensitivity, improve immune function and increase heat production. Tonic hydrotherapeutic measures can be used in practically all diseases, but are particularly indicated for anaemia, fatigue, digestive disorders, insomnia, arthritis, obesity and flaccid paralysis.

Abbott (1915) lists the hydrotherapeutic tonic treatments in order of their intensity as follows:

- wet hand rub
- cold mitten friction

- cold towel rub
- salt glow
- pail pour
- cold douche
- wet sheet rub
- dripping sheet rub
- shallow bath
- cold plunge.

The towel treatment of constitutional hydrotherapy should also be classified as a tonic treatment.

Sedative effects of hydrotherapy

Hydrotherapy can also be used to bring about a sedative effect. A sedative effect was classically referred to as a nerve sedative in the hydrotherapeutic literature. The principal hydrotherapy sedatives as classified by Abbott (1915) are as follows:

- cold sitz bath
- hot foot bath with cold to the head
- alternate hot and cold foot bath
- neutral or warm bath: 94–98°F (34.4–36.7°C)
- neutral wet sheet pack
- sponge baths (cool, tepid or warm)
- warm or hot shower, spray, douche or affusion.

Pure sedative techniques are indicated in nervous disorders, mania, insomnia and spasticity.

Hydrotherapy in fibromyalgia

As discussed in Chapter 2, fibromyalgia symptom patterns are complex and overlapping. Various overlapping diagnostic categories and conditions may be contributory factors in the evolution of FMS. Hydrotherapy applications have the potential to simultaneously affect several of the involved parameters, both generally (by encouraging homeostatic regulatory mechanisms) and specifically (by addressing either symptomatic pain or specific pathological entities).

Box 13.1 provides a convenient categorization for understanding the potential areas of beneficial influence of hydrotherapy in FMS.

The utility of hydrotherapy for these widespread areas is best understood by appreciating the homeostatic regulation that hydrotherapy enhances. The predictable physiological response of the thermic impressions of hydrotherapy essentially exercises fluid distribution and thermoregulation mechanisms of the body. The thermic impressions, appropriately applied to patient tolerance, institute a series of vasoregulatory reactions resulting in lymphatic, arterial, and venous fluid movement, principally mediated through neurological and hormonal adaptative mechanisms.

Box 13.1

Stressors in fibromyalgia that may be positively benefited by hydrotherapy

- Allergic and autoimmune conditions
- Infections
- Multiple current symptoms such as pain, digestive complaints, fatigue, etc.
- Nutrient deficiencies
- Acquired environmental toxicities
- Bowel dysbiosis
- Digestive enzyme deficit
- Thyroid function and thermoregulation

Treatment description: standard constitutional hydrotherapy

A large number of health care practitioners apply various hydrotherapy modalities in practice. Unique naturopathic approaches have also been developed. One such approach is the constitutional hydrotherapy system developed by Dr O. G. Carroll in the first half of the 20th century. Dr Carroll developed a flexible clinical system that combined Kneipp hydrotherapy methods with a variety of physiotherapy modalities. These included most commonly the low volt alternating current, low volt galvanic, shortwave diathermy and high frequency. It is conceivable that frequency-specific microcurrent could be incorporated alongside the hydrotherapy towel treatment for additive effect.

Dr Carroll also incorporated iris diagnosis, heart tone diagnosis, food intolerance evaluation and physiomedicalist botanical prescriptions, and used the Schuessler Biochemic minerals in a systematic approach to naturopathic clinical practice. He was trained by Dr Ledoux of New Orleans and Dr Henry Lindlahr of Chicago. Dr Carroll was encouraged to move to the American West and establish a naturopathic college. While he was unable to do

that, he did operate a very busy and well-known clinic until his death in 1962.

The standard constitutional hydrotherapy treatment combined a modified Kneipp torso pack with the spondylotherapy methods pioneered by Dr Albert Abrams. The spondylotherapy levels in the standard constitutional are T5–T8 and T11–L2. Surging low volt stimulation of these spinal levels influences primarily the organs of digestion and elimination (stomach, pancreas, liver and kidneys). The strategy of application within the constitutional hydrotherapy system is to improve digestion, detoxification and elimination. This treatment can also be modified in a number of ways with various physiotherapy modalities to direct treatment to appropriate organs or to treat particular pathology or functional complaints.

The standard treatment is a tonification of the organism and as such embodies the basic representative treatment of the system. The approach is constitutional in nature, treating the whole organism to enhance general adaptation mechanisms particularly relevant to circulatory distribution and metabolic function.

Indications

The standard constitutional treatment is designed to tonify digestion, enhance appropriate immune function, improve intestinal flora balance and gently detoxify the body. Modifications of the physiotherapy modalities allow for a flexible application to a large variety of clinical conditions such as inflammatory bowel disease, asthma, upper respiratory infection, dermal infections, organ-specific infections, endocrine dysfunction, cancer, musculoskeletal injury and/or disease, metabolic diseases, as well as cardiac conditions (Blake 2006, Boyle & Saine 1988, Scott 1992).

Methodology

Patient supine, undressed from the waist up, covered with a vellux blanket.

1. Two Turkish towels, each folded in half, well wrung from hot water (130–140°F/54–60°C – note the relatively high temperature of the compress) are applied covering the chest and abdomen from clavicle to anterior superior iliac spine (ASIS). Fold the lateral edges of the towel as needed so that they do not lie beyond the anterior axillary line. Cover the patient with a blanket. (*Note*: If a cotton sheet is used to separate the patient and the blanket, as is common for sanitation reasons, an impermeable barrier (such as a thin rubber mat) should be placed over the wet towels so as to avoid wetting the cotton sheet and thus fundamentally changing the treatment outcome.)
2. At the 5-minute mark, one Turkish towel, folded in half, well wrung from hot water, replaces the two Turkish towels previously applied.
3. Ask the patient to arch the back or roll onto one shoulder. Slide two 4 inch electrode pads underneath the patient, *one from each side*, so that each is on one side of the spine with the upper edge of the electrode level approximately with the fifth thoracic vertebra. This is referred to as the 5-5 treatment.
4. Replace the hot towel with one Turkish towel well wrung from cold water from the tap (40–55°F/4–12°C; note that this does not include iced or especially cold water) and folded in half. The application should cover the same area as the hot towels, from clavicle to ASIS, bordered at the anterior axillary lines. Again cover the patient with the blanket.
5. Place the low volt alternating current sine wave unit within the reach of the patient and instruct them to adjust the intensity. The current output should be on the surge (massage) setting with a low duty cycle of 6–10 cycles each minute. Current intensity is adjusted by the patient, and the following levels are noted in this order:
   a. The patient will feel a tingling on the back.
   b. Patient will feel a gentle contraction somewhere in the abdomen, usually under the costal margin on the right, but not always. This is the ideal setting.
   c. Patient will feel strong contractions of the muscles of the upper back. This is unnecessary and counterproductive.
6. At the 10-minute mark (approximately 15 minutes of total treatment time have elapsed) check the centre of the towel over the solar plexus to see if the patient has warmed the

towel to at least body temperature. If they have warmed the towel, then remove the towel and proceed. If they have not, cover the patient again with the blanket, wait 2 minutes, then remove the towel.

7. Ask the patient to arch the back or lift the shoulders in order to move the sine wave pads from the upper back to the abdomen. One pad is placed on the back and will be *centred* over the spine at the thoracolumbar junction, the top edge at approximately the eleventh thoracic vertebra. The second pad is placed on the abdomen overlying the stomach. Place a bean bag on top of the abdominal pad. This is referred to as the stomach treatment.
8. Instruct the patient to adjust the sine wave intensity until a gentle contraction at one or both pads is felt. The sine wave output remains on the surge (massage) cycle at the same low duty cycle.
9. At the 10-minute mark (approx 25 minutes total), remove the sine wave pads. Ask the patient to turn over onto their abdomen.

Repeat the towel treatment, this time applied to the back:

10. Place two Turkish towels (the same as previously used), freshly well wrung from hot water, each folded in half, on the patient's back. The towels should cover from the superior edge of the scapula to the posterior superior iliac spine (PSIS). The lateral towel edges should be folded up so as not to lie beyond the posterior axillary line.
11. At the 5-minute mark (approx 30 minutes total), replace the two towels with one fresh towel wrung from hot water. Quickly replace this towel with a towel well wrung from cold water. The towels should cover from the superior edge of the scapula to the PSIS. The lateral towel edges should be folded up so as not to lie beyond the posterior axillary line.
12. At the 10-minute mark (approximately 40, usually 45, minutes), check the centre of the towel to see if the patient has warmed the towel to at least body temperature. If they have warmed the towel, then remove the towel and proceed. If they have not, cover the patient again with the blanket, wait 2 minutes, then remove the towel.

Finish with a dry friction rub to the back:

13. Use a fresh dry towel to give a 20–30 second dry friction rub to the patient's back.

Safety issues

Care should be taken when applying any thermal modality not to burn the patient. Regardless of the relatively high temperature of the constitutional towel application, the temperatures are *usually* well tolerated by patients. Low volt alternating current should not be applied to torn muscle fibres and should not be applied with active gastrointestinal bleeding.

Validation

The standard constitutional treatment has been in continuous and widespread clinical use since the 1920s. Numerous practitioners have observed significant beneficial clinical outcomes, and a number of cases have been described in the literature (Watrous 1996).

Alternatives

Standard constitutional hydrotherapy is a broadly applicable modality for a wide variety of clinical complaints. Internal medications, such as homeopathic and botanical, may provide an alternative for portions of the treatment. The alternative will vary with the condition and the desired outcome.

Physiological effects

There have been a number of preliminary investigations into the clinical and laboratory effects observed. Current (2008) research is being conducted at the National College of Natural Medicine (formerly the National College of Naturopathic Medicine) to investigate the blood count parameters and to identify if heat shock proteins are involved in any changes observed. Previous investigation has identified that post-treatment core temperature is more likely to show a net increase in temperature than a decrease or no change (55% of patients). Additionally, peripheral temperatures likewise are more likely to show a net increase in temperature (91% of patients) (Wickenheizer et al 1995).

Another study demonstrated increased vitality, physical role, decreased pain (SF-36 subjective form), decreased body fat, increased total body water (bioelectrical impedance), increased T_3, T_4, T_7, decreased alkaline phosphatase, cholesterol, triglycerides, and high- and low-density lipoprotein, a slight increase in oral temperature and a slight decrease in mean arterial pressure (M Carney, B McConnell, unpublished research conducted at the Southwest College of Naturopathic Medicine, 2000).

A small study showed a post-treatment increase in leukocyte circulation that remained elevated for 2 hours (longest point of observation), particularly the monocyte levels (K Wiggin, unpublished research at the National College of Naturopathic Medicine), and clinical documentation of improved blood glucose regulation after one standard treatment in 15 random cases has been reported (E Blake, L Watrous, unpublished clinical observational research at Windrose Naturopathic Clinic, Spokane).

Drs Carroll and Scott regularly observed a decreased urinary indican level following a course of treatments, as compared to before the treatment series (Boyle & Saine 1988). Simultaneously, after completing a course of treatments, the urine specific gravity has been observed to increase post treatment (Boyle & Saine 1988). These two observational trends suggest improved intestinal flora balance and improved kidney function.

Naturopathic perspectives

The constitutional hydrotherapy system is a uniquely naturopathic approach to clinical physiotherapy treatments. The overarching goal of the treatment is detoxification of the system, immune enhancement and improved digestive function. There are also focused treatments for addressing local pathological conditions.

Urinary indican levels are a measure of intestinal putrefaction. Intestinal putrefaction by-products that are excreted via the kidneys are presumably absorbed via intestinal circulation. All intestinal circulation enters into portal circulation prior to entrance into pulmonary and then systemic circulation. Presumably liver detoxification pathways are required for oxidation/reduction and conjugation of certain putrefaction by-products.

An increased urine specific gravity is indicative of an increased urine concentrating capacity of the kidneys. The observation of improved urinary indican levels and increased kidney concentrating capabilities point to the adaptation benefits of the treatment and the overarching global benefits to the organism.

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Chapter Fourteen

14

Integration: what seems to be helping?

CHAPTER CONTENTS

In this book a number of different approaches to the treatment of fibromyalgia have been presented: Peter Baldry (Ch. 6) describes the potential of acupuncture in treating the pain of both fibromyalgia syndrome and myofascial pain syndrome. Paul Watson (Ch. 7) describes the potential benefits of cognitive behaviour therapy. In Chapter 8 Jan Dommerholt and Tamer Issa describe in detail the connections, similarities, differences and clinical methods associated with the interconnection between FMS and myofascial pain syndrome in general, and trigger point activity in particular. Carolyn McMakin (Ch. 9) describes the remarkable success

achieved by use of frequency-specific microcurrent (FSM) in treating that subset of FMS patients in whom cervical trauma seems to be the key aetiological feature in its evolution. In Chapter 10 John Lowe describes his research into thyroid treatment (combined with bodywork) in fibromyalgia syndrome care. In Chapter 11 John McPartland reveals the remarkable research into the endocannabinoids, self-produced by the body in response to manual therapies, exercise and acupuncture, and their ability to modify pain and mood. In Chapter 12 Pat Winstead-Fry and Rebecca Good describe Therapeutic Touch methods, while in Chapter 13 Eric Blake offers information on hydrotherapy and FMS, both therapeutically and as self-help. In this chapter (14) a variety of treatment methods are evaluated – as we ask the question: What seems to help, and what is the evidence? And in the next chapter (Ch. 15) a range of practical protocols and methods are presented, relating to treating the associated conditions of FMS, ranging from infections to sleep disturbances and toxicity. Chapter 16 considers a wide range of manual methods of treatment of FMS. Chapter 17 highlights the importance of enhanced respiratory function in chronic conditions such as FMS, while self-help measures are detailed in Chapter 18.

In most of the many approaches considered, the overlap between mainstream and complementary/alternative health care is evident. The vast majority of people suffering these ill-defined and multisymptomatic conditions turn for help, at least partially, to sources outside mainstream medicine, and an increasing number of specialists are utilizing one or other – or a combination – of such methods in their treatment and rehabilitation protocols.

To re-emphasize: this chapter reviews those methods, both orthodox and alternative, for which claims are made of benefit for the patient with FMS/CFS – and as mentioned, Chapter 15 examines additional approaches for which some evidence exists of potential benefit in relation to the *associated conditions* which often accompany FMS.

The methods to be discussed in this chapter include:

- aerobic exercise
- antibiotic and auto-vaccine treatment (against *Mycoplasma*)
- acupuncture (see also Ch. 6)
- chiropractic (see also Ch. 16)
- diet and detoxification (see also Ch. 15)
- homeopathy
- hydrotherapy (see also Chs 13 and 15)
- hypnotherapy
- combined group therapy (see also Ch. 7)
- massage therapy (see also Ch. 16)
- medication
- nutritional therapy and supplementation (see also Ch. 15)
- osteopathy (see also Ch. 16)
- probiotics (and prebiotics) (see also Ch. 15)
- thyroid replacement therapy (see also Ch. 10)
- . . . and finally, some other methods which have no category.

Individualized integrated approach

Teitelbaum and colleagues (2001) demonstrated, in a randomized, double-blind, placebo-controlled trial, the effectiveness of selectively employing individualized approaches when treating 72 patients with FMS (69 of whom also 'qualified' as having CFS). They noted that:

> *Hypothalamic dysfunction has been suggested in fibromyalgia (FMS) and chronic fatigue syndrome (CFS). This dysfunction may result in disordered sleep, subclinical hormonal deficiencies, and immunologic changes. Our previously published open trial showed that patients usually improve by using a protocol which treats all the above processes simultaneously. Seventy-two FMS patients (38 active: 34 placebo; 69 also met CFS criteria) received all active or all placebo therapies as a unified intervention. Patients were treated, as indicated by symptoms and/or lab testing, for: (1) subclinical thyroid, gonadal, and/or adrenal insufficiency, (2) disordered sleep, (3) suspected neurally mediated hypotension (NMH), (4) opportunistic infections, and (5) suspected nutritional deficiencies.*

The results showed significant improvements by the patients who were actively treated, with benefits still evident with long-term follow-up after several years. The researchers observed: 'Significantly greater benefits were seen in the active group than in the placebo group for all primary outcomes. An integrated treatment approach appears effective in the treatment of FMS/CFS.'

In the end, an integrated protocol which meets the individual needs of the patient should be selected from what is of proven value. It is only by selecting therapeutic choices on evidence-informed approaches that a way forward will emerge in handling the devastation that chronic fatigue and fibromyalgia syndromes can cause to people's lives.

Systematic study of interdisciplinary/integrated approach

Anderson & Winkler (2006) conducted a placebo-controlled trial that compared standard pharmacological medical (rheumatology) care of a group of FMS patients with (for the treatment group) a multidisciplinary programme that included cognitive behavioural therapy/psychoeducational classes, exercise, massage, auricular [acupuncture] therapy, microcurrent therapy and nutritional counselling, in a case controlled manner. The study ran for 1 year as an outpatient programme.

The results showed: 'a significant decrease in pre- versus post-treatment measures of function, chronic depression, general anxiety, somatization, pain, anxiety, and tender points for the treatment group. A significant increase in Short Form-36 scores indicated a patient's perceived overall better health. No significant changes were revealed with the control group.'

Patient advice and adherence issues

A useful overview of what can help in encouraging self-management of chronic pain conditions is offered by Jensen et al (2003a). In summary, the objectives they suggest include a need to:

- increase the perceived importance of pain self-management
- encourage positive outcome expectancies
- reduce negative outcome expectancies
- identify and incorporate consideration of contingencies (events that may but are not certain to occur)
- reinforce self-management coping behaviours
- increase self-efficacy for pain self-management
- encourage the practice of self-management strategies
- provide patients with opportunities to observe other patients engaging in pain self-management strategies
- gently challenge distorted cognitions and provide directed active listening to encourage and support self-efficacy beliefs.

Adherence and exercise

Useful information regarding compliance/adherence issues, in relation to physical exercise protocols, is described later in this chapter (Jones et al 2006). The most pertinent finding appears to be that low impact, moderate forms of exercise are more likely to achieve compliance, as well as resulting in the greatest gains in terms of reduced pain and improved function.

Advice

Individuals should be encouraged to listen to their bodies; they should do no more than they feel is appropriate, in order to avoid potentially severe setbacks in progress when they exceed their current capabilities. It is vital that the whole process (whether this involves dietary change, exercise, use of hydrotherapy or anything else which is meant to be self-applied) is very carefully explained, as adherence is not high when novel routines or methods are suggested unless they are well understood. This means that any procedures should be explained in terms that make sense to patients and their carer(s).

Written or printed notes – ideally illustrated – help greatly to support and encourage adherence to verbal instructions, especially if simply translated instances of successful trials can be included as examples of potential benefit. Instructions, both verbal and written, need to answer in advance questions such as:

- Why is this being suggested?
- How often, how much?
- How can it help?
- What evidence is there of benefit?
- What reactions might be expected?
- What should I do if there is a reaction?
- Can I call or contact you if I feel unwell after exercise (or other self-applied treatment)?

It is useful to explain that *all* treatment makes a demand for a response (or several responses) on the part of the body, and that a 'reaction' (something feels different) is normal and expected and is not

necessarily a cause for alarm – but that it is OK to make contact for reassurance.

It may also be useful to offer a reminder that symptoms are not always bad and that change in a condition towards normal may occur in a fluctuating manner, with minor setbacks along the way.

Educational tools

Use of figures such as Figure 2.3 (see Ch. 2) can be helpful to explain to patients, in simple terms, that there are many stressors being coped with and that progress is more likely to come when some of the 'load' is lightened, especially if particular functions (digestion, respiratory, circulation, etc.) are working better.

A basic understanding of homeostasis (see Fig. 2.4A–C in Ch. 2) is also helpful ('broken bones mend, cuts heal, colds get better – all are examples of how your body always tries to heal itself'), with particular emphasis on explaining in simple terms some of the processes at work in FMS or CFS.

The breathing connection, for example, is dramatically illustrative of a common function which has the potential to influence many symptoms that are common to FMS/CFS. Although somewhat complicated, Figures 3.5 and 3.6 could usefully be shown to the more intelligent patient to help with insights into the ramifications of FMS. Figure 14.1 is, however, a simpler representation of the same information, and makes an excellent educational tool, allowing the key symptoms of CFS/FMS to be displayed on the outline of the human body, with the bold statement that 'all of these symptoms *can* derive from hyperventilation and altered breathing patterns'. Clearly it is both accurate and important to stress that all these symptoms can also derive from other causes, and that a habitually unbalanced breathing pattern might merely aggravate rather than cause them. Either way, it may help motivate the individual toward compliance in application of home breathing exercises.

Similarly, Figures 3.7 (more complicated) and 14.2 (simpler; see later in this chapter) can usefully be used as educational tools in helping the individual grasp the possible connections between gut dysfunction and their symptoms.

What seems to be helping?

Research by Goldenberg (1993) involving a 3-year observation of the natural history of 39 patients with FMS showed that over this period 60% complained of continuing symptoms despite virtually constant medication to control the symptoms. Remissions were rare and short-lived.

Goldenberg suggested that the following methods all produce benefits in treatment of FMS:

- cardiovascular fitness training (McCain et al 1988, Richards & Scott 2002)
- EMG-biofeedback (Ferraccioli et al 1989)
- hypnotherapy (Bengtsson & Bengtsson 1988)
- regional sympathetic blockade (Felson & Goldenberg 1986)
- cognitive behavioural therapy (Goldenberg et al 1991).

Block (1993) discusses the waxing and waning nature of the symptoms of FMS, and reports that about 20% of patients with 'generalized rheumatism' achieve remissions which can last for a long time; he believes that therapy should be aimed at alleviating the symptoms where possible and helping patients to cope better.

Research by Wolfe (1986) of a selected patient group reported the results given in Table 14.1. Clearly all the forms of treatment listed in Table 14.1 helped some patients; however, those groups of patients in this survey who tried exercise, rest, relaxation, physical treatment and chiropractic were the only ones where more people benefited than did not benefit. In the groups using the antidepressant medication there were more patients left feeling that they did not benefit than those feeling that they did; the same was found in the exercise group.

Now we cannot analyse just what exercise or physical therapy was employed, or the benefits, if any, of methods not included in the survey – and so the best we can do from this survey is to learn that everything helps someone, and some methods help some people more than others. What also emerges from this review is that some orthodox medical approaches, as well as some unorthodox ones, seem to offer hope and relief.

Review of 'what works'

A wide-ranging 2005 review by Youseffi & Coffey concluded:

> *Among nonpharmacological interventions, aerobic exercise and cognitive behavioral therapy have the strongest evidence of effectiveness. A systematic review assessing*

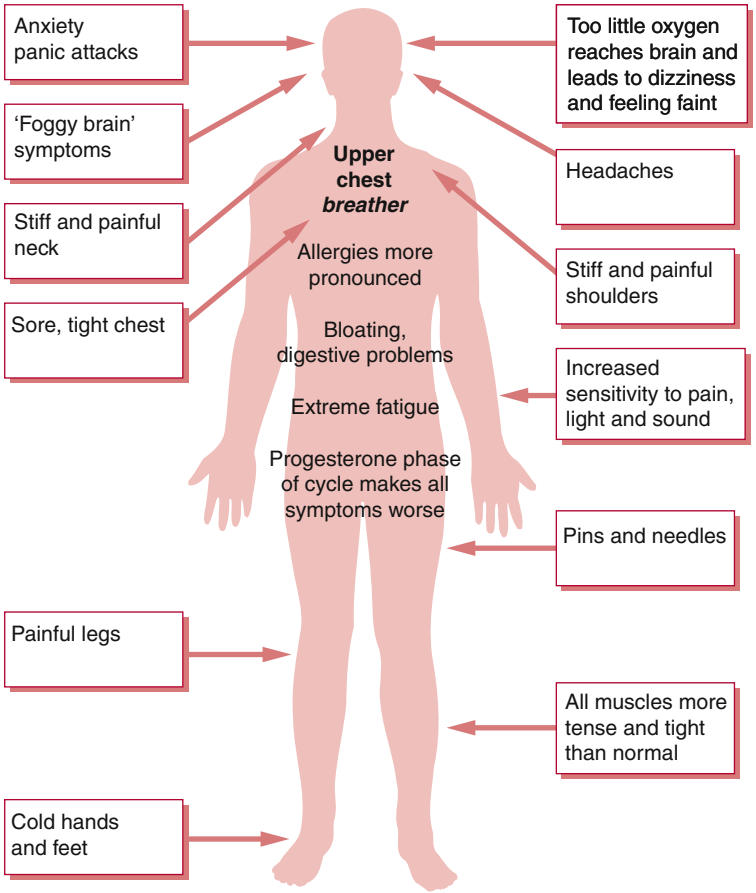

Figure 14.1 • The symptoms that result from upper chest breathing patterns (overbreathing as well as true hyperventilation) are caused by too much carbon dioxide being breathed out rather than too little oxygen being breathed in. This breathing pattern is often a habit we have learned from childhood. When we breathe out too much carbon dioxide, the blood becomes too alkaline, and all the symptoms listed in this figure can appear within a few seconds. The tightness in the chest, neck and shoulder muscles produced by breathing like this, as well as the anxiety caused by the carbon dioxide imbalance, both make the breathing worse. To recover, the tight muscles need to be better released, and the patient needs to learn how to breathe in a better way. (Reproduced with permission from Chaitow et al 2002.)

various exercise programs on symptoms of fibromyalgia showed that aerobic exercise produces short-term improvements in cardiovascular fitness, tender-point pressure pain threshold, and patient- and physician-rated global well-being. Three of these trials included long-term follow-up of the exercise group participants. Patients who continued exercising maintained their improved physical functioning. Cognitive behavioral therapy has been shown to reduce symptoms in 5 RCTs.

Combining cognitive behavioral therapy with education and exercise has also been effective in 5 additional RCTs. Some evidence suggests that acupuncture, massage, warm baths, and biofeedback are effective, but this is limited because of methodological issues in the studies that have been conducted to date.

Table 14.1 Results of research in a selected patient group (Wolfe 1986)

Treatment	% who tried treatment	% no improvement	% improvement
Exercise*	86.8	31.8	40.9
Relaxation*	84.2	21.8	46.8
Rest*	97.3	15.1	65.7
Vacation	76.3	53.4	29.3
Pain-killing drugs	88.2	46.3	31.3
Narcotics	61.5	45.8	45.8
Steroid injections	52.6	45.0	35.0
Tranquillizers	28.6	28.6	23.8
Antidepressants	51.5	51.5	36.3
Amitriptyline (bedtime low dose)	51.0	56.6	30.2
Physical therapy*	37.5	31.5	37.5
Chiropractic*	48.7	16.2	45.9

*Methods highlighted by an asterisk indicate treatments where more patients reported benefit than reported feeling worse.

Individually many methods appear to help one aspect or another of FMS, and in combination efficacy appears to improve further.

CAUTION: Because examination of a particular method is included in this review (in this, previous and following chapters), it should not be taken as a recommendation for its use. The discussions in this chapter represent an exercise in reporting what is being claimed in what appear to be responsible publications, by a wide range of therapists and practitioners; however, there is no absolute 'quality control' or ability to adequately compare the accuracy of the reports on which these discussions are based.

Aerobic and other exercise

Cardiovascular exercise is stated to be helpful in rehabilitation from FMS. The guidelines most commonly given involve the patient performing active aerobic exercise three times weekly (some say four times) for at least 20 (some say 15) minutes, during which time they are required to achieve between 60 and 85% of their maximum predicted heart rate. The methods of exercise best suited to FMS patients are said to be cycling (static cycle), walking and swimming.

Appropriate warm-up and warm-down periods are suggested, and a slow incremental programme is needed to reach the prescribed length and frequency of exercising. The release of hormone-like substances (endorphins and endocannabinoids – see Chapter 11) during aerobic exercise is thought to offer the means whereby pain relief and well-being are enhanced, along with the obvious increase in self-esteem and psychological boost which come with increased fitness.

If, as is suggested, regular aerobic (and other) exercise for patients with conditions such as FMS/CFS can lead to reduction in pain levels, improved general circulation and a more balanced psychological status, these benefits alone would justify emphasis on this low-cost approach. But it seems even more can derive from other forms of exercise, such as strength training (see below). It is important to realize that some people with CFS (ME) may be unable to do any exercise at all in some stages of their illness (Richards & Scott 2002).

Hakkinen et al (2002) have shown that it is possible for strength training exercise to enhance growth hormone production in premenopausal women with FMS. They found that the strength training induced adaptation of the endocrine system, and conclude that the positive growth hormone (GH) response may become systematic following strength training in women with FMS. Since GH deficiency is considered to be a feature of fibromyalgia, this evidence should encourage graded strength training for FMS patients (see Chs 2, 3 and 4 for notes on GH).

Positive benefits for FMS shown by exercise research

Richards & Scott (2002) note that fibromyalgia is a common debilitating medically unexplained condition, affecting about 1% of the population, and that current treatments are unsatisfactory, with most people remaining in the same degree of distress, even after several years of treatment.

In a randomized controlled trial, lasting 12 weeks and involving 136 patients with FMS (male and female, age range 18–70 years), the researchers evaluated the effect on their conditions of either graded cardiovascular fitness exercise or relaxation and flexibility activities, to which they were randomly assigned. Exercise classes, led by qualified personal trainers, took place twice weekly and lasted 1 hour. The aerobic exercise classes are described as follows:

> *Exercise therapy comprised an individualised aerobic exercise programme, mostly walking on treadmills and cycling on exercise bicycles. Each individual was encouraged to increase the amount of exercise steadily as tolerated. When people first started classes they usually did two periods of exercise per class lasting six minutes. By 12 weeks they were doing two periods of 25 minutes at an intensity that made them sweat slightly while being able to talk comfortably in complete sentences.*

The flexibility exercises are described as follows:

> *Relaxation and flexibility comprised upper and lower limb stretches and relaxation techniques . . . as the classes continued more techniques were introduced progressing through progressive muscle relaxation, release only relaxation, and visualisation, cue controlled relaxation, and differential relaxation. This occupied the whole one hour class.*

Outcomes were measured using self-assessment of improvement, tender point count, impact of condition measured by the Fibromyalgia Impact Questionnaire and short form McGill Pain Questionnaire. Compared with relaxation and flexibility exercises, aerobic (cardiovascular) exercise led to significantly more participants rating themselves as much, or very much, better at 3 months. It is worth noting, however, that in both groups the tender point counts had fallen significantly at 3 months and that this was maintained or improved at 1-year follow-up.

After 12 months fewer participants in the aerobic exercise group fulfilled the criteria for fibromyalgia; by this time only 75 (55%) participants still met these diagnostic criteria.

The researchers conclude that: 'For people with fibromyalgia prescribed graded aerobic exercise is an effective treatment that leads to improvements in self reported health status. Prescribed exercise can be undertaken effectively in the community by personal trainers previously inexperienced in management of people with ill health.' However, adherence remains an issue:

> *Exercise treatment has limitations. Compliance is a considerable problem, giving high dropout rates. Reasons include the initial increases in pain and stiffness immediately after exercise and patients believing that exercise worsens the condition. Future strategies to increase the efficacy of exercise as an intervention should confront the issue of compliance. Potential strategies include additional cognitive behavioural therapy and providing physiological explanations for symptoms.*

Additional positive exercise studies reviewed

Busch et al (2002) in a Cochrane Review reported that:

> *Individuals with fibromyalgia benefit from aerobic fitness training. There is evidence from well-defined and conducted studies that some of the symptoms of fibromyalgia (FMS) are improved by short-term aerobic fitness training. The most consistent improvements were noted in*

pain threshold using pressure, global well being (including ratings of general improvement in FMS) and aerobic performance. Muscle strengthening also holds promise as a treatment but requires further study. To date, limited examination of flexibility training prohibits conclusions about its benefits as a treatment for FM.

Comment

There is much to learn from this study. Both forms of intervention helped a good number of participants, although clearly aerobic activity produced the most benefit. Over 50% of patients reached a stage where they no longer met the criteria for an FMS diagnosis, suggesting that this low-tech, low-cost, high-benefit outcome should be seen as offering a beacon for individuals in chronic pain. And yet adherence remains a major problem. Sadly, despite obvious benefits, individuals commonly slip back into old habits, abandon exercise regimes, and return to their pain condition over time.

In an Open Access (BioMed Central) publication, Jones et al (2006) reported on a comprehensive review of 46 exercise studies, relative to FMS, that had been published between 1988 and 2005. A summary of their major findings is as follows:

- Most fitness measures improved in people who could tolerate the intervention.
- The exercise interventions in most studies did not meet the current exercise recommendation for health as developed by the Centers for Disease Control and Prevention and the American College of Sports Medicine (i.e. 30 minutes of moderate intensity exercise on most days of the week for health-related benefits).
- Those studies that used a higher heart rate or RPE, higher impact movements (e.g. running, jumping) or those where subjects could not self-adjust exercise intensity (e.g. during a flare) suffered the highest attrition rates.
- Subjects attained symptom relief, particularly decreased pain and fatigue as well as improved sleep and mood, with low to moderate intensity exercise of any type. Even very low movement therapies such as QiGong had significant effect sizes for symptom improvement.
- Those studies with 50% maximum heart rate had lower attrition and better symptom improvement than those with the higher intensity.
- Higher intensity studies resulted in greater fitness gains compared to lower intensity in subjects who could complete the intervention.
- Strength and flexibility training are beneficial for symptom control and fitness improvements but there are insufficient data for recommending a uniform, evidence-based prescription for either of these modalities.
- Descriptive data as well as exercise intervention studies in men, minorities, children and older adults with FM are lacking. The fitness gains in older subjects were comparable to gains seen in age-matched healthy controls and were significant compared to the subject's own baseline scores.
- No FM intervention to date has included only overweight or obese persons or individualized the intervention to their unique movement needs (e.g. lower extremity joint protection during weight bearing, awareness of comorbidities such as plantar fasciitis, ankle tendonitis, knee osteoarthritis and a myriad of psychological stigma regarding appearance).
- There is a lack of couples or family-based exercise studies in FM, though these are common in healthy elderly, heart disease and other chronic illnesses.

Maquet et al (2007) conducted a systematic review of research into the therapeutic use of physical exercise in the treatment of FMS and CFS. They concluded:

Although some systematic reviews have not established an unequivocal benefit of physical training, most authors report a benefit for patients with chronic pain or fatigue. Ideally, such a therapy should be a part of multidisciplinary program. Muscular rehabilitation is reserved for preventing the deconditioning syndrome often reported in patients and the vicious cycle of pain, avoidance and inactivity behaviors, or even kinesiophobia, deconditioning, incapacity and psychological distress.

CAUTION: Reactions to any treatment should be particularly carefully observed where exercise is

being suggested – see cautions in the summary provided by Jones et al (2006). Exercise routines should be gradually introduced (see the protocol used by Richards & Scott (2002) described above) with caution and patience in individuals with FMS, and even more so with CFS. Unsupervised home exercising is probably unwise until the individual has attended classes where the degree, intensity and timing of exercise can be learned. *Most importantly, low intensity exercise acquires both the best compliance and the best results.*

A (partially) negative exercise study

Ramsay et al (2000) compared a supervised 12-week aerobic exercise class with unsupervised home aerobic exercises in the treatment of patients with FMS. The results suggested that neither the supervised nor the home exercise regimes showed an improvement in pain compared with baseline. There was, however, some significant benefit in psychological well-being in the supervised exercise class group, and perhaps a slowing of functional deterioration in this group.

Walking for FMS: the 6-minute walk test

Gowans et al (1999a, 1999b) discuss the use of the 6-minute walk test. This involves noting the distance comfortably covered by someone with (for example) FMS, in 6 minutes of walking. It is used as one of the means of evaluating the benefits of interventions such as hydrotherapy pool work (Gowans et al 1999b): 'We believe the 6-minute walk test is an outcome measure that may be useful in directly assessing physical function.'

Fear of exercise

Silver et al (2002) looked at the phenomenon of kinesiophobia – fear of active movement. Having discovered that avoidance of exercise did not correlate with maximal heart rate or resting heart rate, level of tiredness, symptom severity, illness identity or emotional distress, they concluded that *what the individual believes about activity* appears to be the important variable in predicting behaviour and avoidance of exercise. This re-emphasizes the importance of patients receiving support, information, education and understanding, if their initial belief is to change.

Antibiotic and auto-vaccine treatment (against *Mycoplasma*)

The evidence that has emerged regarding mycoplasmata and FMS was discussed in Chapter 3. Treatment advocated for the systemic mycoplasmal infections described in Chapter 3 was seen to involve heroic use of antibiotics for extended periods of time (Nicolson et al 2000) together with nutritional support (Nicolson 1998).

Endresen (2003) reports that in studies using polymerase chain reaction methods, mycoplasma blood infection has been detected in about 50% of patients with CFS and/or FMS, including patients with Gulf War illnesses and symptoms that overlap with one or both syndromes. Such infection is detected in only about 10% of healthy individuals. Most patients with CFS/FMS who have mycoplasma infection appear to recover and reach their pre-illness state after long-term antibiotic therapy with doxycycline, and the infection cannot be detected after recovery. It is not clear whether mycoplasmas are associated with CFS/FMS as causal agents, cofactors or opportunistic infections in patients with immune disturbances.

Alternative views also suggest that mycoplasmal infections are nowhere near as widespread as has been suggested, in FMS or in associated conditions such as Gulf War illness (Lo et al 2000).

An alternative to antibiotic treatment of systemic mycoplasmal infection uses autologous vaccines which are based on the patient's own tissues or serum, from which the vaccine is produced. In this way the individual's unique internal microbial environment is incorporated into the vaccine (Issels 1999). The theory is that certain micro-organisms (such as *Mycoplasma*) in human blood, body fluids and tissues are highly 'pleomorphic', i.e. they can appear in various developmental stages, and in diverse forms, while maintaining their essential characteristics. When the internal environment of the individual deteriorates, they have been observed to transform from primitive forms into higher cyclogenetic structures. They can then become pathogenic and are thought by many to be causative, or contributory, factors in the development of malignancies, various chronic degenerative diseases and immune disorders including AIDS (Gerlach 1970, Shi & Lo 1995).

Issels (1999) claims that after more than 40 years of clinical application of autologous vaccines (in his case mainly in treating cancer), there is ample

evidence that the vaccines have contributed to the retardation, cessation and remission of tumour growth in a variety of cancers, as well as to the improvement of various immune disorders. This method of treatment is mainly available in Germany.

Acupuncture

Acupuncture in general has an excellent track record in the treatment of pain (see Ch. 6). One of the leading experts in the use of acupuncture in pain relief, Dr Peter Baldry, after asserting categorically that acupuncture is certainly the treatment of choice for dealing with myofascial pain syndrome or trigger point problems, states: 'The pain in FMS – which would seem to be due to some as yet unidentified noxious substance in the circulation giving rise to neural hyperactivity at tender points and trigger points – takes a protracted course and it is only possible by means of acupuncture to suppress this neural hyperactivity for short periods' (Baldry 1993).

Baldry believes that it is necessary to repeat treatment every 2–3 weeks for months or even years, which he regards as unsatisfactory, 'but nevertheless some patients insist that it improves the quality of their lives'.

Relief from pain for weeks on end and an enhanced quality of life would seem quite a desirable objective, perhaps helping to ease the pain burden while more fundamental approaches are dealing with constitutional and causative issues.

How can acupuncture influence chronic pain problems such as FMS?

Using functional MRI imaging of the brain, researchers investigated the effects of acupuncture, on fibromyalgia patients and normal subjects, after initiating pain via cold stimulation (30-second cold pack application to the right elbow) (Huang et al 2004).

FMS patients showed significantly higher activation in the prefrontal and insular cortices, corresponding to significantly higher pain ratings (4.0 vs 1.5). Healthy subjects showed increased activation in the postcentral gyrus (Brodmann area 7) and caudate nucleus. Following additional functional magnetic resonance imaging (fMRI) of these areas following acupuncture, the authors report that:

> *This pilot study confirms that CNS pain pathway activation, in response to cold stimulation in the fibromyalgia patients, suggests an analgesic role of acupuncture with immediate modification of central pain processing, and elucidates the possible benefits of acupuncture in the fibromyalgia population by 'correcting' the CNS response to cold stimulation by facilitating sensory pathway.*

Electro-acupuncture

A Swiss research team in Geneva has examined the effectiveness of electro-acupuncture in treating FMS in 70 patients (54 women) who all met the American College of Rheumatology criteria for FMS. They received either sham acupuncture ('wrong' points used) or the real thing. Various methods were used for patients to record their level of symptom activity and the amount of medication they used before and after treatment. Sleep quality, morning stiffness and pain were all monitored.

The electro-acupuncture treatment was administered over a 3-week period. Only the doctor giving the treatment knew whether or not the needles were being placed correctly and whether the amount and type of electrical current being passed through the needles was correct. Seven out of the eight measurements showed that only the acupuncture group and not the placebo (dummy acupuncture) group had benefits (as in all such studies a few minor improvements are always noted in the dummy or placebo group but these were only slight). The acupuncture group, after treatment, required far more pressure on tender points to produce pain while use of pain-killing medication was virtually halved, as was these patients' assessment of regional pain levels. There was also a significant improvement in quality of sleep. The length of time morning stiffness was experienced only improved a small amount. About 25% of the treated group did not improve significantly; all the others showed a remarkable amount of improvement, with some having almost complete relief of all symptoms. The duration of the improvement was noted to be 'several weeks' in most patients, which seems to

be in line with Dr Baldry's observation of it being necessary to repeat treatment every few weeks (DeLuze et al 1992).

Dry needling and myofascial trigger points (Sandford Kiser et al 1983)

In a study, 46% of those people with myofascial pain syndrome found that 'dry needling' (see Chs 6 and 8) offered them the longest lasting relief of symptoms compared with other forms of treatment they had received. And 69% required less medication for some time afterwards.

CAUTION: Acupuncture (and dry needling) should only be applied by suitably trained practitioners or therapists. Clinical experience suggests that following acupuncture a degree of 'soreness and discomfort' at the needle sites will be experienced by individuals with FMS, and they should be cautioned to expect this. Anyone with a fear of acupuncture should not be persuaded into trying it.

Chiropractic

Chiropractic is one of the alternative approaches most used by patients with fibromyalgia. In one review it was reported that almost 50% of FMS patients attend for chiropractic treatment, with 46% of these reporting a moderate to a great degree of improvement (Wolfe 1986).

Significantly, in their review of chiropractic efficacy in treatment of FMS, Blunt and colleagues suggest that chiropractic management would be associated with additional potentially useful methods, including soft tissue massage and 'spray and stretch' (Blunt et al 1997). To what extent, in any given case, the soft tissue approaches alone produce the major benefits is certainly open to debate. They highlight various mechanisms that might be involved:

- Pain inhibition may be achieved in the following ways:
  - **a.** spinal mobility following manipulation tends to decrease central transmission of pain from adjacent structures (Gatterman & Goe 1990)
  - **b.** endogenous opioids may also be released following manipulation (Irving 1981)
  - **c.** pressure pain thresholds of cervical paraspinal musculature increases following manipulation.
- Paraspinal muscles relax due to stretching of apophyseal joint capsules, reflexly inhibiting motor neuron pools which may be facilitated and so be responsible for increased tone. Intrafusal fibres are stretched during manipulation, helping restore balanced afferent/efferent impulses in the proprioceptive system of the joint and local musculature (Korr 1975, Shambaugh 1987).
- Articular adhesions may be reduced or broken in chronic cases (Kirkaldy-Willis et al 1984).
- Range of motion should increase (Lewit 1985).

Studies

To date there have been no large controlled trials to validate benefit following the use of chiropractic in treatment of FMS; however, what evidence there is suggests possible value, particularly when combined with other manual approaches (Holdcraft et al 2003).

Randomized trial

In a pilot study (a randomized cross-over pilot trial), a group of Canadian chiropractors (Blunt et al 1997) selected 21 rheumatology patients with FMS, aged between 25 and 70 years. Ten patients received treatment 3–5 times per week for 4 weeks. During this time the remainder (the controls) received no treatment, but received it in the following 4-week period (only nine were involved by this stage, as two patients had dropped out). Treatment consisted of:

- soft tissue massage using a counterirritant cream
- soft tissue stretching with and without fluoromethane as a chilling agent (used especially in early stages and on the scalene muscles)
- spinal manipulation (minimal amplitude, low velocity) applied to joints with a 'hard' end-feel
- education, involving provision of information of aggravating factors, sleep habits, body mechanics, understanding the aetiology of FMS.

The study confirms the benefit in pain modulation and functional status in FMS patients of carefully applied manipulative methods incorporating both osseous and soft tissue methods. Studies which compare joint manipulation with soft tissue approaches would help to clarify their relative benefits. There is no evidence that the underlying condition is assisted by these methods, although they may have an important role to play in management (as suggested by Lowe in Ch. 10).

Biochemistry and manipulation

In Chapter 11 McPartland explains the ways in which endocannabinoids can be upregulated, and one of these is following the sort of manipulation offered in chiropractic care. Indeed, the stimulation of pain-relieving, mood-enhancing endocannabinoids might well explain many of the benefits offered by manual modalities – and exercise.

Diet and detoxification

Vegan diet and FMS

Clinical research studies in Finland have shown that a 'strict, low-salt, uncooked vegan diet, rich in lactobacteria' produces 'significant improvements' in pain levels, joint stiffness, quality of sleep and general health in patients with fibromyalgia over a 3-month period (Hanninen et al 2000, Kaartinen et al 2000).

The researchers noted that 18 patients (whose progress was compared with 15 omnivorous control patients during the study) showed a 33% drop in urine sodium levels, as well as significant lowering of cholesterol levels. 'It can be concluded that a vegan diet had beneficial effects on FMS symptoms at least in the short run' (Kaartinen et al 2000).

Speculating on the reasons for general improvements in rheumatic symptoms of patients on a vegan diet, in a randomized, controlled clinical trial, Hanninen et al (2000) observed:

> *Plants are rich natural sources of antioxidants in addition to other nutrients. Interventions and cross sectional studies on subjects consuming uncooked vegan diet called 'living food' (LF) have been carried out. We have clarified the efficacy of LF in rheumatoid diseases as an example of a health problem where inflammation is one of the main concerns [see fibromyalgia study reported above]. LF is an uncooked diet and consists of berries, fruits, vegetables and roots, nuts, germinated seeds and sprouts, i.e. rich sources of carotenoids, vitamin C and E. . . . The shift of fibromyalgic subjects to LF resulted in a decrease of their joint stiffness and pain as well as an improvement of their self-experience of health.*

The researchers report that similar benefits were noted with rheumatoid arthritis patients.

Comment

Adherence might be expected to become an issue in a radical dietary programme such as this, despite the clear evidence of benefit. Kaartinen et al (2000) mention that adherence can be judged by the changes noted in urinary sodium levels.

Blood type

The concept that an individual's blood type might be associated with particular eating patterns which are more suitable than others remains controversial. However, a great deal of anecdotal, and a fair amount of evidence-based, backing is now available. Peter D'Adamo (2002), the leading proponent of this model, states:

> *My own patients and the outcomes registered on this website, have made it obvious that those who are type O and suffering from fibromyalgia can see quite dramatic responses if they can stick to the wheat-free component of the diet for long enough duration. A recent study indicates that dietary lectins interacting with enterocytes (cells lining the intestines) and lymphocytes may facilitate the transportation of both dietary and gut-derived pathogenic antigens to peripheral tissue, which in turn causes persistent immune stimulation at the periphery of the body, such as the joints and muscles (Cordain et al 2000). This, despite the fact that many nutrition 'authorities' still question whether lectins even get into the systemic circulation! In genetically susceptible individuals, this lectin stimulation may ultimately result in the expression of disorders like rheumatoid arthritis and fibromyalgia via molecular mimicry, a process whereby foreign peptides, similar in structure to endogenous peptides, may cause antibodies or T-lymphocytes to cross-react and thereby break immunological tolerance. Thus by removing the general and type O specific lectins from the diet, we allow for the immune system to redevelop tolerance, the inflammation begins to ebb, and healing can begin.*

Food intolerance and muscle pain

Mathews & Campbell (2000a) have described a number of cases of lactose intolerance linked to

symptoms that mimic FMS in all but name, including: 'severe muscle pain, headache, fatigue, tachycardia, and labile hypertension'.

They note (Mathews & Campbell 2000b) that: 'Muscle pain, Allergy, Tachycardia and Tiredness, and Headache (MATHS) [can be] caused by sugar overload in the large intestine. Colonic bacteria metabolise sugars to produce systemic toxins (e.g. acetaldehyde, formate, diacetyl, acetoin, butan-2,3-diol, propan-1,3-diol and hydrogen).' When levels of these systemic toxins reach a critical level, Mathews & Campbell maintain that symptoms emerge. They observe that removal of the trigger (in the cases that they describe, sugars deriving from milk) completely relieves the symptoms, and that such symptoms [MATHS] can be caused by sugars other than lactose.

Excitotoxins

Smith et al (2001) demonstrated that the symptoms of FMS can be dramatically eased if excitotoxins can be avoided. Four female patients, diagnosed with fibromyalgia syndrome for 2–17 years, all of whom had undergone multiple treatment modalities with limited success, had complete or nearly complete resolution of their symptoms within months after eliminating monosodium glutamate (MSG) or MSG plus aspartame from their diet. The authors note: 'Excitotoxins are molecules, such as MSG and aspartate, that act as excitatory neurotransmitters, and can lead to neurotoxicity when used in excess. We propose that these four patients may represent a subset of fibromyalgia syndrome that is induced or exacerbated by excitotoxins or, alternatively, may comprise an excitotoxin syndrome that is similar to fibromyalgia.' (See also the notes on toxicity and allergy/sensitivity in Chs 3 and 4.)

Homeopathy

Several studies have looked at the effects of a specific homoeopathic remedy, Rhus Tox, in treating FMS and 'fibrositis' – with quite different results.

It is important to understand the basis of homeopathic prescribing in order to make sense of the different results in trials of this substance. Homoeopathic remedies comprise minute quantities of substances which in larger amounts would produce symptoms very similar to, or identical with, the symptoms being experienced. Once the substance has been 'proved' – by many human trials – it is then used in an extremely diluted form to treat the symptoms of the condition in people whose temperament and personality, as well as numerous other characteristics, fit the picture of the people most affected by the medication during its trials. When a remedy is selected in classical homeopathy, therefore, it is not just the symptoms that are taken into account but a 'constitutional profile' of the person affected. This means that while two people might have the same named condition (say asthma), they might require different remedies if they have different personalities, likes and dislikes, and are affected by different factors.

Although treatment of painful rheumatic conditions by homeopathy often involves the use of Rhus Tox, it is considered not to be suitable for all people with such conditions, but only for those with the profile of the medicine.

The ideal person for using Rhus Tox is:

- Restless, continually changing position, having a great deal of apprehension, especially at night, and finds it difficult to stay in bed; the head will feel heavy, and the jaw may be noisy, creaking, with temporomandibular joint pain.
- The tongue tends to be coated except for a red triangular area near the tip, and there is frequently a bitter taste in the mouth and a desire for milky drinks; there is often a drowsy feeling after eating.
- There may be a nagging dry cough and a sense of palpitation, most noticeable when sitting still. The back tends to be stiff and normally feels better for moving about; limbs are stiff and any exposure to cold makes the skin feel sensitive or painful.
- Cold, wet weather makes symptoms worse, as does sleep and resting.
- What helps most, as far as symptoms are concerned, is warm, dry weather, movement, rubbing the uncomfortable areas, warm applications and stretching.

The remedy is Rhus Tox in the 6C potency.

Studies

In Britain, a study found that using the 6C dilution of Rhus Tox was effective in moderating the symptoms of patients with FMS, whereas in a trial in Australia involving just three patients who fitted all the criteria, including the profile for Rhus Tox, there was no benefit when a 6X dilution was used.

The difference between 6X and 6C may seem unimportant, but the dilution difference is enormous. To make a 1C dilution, one part of the substance is vigorously mixed with 99 parts of ethanol (an alcohol used to preserve the substance). To make 2C dilution, one drop of the first mix is placed with another 99 drops of ethanol and the process is repeated. By the time you get to 6C the dilution is minute, and this is what was used in the first – successful – study mentioned. Paradoxically, this is called a 'high' potency and is considered more powerful and faster acting in terms of triggering a healing response than a low potency. 'X' potencies are low: one drop of the substance to nine drops of ethanol are needed to make 1X, with the process being repeated five more times to make 6X, as used in the second – unsuccessful – trial discussed above.

Since there is absolutely no chance of side-effects with homeopathy, there is little to be lost in trying the 6C dilution (Fisher et al 1989).

Controlled study

A double-blind, randomized, parallel-group, placebo-controlled trial of homeopathy was conducted involving 53 patients with FMS (Bell et al 2004). Patients were randomized to receive an oral daily liquid, individually prescribed, homeopathic remedy or an indistinguishable placebo. Tender point count and tender point pain on examination by a medical assessor uninvolved in providing care, self-rating scales on fibromyalgia-related quality of life, pain, mood and global health at baseline and 3 months, were the primary clinical outcome measures.

Results: Participants on active treatment showed significantly greater improvements in tender point count and tender point pain, quality of life, global health and a trend toward less depression compared with those on placebo (Gemmell et al 1991).

CAUTION: There are no contraindications to homoeopathic medication.

Hydrotherapy

Numerous studies show that hydrotherapy can offer benefits that include reduced pain and enhanced functionality for FMS patients. Chapter 13 offers evidence for this statement, together with details of a number of hydrotherapy protocols.

Hypnotherapy (Haanen et al 1991)

In controlled trials it has been found that hypnotherapy helps more than physical therapy in those patients who do not seem to respond well to most other forms of treatment. Pain is reduced, fatigue and stiffness on waking are improved and general feeling of well-being is greater.

CAUTION: Only fully qualified hypnotherapists should employ these techniques.

Interdisciplinary combined (group) treatment (Bennett et al 1996)

Research at the department of medicine of Oregon Health Sciences University in the USA evaluated the impact of 6 months (1 hour per week) of group treatment involving lectures and group sessions of active fitness training, stress reduction, relaxation, behaviour modification and flexibility (stretching exercises).

A questionnaire was used to evaluate the impact of FMS on people's lives and their total tender point score was also measured regularly. Also measured were levels of fitness (how far could the person walk in 6 minutes (see above)), depression scores, quality of life scores, etc.

Between 15 and 25 patients turned up regularly and their condition was monitored for 2 years after the end of the 6 months of the trial. Over a 4-year period, 170 patients took part in the study, with 104 completing the full 6 months during their time on the programme. The findings were as follows:

- After 6 months on this combined group programme, 70% of those completing it had reduced their number of tender points to fewer than 11.
- There was a 25% improvement in the impact of fibromyalgia on their lives.
- After 2 years, 33 patients who were questioned and examined showed continued improvement.
- Approximately 30 people who never entered the programme were followed, for comparison with those in the active group. These non-active FMS patients showed no improvement over the same period.

In Chapter 7 of this book Paul Watson looks at interdisciplinary approaches to pain in general, and FMS in particular, and highlights the need to deal with both mind and body aspects of the problem. The objectives of interdisciplinary pain management deserve repetition:

> *The Pain Society of Great Britain and Ireland (Pain Society 1997) clarified the overall aim of a pain management programme: 'The aim of a Pain Management programme is to reduce the disability and distress caused by chronic pain by teaching sufferers physical, psychological and practical techniques to improve their quality of life.'*

See also notes, earlier in this chapter, on integrated, multidisciplinary approaches to FMS.

Massage therapy (see also chiropractic section, above, and Chapter 16)

Research from the Touch Research Institute, University of Miami Medical School, indicates benefits from appropriate forms of massage in treatment of FMS (Field et al 2003, Sunshine et al 1996).

While many FMS patients frequently request deep work, this is contraindicated, based on what is known of the mechanisms involved in FMS. The most useful manual methods seem to involve non-specific wellness massage and lymphatic drainage, plus finely targeted specific interventions using aspects of soft tissue manipulation, most specifically positional release and vibrational methods (see notes on osteopathy, below, and Ch. 16).

The removal or deactivation of myofascial trigger points and other local dysfunction by minimally invasive methods, combined with homeostatic enhancing approaches (nutrition, relaxation methods, hydrotherapy, etc.) would seem to be additionally useful applications of massage therapy (see Ch. 8).

When massage and movement treatment was compared with relaxation and movement in treating FMS patients, there were markedly more benefits in the group receiving massage as well as movement therapy. The greatest benefits were noted in areas of mood and depression, as well as in reduced pain levels (Field et al 2003).

Manual lymphatic drainage (MLD)

A pilot study evaluated the benefits of very light massage (MLD) on pain and stiffness, sleep and sleepiness, and well-being in 17 women with long-standing fibromyalgia (Asplund 2003). All symptoms showed favourable progress during a 4-week period with manual lymph drainage therapy. One of the main findings in this pilot study of women with initially severe pain due to long-standing and incapacitating fibromyalgia was that they experienced a substantial reduction in their pains during treatment with very light massage in accordance with the technique of manual lymph drainage therapy.

CAUTION: Massage requires skill and patience, and only fully qualified massage therapists who understand the risks regarding excessively deep treatment or overtreatment in conditions such as FMS should be referred to. FMS patients often 'demand' deep tissue treatment for painful muscles, despite the fact that this is inappropriate (for reasons explained in earlier chapters, and in Ch. 15). Massage therapists specializing in chronic fatigue and FMS patients would be aware of this.

Medication

Robinson & Jones (2006) have reviewed the pharmacological approaches to FMS, and conclude: 'The literature lacks pharmacoeconomic studies that balance the cost and benefit of interventions ... [and] due to inconclusive results, further study is needed on fibromyalgia treatment cost-effectiveness.'

Studies

- The most widespread treatment approach to FMS involves the use of various pharmacological agents and it is useful to evaluate the results of studies as to their efficacy. Tricyclic antidepressant medication increases the amount of serotonin in the central nervous system and increases the delta-wave sleep stage; it is found consistently to improve the symptoms of fibromyalgia, though not by acting as an antidepressant and not in all patients treated.
- Studies involving various forms of antidepressant medication tend to support use of amitriptyline

(25–50 mg daily), with pain scores, stiffness, sleep and fatigue all improving on average, but by no means in all patients (Carette et al 1986).

- In one study, 77% of FMS patients receiving amitriptyline reported general improvement after 5 weeks as against only 43% of those receiving placebo medication. Side-effects from the antidepressant were, however, measurable, with a selection of drowsiness, confusion, seizure, agitation, nightmares, blurred vision, hallucinations, uneven heartbeat, gastrointestinal upsets, low blood pressure, constipation, urinary retention, impotence and mouth dryness all being observed or reported (Goldenberg et al 1986).
- When combined with osteopathic manipulative methods (mainly soft tissue techniques – see below), antidepressant medication offered greater relief (Rubin et al 1990).
- A study by Carette & Bell (1994) showed that amitriptyline was no more effective than placebo and that Flexyril caused widespread adverse effects in 98% of those taking it, with these being so severe in 13% that they had to cease taking it. Only 12% showed mild improvement in FMS symptoms (Carette & Bell 1994).

Prozac and FMS: test results

Arnold et al (2002) studied Prozac (fluoxetine hydrochloride) in treatment of FMS. Prozac is an antidepressant used orally which is chemically unrelated to tricyclic, tetracyclic or other available antidepressants. Its effects are presumed to be linked to its inhibition of CNS activity that also affects chemical messengers within the brain. Sixty outpatients (all women, aged 21–71 years) with fibromyalgia were randomly assigned to receive fluoxetine (10–80 mg/day) or placebo for 12 weeks in a double-blind, parallel-group, flexible-dose study. Women who received fluoxetine had significant ($P = 0.005$) improvement in the Fibromyalgia Impact Questionnaire total score compared with those who received placebo. They also had significant ($P = 0.002$) improvement in the Fibromyalgia Impact Questionnaire pain score, as well as in the Fibromyalgia Impact Questionnaire fatigue ($P = 0.05$) and depression ($P = 0.01$) scores and the McGill Pain Questionnaire ($P = 0.01$), when compared with subjects who received placebo. Although counts for the number of tender points and total myalgic scores improved more in the fluoxetine group than in the placebo group, these differences were not statistically significant.

Other drugs and FMS

- A study involving the use of systemic corticosteroids (prednisone 15 mg daily) showed that there were no measurable improvements, and since side-effects with such medication are usual, this approach is clearly not desirable. In fact, if such medication were to produce an improvement it would be sensible to question whether fibromyalgia was indeed the correct diagnosis – some other rheumatic condition is more likely to improve symptomatically with the use of corticosteroids (Clark et al 1985).
- When muscle relaxants were tested in FMS patients, most were found to be useless, but cyclobenzaprine (10–40 mg daily, given at night to prevent daytime drowsiness) was found to improve pain levels, sleep and tender point count; this is thought to be because it has a chemical similarity to amitriptyline (Campbell et al 1985).
- Goldenberg conducted a double-blind, placebo-controlled, crossover study involving 19 FMS patients in which a combination of drugs was evaluated. The results (reported in Fibromyalgia Network 1996) indicated that a combination of 20 mg Prozac in the morning and 25 mg Elavil in the evening produced the best results, reducing pain and enhancing sleep. Benefits were noted within 3 weeks of starting. However, the report concludes, 'Goldenberg could not offer reassurance as to how long this positive improvement would last' (Fibromyalgia Network 1996).
- Many other drugs are currently being researched and tried in treatment of FMS, ranging from antiviral agents to substances which modulate the immune system. Various cocktails of antidepressant and sedative medications are being tried out as well. Even aspirin has been tested and is said to be mildly useful!

CAUTION: There exists a range of herbal and nutrient-based alternatives to the sort of pharmacological agents discussed above (St John's wort, for example, see below). Although these are potentially 'safer' than prescription drugs, it is suggested that only practitioners who have had training in this area, or who have had appropriate postgraduate experience and training (medical physicians, medical herbalists, naturopaths, homeopaths, osteopathic

physicians, chiropractors, etc.), should prescribe nutrients or herbal products which have the potential to modify depression or anxiety states.

Nutritional supplementation

Much of the information in this section on nutritional supplementation, as a factor in fibromyalgia treatment, is derived from information generously provided by one of the world's leading researchers into nutritional influences on illness, Melvyn Werbach MD, of Tarzana, California, whose texts *Nutritional Influences on Illness* and *Nutritional Influences on Mental Illness*, and his authoritative and comprehensive CD-Rom (Werbach 1998), offer clinicians and researchers invaluable resources. A summary of nutritional supplementation research as it applies to fibromyalgia (or 'muscular rheumatism', or non-articular rheumatism) is listed below.

Please note the cautions within and at the end of this section.

Arginine

- Generalized pain and fatigue induced by growth hormone and serotonin depletion may be treated with arginine (or ornithine) supplementation (Eisinger et al 1992b). Up to 4 g arginine (or 2 g ornithine) are taken both morning and evening, away from meal times.

CAUTION: If arginine or ornithine is taken, it should be for a period of 2–3 months only, with a similar rest period before starting again. This is suggested to prevent imbalances in the amino acid content in the body from developing.

- Growth hormone stimulators should never be taken (unless under supervision) by anyone who has not completed their growth phase.
- Skin may become coarse if excessive growth hormone is released.
- A supplement of antioxidants (vitamins A, C, E, selenium) is suggested as a useful accompaniment to taking these amino acids.

Ascorbigen

Twelve female FMS patients were supplemented with 500 mg daily of a blend of ascorbigen (100 mg) and broccoli powder (400 mg) for a month (Bramwell et al 2000). The results showed that there was a mean 20.1% decrease in physical impairment and 17.8% decrease in total FMS impact scores. Pain thresholds also increased.

Chlorella

- *Chlorella pyrenoidosa* is a unicellular green alga. Eighteen FMS patients completed a 2-month trial (20 patients commenced the trial). The participants were supplemented with 10 g daily of Sun Chlorella tablets and 100 ml daily of liquid Wakasa Gold. The average tender point index decreased over the 2 months by a statistically significant 22%. Of the 18 patients completing the study, seven felt their FMS had improved, six felt no different and five felt worse. The conclusion is that some people with FMS benefit in terms of their pain levels by supplementing with *Chlorella* (Merchant et al 2000).
- In a subsequent double-blind, placebo-controlled, randomized clinical trial (Merchant & Andre 2001), patients with hypertension (33 individuals), ulcerative colitis (9) and FMS (55) were treated with *Chlorella* supplementation as in the previous study described above. Results showed that all patients benefited and that there was the potential for *Chlorella* to relieve symptoms, improve quality of life, and normalize body functions in patients with fibromyalgia.

Hydrolytic enzymes

- Administration may be beneficial after some weeks or months. In an experimental double-blind multicentre study, 424 patients with non-articular rheumatism received either a mixture of trypsin, chymotrypsin, lipase, amylase, pancreatin, papain and bromelaine or placebo. Significant symptom improvement was noted in the enzyme group. Side-effects were rare and minimal (Uffelmann et al 1990).
- In an experimental study, 1004 patients with rheumatic disability (407 with arthrosis, 238 with arthritis, 155 with soft tissue rheumatism and 204 with multiple rheumatoid diagnoses), seen by 141 practising physicians and specialists, received treatment with an enzyme mixture (trypsin, chymotrypsin, amylase, lipase, pancreatin, bromelaine and papain). Clinical findings were rated on a 0–3 scale for pain at rest, pain upon weight-bearing, pain on pressure, morning stiffness and functional impairment. Of the total group, 67% had a good to excellent response ($P = 0.05$).

Improvement was noted in 76% of patients with arthrosis, 86% of those with arthritis, 90% of those with soft tissue rheumatism and 76% of those with multiple diagnoses. The shorter the duration of illness, the better the results. Over 99% of patients and doctors reported that enzyme therapy caused virtually no side-effects (Horger et al 1988).

L-Tryptophan

Plasma/serum levels may be reduced in patients with fibromyalgia (Yunus et al 1992).

CAUTION: The amino acid tryptophan is no longer available over the counter after a contaminated batch from Japan caused severe toxic reactions. 5-HTP (5-hydroxy-L-tryptophan), a tryptophan-like substance derived from an African bean, is now available and clinical experience suggests it is useful in sleep enhancement.

5-Hydroxy-L-tryptophan (available in health food stores and pharmacies)

- Supplementation may be beneficial. In an experimental study, 50 patients with primary fibromyalgia syndrome received 5-hydroxy-L-tryptophan 100 mg three times daily. After 90 days, the number of tender points, anxiety, pain intensity, quality of sleep, and fatigue all showed significant improvement ($P<0.001$). Fifteen of the 50 (30%) reported side-effects, but only one patient needed to be withdrawn. There were no abnormalities due to the treatment in laboratory testing (Puttini & Caruso 1992).
- In an experimental double-blind study, 50 patients with primary fibromyalgia syndrome randomly received either 5-hydroxy-L-tryptophan 100 mg three times daily or placebo. After 30 days there were significant declines in the number of tender points and in the intensity of subjective pain, and significant improvements in morning stiffness, sleep patterns, anxiety and fatigue compared to placebo. Only mild and transient side-effects were reported (Caruso et al 1990).

L-Serine

- Studies investigating a molecular basis to chronic fatigue syndrome (ME/CFS) reported that urinary excretion of the amino acid serine is an important discriminatory metabolite distinguishing subjects from controls. Excretion of serine has been correlated negatively to neurological and total symptom indices, and positively with overall symptom severity. Serine deficiency is suggested as an important factor contributing to the severity of symptoms in ME/CFS (and possibly FMS) patients. Serine is proposed to be conditionally essential wherein the disease process may increase metabolic demands. The essential amino acid tryptophan, an indirect precursor of the neurotransmitter serotonin, can be synthesized directly from serine by micro-organisms in the gut. It is thought that altered production of serotonin could result in cognitive dysfunctions characteristic of ME/CFS.
- A study assessed the potential efficacy of L-serine with a view to a larger, fully controlled study (Emms et al 2002). Twenty-eight ME/CFS patients with low urinary serine excretion were supplemented with 1–3 g L-serine daily ($n = 17$) or in combination with other mineral, protein or probiotic supplements ($n = 11$). The mean treatment time was 14.6 weeks (range: 74). Significant reductions in symptom expression were seen in core CFS diagnostic symptoms, cognitive, neurological and musculoskeletal symptoms. Preliminary results indicate L-serine supplementation, alone or in combination therapy, shows potential for symptom management in ME/CFS subjects.

Magnesium

- A number of symptoms associated with FMS, including muscle pain, fatigue, sleep disturbance and anxiety, may result from magnesium deficiency (Romano & Stiller 1994).
- Many researchers believe that FMS may involve chronic hypoxia, predominantly caused by enhanced gluconeogenesis associated with muscle protein breakdown and deficiency of oxygen and other substances needed for ATP (energy) synthesis. Magnesium deficiency would result in such an inefficient respiratory chain (Abraham & Flechas 1992).
- When 100 patients with FMS were compared with osteoarthritic patients and what are regarded as normal levels, it was found that erythrocyte levels in FMS patients were on average lower, with the implication that magnesium status was low (Romano & Stiller 1994). In some studies, red-blood cell levels of magnesium were found to be low in FMS patients (Eisinger et al 1988b), whereas

in other studies (Eisinger & Ayavou 1990, Prescott et al 1992) no differences were found in red-cell magnesium concentrations when patients with FMS were compared with age- and sex-matched normal controls.

- Researchers, noting that plasma levels of calcium and magnesium are usually normal in FMS patients, studied the balance of these nutrients intracellularly. The study involved 100 individuals with FMS and 40 healthy controls, and revealed that intracellular calcium and magnesium concentrations were unbalanced. The researchers describe this as a 'peculiar characteristic of FMS, which may be responsible for muscular hypertonus' (Magaldi et al 2000).
- Hair analysis has been used to identify calcium and magnesium deficiency/imbalance in people with FMS in a retrospective study (Ng 1999). The notes of 12 consecutive patients with FMS, and the notes of 12 non-FMS patients, matched by age and sex, were evaluated to compare the results of hair analysis. The results showed that the FMS patients had significantly higher levels of hair calcium and magnesium, suggesting high levels of excretion, and therefore low systemic levels. The conclusion was that, 'supplements of calcium and magnesium may be indicated as an adjunctive treatment of fibromyalgia'.

Malic acid

- This is both derived from food sources (especially apples) and synthesized in the citric acid cycle, and plays an important role in generating mitochondrial ATP under both aerobic and hypoxic conditions. Supplementation, together with magnesium, may be beneficial.
- Not all trials have proved positive: for example, an experimental double-blind crossover study involving 24 patients with primary fibromyalgia who randomly received magnesium malate (Super Malic) 3 tablets twice daily (containing a total of 300 mg magnesium as magnesium hydroxide and 1200 mg malic acid) or placebo, each for 4 weeks, with a 2-week wash-out period in between, produced no evidence of benefit. The results of those patients taking magnesium malate were not significantly better than those taking the placebo, as assessed by pain, tenderness, and functional and psychological measures. Side-effects were limited to loose stools (Russell et al 1995).
- On the other hand, benefits were noted during an experimental study involving 16 patients with primary fibromyalgia who completed a 6-month open trial of magnesium malate (Super Malic, each containing 50 mg magnesium as magnesium hydroxide and 200 mg malic acid) in which the dose of magnesium malate was gradually increased to a mean of 8.8 tablets daily (range 4–14 tablets daily). Significant improvements were seen in pain and tenderness after 2 months but there were no improvements in functional or psychological measures. Side-effects were limited to loose stools (Russell et al 1995).
- In another single-blind experimental study, 15 patients with primary fibromyalgia were treated for an average of 8 weeks with 2–600 mg magnesium and 12–2400 mg malate. Pain scores dropped steadily during the trial and went up again within 24 hours of placebo being used instead of the malic acid/magnesium (Abraham & Flechas 1992).

S-Adenosyl-L-methionine (SAMe)

- Supplementation with SAMe may be beneficial in fibromyalgia, starting with an initial dosage of 600–1200 mg daily. If gastrointestinal symptoms occur, the dosage should be reduced by half, then gradually increased again as tolerated. It may take several months for SAMe to achieve its full therapeutic effect (SAMe 1997).
- In an experimental study, 47 patients received 200 mg of intramuscular SAMe daily plus 400 mg SAMe orally twice daily. After 6 weeks of SAMe supplementation, tenderness was significantly reduced, as were scores for depression and anxiety. It was well tolerated with few side-effects (Grassetto & Varotto 1994).
- In another experimental study, 30 patients with primary fibromyalgia received either SAMe or transcutaneous electrical nerve stimulation (TENS). After 6 weeks, those patients receiving SAMe demonstrated a significantly decreased number of tender points, felt better generally and had lower scores in depression and anxiety assessment. Patients in the TENS group only had significant reductions in anxiety levels with no significant pain reduction or alteration in depression levels (Benedetto et al 1993).
- In an experimental double-blind study, 44 patients with fibromyalgia received 800 mg SAMe daily for 6 weeks. Improvements were seen

for clinical disease activity ($P = 0.04$), pain experienced during the last week ($P = 0.002$), fatigue ($P = 0.02$), morning stiffness ($P = 0.03$) and mood evaluated by Face Scale ($P = 0.006$) in the actively treated group compared to placebo. The tender point score, isokinetic muscle strength, mood evaluated by Beck Depression Inventory and side-effects did not differ in the two treatment groups (Jacobsen et al 1991).

- In a short-term crossover trial, 17 patients with primary fibromyalgia, 11 of whom had a substantial depression, were treated with SAMe and placebo. The number of trigger points plus painful anatomical sites decreased after SAMe ($P<0.02$) but not after placebo. In addition, scores in various depression rating evaluations decreased significantly after SAMe but not after placebo (Tavoni et al 1987).

Selenium

- A number of studies suggest that selenium deficiency may be associated with muscle pain (van Rij et al 1979).
- Serum levels of selenium may be low in people with chronic muscular pain conditions (James et al 1985).
- Supplementation of selenium may be beneficial (100 micrograms daily as selenomethionine). In one trial in New Zealand (where selenium levels in the soil are very low), an experimental double-blind study, nearly 60% of those with 'fibromuscular rheumatism' who were supplemented benefited after 12 weeks (Robinson et al 1981).
- When selenium (140 micrograms sodium selenite) was supplemented together with vitamin E (100 mg daily α-tocopherol) in people with disabling muscular pain, marked benefits in pain reduction were achieved, especially in those patients who displayed an increase in glutathione peroxidase following supplementation (75% of those treated) (Jameson et al 1985).

Thiamine

- The nutritional status of thiamine may be impaired in fibromyalgia (Eisinger & Ayavou 1990, Eisinger et al 1992a) and this may be associated with magnesium deficiency since thiamine-dependent enzymes require adequate magnesium (Eisinger et al 1994).
- Supplementation with thiamine (via intramuscular injection) has been shown to be helpful in treating FMS in a French study in which 21 patients were supplemented with 50 mg thiamine pyrophosphate intramuscularly three times a week for 6 weeks: 20 of the patients (95%) showed good results. These results were compared with just five of 13 FMS patients benefiting who received 100 mg intramuscular thiamine hydrochloride three times weekly for 6 weeks. This indicates that deficiency of thiamine was not the problem but a defect in thiamine metabolism (Eisinger 1987, Eisinger et al 1988a).

Vitamin D deficiency and FMS

- Low levels of vitamin D have been frequently reported in fibromyalgia (Jensen et al 2003b).
- Armstrong et al (2007) report that 75 FMS patients were tested by having serum vitamin D levels measured and completing the Fibromyalgia Impact Questionnaire (FIQ) and Hospital Anxiety and Depression Score (HADS). Deficient levels of vitamin D were found in 13.3% of the patients, while 56.0% had insufficient levels and 30.7% had normal levels. Patients with vitamin D deficiency (<25 nmol/l) had higher HADS than patients with insufficient levels or than patients with normal levels. They note that: 'The nature and direction of the causal relationship remains unclear, but there are definite implications for long-term bone health.'
- Gerwin (2005) notes that: 'Chronic myalgia may not improve until the underlying precipitating or perpetuating factor(s) are themselves managed. Precipitating or perpetuating causes of chronic myalgia include structural or mechanical causes like scoliosis, localised joint hypomobility, or generalised or local joint laxity; and metabolic factors like depleted tissue iron stores, hypothyroidism or Vitamin D deficiency. Sometimes, correction of an underlying cause of myalgia is all that is needed to resolve the condition.'

Note: No studies have been located in which FMS has been treated specifically using vitamin D.

CAUTION:

1. Supplements should be taken according to recommended dosages only – more is not necessarily better and some nutrients can be toxic.

2. When recommending any of these supplements to someone who has a tendency to

allergy or food intolerance/sensitivity, it is wise to introduce just one at a time and to evaluate for reactions for some days before commencing any other supplement or therapeutic change. 'One at a time' is a rule which should be used for *all* changes in lifestyle, diet, medication and therapeutic intervention in individuals whose coping and adaptation mechanisms are already stretched and struggling. It is as well to keep in mind the example of allostasis, in which normal homeostatic responses are exaggerated or deficient, and to therefore ask for only one change at a time, however innocuous it may seem.

Osteopathy

Osteopathic medicine, from which both SCS (strain/counterstrain – a form of positional release) and muscle energy technique (MET) derive (see Ch. 16), has conducted many studies involving FMS, including:

- Doctors at Chicago College of Osteopathic Medicine (led by A. Stoltz and R. Keppler) measured the effects of osteopathic manipulative therapy (OMT, which includes SCS and MET) on the intensity of pain felt in the diagnostic tender points in 18 patients who met all the criteria for FMS. Each had six visits/treatments and it was found over a 1-year period that 12 of the patients responded well in that their tender points became less sensitive (14% reduction in intensity as against a 34% increase in the six patients who did not respond well). Most of the patients – the responders and the non-responders to OMT – showed (using thermographic imaging) that their tender points were more symmetrically spread after the course than before. Activities of daily living were significantly improved, and general pain symptoms decreased overall (Stoltz 1993).
- Doctors at Texas College of Osteopathic Medicine selected three groups of FMS patients, one of which received OMT, another had OMT plus self-teaching (learning about the condition and self-help measures), and a third group received only moist-heat treatment. The group with the least reported pain after 6 months of care was that receiving OMT, although some benefit was noted in the self-teaching group (Jiminez et al 1993).
- Another group of doctors from Texas College of Osteopathic Medicine tested the difference in results involving 37 patients with FMS of using:
  - **a.** drugs only (ibuprofen, alprazolam)
  - **b.** OMT plus medication
  - **c.** a dummy medication (placebo) plus OMT
  - **d.** a placebo only.

  The results showed that drug therapy alone resulted in significantly less tenderness being reported than did drugs and manipulation, or the use of placebo and OMT, or placebo alone. Patients receiving placebo plus manipulation reported significantly less fatigue than the other groups. The group receiving medication and OMT showed the greatest improvement in their quality of life (Rubin et al 1990).
- At Kirksville, Missouri College of Osteopathic Medicine, 19 patients with all the criteria of FMS were treated once a week for 4 weeks using OMT. Of these 19 patients, 16 (84.2%) showed improved sleep patterns, 18 (94.7%) reported less pain, and most had fewer tender points on palpation (Rubin et al 1990).

CAUTION: Unless osteopathic practitioners/physicians have experience of FMS, it is suggested that they avoid their normal degrees of force and pressure in treating such conditions, or that they refer to colleagues with appropriate experience. Cranial osteopathic treatment can be helpful, since it is both extremely gentle and of particular value in such conditions.

Probiotics and prebiotics for gut dysfunction (Fig. 14.2)

If the digestive systems flora are dysfunctional due to any of a number of reasons, including steroid medication, antibiotics or a high fat/high sugar diet, bowel dysbiosis may result. Irritable bowel problems, yeast and undesirable bacterial overgrowth are just some of the possible precursors of major systemic dysfunction involving toxicity, deficiency and liver and/or kidney overload (Sneath 1986) (see also Figs 3.5 and 14.2).

Use of probiotics – freeze-dried 'friendly' bacteria – has been shown to be one way of encouraging 'refloras-tation' of the gut, as long as those practices mitigating against healthy bowel status are also addressed.

D'Souza et al (2002) have definitively shown, via a meta-analysis involving nine randomized, double-blind, placebo-controlled trials, that probiotics can effectively be used to prevent antibiotic associated diarrhoea. The main probiotics organisms, such as

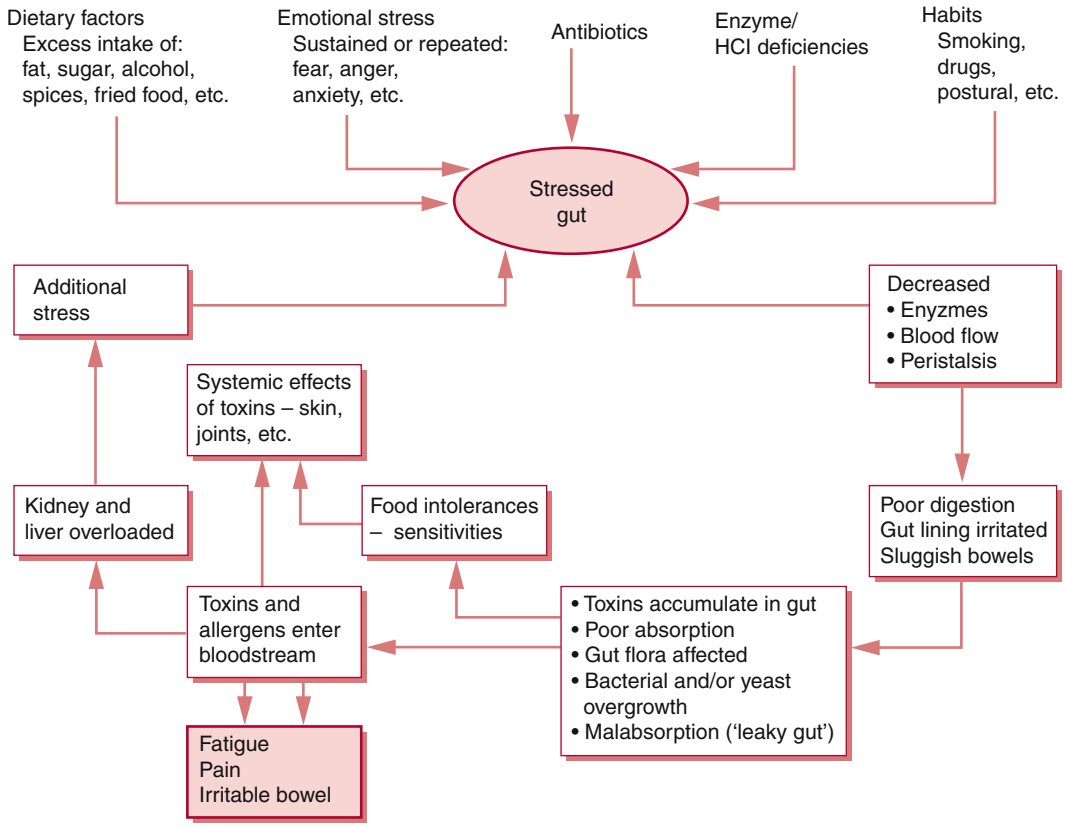

Figure 14.2 • Stressed gut.

bifidobacteria and lactobacilli, have been shown to help to improve resistance to gut infections by inhibiting the growth of harmful micro-organisms (that may onset both acute and chronic gut disorder), reduce blood lipid levels, improve the immune response and be involved in protection against gut cancers (Gibson & Roberfroid 1995).

Discussion and explanation for therapeutic use of probiotics and prebiotics (which enhance the function of probiotics) is to be found in Chapter 15 (see also Gibson & Roberfroid 1995, 1999 and Gibson et al 2000).

Thyroid replacement

Chapter 10 examines in detail the connection, in many instances, of an underactive thyroid condition as an associated, sometimes causal, feature of FMS.

As noted previously (see Ch. 3), certain mycoplasma cells have similarities in antigenicity to human thyroid tissues. Mycoplasmal infection may therefore be responsible, in some instances, for thyroid dysfunction, particularly where autoimmune processes are involved (Sack et al 1989).

It is perhaps significant to note that Shiroky et al (1993) found that thyroid dysfunction is seen at least three times more often in women with rheumatoid arthritis than in women with similar demographic features with non-inflammatory rheumatic diseases such as osteoarthritis and fibromyalgia. Nevertheless, as Lowe has demonstrated (Ch. 10), when FMS is primarily the result of hypothyroidism, replacement can produce dramatic results.

. . . And finally, methods which have no category

Two items make up this final segment of the chapter: magnetic mattress pads and cryotherapy.

Magnetic mattress pads

A study was undertaken to determine whether chronic pain and sleep disturbance in FMS patients could be improved by sleeping on magnetic mattress pads. The double-blind, placebo-controlled trial involved 35 female patients diagnosed with FMS (Colbert et al 1999).

The patients using the magnetic pads slept (for 16 weeks) on a surface magnetized at a magnet surface field strength of 1100 gauss, delivering 200–600 gauss to the skin surface. The controls slept on a sham non-magnetized pad. The results showed that patients sleeping on the magnetized pads experienced a significant decrease in overall pain, fatigue and total muscle pain score, and also showed improvement in sleeping patterns and physical functioning. There were no significant changes experienced by the sham/control group. A placebo effect was noted in that both groups reported being less tired on waking.

Whole body cryotherapy

Cryotherapy is a whole body cold therapy in which cold air (created using compressor technology) is blown onto the patient resting in a closed chamber. The method is a variation on older cold therapy which was based on the use of nitrogen-cooled air.

The 120 patients in the study (Metzger et al 2000) were 75% female, aged from 30 to 67 years, with a mean age of 52, suffering from FMS (about 45% of the patients), rheumatoid arthritis, chronic low back pain, ankylosing spondylitis, osteoarthritis and autoimmune diseases.

Treatment involved exposure daily for 2.5 minutes (on average) for 4 weeks, to temperature of minus 105°C. The study notes: 'Pain levels after exposure decreases significantly. The pain reduction lasts for approximately 90 minutes. The initial pain level decreases during the whole time of treatment, no significant improvement, though, can be shown from the middle to the end of the four weeks treatment.'

Apart from the relative pain decrease, the value of this approach seems to be that it 'facilitates intensive application of physiotherapy and Occupational Therapy'. The researchers believe that, 'From the patient's point of view, whole-body cold therapy is an essential part of the rehabilitation programme.'

Conclusion

What's working? Quite a lot it seems . . . ranging from exercise to acupuncture, from balneotherapy and cryotherapy to massage and nutritional approaches, not forgetting magnets and thyroid replacement therapy.

Clearly not all methods will suit all cases, but the choices are wide, the research is good, and the benefits are apparent. The low-tech approaches of hydrotherapy and exercise, together with a suitable dietary pattern and appropriate supplementation, would seem to offer almost universal benefits, as does combined (cognitive behavioural) therapy. Antidepressant medication seems to have a place, although side-effects (even though usually minimal) might deter some from this approach.

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Chapter Fifteen

15

Fibromyalgia: treating associated conditions

CHAPTER CONTENTS

The methods outlined in previous chapters represent some of the approaches for which evidence exists of benefit in treating FMS. This chapter concentrates on conditions associated with fibromyalgia and the therapeutic use of a variety of the complementary methods discussed in previous chapters, as well as a number of additional approaches, ranging from hydrotherapy to exclusion and detoxification diets, along with breathing retraining and relaxation methods. Many of these methods are of proven value while others have a good clinical track record without having research evidence to back up their usefulness. You are asked to evaluate the evidence presented and cited

(in this and earlier chapters), and to make up your own mind as to what is most useful from among this collection of therapeutic possibilities, basing your decisions on your own belief systems, training and the evidence.

Assessment and treatment choices

At the end of Chapter 16 a protocol is presented which describes the authors suggested treatment choices in treatment of FMS. A protocol outlined in the first edition of this text by Regina Gilliland MD, a physician with a special interest in FMS, is given in Box 15.1 (Chaitow 2000). Dr Gilliland's thoughts are offered as background to the information in this chapter, which describes ways of helping the patient to deal with some of the most common FMS symptoms and associated conditions. These include:

- allergy and chemical sensitivity (including 'Gulf War syndrome')
- anxiety (and effects of stress)
- 'brain' symptoms
- candidiasis (yeast overgrowth)
- deconditioning

Box 15.1

Dr Gilliland's fibromyalgia treatment protocol (Chaitow 2000)

- Take a detailed history
- Perform a thorough physical examination
- Discuss the diagnosis
  - involve the spouse/partner and family
  - educate
- Discuss the treatment

1. Sleep
   a. Discuss normal sleep and abnormal sleep
   b. Keep a sleep diary for 2 weeks
   c. Sleep hygiene
2. Diet
   a. Eliminate caffeine from the diet slowly
   b. Stop all alcohol and tobacco
   c. Eliminate all refined sugar and white flour
   d. At least 64 fluid ounces of water a day
   e. For 8–12 weeks limit carbohydrates to less than 60 grams a day
   f. Eat fresh fruits, vegetables, lean meats and fish, and drink skimmed milk
   g. Read food labels – know what is in the foods you eat
   h. Avoid bananas, carrots, corn, raisins and popcorn
   i. Low carbohydrate foods to be encouraged: berries, citrus fruit, mangoes, papaya, peaches, cantaloupe, watermelon, leafy green vegetables, green beans, crooknecked squash, broccoli, cauliflower, cucumber, leeks, okra, garlic and peppers
   j. Grains and cereals should be whole-grain only
   k. Consider liberalizing the diet if the symptoms are improved after 3 months
3. Medication
   a. If narcotics are necessary for pain management, use them only for short periods of time
   b. Avoid steroids
   c. Most muscle relaxers are of limited benefit
   d. Trazodone, clonazepam, sertraline and fluoxetine – good choices for restoring sleep maintenance disorders
   e. Zolpidem – good choice for sleep onset disorders
   f. Start all medications at low doses – have the patient cut the lowest dose available into quarters or halves for the first few doses, then titrate to the desired dose
   g. When medications are stabilized, review every 6 months
4. Education
   a. Include spouse, family, friends, and employers
   b. Use handouts, videos, and group classes
   c. Provide reference materials; include information on local support groups

Follow-up office visits

1. Routine visits
   a. 2 weeks
   b. Every 4–8 weeks during acute rehabilitation
   c. At 1 and 3 months after completing the rehabilitation
   d. Thereafter, every 6 months
2. Non-routine visits
   a. As needed
   b. For flare-ups

- depression
- fatigue
- hyperventilation
- hypoglycaemia
- infection: viral and bacterial
- inflammation/pain
- irritable bowel syndrome
- obesity
- pelvic pain and interstitial cystitis
- premenstrual tension syndrome
- probiotics and prebiotics for gut dysfunction
- sleep (and growth hormone) problems
- toxicity and detoxification strategies.

Note: Non-manual therapeutic approaches to treatment and management of many of these FMS-associated conditions are outlined in this chapter, while manual methods are discussed in Chapter 16.

Allergy and chemical sensitivity/toxicity (including Gulf War syndrome) (Balch 1990, Chaitow 1994, Davies 1987, Werbach 1990; see also Figs 3.2, 3.3 and 14.2, and Table 3.1)

Note: Where citations are not offered, the advice in this chapter derives from my own (LC) clinical experience. The normal precautions relating to change of diet and prescription of herbs and supplements should be kept in mind. These notes are not meant to be prescriptive, and each patient should be evaluated as to the suitability or otherwise of their implementation.

People with allergies are more likely to develop FMS and people with FMS are more likely than not to have allergies.

- Brown & Jason (2007) report that chronic fatigue syndrome (CFS), multiple chemical sensitivity (MCS) and fibromyalgia (FM) commonly co-occur.
- Thomas et al (2006) note that Gulf War veterans were approximately three and a half times more likely than non-Gulf War veterans to report multiple chemical sensitivity or chronic multi-symptom illness (such as FMS and CFS) as defined by the Centers for Disease Control (CDC).

Gulf war syndrome

Many thousands of veterans of the Gulf War have reported a long list of symptoms: unexplained joint and muscle pain, fatigue, difficulty sleeping, memory/concentration problems, headaches, chest pain, breathing problems, gastrointestinal problems, skin rashes, allergies to foods and odours ... and so on. Experts state that in many instances what is being complained of is the same as FMS (Haley et al 2004, Stein et al 2004).

Most participants in the Gulf War received numerous immunization procedures against usual diseases as well as against anthrax and botulinus toxin (in anticipation of biological warfare) while also taking anti-nerve gas pills (pyridostigmine bromide). Vehicles were sprayed with chemical agent-resistant coatings and areas surrounding the military operations were sprayed with pesticides. There were also numerous oil-well fires and atmospheric pollution, diesel exhausts, solvents vaporized by intense heat, poor hygiene (despite the best efforts) and extremes of stress.

In investigating the condition, experts note that there is a direct link between what is inhaled and the brain since there is no protective shield for the brain at this level of acquiring chemicals into the body. Limbic dysfunction due to chemical overload (multiple chemical sensitivities, or MCS) is therefore one explanation for the symptoms described above (Ishoy et al 2002).

Immune dysfunction

Dr Anne Macintyre, medical adviser to ME [CFS] Action, an active patient support group for patients with chronic fatigue conditions in the UK, supports an 'immune dysfunction' model as the underlying mechanism for CFS/FMS: 'The immune dysfunction may be associated with increased sensitivities to chemicals and/or foods, which can cause further symptoms such as joint pain, asthma, IBS and headache' (Macintyre 1993).

According to the Fibromyalgia Network (October 1993, p 12), the most commonly identified foods which cause problems for many people with FMS and CFS (ME) are wheat and dairy products, sugar, caffeine, Nutra-Sweet®, alcohol and chocolate. Elimination and rotation diets are explained below.

Yeasts and parasites as a 'cause' of allergy

Infestation of the bowel by yeast or parasites can result in damage to the delicate lining of the intestinal tract as well as reduced health and efficiency of the bowel flora (see Ch. 3). This can lead to substances (food breakdown products, toxins, etc.) being absorbed from the gut into the bloodstream, triggering allergic symptoms (often including fatigue and muscle pain) (Crooke 1983, Ramirez De Knott et al 2005, Shulman 2006, Truss 1982). In this way, the allergy and irritable bowel conditions can be seen as two links in a chain of events in which fatigue (a common side-effect of allergy) and muscle pain can also occur (see Fig. 14.2).

Exclusion and rotation diets

Food allergy can be dealt with by eliminating the allergen(s) through specific exclusion or hypoallergenic diets. The identification of foods to which we are allergic or intolerant can be difficult. In some cases it is obvious, and we therefore avoid the food; in other cases we may need to undertake long and difficult detective work in order to identify culprits. The notes in Boxes 15.2, 15.3 and 15.4, on exclusion and rotation and oligoantigenic diet, can be adapted for patients to use (Drisko et al 2006).

Box 15.2

Notes for exclusion diets (Drisko et al 2006, Randolph 1976)

Make notes of the answers to the following questions:

1. List any foods or drinks that you know disagree with you, or which produce allergic reactions (skin blotches, palpitations, feelings of exhaustion, agitation, or other symptoms)
   NOTES .....
2. List any food or beverage that you eat or drink at least once a day
   NOTES .....
3. List any foods or drink that if you were unable to obtain, would make you feel really deprived
   NOTES .....
4. List any food that you sometimes have a definite craving for
   NOTES .....
5. What sort of food or drink is it that you use for snacks? List these
   NOTES .....
6. Are there foods that you have begun to eat (or drink) more frequently/more of recently?
   NOTES .....
7. Read the following list of foods and highlight in one colour any that are eaten at least every day, and in another colour those that are eaten three or more times a week: bread (and other wheat products); milk; potato; tomato; fish; cane sugar or its products; breakfast food; sausages or preserved meat; cheese; coffee; rice; pork; peanuts; corn or its products; margarine; beetroot or beet sugar; tea; yogurt; soya products; beef; chicken; alcoholic drinks; cake; biscuits; oranges or other citrus fruits; eggs; chocolate; lamb; artificial sweeteners; soft drinks; pasta.

Exclusion diet methods

Exclude from the diet the foods that appear most often on the list (in questions 1 to 6, and the ones highlighted in the first colour as being eaten daily). These are the foods to test (by exclusion) first – one by one.

- Decide which foods on the list are the ones eaten most often (e.g. bread) and test wheat and other grains by excluding these from the diet for at least 3 weeks (wheat, barley, rye, oats and millet).
- No benefit may be noted from this exclusion (if wheat or other grains have been causing allergic reactions) for at least a week, and you may even feel worse for that first week (caused by withdrawal symptoms).
- If after a week symptoms (fatigue, palpitations, skin reactions, breathing difficulty, muscle or joint ache, feelings of agitation – or whatever) are improving, the exclusion should be maintained for several weeks before reintroducing the excluded foods – the challenge – to see whether symptoms return.

Box 15.2—Cont'd

- If symptoms do return after eating a previously excluded food, this suggests that it would be better, for the time being at least, to avoid this food for a period.
- Remove this from the diet (in this case grains – or wheat if that is the only grain tested) for at least 6 months before testing it again. By then the system may have become desensitized to it and be able to tolerate it again.
- If nothing was proved by the wheat/grain exclusion, similar elimination periods on a diet free of dairy produce, or fish, or citrus, or soya products, etc. can also be attempted – using your questionnaire results as a guide – always choosing the next most frequently listed food (or food family).

This method is often effective. Dairy products, for example, are among the commonest allergens in asthma and hay fever problems. A range of gluten-free and dairy-free foods are now available from health stores which makes such elimination far easier.

Box 15.3

The rotation diet (Carroccio et al 2005)

In the rotation diet, foods from any particular family of suspect foods (identified by the questionnaire) are eaten only once in 5 days or so. This system is effective, especially if a detailed 'food and symptom' diary is kept, in which all deviations from your normal state of health are noted down, as are all foods eaten.

- Symptoms such as feelings of unusual fatigue, or irritability, or difficulty in concentrating, or muscular pains or actual breathing difficulties should be listed and given a daily score out of (say) 10, where 0 = no problems and 10 = the worst it has ever been.
- Make sure each symptom is scored each day to see how it varies, and to link this to when suspect foods are eaten (sometimes reaction to foods takes up to 12 hours to be noticed).
- If such a score sheet is kept and note is made of suspect foods, a link may be uncovered.
- By comparing the two lists (suspect foods and symptoms) it is often possible to note a pattern connecting particular foods and symptoms, at which time the exclusion diet (Box 15.4) can be started.

Box 15.4

Oligoantigenic diet

To try a modified oligoantigenic exclusion diet, evaluate the effect of following a pattern of eating in which the foods as listed below are excluded for 3 weeks.

Fish

Allowed: white fish, oily fish
Forbidden: all smoked fish

Vegetables

None are forbidden but people with bowel problems are asked to avoid beans, lentils, Brussels sprouts and cabbage

Fruit

Allowed: bananas, passion fruit, peeled pears, pomegranates, paw-paw, mango
Forbidden: all fruits except the six allowed ones

Cereals

Allowed: rice, sago, millet, buckwheat, quinoa
Forbidden: wheat, oats, rye, barley, corn

Oils

Allowed: sunflower, safflower, linseed, olive
Forbidden: corn, soya, 'vegetable', nut (especially peanut)

Dairy

Allowed: none
Forbidden: cow's milk and all its products including yogurt, butter, most margarine, all goat, sheep and soya milk products, eggs

Continued

Box 15.4—Cont'd

Drinks

Allowed: herbal teas such as camomile and peppermint
Forbidden: tea, coffee, fruit squashes, citrus drinks, apple juice, alcohol, tapwater, carbonated drinks

Miscellaneous

Allowed: sea salt
Forbidden: all yeast products, chocolate, preservatives, all food additives, herbs, spices, honey, *sugar of any sort*

- **If benefits are felt after this exclusion, a gradual introduction of one food at a time, leaving at least 4 days between each reintroduction, will allow you to identify those foods that should be left out altogether – if symptoms reappear when they are reintroduced.**
- **If a reaction occurs (symptoms return having eased or vanished during the 3-week exclusion trial), the offending food is eliminated for at least 6 months and a 5-day period of no further experimentation follows (to clear the body of all traces of the offending food), after which testing (challenge) can start again, one food at a time, involving anything you have previously been eating which was eliminated by the oligoantigenic diet.**

CAUTION: When a food to which there is a strong allergic reaction occurs, especially one which has been consumed regularly in the past, is stopped, the individual may experience 'withdrawal' symptoms for a week or so, including flu-like symptoms and marked mood swings, anxiety, restlessness, etc. This will usually pass after a few days, and can be interpreted as a strong indication that whatever has been eliminated from the diet is responsible for a 'masked' allergy, which may be producing many of your symptoms. See notes on this in Chapter 3 (Randolph 1976).

Rotation diet

There are other ways of reducing the stress of irritant foods, and one of these involves the use of a rotation diet (Box 15.3).

Another way of 'unmasking' allergy-provoking foods is the 'oligoantigenic diet' developed at Great Ormond Street Hospital for Sick Children (below and Box 15.4) (Carroccio et al 2005).

Oligoantigenic diet

The oligoantigenic diet (Box 15.4) was developed at Great Ormond Street Hospital for Sick Children, London, and at Addenbrookes Hospital, Cambridge, as a means of identifying foods that might be causing or aggravating the conditions of young patients.

By avoiding foods that may be provoking symptoms for not less than 5 days, all traces of any of the food will have cleared the system and any symptoms caused by these should have vanished. Symptoms that remain are either caused by something else altogether (infection for example, or hormonal imbalance or emotions) or by other foods or substances. On reintroduction of foods in a carefully controlled sequence (the 'challenge'), symptoms which reappear are shown to derive from a reaction to particular foods which are then eliminated from the diet for at least 6 months.

There is some evidence to support the idea that those foods which have become a major part of human diet since stone age times – mainly grains (particularly wheat) of all sorts, and dairy produce – are the most likely to provoke reactions. All modern processed foods involving any chemicals, colourings, flavourings, etc. are also suspect.

The oligoantigenic diet is usually followed for 3 weeks while a careful check is kept on symptoms (pain, stiffness, mobility, etc.). If symptoms improve or vanish, then one or more of the foods being avoided may be to blame. Identification and subsequent avoidance of the culprit food(s) depends upon the symptom returning upon the reintroduction (challenge) of the food. The eating pattern listed in Box 15.4 is a modified version of the hospital pattern.

CAUTION:

1. No one with a history of an eating disorder should be encouraged to follow exclusion diets unless they have support and supervision.

2. If bowel malabsorption or increased permeability problems exist, resulting perhaps from yeast or parasite activity, then the bowel condition needs to be addressed, either concurrently or before the allergy is tackled (see IBS and Candida discussion later in this chapter).

3. Sometimes allergy occurs when incomplete digestion of food takes place due to inadequate hydrochloric acid levels or poor digestive enzyme production, and expert nutritional and herbal methods can help in normalizing these imbalances.

Chemical sensitivities

Supplementation with antioxidant nutrients such as:

- vitamin C (1–3 g daily)
- vitamin E (400 IU daily)
- selenium (200 micrograms daily)
- zinc (15–30 mg daily)

can all be useful in helping to increase the tolerance of the body for chemicals, as well as for neutralizing many of their harmful oxidation effects. Vitamin C acts as mild antihistamine (Pizzorno 1996).

Note: The text below highlights the connection between anxiety, hyperventilation, hypoglycaemia and allergy.

Anxiety, hyperventilation (and hypoglycaemia) (see also Figs 3.6 and 14.1)

Chapter 3 discussed the possible direct connection between the symptoms of hyperventilation and those of CFS/FMS. Anxiety is common to both fibromyalgia (Raphael et al 2006) and to hyperventilation (Han et al 1996, Lum 1984).

A summary of the major influences follows, as well as a list of additional connections between breathing dysfunction and allergy, and also low blood sugar tendencies. Much of the information in this segment is summarized from Chaitow et al (2002).

Summary

Hypoxia ('reduced oxygen tension'), which results from hyperventilation, has the following effects (Timmons 1994):

1. The first and most direct response to hyperventilation is cerebral vascular constriction – reducing oxygen availability by about 50%.
2. Of all body tissues, the cerebral cortex is the most vulnerable to hypoxia.
3. This depresses cortical activity, causing dizziness, vasomotor instability and blurring of consciousness ('foggy brain') and vision.
4. Loss of cortical inhibition results in crying and emotional lability.

Neural repercussions of hyperventilation

1. Loss of CO_2 ions from neurons during moderate hyperventilation stimulates neuronal activity, producing muscular tension and spasm, and speeding spinal reflexes, as well as producing heightened perception (pain, photophobia, hyperacusis).
2. When hypocapnia is more severe, it depresses activity until the nerve cell becomes inert.

Tetany

1. Tetany is secondary to alkalosis. Muscles which maintain 'attack–defence' mode – hunched shoulders, jutting head, clenched teeth, scowling – are those most likely to be affected.
2. Painful nodules develop and are easily felt in nape of neck, anterior chest and shoulder girdle.
3. Temporal headache centred on painful nodules in the parietal region are common.
4. Also present in some but not all are painful legs.
5. The whole body expresses tension and patients cannot relax in any position.
6. Sympathetic dominance is evident by virtue of dilated pupils, dry mouth, sweaty palms, gut and digestive dysfunction, abdominal bloating and tachycardia.
7. Allergies and food intolerances are common due to increased circulating histamines (see also allergy notes above).
8. Hyperventilation increases circulating histamines, making allergic reactions more violent and possibly more likely.

Nasal connection with breathing dysfunction

A high proportion of people with CFS/FMS suffer from rhinitis – possibly allergic in origin. Barelli

(1994) states that reflex effects and referred phenomena exist between nose and heart, lungs and diaphragm. Unilateral nasal obstruction/narrowing can decrease movement of the diaphragm on that side.

Nasal reflexes influence cardiac and peripheral circulation, these being among the most powerful reflexes observed in experimental settings:

- On lying down on one side, the lower nostril normally narrows and becomes congested, the lumen closes during sleep, breathing becomes unilateral, movement of the head and turning of body are inaugurated.
- With poorly functioning nasal function (blocked due to allergic rhinitis for example), the head remains in one position, and symptoms such as backache, numbness, cramp and circulatory deficit become more likely. When normal nasal function is disturbed, a poor sleep pattern is more likely.

Low blood glucose and hyperventilation (Lum 1994)

1. The symptoms of hypocapnia resemble hypoglycaemia.
2. The brain is fuelled by glucose as well as by oxygen, therefore feelings of faintness, cold sweats, weakness, disturbed consciousness are common to both hyperventilation and hypoglycaemia.
3. Coincident hypoxia and hyperventilation increase such symptoms, which are reduced when blood sugar and oxygenation (Pa_{O_2}) are both high.
4. During overbreathing both EEG and cortical functions deteriorate as glucose values fall below 100 mg%.
5. Three minutes of hyperventilation has minimal effects when the blood sugar is in the range of 85–90 mg%, but with blood sugar at 70–75% gross disturbances can be noted. *Note*: these values of blood sugar are well within normal ranges of fasting blood sugar.
6. Hypoglycaemic effects are greater when clustered late morning and late afternoon when blood sugar is likely to be lowest.
7. Hypoglycaemic symptoms are greater in the autumn (fall) – even if glucose levels are in the normal range.
8. High carbohydrate diets are not considered desirable in cases of hypoglycaemia as these lead to increased blood sugar levels followed by sharp falls to fasting levels or below.
9. Proteins (consumed little and often) produce moderate and prolonged glucose rise. This is particularly important relative to panic attacks and any type of seizure.

Dr Jonathan Brostoff (Brostoff 1992) states that some experts are dismissive of the concept of food intolerance and believe that a large number of people so diagnosed are actually hyperventilators. He considers the picture to be more complex: 'Hyperventilation is relatively uncommon and can masquerade as food sensitivity.' It is also possible that anxiety brought on by the food reaction produces breathing changes, so that the two disorders aggravate each other.

Brostoff believes that mild hyperventilation is a symptom of food reactions which vanishes if the intolerance is dealt with (by elimination or desensitization). He suggests that if symptoms vanish when air is rebreathed (e.g. paper bag treatment) the cause lies in the breathing, but if not, it may lie in food intolerance.

Ogata et al (2006) have researched the question and note: 'There is a high prevalence of hyperventilation amongst hospital attendees in general, [but] no significant difference in prevalence of hyperventilation between allergy clinic and routine ENT clinic patients (25/100 vs. 23/100).'

Action on hyperventilation/hypoglycaemia/allergy/anxiety involvement in CFS/FMS

- Understand the processes involved.
- Avoid coffee and other stimulants which raise blood sugar and stimulate the sympathetic nervous system.
- Eat little and often – especially protein.
- Avoid sugar rich foods; start detoxification.
- Eliminate likely culprit foods to assess effects (see allergy notes earlier this chapter).
- Practise relaxation and breathing retraining exercises (see below).
- Identify vulnerable periods (premenstrual, stress, etc.).
- Have regular constructive therapeutic, as well as relaxation, bodywork.

- Use natural relaxing and sleep-enhancing herbs.
- Employ appropriate nutritional supplements such as glucose tolerance factor (GTF) (chromium).
- A combination of relaxed muscles, full breathing, mental calm and nutritional excellence offer protection from the worst effects of stress as well as reducing sympathetic over-arousal.

These descriptions and notes are not meant to suggest that FMS is always caused by a shallow overbreathing tendency. It can, however, be seen to link with many of the common symptoms and to need attention (such as appropriate bodywork methods and breathing retraining) in order to minimize the waste of energy and the mechanical stress to the muscles and joints of the neck, shoulder and chest region in particular.

Note: Exercises for breathing retraining are to be found in Chapter 17.

Relaxation methods for anxiety and stress management

Few studies use just one approach to stress management/anxiety in conditions such as FMS. Both autogenic training and progressive muscular relaxation have been evaluated in the context of an integrated therapeutic approach. For example:

- Italian researchers compared the benefits of autogenic training (AT) and progressive muscular relaxation (PMR, also called Erickson's technique) for patients with FMS (Rucco et al 1995). They found that both groups benefited in terms of pain relief if they carried out the exercise regularly, but that because PMR is easier and quicker to learn, patients are more likely to perform this regularly compared with AT. Those learning AT complained of 'too many intrusive thoughts' which is precisely what AT is designed to eventually quieten – that is the 'training' part of the exercise.
- A Scandinavian study (Jäckel et al 2004) reported on a fibromyalgia treatment programme that concentrated on patient education, drugs, physiotherapy (including Nordic Walking and exercise), physical therapy (including whole-body cryotherapy), as well as psychological treatment involving *autogenic training* and/or *progressive muscle relaxation* (see below). This prospective study on 317 patients with FMS showed that, at admission, nearly all patients were severely affected by somatic symptoms, pain, functional impairments and emotional problems. After 3–4 weeks of treatment – as above – overall health and the somatic and psychological status were significantly improved. These positive effects declined continually at 3, 6 and 12 months after discharge, but were still maintained in a statistically significant way.

Relaxation technique 1: autogenic training (Jevning 1992, Schultz 1959)

The following modified form of AT is an excellent way of achieving some degree of control over muscle tone and/or circulation, and therefore over pain.

Every day, ideally twice a day, for 10 minutes at a time, do the following:

1. Lie on the floor or bed in a comfortable position, small cushion under the head, knees bent if that makes the back feel easier, eyes closed. Perform the anti-arousal breathing exercise described in Chapter 17 for five cycles (one cycle equals an inhalation and an exhalation), then let breathing resume its normal rhythm.

2. When you feel calm and still, focus attention on your right hand/arm and silently say to yourself: 'My right arm (or hand) feels heavy.'

Try to sense the arm relaxed and heavy, its weight sinking into the surface it is resting on. Feel its weight. Over a period of about a minute repeat the affirmation as to its heaviness several times and try to stay focused on its weight and heaviness.

You will almost certainly lose focus as your attention wanders from time to time. This is part of the training in the exercise – to stay focused – so do not feel angry; just go back to the arm and its heaviness.

You may or may not be able to sense the heaviness – it does not matter too much at first. If you do, stay with it and enjoy the sense of release – of letting go – that comes with it.

3. Next, focus on your left hand/arm and do exactly the same thing for about a minute.

4. Move to the left leg and then the right leg, for about a minute each, with the same messages and focused attention.

5. Go back to your right hand/arm and this time affirm a message which tells you that you sense a

greater degree of warmth there: 'My hand is feeling warm (or hot).'

6. After a minute or so, go to the left hand/arm, the left leg and then finally the right leg, each time with the 'warming' message and focused attention. If warmth is sensed, stay with it for a while and feel it spread. Enjoy it.

7. Finally, focus on your forehead and affirm that it feels cool and refreshed. Stay with this cool and calm thought for a minute before completing the exercise.

By repeating the whole exercise at least once a day (10–15 minutes) you will gradually find you can stay focused on each region and sensation. 'Heaviness' represents what you feel when muscles relax and 'warmth' is what you feel when your circulation to an area is increased, while 'coolness' is the opposite, a reduction in circulation for a short while – usually followed by an increase due to the overall relaxation of the muscles.

Measurable changes occur in circulation and temperature in the regions being focused on during these training sessions and the benefits of this technique to people with Raynaud's phenomenon and to anyone with pain problems is proved by years of research. Success requires persistence – daily use for at least 6 weeks – before benefits are noticed, notably a sense of relaxation and better sleep.

CAUTION: There are no contraindications to autogenic training as described in this modified form. Any focus on breathing or heart function during autogenic training should be under supervision of a trained expert.

Relaxation technique 2: progressive muscular relaxation

1. Wearing loose clothing, lie with arms and legs outstretched.
2. Clench one fist. Hold for 10 seconds.
3. Release the fist, relax for 10–20 seconds and then repeat exactly as before.
4. Do the same with the other hand (twice).
5. Draw the toes of one foot towards the knee. Hold for 10 seconds. Relax. Repeat and then do same with the other foot.
6. Perform the same sequence in five other sites (one side of the body and then the other, involving 10 more muscles/muscle groups) such as:
   - back of the lower legs: point and tense the toes downwards and then relax
   - upper leg: pull the kneecap towards the hip and then relax
   - buttocks: squeeze together and then relax
   - back of shoulders: draw the shoulder blades together and then relax
   - abdominal area: pull in or push out the abdomen strongly and then relax
   - arms and shoulders: draw the upper arm into the shoulder and then relax
   - neck area: push neck down towards the floor and then relax
   - face: tighten and contract muscles around eyes and mouth or frown strongly and then relax.
7. After 1 week combine muscle groups:
   - hand/arm on both sides: tense and then relaxed together
   - face and neck: tense and relax all the muscles at the same time
   - chest, shoulders and back: tense and relax all the muscles at the same time
   - pelvic area: tense and relax all the muscles at the same time
   - legs and feet: tense and relax all the muscles at the same time.
8. After another week abandon the 'tightening up' part of the exercise – simply lie and focus on different regions, noting whether they are tense. Instruct them to relax if they are. Do the exercise daily.

There are no contraindications to these relaxation exercises.

Note: Various methods involving hydrotherapy can be used for home care in FMS and associated symptoms (Chaitow 1993). See also Chapter 13.

Brain symptoms/'foggy brain' syndrome (Fibromyalgia Network 1993–94, Journal for Action for ME 1994)

Memory lapses, inability to concentrate, dyslexic episodes and inability to recall simple words are all part of many people's fibromyalgia (and of most people's chronic fatigue). Modern technology has now identified what may be happening in the brain with these conditions.

Among the abnormalities so far found in the brains of many patients with FMS and CFS (ME) are reduced blood flow and energy production in key sites of the brain. While any such changes might themselves merely be symptoms of the syndrome, it is thought by many researchers that the most important imbalance in these conditions probably lies in the brain and central nervous system itself. New technologies for visualizing the brain in a non-invasive manner (SPECT, BEAM, PET) show that there are few, if any, differences in the scans of patients with CFS (ME) and FMS.

Scan evidence (Komaroff 1996)

- Eighty percent of 144 CFS patients displayed small areas of 'high signals' compared with 20% of controls on MRI scans.
- SPECT scans showed significant reduction in brain blood flow in CFS patients compared with healthy controls, similar to changes seen in AIDS patients.
- Over 50% of CFS patients displayed abnormal vestibular function tests, which may result from balance control centres in the brain.
- Tilt-table testing of CFS patients reveals that autonomic function is dysfunctional.

Therapeutic possibilities (including hydrotherapy)

- Autogenic training combined with the anti-arousal breathing techniques described in Chapter 17 may improve circulation to and through the brain, as may thermoregulatory hydrotherapy (see below).
- Bodywork options include attention to the vital area of the suboccipital triangles, as described in Chapter 3. Refer back to research into the influence on traumatized muscles in this area and FMS (see notes on whiplash injury in Ch. 3).
- Allergy, toxicity, candidiasis or viral problems can cause or aggravate the brain-related typical symptoms. Appropriate treatment protocols are outlined elsewhere in these notes.
- A herbal approach involving the taking of standardized extracts of the plant *Ginkgo biloba* is suggested for a 6-month trial since this has been shown in medical studies (using between 120 and 240 mg daily) to improve memory and reduce the symptoms of inadequate circulation to the brain (Foster 1991). Ginko has few side-effects or contraindications (see precaution note below) and is now one of the most prescribed medications in Germany and Scandinavia for cerebral dysfunction, specifically indicated for dizziness, memory loss, tinnitus, headaches and emotional instability combined with anxiety. It is also used for treating peripheral circulation (involved in cold hands and feet) (Schulz 1997).
- Additional circulatory support is available by taking not less than 90 mg daily of the nutrient coenzyme Q10 (CoQ10). This takes up to a month to be effective in enhancing oxygen transportation and easing fatigue (Kamikawa et al 1985, Ulbricht & Basch 2005, Vanfraechem 1981).

CAUTION: Avoid ginkgo and/or CoQ10 during pregnancy or lactation. Avoid for children. Avoid if taking anticoagulant medication.

Thermoregulatory hydrotherapy (TRH) (see also Ch. 13)

Method 1 (Ernst 1990) In 1990, at Hanover Medical School in Germany, volunteer students were asked to take either warm morning showers or cold morning showers, and their levels and intensity of infection (colds mainly) over the following 6 months were monitored.

Those taking cold showers were asked to gradually increase the degree of coldness so that by the end of the first 3 weeks they were taking a 2–3 minute shower with the water as cold as possible (if any of them developed a cold during the 6-month trial they were told to stop for its duration and for 1 week afterwards). By the end of the 6-month trial those students taking cold showers had had half the number of colds compared with the group taking warm showers, and the colds they did have lasted half as long – they were less acute, their immune systems cleared them up faster.

This trial gives clear evidence that regular cold showers offer an increase in resistance to infection as well as enhanced efficiency of immune function should infection occur. The London research (below) takes this much further and is of specific interest in cases of CFS/FMS.

Method 2 (Boyle 1991, Chaitow 1994, Pizzorno & Murray 1989) The results of important hydrotherapy research in London involving 100 volunteers were published in *The European* on 22 and 29 April 1993. The Thrombosis Research Institute (who conducted the research) claim that the use of this

form of self-treatment proves without question the dramatic value of carefully graduated cold baths, regularly taken (6 months daily use for optimal results). The method has been called thermoregulatory hydrotherapy (TRH). The results of this study showed that when applied correctly the effects of TRH were as follows:

- A boost to sex hormone production, which helps regulate both potency in men and fertility in women.
- Renewed energy. Many sufferers from chronic fatigue syndrome (CFS/ME) were found to improve dramatically. In one case, a person confined to bed 18 hours a day in a state of exhaustion acquired 'a new lease of life'. The person is quoted in *The European* as stating: 'From the first day I have regularly undertaken the hydrotherapy. With each day the feeling of well-being increases to such an extent that I can hardly wait for the next morning.'
- Improved circulation in people with cold extremities. Circulation is found to improve rapidly with TRH, along with levels of specific enzymes which help circulation.
- Reduced chances of heart attack and stroke because of improved blood clotting function.
- Increased levels of white blood cells.
- Reduced levels of unpleasant menopausal symptoms.
- Some of the volunteers found that their nails became harder and their hair growth improved.

TRH method

There are four stages to TRH (see below) and it is essential to 'train' the body towards the beneficial response by going through these stages.

The equipment you will need is a bath, a bath thermometer, a watch and a bath mat.

The bathroom needs to be at a reasonably comfortable temperature – not too cold and not very hot. The temperature of the water should eventually be as it comes from the tap – cold – however, it is possible to train towards the cold bath by first having a tepid bath for a few weeks, and gradually making the water colder so that it goes below body heat, until having a really cold bath is no longer a shock. The timing described below can also be modified so that at first the whole process takes just a few minutes as the various stages of immersion are passed through, with a slow increase in the timing of each stage as well as a reduction in temperature.

CAUTION: When cold water treatments are prescribed for people with FMS/CFS, the degree of stimulus used (how cold the water is, and how long a time is spent immersed) needs to be modified so that a very SLOW increment in contrast is achieved, gradually training and 'hardening' the body to what is potentially a stress factor.

The original TRH programme ran for 80 days and the degree of coldness and the length of time in the water were only gradually increased. It makes sense in cases of extreme sensitivity to cold to make this an even slower process, taking 6 months if necessary to reach the degree of cold achieved in 80 days in the initial studies. To plunge someone who is extremely fragile in their ability to handle stress of any sort into cold water straight from the tap would be foolhardy, whereas taking a shower or bath in 'neutral' (body heat) water for a week before extremely gradually starting the process of, day by day, getting the water cooler and cooler, perhaps over a period of many months before tap-cold water is used, is both sensible and effective.

Stage 1 Stand in the bath in cold water (the range recommended is between 12.7°C and 18.3°C (N.B. 10°C = 50°F while 15°C = 59°F) (but take account of the note above as to how cold the water should be in relation to the degree of fragility/robustness) for about 1 minute, increasing to 5 minutes when fully used to the process, perhaps after some weeks, as the internal thermostat (in the hypothalamus) responds. Have a non-slip mat in place and avoid standing still but 'walk' up and down the bath or march on the spot.

Stage 2 The internal thermostat is now primed. Sit in cold water for another 1–5 minutes (5 minutes when fully used to the process, perhaps after some weeks) – up to the waist ideally – so that the pooled blood in the lower half of the body is cooled, further influencing the hypothalamus.

Stage 3 This is the most important part of the programme in which it is necessary to immerse the entire body up to the neck and back of the head in cold water. Gently and slowly move the arms and legs to ensure that the slightly warmer water touching the skin is not static, so that the cooling effect continues. This stage ultimately lasts between 10 and 20 minutes but could be for as little as 2 minutes at first, with the degree of coldness being adjustable according to sensitivity.

Stage 4 This is for 'rewarming'. Get out of the bath, towel dry and move around for a few minutes. As warming takes place, a pleasant glowing sensation will usually be felt in the chest, feet and between the shoulder blades.

The whole sequence, *modified at first by reducing time and temperature*, needs to be performed daily if the training or 'hardening' effect is to be achieved, with some people finding that several cold baths daily improves their function and energy.

CAUTION: Despite possibly having value in such conditions, this cold water bath method (TRH) is not recommended as a self-help measure for people with well-established heart disease, high blood pressure or other chronic diseases which require regular prescription medication, unless a suitably qualified physician has been consulted as to safety and supervision.

Candida (yeast) overgrowth (see also Fig. 14.2)

Dr Carol Jessop (Fibromyalgia Network Newsletters 1990–94) reported that nearly 90% of her patients with FMS (men and women) had yeast infections and that the vast majority had records of recurrent antibiotic use (for sinus, acne, prostate, urinary tract and chest infections in the main); 70% of the women with CFS/FMS had been on the contraceptive pill for 3 years or more; and 63% reported a sugar craving.

The use of antibiotics and steroid medication (including the contraceptive pill) can lead to the spread in the intestinal tract and the body generally of yeasts that are normally controlled by 'friendly' bacteria which are damaged by this medication (see the notes on probiotics later in this chapter for more information on this) (Chaitow 1991, Shulman 2006).

The main yeast engaged in such activity is *Candida albicans*, best known for causing thrush. Candida is dangerous because of its ability to turn from a simple yeast into an aggressive mycelial fungus which puts down 'rootlets' (rhizomes) into the mucous membrane of the intestinal tract, so permitting undesirable toxins to move from the gut into the bloodstream, with the strong possibility of allergic and toxic reactions taking place (Truss 1982).

Among the many symptoms that have been catalogued in people affected in this way are a range of digestive symptoms (bloating, swings from diarrhoea to constipation and back), urinary tract infections, menstrual disturbances, fatigue, muscle aches, emotional disturbances, 'foggy brain' symptoms and skin problems (Crooke 1983).

The frequency with which such symptoms are suffered by people with FMS is enormous. Laboratory tests are commonly inaccurate although one of the most useful involves a sugar loading test which assesses blood alcohol levels before and after the sugar intake because yeast – and some bacteria – can turn sugar into alcohol rapidly in the intestines (Mori & Ando 2005).

Three-month anti-candida strategy (Chaitow 1991)

- Antifungal medication (or herbs), as advised by a qualified practitioner.
- To encourage repopulation of intestinal flora: between meals (three times daily) a high quality acidophilus and bifidobacteria (powder or capsule form – see probiotics/prebiotics notes later in this chapter); either a capsule of each, or between a quarter and a whole teaspoon of powdered versions of each, should be taken.
- General nutritional support is useful: a well formulated, yeast-free, hypoallergenic, multivitamin/multimineral to provide at least the recommended daily allowance for the major nutrients is suggested.

Dietary suggestions for candida (Skidmore-Roth 2001, Ulbricht & Basch 2005)

- Eat three small main meals daily as well as two snack meals where possible (no sugar-rich food).
- Include in the diet as much ginger, cinnamon and garlic (as well as other aromatic herbs such as oregano) as possible, as these are all antifungal and most also aid digestive processes.
- Avoid all refined sugars and for the first few weeks avoid very sweet fruit as well (melon, sweet grapes).
- Eat vegetables (either cooked or raw), pulses (bean family), fish, poultry (avoid skin), whole grains, seeds, nuts (fresh) and, after the first few weeks, fruit.

- To assist with bowel function, take at least a tablespoonful of linseed, swallowed unchewed with water to provide a soft fibre.
- Avoid aged cheeses, dried fruits (because of their fungal and mould content) and any food obviously derived from or containing yeast (in case of sensitization).
- Avoid caffeine-containing drinks and foods (coffee, tea, chocolate, cola) as these produce a sugar release which encourages yeast activity.
- Avoid alcohol.
- If possible, avoid all yeast-based foods, including bread and anything that has contained yeast in its manufacture or which might contain mould.

CAUTION: The patient may feel off-colour for the first week of such a programme as yeast 'die-off' (Herxheimer's reaction) takes place. This will pass on its own; however, anyone with a severe and longstanding yeast problem might consider supplementing with high doses of probiotics for a week or so before starting the anti-candida programme to reduce the intensity of the die-off reaction. Increased thrush activity may be noticed after starting the diet; this will usually calm down after a few days. The process of recovery from yeast overgrowth (candidiasis) can be slow (seldom less than 3 months and usually 6 months or more of strict adherence to the diet and nutrient/herbal protocol) and many setbacks are commonly experienced, especially when the patient attempts to return to a normal eating pattern. Patients need to be given a great deal of support and the process can be almost as draining for the practitioner as for the patient (Hollier & Workowski 2003).

Local treatment

- Mix 1 rounded teaspoon of *L. acidophilus* with 2 tablespoons of plain regular yogurt (not low or non-fat). Insert vaginally or rectally before bedtime as needed.

Douche and/or pessaries

- Mix 1 teaspoon of *L. acidophilus* in warm water. Stir briskly and let stand for at least 5 minutes. Stir again. Use as a douche each morning for 10 days.
- Use diluted tea tree oil (15% solution) directly onto irritated areas or place 10 drops of pure tea tree oil into warm bath.
- Alternatively, use tea tree or probiotic pessaries. Follow package instructions.

Deconditioning

Deconditioning is the term used to describe the virtual opposite of being aerobically conditioned and fit. Nixon & Andrews (1996) have described the associated symptoms in patients with chronic fatigue syndrome as follows: 'Muscular aching at low levels of effort; restlessness and heightened sympathetic activity; increased neuronal sensitivity as well as constriction of smooth-muscle tubes (e.g. vascular, respiratory and gastric-intestinal), can accompany the basic symptom of inability to make and sustain normal levels of effort.'

Treatment options include exercise, building towards aerobic levels, as described in Chapter 14 (Jones et al 2006, Youseffi & Coffey 2005). See also notes on compliance in Chapter 14.

Depression

Signs of depression are often noted in people with CFS (ME) and FMS (Raphael et al 2006). This, however, is not surprising, since there can be few more depressing situations than being constantly tired, lethargic and in pain. Matters are made worse when there is a lack of understanding on the part of doctors.

The diagnosis of depression as the 'cause' of the condition is now discredited, since most depression related to FMS is a direct reaction to the condition (loss of health) and is not a clinical depression which has no obvious external cause. Nordahl & Stiles (2007) studied depression in FMS patients and concluded: 'depressotypic personality style is related to depressive disorder, but not to FMS'. The fact that antidepressant medication helps to restore some degree of sleep normality and therefore minimizes the symptoms of FMS should not be taken to indicate that depression causes FMS – it does not (see Ch. 4).

Treatment choices

- *Low dosage antidepressant* medication under medical direction.
- *St John's wort* (*Hypericum perforatum*) has an excellent record of helping 'long-term, low-grade

depression and for mild to moderate major depression' with a number of double-blind placebo controlled trials. Pizzorno reports that studies comparing St John's wort to regular medication (imipramine) produced comparable results, and that there have been '28 controlled studies involving 1500 depressed patients with consistently positive results in mild-to-moderate depression' (Pizzorno 1996). The recommended dosage is 300 mg three times daily. Side-effects are very rare (Muldner & Zoller 1984).

Nutritional tactics

These may include the following:

1. Cut out/down sugar/caffeine. Approximately half of a depressed group of 23 demonstrated significant and sustained mood deterioration following caffeine or refined sucrose challenge (with cellulose and aspartame as placebo) (Kreitsch et al 1988). In another experimental double-blind study, seven out of 16 patients complaining of depression and fatigue improved on a 2-week sucrose- and caffeine-free diet and had a return of symptoms when challenged with caffeine and refined sucrose for 6 days (with cellulose and aspartame as placebo) (Christensen 1988).

2. Folic acid supplementation (200 micrograms daily) may be useful, especially in patients whose depression is secondary to easy fatigability (experimental double-blind study) (Coppen 1986).

3. Nutritional interventions which help to balance serotonin levels (see notes on 5-hydroxy-L-tryptophan, p. 352). If the pain and fatigue elements can be modified, depression usually improves.

4. Supplementation with *S*-adenosyl-L-methionine (SAMe) may be beneficial in fibromyalgia, starting with an initial dosage of 600–1200 mg daily. If gastrointestinal symptoms occur, the dosage should be reduced by half, then gradually increased again as tolerated. It may take several months for SAMe to achieve its full therapeutic effect (see Ch. 14 for notes on this nutrient).

Fatigue

In Chapter 5 the fatigue link with FMS was examined and the caution offered that doing too much, too soon, is a major cause of setbacks for patients with this chronic condition.

Treatment choices

- Use of constitutional hydrotherapy (see Ch. 13), and/or relaxation methods (as discussed earlier in this chapter), and/or appropriate bodywork (see Ch. 16), and/or following a structured and balanced diet, that considers both toxicity and allergy factors (see above) as well as specific medical or herbal/homoeopathic/acupuncture interventions, where appropriate (see Ch. 14), form the 'team' approach for restoration of energy and well-being. This will be individual to each person.
- Particular emphasis on the restoration of normal breathing function is also suggested (see this chapter and Ch. 17).
- Low thyroid function (hypothyroidism – see Ch. 10), as well as adrenal dysfunction ('adrenal exhaustion'), can also produce or contribute to chronic fatigue.

Allergy and fatigue In one study of what was called 'the allergic tension–fatigue syndrome' it was found that 75% of 50 patients (diagnosed as having FMS) with 'tension/fatigue' had a history of nasal, ocular, respiratory or skin allergy, and that over half the patients treated by elimination diets (see earlier in this chapter) had excellent results, while a further 16 of the 50 had good results (Cleveland et al 1992).

Deficiencies and fatigue Werbach (1991) has shown that nutritional deficiencies of potassium, magnesium, iron, folic acid, pantothenic acid (vitamin B_5), pyridoxine (B_6), B_{12}, vitamin C, zinc, aspartic acid, the amino acids carnitine, glutamine, inosine and coenzyme Q10 have *all* been shown, in various studies, to link with fatigue, and that supplementation, as appropriate, based on individual requirements, can be helpful.

Tryptophan and fatigue Discussing fatigue in relation to fibromyalgia in particular, and chronic pain conditions in general, Clauw & Crofford (2003) note that: 'Neuroactive compounds [especially those that raise central levels of noradrenaline (norepinephrine) or serotonin] are most effective for treating central pain. 5HTP [precursor to tryptophan and therefore to serotonin] is one such substance.' Usual recommendations are to take 100 mg of 5-HTP, three times daily (Puttini & Caruso 1992, White & Harth 1996) (see Ch. 14 for more detail).

Low blood sugar and fatigue (see also notes on hypoglycaemia earlier in this chapter in relation to

anxiety). If there is a tendency towards hypoglycaemia (characterized by mood swings, sugar and stimulant craving, a feeling of being spaced out and anxious if meals are missed, as well as fatigue) it may be helpful to:

- twice daily, between meals, take 4–5 g of full spectrum amino acid complex (or whey protein isolate) in powder or capsule form, in order to help stabilize blood sugar fluctuations and to decrease sugar craving episodes
- follow a 'grazing' pattern of eating – little and often – avoiding sugar and stimulants (caffeine and alcohol in particular) while concentrating on obtaining adequate protein
- facilitate a more balanced sugar management glucose tolerance factor (GTF) by incorporating the vital nutrient chromium (100–200 micrograms daily).

In one study of FMS approximately half of the patients seen were found to have reactive hypoglycaemia (St Amand 1996).

Hyperventilation

See notes on anxiety and hyperventilation earlier in this chapter.

Hypoglycaemia

See notes on anxiety and hypoglycaemia earlier in this chapter.

Infection: viral and bacterial

In Chapter 3 the possibility of a viral connection with CFS/FMS was explored. Viruses that have been suggested as having an aetiological link include HIV, hepatitis C, human herpesvirus 6 (HHV-6) and human T-cell lymphotropic virus type I (HTLV-I) (Lormeau et al (2006).

Evidence is, however, equivocal – for example:

- Ribeiro & Proietti (2005) observe: 'Chronic viral infections have been implicated in the pathogenesis of fibromyalgia syndrome. . . . *However, in spite of intense research no viruses have unequivocally been identified as directly causing fibromyalgia. Exception may be the probable association between fibromyalgia and hepatitis C virus chronic infection.*' [italics added]
- Ablin et al (2006) confirm that: 'Multiple infectious agents have been associated with the development of either full-blown fibromyalgia (e.g. hepatitis C), or with symptom complexes extensively overlapping with that syndrome (e.g. chronic Lyme disease). . . . *Despite the described associations, no evidence is available demonstrating the utility of antibiotic or antiviral treatment in the management of fibromyalgia.*' [italics added]
- Palazzi et al (2008) note that: 'Our present report *does not confirm previous data indicating an increased prevalence of hepatitis C Virus infection (HCV) in fibromyalgia (FM) patients and does not seem to support a significant pathogenetic role of HCV for this condition.*' [italics added]

If, however, viral (or bacterial) activity appears in any individual case to be associated with FMS, low grade or recurrent viral or bacterial infections can be treated using herbal products, with reduced risks of side-effects, such as may result from antibiotic use, and with less risk of resistance being encouraged. In this way antibiotics can be reserved for use in life-threatening situations (Bongiorno et al 2008, Pesewu et al 2008, Poon et al 2006).

Herbal methods using echinacea, hydrastis and berberine plus a host of other antiviral and antibacterial products emerging from traditional Chinese and Western medicine can be employed, ideally under expert supervision (Kahn et al 2005).

CAUTION: A caution is offered by Bernuau & Durand (2008) in regard to use of herbs in connection with hepatitis E infection, where fatalities have occurred: 'The hypothesis is proposed that some of the fatal cases of acute hepatitis E in pregnant women, a common observation in India, could result from an earlier consumption of herbal medicines at the onset of the symptoms of acute hepatitis E.'

Allium sativum (garlic)

This is a powerful antibacterial, antiviral, antiparasitic and antifungal agent with recent evidence of anti-HIV potential (Bongiorno et al 2008, Pizzorno & Murray 1989, Singh & Singh 2008). It is also effective against worms and protozoa, including organisms resistant to standard antibiotics (Adetumbi & Lau 1983, Hu Nan Medical College 1980, Vahora et al 1973).

Bongiorno et al (2008) note: 'With its sulfur containing compounds, high trace mineral content, and enzymes, garlic has shown anti-viral, anti-bacterial, anti-fungal and antioxidant abilities.'

Astragalus membranaceus

This has long been used in Chinese medicine to enhance immune function (increased phagocytosis, enhanced T-cell transformation, increased numbers of macrophages, increased IgA and IgG levels, induced formation of interferon, enhanced blastogenesis in white blood cells of normal and cancer patients) (Sun et al 1983a, 1983b) and for antiviral effects (Huang et al 2008).

Dionaea muscipula (Venus fly trap plant) (carnivora)

Immune stimulator and modulator (increases number and activity of T cells, increases phagocytosis of macrophages). Used intravenously, intramuscularly by inhalation and orally (Cushnie & Lamb 2005, Didry et al 1998, Walker 1991, 1992a, 1992b).

Echinacea angustifolia (and *E. purpurea*)

This is an amazingly useful and safe herb which has powerful immune-enhancing properties including macrophage activation, as well as inhibiting viral, fungal and bacterial activity (Barrett 2003). It also possesses anti-inflammatory and analgesic properties (Birt et al 2008).

The effect of echinacea seems to be directly on the thymus gland, which is a vital component of immune defence. Research has shown extracts of the root of echinacea to include substances such as inulin which activates the production of a wide range of immune chemicals. Echinacea has been a traditional Native American herbal substance for centuries, and has now been widely researched and used throughout the world (Senchina et al 2006).

It can be taken in capsule form or as a liquid (as an alcohol extract). Many experts believe this (liquid) form to be superior in that it is absorbed and used by the body more efficiently. Liquid extract of echinacea, taken by healthy individuals (30 drops three times a day for 5 days) boosts the presence of leukocytes by about 40% (Stimpel et al 1984, Wacker & Hilbig 1978). A dose of three or four 500 mg capsules at least twice daily is usually suggested during an infection. Combination capsules and liquids are now available in which echinacea and other herbs are combined for a potent effect against infection and to enhance immune function.

Ginseng (or *Eleutherococcus*: 'Siberian ginseng')

These are adaptogens which enhance resistance to all forms of stress and which have tonic effects on the thymus gland which is vital for production of T cells (Brekhmann 1980, Liu et al 2004, Rivera et al 2005, Takada et al 1981).

Glycyrrhiza glabra (liquorice)

This is an immune system enhancer (Abe et al 1982). It improves both macrophage activity and production of interferon. Liquorice extract also has broad-spectrum antimicrobial effects (Mischer et al 1980). In addition, it is an antioxidant, protecting tissues from free radical damage, especially the liver (Kiso et al 1984). Glycyrrhizin is also an anti-inflammatory agent and protects against allergy and its effects, most notably related to skin conditions (Kuroyanagi & Sato 1966, Onuchi 1981). It protects the thymus from shrinking when steroids such as cortisone are used as well as enhancing the anti-inflammatory effects of cortisone (Kumazai et al 1967).

As far as immune support is concerned, this remarkable herb acts against numerous undesirable pathogenic bacteria (*Staphylococcus aureus*, for example, and *Candida albicans*), but for many naturopathic and herbal practitioners this is the herb of first choice in dealing with viral infections (three 500 mg capsules four times daily during infection) (Abe et al 1982, Fiore et al 2008, Ito et al 1988, Nassiri Asl & Hosseinzadeh 2007, Pompei et al 1979).

Hydrastis canadensis (golden seal)

Immune enhancer, macrophage activator, increases natural killer cell activity, enhances gastrointestinal function (especially diarrhoea), antibacterial, antifungal, anti-*Candida albicans*. For many naturopathic and herbal practitioners this is the herb of first choice for use in treating bacterial infection (four 500 mg capsules four times daily during

infection) (Hwang et al 2003, Sack & Froelich 1982, Sharma et al 1978).

Hypericum perforatum (St John's wort)

Apart from its usefulness in treating mild to moderate depression (see notes above), this is commonly used for its antibacterial and antiviral qualities and for its specific antiretroviral effects. In doses of about 1500 mg daily (in divided doses) it enhances the function of the immune system – apparently by improving circulation to the spleen – with macrophage activity being increased (Fritz et al 2007, Mazandarani et al 2007, Roby et al 2000).

Usnea barbata

The extract of this European 'plant' (a lichen, and therefore more of a cross between a fungus and an algae) has powerful antibiotic effects on some of the nastiest bacterial agents, including *Staphylococcus* spp. and *Mycobacterium tuberculosis*. It is taken as a liquid extract, starting (to ensure tolerance) with three to four drops in water twice a day and building up to around 10 drops three times a day during an active infection. It can also be used for sore throats as a gargle (one drop in sufficient water with which to gargle) and as a douche for vaginal infections. Ideally it should be used under expert guidance as it can irritate the stomach and bowels if used excessively. Some experts claim that it is a more powerful antibacterial agent than penicillin, but far safer (Madamombe & Afolayan 2003, Wagner & Prokcsh 1983, Weckesser et al 2007).

CAUTION: All herbal compounds and many individual herbs are toxic if used in excessive amounts. Many produce mild digestive side-effects (Chen & Chen 1992). In addition, interactions with drugs are common, and not always beneficially so. Prudence calls for potential interactions to be investigated prior to prescribing herbal substances (Ulbricht & Basch 2005).

Inflammation/pain

See also notes on leptin, obesity, toxic adipose residues and inflammation ('metabolic syndrome') in Chapter 3 (Berg & Scherer 2005, Juge-Aubry et al 2005).

Fibrositis/FMS does not usually involve active inflammation; however, many of the associated muscle, soft tissue and joint problems involving pain appear to involve inflammatory processes (Bazzichi et al 2007, Faggioli et al 2004).

The dietary strategies outlined below are effective and safe and can be incorporated into a normal eating pattern without difficulty. A strong correlation exists between the patterns of eating advised below and the so-called Mediterranean diet, which has been shown to produce anti-inflammatory effects (Giugliano & Esposito 2008).

There are two major anti-inflammatory nutritional methods that are useful in most pain situations: the dietary approach (e.g. dietary patterns rich in phytochemicals) and the enzyme approach discussed below (Béliveau & Gingras 2007).

Apart from nutritional strategies, hydrotherapy can be invaluable in easing pain and inflammation (see Ch. 13 and also the notes earlier in this chapter, particularly the constitutional hydrotherapy protocols which have proved to be extremely valuable, in my experience).

Nutritional anti-inflammatory treatment approaches

1. *Reduce animal fats*. A major aspect of pain and inflammation processes involves prostaglandins and leukotrienes. These are themselves to a great extent dependent upon the presence of arachidonic acid which humans manufacture mainly from animal fats. Reducing animal fat intake cuts down access to the enzymes which help to produce arachidonic acid, and therefore lowers the levels of the inflammatory substances released in tissues which contribute so greatly to pain (Donowitz 1985, Ford-Hutchinson 1985, Serrano-Mollar & Closa 2005). Drug use to reduce inflammation, for example using non-steroidal anti-inflammatory drugs (NSAIDs), is potentially dangerous (Fosslien 2005); calling for safer methods and nutritional approaches can offer these (Adam 2007).

The first priority in an anti-inflammatory dietary approach is to cut down or eliminate dairy fat (García et al 2006). Fat-free or low fat milk, yogurt and cheese should be eaten in preference to full fat varieties, and butter avoided altogether. Meat fat should be completely avoided, and since much fat in meat is invisible, meat itself can be left out of the diet for a time (or permanently). Poultry skin should be avoided. Hidden fats in products such as biscuits and other manufactured foods should be looked for on packages and avoided.

2. *Eating fish or taking fish oil*. Fish that come from cold water areas contain high levels of eicosapentaenoic acid (EPA) which reduces levels of arachidonic acid in tissues and therefore helps to create fewer inflammatory precursors. Fish oil has these anti-inflammatory effects without interfering with those prostaglandins that protect the stomach lining and maintain the correct level of blood clotting. This is important because drugs which do just what fish oil can do commonly cause new problems by interfering with prostaglandin function (Massaro et al 2007).

Advice for patients should be to eat fish such as herring, sardine, salmon and mackerel at least twice weekly – more if desired – and to take EPA capsules (5–10 daily) regularly when inflammation is at its worst until relief appears and then a maintenance dose of 6 daily (Iglesias Del Sol & Smulders 2006).

3. *Anti-inflammatory (proteolytic) enzymes*. It has been found that proteolytic enzymes have a substantial anti-inflammatory influence (Mazourov et al 1997). Proteolytic enzyme-rich products include bromelaine which comes from the pineapple plant (stem not fruit) and papain from the papaya plant. It is necessary to ensure around 2–3 g of one or other are taken (bromelaine seems to be more effective), spread throughout the day away from meal times (or all they will do is help digest protein) as part of an anti-inflammatory, pain-relieving strategy (Cichoke 1981, Harrach et al 1995).

Irritable bowel syndrome (IBS) (see also Fig. 14.2)

This condition has been shown in research to affect at least three-quarters of FMS patients – fewer in some studies than others but always a significant number (see Dr Jessop's figures in Ch. 2). The symptoms of IBS range from alternating diarrhoea and constipation to abdominal gas/bloating, nausea, just diarrhoea or just constipation. Yunus (2007) notes that FMS and IBS are 'overlapping conditions'.

Lydiard (2007) makes an observation, and asks a question:

> *IBS is non-randomly associated with other functional gastrointestinal (GI) disorders, functional somatic disorders (e.g. fibromyalgia, chronic fatigue, and chronic pelvic pain, among others), and psychiatric conditions. Reports in the medical literature dating back to 1790 describe patients with disturbed intestinal function, muscle tenderness, headaches, severe fatigue, and mental distress. Did these patients have one disorder, such as IBS, or several disorders?*

Treatment

- Stress reduction is usually useful (Naliboff et al 2008).
- Allergic elements need to be considered and dealt with (see allergy earlier in this chapter). The commonest sensitivities are to grains (wheat especially), corn, yeasts, food colourings, coffee, citrus and dairy products. 'Safe' dietary intake usually consists of lamb, fresh white fish, cabbage, peas, carrots, rye-based biscuits/crispbreads (no wheat), rice cakes, milk-free margarine and weak black tea (Zar et al 2005).
- Candidiasis (see above) (Santelmann & Howard 2055) is a common cause, as are parasites (commonest is *Giardia lamblia*) (Penrose et al 2007, Stark et al 2007). See also probiotic notes in this chapter.
- Hydrochloric acid deficiencies (and therefore possibly zinc) are common in IBS, as are deficiencies of digestive enzymes (Davidson et al 2007, Tiscornia et al 2005). Expert advice is required to help normalize such problems but the supplementation of probiotic substances (acidophilus, bifidobacteria and *L. bulgaricus* – all dairy-free if possible) is a safe and effective method for starting to normalize bowel health (Macfarlane et al 2006). The detoxification programme outlined below, plus the stress reduction methods (above) are all recommended.
- Diets high in refined carbohydrate have been implicated in many studies in aetiology of IBS, encouraging intense smooth-muscle spasm; these should be discouraged and a high fibre diet encouraged (Capurso et al 1996).
- Enteric-coated peppermint oil capsules have been shown in experimental double-blind crossover trials to reduce abdominal symptoms (Cappello et al 2007) (see Caution below).
- Probiotic and prebiotic supplementation may help diarrhoea conditions through improved bowel

ecology (Wilhelm et al 2008). See notes on probiotics later in this chapter.

CAUTION: Enteric-coated peppermint oil capsules are required to prevent too rapid release. Dosage is 1–2 enteric-coated capsules (0.2 ml/cap) three times daily between meals (Dew et al 1984, Rees et al 1995).

Obesity

See notes on leptin, obesity, toxic adipose residues and inflammation ('metabolic syndrome') in Chapter 3.

Pelvic pain and interstitial cystitis

Theoharides (2007) noted that: 'Painful Bladder Syndrome and Interstitial Cystitis (PBS/IC) often coexist with allergies, endometriosis, fibromyalgia, irritable bowel syndrome and panic syndrome, all of which are worsened by stress. . . . Pilot clinical trials suggest that the flavonoid *quercetin* may be helpful. Lack of early diagnosis and treatment can affect outcomes and leads to the development of hyperalgesia/allodynia.' This perspective is shared by Brand et al (2007).

Clauw (Clauw et al 1997, Clauw 2001) demonstrated that while in the general population no more than 1% of females suffer from interstitial cystitis, among his FMS patients the number was in the region of 25%.

In Brazil, 80 people with disabling pelvic pain were evaluated. Myofascial pain syndrome (MPS) was diagnosed in all 80. Treatment using heat, stretching, massage and injection of trigger points resulted in significant improvement in pain levels in 60% of patients. Triggers are common in this region, especially in muscles on the pelvic floor. Yunus (1989) reports that pelvic pain is common in FMS, and that research has shown:

- pain thresholds in dysmenorrhoeic women were lower than controls at all body sites
- the pelvic region had lower pain thresholds than other body areas in all women tested
- during premenstruation all women in the study were more sensitive in the pelvic area
- at the same time that dysmenorrhoeic women experienced their greatest levels of pain they were hypersensitive to pain elsewhere (limbs, etc.) – something not noted in women in the control group.

Pukall et al (2006) have shown a higher than average incidence of FMS in patients with vulvar vestibulitis.

Treatment

Pelvic pain and associated interstitial cystitis has been successfully treated by removal of active trigger points in the region (Weiss 2001). Between September 1995 and November 2000, 45 women and 7 men, including 10 with interstitial cystitis, and 42 with the urgency–frequency syndrome, were treated once or twice weekly for 8–12 weeks, using manual therapy applied to the pelvic floor, aimed at decreasing pelvic floor hypertonus (Weiss 2001). Of the 42 patients with urgency–frequency, 35 (83%) had moderate to marked improvement or complete resolution, while 7 of the 10 (70%) with interstitial cystitis had moderate to marked improvement. In 10 of the cases the subjective results (symptom score sheet) were confirmed by measuring resting pelvic floor tension by electromyography, before and after the treatment course.

Similar studies showing the marked benefit of deactivation of myofascial trigger points in males and females with chronic pelvic pain symptoms have been conducted by Anderson et al (2005) and Lukban et al (2001). (See notes on facilitation and trigger points for a greater understanding of the trigger point phenomenon – Ch. 6, Box 6.1 and Chs 1 and 16.)

Premenstrual syndrome (PMS)

Many of the symptoms associated with premenstrual syndrome (fatigue, bloating, muscular pains, sleep disturbance, headaches, anxiety, swelling in extremities, depression, confusion, emotional lability, etc.) are common to CFS (ME) and FMS. The fact that these symptoms are periodic and not constant shows the distinction from the more chronic symptoms of FMS/CFS (ME) and also allows us to glimpse certain possible contributing elements in the maze of potential causes involved in CFS (ME) and FMS.

A number of herbal products have been shown to be useful:

- Chasteberry (*Vitex agnus-castus*): One excellent multicentre, randomized, controlled, double-blind

study, involving 178 women over three cycles, is cited (Schellenberg 2001). The study concluded that: 'Dry extract of agnus castus fruit is an effective and well tolerated treatment for the relief of symptoms of the premenstrual syndrome.' Following a systematic review, Daniele et al (2005) concluded that: 'Although further rigorous studies are needed to assess the safety of VAC, the data available seem to indicate that *Vitex agnus-castus* is a safe herbal medicine.'

- *Ginko biloba*: Tamborini & Taurelle (1993) concluded that: 'Ginkgo biloba extract (EGb 761) was effective against the congestive symptoms of PMS, particularly breast symptoms with a statistical significance between [Ginko] and placebo. Neuropsychological symptoms were also improved.'
- St John's wort (*Hypericum*): Stevinson & Ernst (2000) found that over two-thirds of women using a standardized hypericum extract (Kira 300 mg) demonstrated at least 50% reduction in PMS symptom severity.
- Ulbrich & Basch (2005) suggest that the commonly advised use of oil of evening primrose is of little or no value in treatment of PMS.

Overbreathing and PMS (see notes on hyperventilation (and hypoglycaemia) earlier in this chapter)

Ott et al (2006) note that:

> *It has been known for more than 100 years that women hyperventilate during the second half of the menstrual cycle. Symptoms of the chronic HVS are remarkably similar to the symptoms observed in some women with PMS . . . In women with PMS the sensitivity of the respiratory center to CO_2 is increased more than normal by progesterone, or some other secretory product of the corpus luteum, resulting in pronounced hyperventilation.*

Similar findings are reported by Slatkovska et al (2006), suggesting that a major focus for those with PMS should be breathing rehabilitation. See Chapter 17 for methods.

Probiotics and prebiotics (Astegiano et al 2006, Bruzzese et al 2006, Del Piano et al 2006, Doron et al 2005, Gibson et al 2005, Tuohy et al 2003)

Numerous studies show the marked and rapid improvement in bowel disease when prebiotics and probiotics are administered.

- 'The use of IBS Active [probiotic] led to a significant improvement in pain symptoms, abdominal distension and regulation of bowel movement in IBS patients.' (Astegiano et al 2006)
- 'Altering the intestinal flora with probiotics is an exciting approach to managing intestinal disorders and related conditions. LGG [Lactobacillus GG] and other products are safe, cheap, and easy to administer. Future investigators will be challenged to define their utility in treatment and prevention of the broad array of potential clinical settings.' (del Piano et al 2006)

The major beneficial bacteria inhabiting the gut are as follows:

Bifidobacterium bifidum (Astegiano et al 2006, Liu et al 2007). These friendly bacteria inhabit the intestines, with a greater presence in the large intestine (the colon) than in the small intestine. They also live in the vagina. Their major roles are:

- preventing colonization by hostile micro-organisms by competing with them for attachment sites and nutrients
- preventing yeasts from colonizing the territories which they inhabit
- helping to maintain the right levels of acidity in the digestive tract to allow for good digestion
- preventing substances such as nitrates from being transformed into toxic nitrites in our intestines
- manufacturing some of the B vitamins
- helping to detoxify the liver.

Streptococcus thermophilus (Rastall et al 2005). This is a transient (non-resident) bacterium of the human intestine which, together with *Lactobacillus bulgaricus*, is a yogurt culture, also found in some cheeses. It performs a number of useful roles; for example:

- Some strains produce natural antibiotic substances.
- They enhance the ability to digest milk and its products by producing the enzyme lactase which is absent or deficient in almost half the adults on earth, and in many children, especially if they are of Asian, African or Mediterranean genetic stock.
- Because they produce lactic acid (this is the only streptococcus to produce lactic acid, which it makes in even greater quantities than *L. bulgaricus*), they help to create an environment that encourages colonization by the bifidobacteria (they are therefore known as 'bifidogenic' bacteria) and *L. acidophilus*, as well as helping to prevent colonization by undesirable micro-organisms.

Lactobacillus acidophilus (Sinn et al 2008). This natural inhabitant of the intestines also lives in the mouth and vagina. Its main site of occupation is the small intestine. They:

- prevent colonization by hostile micro-organisms such as yeasts by competing with them for attachment sites and nutrients
- produce lactic acid (out of carbohydrates) which helps maintain the correct environment for digestion by suppressing hostile organisms (other bacteria and yeasts)
- improve the digestion of lactose (milk sugar) by producing the enzyme lactase
- assist in digestion and absorption of essential nutrients from food
- destroy invading bacteria (not all strains of *L. acidophilus* can do this)
- slow down and control yeast invasions such as *Candida albicans*.

Bifidobacterium longum (Rastall et al 2005). This is a natural inhabitant of the human intestines and vagina. It is found in larger numbers in the large intestine than in the small intestine. Together with other bifidobacteria, this is the dominant organism of breast-fed infants (making up 99% of the microflora). In adolescence and adult life the bifidobacteria are still the dominant organism of the large intestine (when health is good). Main benefits include:

- preventing colonization by hostile micro-organisms by competing with them for attachment sites and nutrients
- production of lactic and acetic acids which inhibit invading bacteria
- helping in weight gain in infants by retention of nitrogen
- preventing harmful nitrites being formed from nitrates in the digestive tract
- manufacturing B vitamins
- assisting in liver detoxification.

Bifidobacterium infantis (Gibson 2006). This is a natural inhabitant of the human infant's digestive tract (as well as the vagina, in small quantities). Its presence is far greater in the gut of breast-fed infants compared with bottle-fed infants. Among its main benefits are:

- preventing colonization by hostile micro-organisms by competing with them for attachment sites and nutrients
- production of lactic and acetic acids which inhibit invading bacteria
- helping in weight gain in infants by retention of nitrogen
- preventing harmful nitrites being formed from nitrates in the digestive tract
- manufacturing B vitamins.

Lactobacillus bulgaricus (Hickson et al 2007). This extremely useful friendly bacterium is not a resident of the human body, but a 'transient'. Once it enters the body through food (yogurt for example) it remains for several weeks before being passed, but while in the body it performs useful tasks. It performs a number of useful roles, for example:

- Some strains produce natural antibiotic substances.
- Some strains have been shown to have anti-cancer properties.
- These bacteria enhance the ability to digest milk and its products by producing the enzyme lactase which is absent or deficient in almost half the adults on earth, and in many children, especially if they are of Asian, African or Mediterranean genetic stock.
- Because they produce lactic acid (as do all bacteria which have as the first part of their name 'lactobacillus') they help to create an environment that encourages colonization by the bifidobacteria (they are therefore known as 'bifidogenic' bacteria) and *L. acidophilus*, as well as helping to prevent colonization by undesirable micro-organisms.

Other lactobacilli Additional (useful) lactobacilli found in the digestive tract include:

- *L. casei* – a transient bacterium of the intestine
- *L. plantarum* – a transient bacterium of the intestine

- *L. brevis* – a transient bacterium of the intestine
- *L. salivarius* – a natural resident of the mouth and digestive tract
- *L. delbrueckii* – a transient bacterium of the intestine
- *L. caucasicus* (known as *L. kefir*).

List of benefits

The list of benefits offered by friendly bacteria, *when they are healthy* (Astegiano et al 2006, Bruzzese et al 2006, Del Piano et al 2006, Heyman et al 2005, Madsen 2001, Tuohy et al 2003), includes the following:

- They improve the ability to digest milk products by producing the enzyme lactase.
- They aid digestive function overall and improve the ability to digest and absorb nutrients from food.
- They improve bowel function. When they are not healthy, bowel transit time (how long it takes food to be processed and wastes eliminated) is far slower.
- Some strains (see individual characteristics above) can destroy invading bacteria by producing natural antibiotic products.
- Some strains have anti-tumour effects.
- By acting to detoxify the intestines (preventing amine formation for example) they help to prevent the formation of cancer-causing chemicals.
- They reduce the levels of cholesterol in the system, so reducing the dangers that excess cholesterol poses to the health of the heart and circulatory system.
- Some strains assist in recycling oestrogen which helps overall hormone balance as well as reducing menopausal symptoms.
- They manufacture some of the B vitamins including B_3, B_6, folic acid and biotin.
- They maintain control over potentially hostile yeasts such as *Candida albicans*.
- They produce lactic acid which enhances the digestibility of foods as well as improving the environment for themselves and making it hostile for invading organisms (e.g. they protect against most of the organisms that produce food poisoning).

These are the main benefits which the friendly bacteria offer when they are in good health. And we cannot live in a reasonable state of health ourselves unless the flora of the body – the friendly bacteria – are in good health. We therefore need to know what makes them healthy and what upsets them (see Fig. 14.2).

Prebiotics

A prebiotic has been defined as a 'non-digestible food ingredient that beneficially affects the host by selectively stimulating the growth and/or activity of one or a limited number of bacteria in the colon, and thus improves host health' (Gibson et al 2000). Prebiotics assist the friendly bacteria, but do not nourish disease-causing organisms. Despite being carbohydrate based, prebiotics are not digested and absorbed, and therefore cannot increase weight.

Among the best known of the prebiotics are fructo-oligosaccharides (FOS), gluco-oligosaccharides (GOS) and lactosucrose, which have all been shown to be capable of improving the status of the intestinal flora (*Bifidobacteria* spp and *L. acidophilus*) after only a short period (Gibson & Roberfroid 1995).

Many fruit and vegetables contain prebiotics such as FOS, including onion, garlic, banana, asparagus, leek and Jerusalem artichoke. In order to have an intake of prebiotics, sufficient to make a difference to the bowel ecology, a great deal of such food would need to be eaten.

Prebiotic supplementation

Gibson has shown that it is necessary to take approximately 8 g daily of the powdered forms of FOS (heaped tablespoon) to assist bowel ecology. FOS is widely available through health food stores.

The term *synbiotics* is used to describe an intervention where both probiotics and prebiotics are combined. This may offer the dual benefits of both approaches (Gibson et al 2000).

Sleep (and growth hormone) problems (see Fig. 4.4)

Sleep laboratories have found that nearly half of all people with fibromyalgia and CFS have disturbed (by intrusive alpha wave periods) delta stages, and tend to wake up feeling as tired as – or more tired than – they did when they went to bed. A large

percentage of the remainder of FMS patients suffer from other forms of sleep disturbance (see below). Prescription antidepressant medication which has successfully reduced many of the symptoms of fibromyalgia includes various drugs which, while they increase the amount of sleep, have not been shown to alter the disturbed and limited delta stages by more than a small amount (Kumano-go et al 2007).

Burns et al (2008) note that shorter durations of stage 2 sleep periods distinguish FMS from control female subjects.

The growth hormone connection

Delta stage sleep involves growth hormone being released by the pituitary gland as well as immune system repair functions being more active. Growth hormone, 80% of which is produced during delta stage sleep, has a direct effect on the quality of repair and regeneration of muscles; when deficient because of sleep disturbance this can account, at least in part, for the muscular symptoms of FMS. There is evidence that growth hormone production can be encouraged by specific dietary strategies (Jones et al 2007).

How muscles are affected by sleep disturbance

Moldofsky (1993) conducted a study in which six volunteers had their stage 4 sleep disrupted for three nights in a row. They all developed fatigue, widespread aching muscles and specific tenderness on palpation of the appropriate sites used to diagnose fibromyalgia. When the same sleep disruption pattern was used on volunteer long-distance runners there was no fatigue and no pain. Carefully constructed 'training' can be an effective method in recovery from fibromyalgia.

Other sleep anomalies in FMS patients include sleep apnoea (about 25% of FMS patients), nocturnal myoclonus (about 16% of FMS patients) and bruxism (affecting between 10% and 15% of FMS patients) (Maryon 1991). Moldofsky (1993) reports that all substances containing caffeine (coffee, tea, chocolate, cola) are contraindicated for people with sleep apnoea, as are alcohol and tricyclic antidepressant medication.

A return to a better sleep pattern is clearly a key, some say the major key, to normalizing or helping people with fibromyalgia, but the same treatment is not required for all forms of sleep abnormality.

Supplementation for sleep and growth hormone production

- 5-L-HTP (5-hydroxy-L-tryptophan), a tryptophan-like substance derived from an African bean, is now available and clinical experience suggests it is useful in sleep enhancement (Caruso et al 1990, Puttini & Caruso 1992). This form of tryptophan has been shown to be safe compared with the problems that arose in the past with the use of contaminated forms (Das et al 2004).
- The plant proteins in chlorella and other blue-green algae are ideal sources and a drink containing this (available in most health stores) in the evening will provide tryptophan, as will a full spectrum amino acid powder (or capsules) available from health stores. There is good evidence of usefulness of this protein source in treatment of fibromyalgia. 'The potential of chlorella to relieve symptoms, improve quality of life, and normalize body functions in patients with fibromyalgia, hypertension, or ulcerative colitis suggests that larger, more comprehensive clinical trials of chlorella are warranted.' (Merchant & Andre 2001)
- Calcium and magnesium (in a ratio of 2:1) is another useful relaxing nutrient and a gram of calcium/half a gram of magnesium (tablet, capsule, powder or liquid) taken at night helps the relaxation process (Teitelbaum 2005).
- Herbs such as valerian (Tariq & Pulisetty 2008), passiflora (Staiger & Wegener 2006), hops (Schiller et al 2006) and chamomile (Staiger & Wegener 2006), in various combinations, are helpful as teas, capsules, etc.
- Evidence indicates that melatonin may be effective in treating the pain associated with fibromyalgia syndrome. Melatonin is commonly known as a sleep aid and has a variety of other beneficial effects in the treatment of FMS (Pandi-Perumal et al 2006, Reiter et al 2007).

Sleep and exercise

Gowans & DeHueck (2007) report that pool exercise can be an effective intervention for individuals with fibromyalgia with effects on mood and sleep quality.

Sleep and acupuncture

Lundeberg & Lund (2007) note that: 'Not only pain but also sleep and cognitive dysfunction may be ameliorated in response to acupuncture. Our suggestion – supported by experimental and clinical studies – shows that acupuncture may affect insomnia and alertness, and that there may be neurophysiologic bases for these specific effects.'

Toxicity (and detoxification strategies) (see Box 15.5)

Toxicity can be usefully reduced by following a pattern of regular 'detoxification' days and lifestyle changes (Michalsen et al 2006). Other methods which can help in this task are hydrotherapy methods, skin brushing, sauna baths, aerobic exercise, specific herbal liver treatments, acupuncture and bodywork to assist in lymphatic drainage (Cecchini & LoPresti 2007, Kjeldsen-Kragh et al 1991, Mutter et al 2007) (see also Ch. 13 on hydrotherapy and fibromyalgia).

It is known from research that everyone on the planet has deposits of DDT, petrochemicals, pesticides, lead, cadmium and dioxin in their bodies, as well as measurable serum levels of chlorinated hydrocarbons. As a rule, these are significantly higher in people with CFS (Dunstan et al 1995).

Self-help, including therapeutic fasting (Michalsen 2007)

A number of methods for safe detoxification exist (Box 15.5). These include repetitive short fasting periods which allow the liver in particular to recover from toxic stress. Of particular importance in fibromyalgia is the fact that, on short fasts, growth hormone production is stimulated (see citations contained in Weindruch & Walford 1988).

CAUTIONS: If ANY fast is undertaken for longer than 48 hours it is strongly suggested that a suitably qualified, competent and experienced health care professional should be consulted for advice and to ensure that supervision is available. Fasting is to be actively discouraged outside of a residential setting for anyone with an eating disorder (anorexia, bulimia), or who suffers from any form of mental disease or chronic health condition that requires medication to control it. Fasting is particularly contraindicated for anyone who does not fully understand and agree with its application (Chaitow 1996).

Fasting contraindications

Goldhamer (2002) notes:

> *There are individuals who are not good candidates for therapeutic fasting. But there are few conditions per se that contraindicate its appropriate use. The greatest contraindication to fasting is fear. A lack of understanding of the fasting process can present insurmountable problems. Extreme weakness in various diseases associated with muscular wasting may also contraindicate fasting. There are numerous medications that can complicate the fasting process. Inadequate nutrient reserves would be another potential contraindication to fasting. Certain types of cancer and severe kidney disease may also make an individual a poor fasting candidate.*

Detoxification and dietary programmes

If someone is robust and vital a more vigorous detoxification programme will be appropriate than if they are unwell and somewhat fragile in health. The detoxification programme described in Box 15.5 is safe for *almost* everyone.

CAUTION: If someone is a recovering drug user, or an alcoholic, or has an eating disorder, or is a diabetic, then these methods *should not be applied* without professional advice. If there is a candida or bowel problem, then self-help and/or professional guidance to help normalize this should be used before starting on the detoxification methods outlined in this chapter.

Bland's detoxification approach

Other forms of detoxification are being researched. For example, noted nutritional expert Dr Jeffrey Bland has formulated a meal-replacement product (Ultra-Clear) which is based on rice protein and which is also rich in detoxifying nutrients. By combining avoidance of allergenic foods and using

Box 15.5

Detoxification programme (Beer et al 2001, Kjeldsen-Kragh et al 1991, Michalsen et al 2005, 2006)

Over almost every weekend for a few months (and thereafter once a month at least) choose between:

Method 1

Short water-only fast (24–36 hours) conducted over a weekend (starting Friday evening and ending Saturday evening or Sunday morning; or just all day Saturday, so that work schedules are not interfered with), making sure that not less than 4 and not more than 8 pints of water are consumed during the day. After fasting for 24–36 hours, break the fast with stewed pears or apples (no sweetening) or with a light vegetable soup, or with plain, low-fat, unsweetened yogurt.

On the Sunday have a raw food day (fruit/salad only, well chewed, plus water ad lib) or, if you have a sensitive digestion, lightly cooked (steamed, stir-fried) vegetables, baked potato and stewed fruit (no sugar) plus yogurt could be chosen.

Method 2

A full weekend monodiet (Friday night to Sunday evening on a single food as described below):

Up to 3 lb daily of any of a single (organic, unsprayed if possible) fruit choice such as grapes, apples, pears (best choice if an allergy history exists) or papaya (ideal if digestive problems exist), *or*

Organic (unsprayed) brown rice or buckwheat, or millet or potatoes (skin and all), boiled and eaten whenever desired (up to 1 lb dry weight of any of the grains, which can be made palatable by the addition of a little lemon juice and olive oil, or 3 lb of potatoes daily).

If fruit only is chosen it can be raw or lightly cooked without sweetening.

Whichever type of weekend detoxification is chosen, rest and warmth are essential with no engagements/dates – this is a time to allow energy to focus on the repairing and cleansing processes of detoxification.

Method 3

Milder midweek detoxification days, in between these weekend detoxification intensives:

Breakfast:

Fresh fruit (raw or lightly cooked – no sweetening) and live yogurt, *or*

Home-made muesli (seeds and nuts and grains) and live yogurt, *or*

Cooked grains and yogurt (buckwheat, millet, linseed, barley, rice, etc.).

Drink:

Herbal tea (linden blossom, chamomile, mint, sage, lemon verbena) or lemon and hot water drink.

Lunch/evening meal:

One of these could be a raw salad with jacket potato or brown rice and either bean curd (tofu) or low fat cheese or nuts/seeds, *or*

If raw food is a problem, a stir-fried vegetable/tofu meal or steamed vegetables eaten with potato or rice together with low fat cheese or nuts and seeds.

The other main meal should be a choice between fish, chicken, game or vegetarian savoury (pulse/grain combination) and vegetables lightly steamed, baked or stir-fried.

Desserts:

Lightly stewed fruit – add apple or lemon juice (not sugar) or live natural yogurt.

Food should be seasoned with garlic and herbs, avoiding salt as much as possible.

At least 2 litres of liquid should be consumed daily between meals.

What to expect during detoxification

In the early days (for the first few weekends of short-term fasting or monodiet) a headache and furred tongue are likely. These side-effects of detoxification will slowly become less obvious as detoxification progresses weekend by weekend.

Nothing should be taken to stop the headache.

As the weeks pass, skin should become clearer (it may get a bit spotty for a while), eyes clearer, brain sharper, digestion more efficient, energy levels should start to rise.

When the tongue no longer becomes furred with the weekend detoxification, and headaches no longer appear, the detoxification days can be spread apart – three a month and then two a month and then maintenance of once a month.

When a definite change is noticed, and there is far less reaction to the weekend fasts, the in-between, milder detoxification pattern can also be relaxed a bit.

Detoxification enhancement

1. *Skin brushing*: frictioning skin before bathing or showering enhances skin function/elimination.
2. *The salt glow*: a skin friction using wet coarse (sea) salt or Epsom salts before a bath or shower is particularly beneficial for people who

Box 15.5—Cont'd

have difficulty sweating or who have poor circulation to their hands and/or feet; it is also useful for people prone to rheumatic aches and pains and so is ideal for people with fibromyalgia.

3. *Sauna* – if not too enervating.
4. *Lymphatic drainage massage, and general massage*.

CAUTION: If someone is a recovering drug user, or an alcoholic, or has an eating disorder, or is a diabetic, then these methods should not be applied without professional advice. If there is a candida or bowel problem, then self-help and/or professional guidance to help normalize this should be used before starting on the detoxification methods outlined in this chapter.

products such as this, a modified fast/detoxification programme can be carried out while continuing with normal activities. Research has shown this to be very helpful for many people with FMS/CFS. A study of Bland's detoxification methods involved 106 patients at different clinics, with either CFS or FMS (plus IBS). The programme called for avoidance of known food allergens, encouragement of intestinal repair, stimulation of liver detoxification and a modified fast using the rice protein powder. Over a 10-week period there was a greater than 50% reduction in symptoms as well as laboratory evidence of improved liver and digestive function (Bland 1995).

Liver support

Joseph Pizzorno ND, one of America's leading naturopathic physicians and founder president of Bastyr University, Seattle, encourages liver detoxification in such cases by means of increased eating of brassica family foods (cabbage, etc.), the use of specific nutrients such as *N*-acetyl-cysteine and glutathione, as well as taking the herb *Silybum marianum* (milk thistle) 12 mg three times daily.

He also encourages adrenal gland function (supplementing with vitamins C and B_5). He states: 'The strong correlation between chronic fatigue syndrome, fibromyalgia and multiple chemical sensitivities suggests that all may respond to hepatic (liver) detoxification, food allergy control and a gut restoration diet' (Pizzorno 1996). These benefits are confirmed by Saller et al (2008).

Post-White et al (2007) report that:

> *There is strong preclinical evidence for silymarin's hepatoprotective and anticarcinogenic effects, including inhibition of cancer cell growth in human prostate, skin, breast, and cervical cells. Milk thistle is considered safe and well-tolerated, with gastrointestinal upset, a mild laxative effect, and rare allergic reaction being the only adverse events reported when taken within the recommended dose range.*

Conclusion

The evidence provided in this chapter should hopefully provide support for those whose aim is to guide patients through safe methods by which to manage conditions associated with fibromyalgia and chronic fatigue. The next chapter (Ch. 16) outlines manual (bodywork) approaches to the management of fibromyalgia.

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Chapter Sixteen

16

Physical modalities and fibromyalgia

CHAPTER CONTENTS

The musculoskeletal component of FMS

Although muscular pain is the defining component of fibromyalgia, the consensus is that FMS is not primarily a musculoskeletal problem, but one that emerges as a result of neurohumoral imbalances caused by any of a combination of inherited and acquired factors. The solution, as far as it exists, therefore lies in restoring neurohumoral balance utilizing biochemical, educational and psychosocial tools, as well as biomechanical tools to ease musculoskeletal discomfort, pain and restriction (Katz et al 2007, Nilsen et al 2006, Pamuk et al 2006).

Despite most of the theorizing as to aetiological agents, including biochemical and psychosocial 'causes' (see Ch. 4), there are in fact some very specific musculoskeletal features involved in FMS; these are sometimes aetiological, sometimes symptomatic of the condition – but not unusually both.

Among the biomechanical features and influences – in no particular order of importance – are the following:

- The evidence regarding whiplash injury and the changes this involves in the suboccipital region offer compelling impetus to focus attention to this area (see Ch. 3) (Yunus 2008).
- The evidence relating to cervical injury in general, resulting in disk damage and a sequence leading to chronic pain, as described by Carolyn McMakin in Chapter 9 (McMakin et al 2005).

- The evidence that in many instances a history exists of hypermobility, suggesting that compensation patterns that have evolved deserve attention (see Ch. 3) (Nijs 2005).
- The powerful relationship between the symptoms of overbreathing (hyperventilation tendency) and those of FMS, and the almost universal presence of breathing dysfunction in this patient population, calls for a major focus on restoration of both structural and functional integrity of respiratory function (see Chs 3, 15 and 17). Retraining in breathing function can only effectively be achieved if the structural features (shortened respiratory muscles, restricted rib and spinal structures, etc.) are mobilized (Chaitow 2004a, Roy-Byrne et al 2008).
- The overwhelming evidence of the involvement of myofascial trigger point activity as a part (the major part in some instances) of the pain experienced by the patient with FMS points to this being an area of primary interest for pain relief (see Chs 6 and 8, and later in this chapter) (de las Peñas et al 2005).
- The degree of emotional distress which accompanies FMS, whether as part of the cause, or as a result of the condition, will always have associated with it patterns of myofascial tension, compensation and adaptation (van Middendorp et al 2008, Verkuil et al 2007).

How well will a person respond to treatment?

When people are very ill, as in FMS/CFS where adaptive functions have been stretched to their limits, *any* treatment (however gentle) represents an additional demand for adaptation (i.e. it is yet another stressor). It is therefore essential that treatments and therapeutic interventions are carefully selected and modulated to the patient's current ability to respond, as best as this can be judged (see Fig. 2.5 and Box 2.1, Therapeutic stress).

When symptoms are at their worst, only single changes, or simple interventions, may be appropriate, with time allowed for the body/mind to process and handle these. It may also be worth considering general, whole-body, constitutional approaches (dietary changes, hydrotherapy, non-specific 'wellness' massage, relaxation methods, etc.) rather than specific interventions, both in the initial stages and during periods when symptoms have flared. Recovery from FMS is slow at best and it is easy to make matters worse by over-enthusiastic and inappropriate interventions.

Patience is required by both the health care provider and the patient, avoiding raising false hopes while realistic therapeutic and educational methods are used which do not make matters worse and which offer ease and the best chance of improvement.

Bodywork choices (see pp. 396–397, Box 16.3) and the overall therapeutic protocol (Box 16.1) offer

Box 16.1

A fibromyalgia protocol

Where a condition has multiple interacting causes it makes clinical sense to try to reduce the burden of whatever factors are imposing themselves on the defence, immune and repair mechanisms of the body, while at the same time doing all that is possible to enhance those mechanisms without increasing demands on the patient's adaptive capacity and current vitality (Fig. 1.2).

In my practice (but not always in the order listed) the aim in treating FMS/CFS is to:

- **Get the diagnosis right. Many rheumatic-type problems produce widespread muscular pain (e.g. polymyalgia rheumatica). Laboratory and other tests can identify most non-FMS conditions.**
- **Identify associated myofascial trigger point activity and treat these using methods chosen from bodywork, injection (Xylocaine, etc.), acupuncture, nutrition, hydrotherapy, postural and/or breathing re-education, relaxation methods, etc. (Ch. 6, Box 6.2).**
- **Assess and treat (or refer elsewhere for attention) associated conditions such as allergy, anxiety, hyperventilation, yeast or viral activity, bowel dysfunction, hypothyroid dysfunction, sleep disturbance, depression, etc. (Chs 10, 14, 15).**
- **Introduce (in-house, self-applied or via referral) 'constitutional' health enhancement methods such as:**

Box 16.1—Cont'd

- breathing retraining (Ch. 17)
- deep relaxation methods (e.g. autogenic training)
- graduated (aerobic, stretching and toning) exercise programmes
- regular (weekly or fortnightly) detoxification (fasting) days (to detoxify as well as boost growth hormone production)
- hydrotherapy, e.g. neutral bath or 'constitutional' progressive cold bathing (depending upon vitality and willingness)
- regular non-specific 'wellness' massage
- acupuncture (Ch. 6).

- Offer detailed advice as appropriate, including possibly:
  - elimination and rotation dietary patterns
  - exclusion of nightshade family of foods, sugars, yeast-based foods (if appropriate), processed foods, etc.
  - inclusion of whole foods (organic if possible), adequate protein, probiotics
  - nutritional supplements (antioxidants, magnesium, malic acid, manganese glycinate, methionine, NAC, thiamine, DLPA, 5-HTP, chromium, etc.), and/or
  - amino acids for growth hormone production (arginine, ornithine)
  - specific herbal help to enhance circulation to the brain (e.g. *Ginkgo biloba*) or which have pain-reducing properties (e.g. Boswellia) or are relaxing (kava kava, valerian, etc.), or which have antidepressant effects (hydrastis) or antiviral, immune-enhancing capabilities (*Glycyrrhiza glabra* liquorice, echinacea), etc.
  - homeopathic remedies (Rhus Tox 6C).
- Provide appropriate soft tissue treatment (see soft tissue approach summary in Box 16.3) plus teaching gentle self-help methods (for daily use), for example:
  - 'Strain/counterstrain' for home self-care (see 'Positional release technique' this chapter, and Ch. 18).
- Advice on regular exercise within tolerance, if possible including cardiovascular training and stretching movements (yoga and/or Tai chi):
  - suggest medication (under medical supervision only) in appropriate cases, to enhance sleep; antidepressant drugs (very low dosage) may offer short-term benefit.
- Encourage patients to join support groups, to read about their condition and health enhancement, to take control of their condition, even if progress is apparently slow (Ch. 7).
- Offer stress or general counselling which may help in the learning of coping skills and lead to stress reduction (Chs 7, 15).

a model of care which meets the requirements described earlier of reducing the adaptive load while enhancing function, so allowing self-regulating mechanisms the chance to operate most effectively.

Assessing the body's compensation potential

Zink & Lawson (1979) examined over 1000 hospitalized patients and were able to correlate overall health status with structural decompensation, as evidenced by patterns of rotational adaptation.

They report that most people, in a good state of health, with a degree of adaptational capacity still intact, display alternating patterns of rotatory preference, with about 80% having a common pattern of L-R-L-R, which they termed the 'common compensatory pattern' (CCP), reading from the occipito-atlantal (OA) region downwards:

- occipito-atlantal (OA)
- cervicothoracic (CT)
- thoracolumbar (TL)
- lumbosacral (LS).

Zink & Lawson further observed that the roughly 20% of people whose CCP did not alternate had poor general health histories, and poor prognoses.

A physiologically appropriate fascial compensation pattern (L-R-L-R, where balanced alternating patterns are evident) is seen as a useful, beneficial, and above all functional, response on the part of the musculoskeletal system (i.e. no obvious symptoms are likely to result) because the system retains a degree of adaptability, elasticity.

Decompensation, on the other hand, describes the same phenomenon; however, this time adaptive changes are seen to be dysfunctional (e.g. a rotational pattern of R-R-L-R), producing symptoms and evidencing stressed homeostatic mechanisms (i.e. poor adaptation and self-repair potential).

The message which emerges is that the poorer the compensation pattern, the less adaptive capacity remains, and the gentler and less invasive should therapeutic interventions be.

Treatment aimed at enhancing fascial compliance has the objective of trying, as far as is possible, to restore – over time – an alternating pattern of rotatory motion at these key crossover sites, by means of appropriate (to the patient's current state of health) soft tissue mobilization, stretching and gentle exercise procedures.

Zink & Lawson (1979) have therefore described a model of postural patterning, resulting from the progression towards fascial decompensation, which correlates with overall health status. By testing the tissue 'preferences' (loose/tight) in these different transitional areas, Zink & Lawson were able classify patterns in clinically useful ways:

- *ideal*, which are characterized by minimal adaptive load being transferred to other regions, as evidenced by more or less symmetrical degrees of rotation potential
- *compensated* patterns, which alternate in direction from area to area (e.g. atlanto-occipital–cervicothoracic–thoracolumbar–lumbosacral) and which are commonly adaptive in nature (Fig. 16.1A)
- *uncompensated* patterns which do not alternate, and which are commonly the result of trauma (Fig. 16.1B).

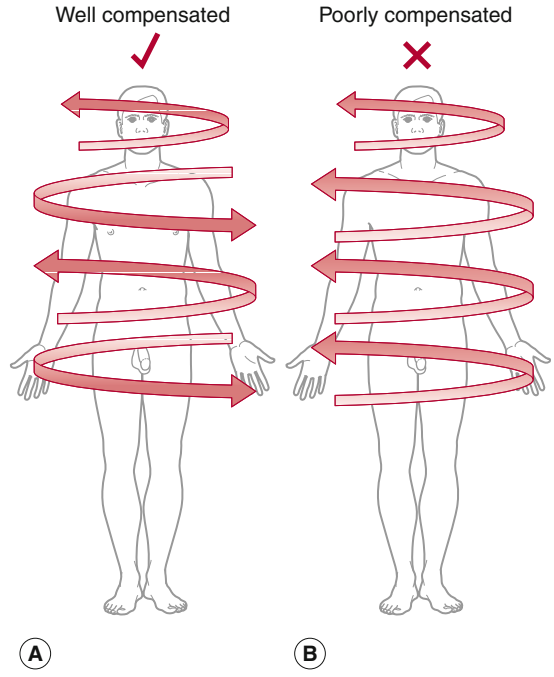


Figure 16.1 • Zink's postural (fascial) patterns. Tissue 'preferences' in different areas identify adaptation patterns in clinically useful ways: ideal = minimal adaptive load transferred to other regions; compensated **A** = patterns alternate in direction from area to area; atlanto-occipital, cervicothoracic, thoracolumbar, lumbosacral; uncompensated **B** = patterns which do not alternate. Therapeutic objectives which encourage better compensation are optimal. (Adapted from Zink & Lawson 1979; reproduced with permission from Chaitow et al 2002.)

Zink's test method (Defeo & Hicks 1993, Liem 2004)

Tissue preference is the sense that the palpating hands derive from the tissues being moved, as to the preferred direction(s) of movement (for example, at its simplest, 'this area turns more easily to the right than the left – and therefore has a "preference" to turn right').

The process of evaluation involves a series of 'questions' posed by the practitioner, to tissues being moved: 'Are you more comfortable moving in this direction, or that?' The terms *comfort*, *position of ease* and *tissue preference* all mean the same thing, and are in contrast to directions that engage barriers, or move towards bind or restriction. The methods for assessing tissue preferences in this context are described as follows:

Occipito-atlantal area

1. The patient is supine, and you stand at the head.
2. Cradle the head as the neck is fully (but painlessly) flexed, so that any rotatory motion will be focused into the upper cervical area only.
3. Carefully introduce rotation left and right of the atlanto-occipital structures.
4. Is there a preference to turn easily to the left, or the right, or is rotation symmetrically free?

Cervicothoracic area

1. The patient is supine and relaxed.
2. You sit or kneel at the head of table, and slide your hands under the patient's scapulae.
3. Each hand, independently, assesses the area being palpated for its 'tightness/looseness' preferences, by easing first one, and then the other, scapula area towards the ceiling.
4. Is there preference for the upper thoracic area to turn right or left?

Thoracolumbar area

1. The patient is supine and you stand at waist level facing cephalad.
2. Place your hands over the lower thoracic structures, fingers lying along lower rib shafts, directed laterally.
3. Treating the structure being palpated as a cylinder, your hands test the preference of the cylinder to rotate around its central axis, one way and then the other.
4. In which direction does the thoracic 'cylinder' prefer to rotate?

Lumbosacral area

1. The patient is supine and you stand below waist level, facing cephalad, and place your hands on the anterior pelvic structures.
2. This contact is used as a 'steering wheel' to evaluate tissue preference, as the pelvis is rotated around its central axis, seeking information as to its 'tight/loose' preferences.
3. In which direction does the pelvis prefer to rotate?

Conclusion: If rotational preferences are all (or are mostly) in the same direction it may be assumed that adaptation potential is close to, or has passed, its ability to compensate any further, without symptoms emerging. The 'elastic' has reached breaking point, metaphorically speaking, and therapeutic focus should shift from specific to constitutional interventions – for example, whole body massage rather than high velocity, low amplitude (HVLA) thrust or a heel lift – as any specific intervention would make demands on tissues that are relatively unable to comply, adapt, compensate.

In Chapter 4 it was observed that the research of Ringsdorf & Cheraskin (1980) has demonstrated that the more fluctuation that is evident through the day, when basic biological rhythms are measured, irrespective of whether this involves the individual's blood pressure, heart rate, blood sugar levels or anything else which is periodically measurable, the less well homeostatic functions can be seen to be operating.

These thoughts on the eliciting of evidence of homeostatic efficiency can be seen to have echoes of Zink & Lawson's observations which can offer guidance as to the latent adaptive capacity with which the practitioner has to work.

Comment

The less well adapted the individual, the gentler the intervention, and/or the greater amount of time that should be allowed for self-repair adaptations to operate, without undue strain being imposed on an exhausted system. 'Less is more' in such circumstances (see additional thoughts along these lines in the treatment protocol in Box 16.1).

Physical modalities and FMS

In Chapter 14 those methods – physical and other – that have been shown to help in treatment of FMS were evaluated. The physical modalities covered included several that require amplification in this chapter.

The methods discussed in Chapter 14 included:

- aerobic exercise
- acupuncture (also discussed in Ch. 6)
- chiropractic manipulation
- hydrotherapy (see also Chs 13 and 15)
- massage therapy (see also Ch. 16)
- osteopathic manipulation – including muscle energy technique (MET) and positional release technique (PRT) (see below)
- soft tissue manipulation – including neuromuscular therapy (NMT) (see Ch. 8 and below).

Patterns of dysfunction

As the body adapts and compensates towards dysfunction in response to a combination of the 'normal' stresses of life (Selye 1956), trauma, overuse and inborn genetic predispositions, particular patterns emerge that can be used diagnostically and prognostically.

The progression is one which involves all or some of following elements:

- inborn anomalies (short leg, hypermobility, fascial distortion, etc.)
- acquired habits of misuse (posture, breathing imbalance, etc.)
- overuse factors (repetitive movement patterns in sport, work, general activities, etc.)
- trauma (Wall & Melzack 1989)

- emotional patterns that have musculoskeletal influences (chronic anger, fear, anxiety, depression, etc.) (Latey 1983)
- additional stressors (toxicity, deficiency, infection, allergy, hormonal imbalance, etc.)
- frank musculoskeletal disease (e.g. osteoarthritis) or trauma such as whiplash
- reflexive activity (myofascial trigger points or areas of segmental facilitation) (Lewit 1992).

Masi (2000) presents an integrative physiopathogenetic perspective of hormonal and immunological risk factors leading to such diseases as rheumatoid arthritis and fibromyalgia. This model outlines a multilayer preclinical phase in which, during a long interval of symptomatically silent disease incubation, multiple genetic, somatic, behavioural and environmental risk factors (stressors) perturb the normal homeostasis of the core systems (i.e. the neuroendocrine, immunological and microvascular compartments).

When physiological homeostasis is sufficiently disturbed by such stressors (i.e. when adaptation fails), inflammatory and clinical manifestations ensue. Conversely, regulatory mechanisms controlling the homeostasis of perturbed core systems may also be normalized to a point that favours clinical improvements, especially in people with lesser predispositions towards particular disease processes, and with fewer accumulated non-genomic risk factors (Masi & Chang 1999).

Soft tissue: stress response sequence

When the musculoskeletal system is 'stressed', it commonly involves:

- increased muscular tone
- retention of metabolic wastes
- localized oxygen lack resulting in ischaemia
- possibly a degree of oedema
- discomfort/pain leading to increased or maintained hypertonicity
- inflammation – or at least chronic irritation.

The patient will experience intermittent stiffness, discomfort and possibly some pain. And relaxation methods and simple stretching may be all that is required to ease the soft tissue changes, along with re-education. If this is not achieved and the pattern continues as above:

- Neurological bombardment of the CNS may lead to a degree of sensitization of neural structures and the evolution of hyper-reactivity.
- Macrophages are activated, as is increased vascularity and fibroblastic activity.
- Connective tissue production increases, with cross-linkage leading to shortened fascia.
- This may lead to more widespread dysfunction, negatively influencing structures supported by, or attached to, the fascia, including nerves, muscles, lymph structures and blood vessels.
- Chronic hypertonicity and ultimately fibrotic changes may result.
- Hypertonicity produces inhibition of antagonist muscles.
- Chain reactions evolve in which some muscles (postural – Type I) shorten while others (phasic – Type II) weaken (see below).
- Ischaemia in tendinous structures occurs and periosteal pain areas develop.
- Malcoordination of movement occurs with antagonist muscle groups being hypertonic (e.g. erector spinae) or weak (e.g. rectus abdominis group) (see Fig. 16.2).

At this stage therapeutic interventions should attempt to restore shortened structures to their

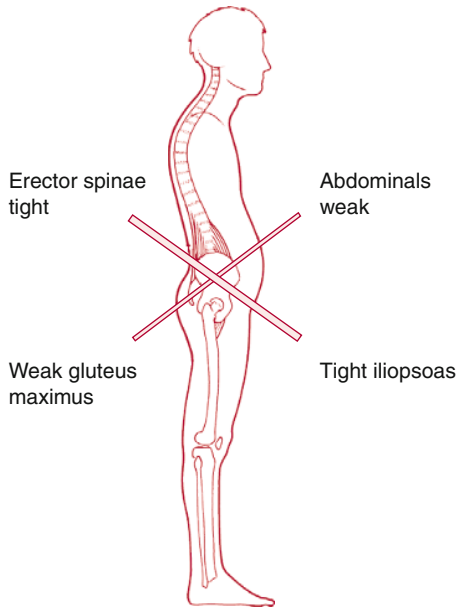


Figure 16.2 • The lower crossed syndrome, as described by Janda (1982).

normal length, while enhancing strength in inhibited muscles. Re-education patterns of use are commonly required. If this is not achieved and the pattern described above continues:

- Joint restrictions and/or imbalances and fascial shortenings develop.
- Local sensitization (facilitation) and hyperreactivity develop in the myofascia, i.e. trigger points.
- Sustained hypertonicity leads to fatigue.
- Widespread functional and structural changes evolve (see Fig. 16.3).
- Heightened sympathetic arousal leads to increased hypertonicity.
- Functional patterns of use of a biologically unsustainable nature emerge, involving chronic musculoskeletal problems and pain.

At this stage, restoration of normal function requires therapeutic input which addresses the multiple changes that have occurred, as well as the need for a re-education of the individual as to how to use their body, to breathe, carry and use themselves in less stressful ways. Chronic adaptive changes lead to the likelihood of acute exacerbations as the increasingly chronic, less supple structures attempt to cope with the normal demands of modern living (Basmajian 1974, Dvorak & Dvorak 1984, Janda 1982, 1983, Korr 1978, Lewit 1992, Travell & Simon 1983, 1991). As a result, acute and painful problems overlaid on chronic soft tissue changes become the norm.

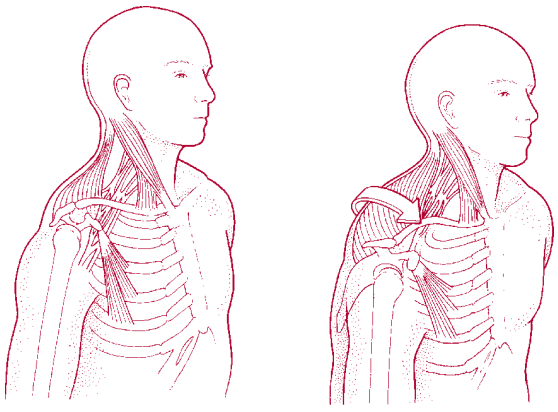


Figure 16.3 • A progressive pattern of postural and biomechanical dysfunction develops resulting in, and aggravated by, inappropriate breathing function.

Source of pain

In tense musculature, in the absence of pathology, pain may result from:

- The muscle itself via noxious metabolic products such as substance P (see Fig. 3.6, Ch. 3) (Lewis 1942) and/or bradykinin, prostaglandins, histamine, serotonin and potassium ions (Baldry 1993), or interference in blood flow, due to spasm, resulting in relative ischaemia (Simons 1987).
- The muscular insertion into the periosteum following marked, sustained or repetitive muscular tension (Lewit 1992).
- Joint restriction and over-approximation, leading to uneven wear and tear (Liebenson 1990, 1996, 2006).
- Neural irritation, possibly involving disc or general spinal mechanical dysfunction (Korr 1976).

Variations in pain threshold which have to do with perception (Melzack 1983) or interpretation in FMS (see Fig. 4.5, Ch. 4) will make all these factors more or less significant and obvious.

Trigger points (see Figs 6.4 and 6.5) which evolve from such a progression themselves become the source of new problems, locally as well as at distant sites (see Ch. 8) (Simons 1987).

Different responses to stress in postural and phasic muscles (Engel et al 1986, Woo & Buckwalter 1987)

Muscles have a mixture of fibre types. Type I contract slowly ('slow twitch fibres') and have low stores of energy-supplying glycogen, but carry high concentrations of myoglobulin and mitochondria. These fatigue slowly and are mainly involved in postural/stabilizing tasks. Type II fibre forms (phasic muscles) have been divided as follows:

- Type IIa fibres ('fast twitch') contract rapidly and are more resistant to fatigue.
- Type IIb fibres ('fast twitch/glycolytic fibres') are less fatigue-resistant and depend more on glycolytic energy sources.
- Type IIm ('super fast fibre'), found mainly in the jaw muscles, depend on a unique myosin structure and a high glycogen content (Rowlerson 1981).

Chronic stress involving Type I muscles (postural) leads them to shorten, whereas Type II

muscles (phasic) undergoing similar stress will weaken and may lengthen. Shortness and tightness of postural muscles does not imply strength.

Apparently committed muscle fibres can be transformed from slow-twitch to fast-twitch, and vice versa depending upon the patterns of use to which they are put (Lin et al 1994). For example, Lewit (1986) confirms that the scalenes can be classified as either postural or phasic. If these largely phasic (dedicated to movement) muscles have postural functions thrust upon them (as in an asthmatic condition or in chronic hyperventilation), their fibre type will alter and they will shorten, becoming postural muscles.

Postural muscles

Postural muscles that shorten in response to dysfunction include:

- trapezius (upper), sternocleidomastoid, levator scapulae and upper aspects of pectoralis major, in the upper trunk, and the flexors of the arms
- quadratus lumborum, erector spinae, oblique abdominals and iliopsoas, in the lower trunk
- tensor fascia lata (TFL), rectus femoris, biceps femoris, adductors (longus, brevis and magnus), piriformis, hamstrings, semitendinosus, in the pelvic and lower extremity region.

Phasic muscles

Phasic muscles that weaken in response to dysfunction (i.e. are inhibited) include:

- the paravertebral muscles (not erector spinae) and scaleni (which can become postural through stress), the extensors of the upper extremity, the abdominal aspects of pectoralis major, middle and inferior aspects of trapezius, the rhomboids, serratus anterior, rectus abdominus, the internal and external obliques, gluteals, the peroneal muscles and the extensors of the arms.

Indications of soft tissue adaptation

A fully functional muscle or joint will be pain free and have a normal firing sequence, range, motion and end-feel, while a dysfunctional one will not. Evidence of dysfunction is found by assessing for altered range, modified quality during motion and a changed 'end-feel'. Commonly, the firing sequence of dysfunctional muscles alters (as associated structures undertake its tasks), offering further evidence of dysfunction.

The checklist in Box 16.2 can be used to follow (and record results of) the simple sequence of postural muscle assessment, some of which are described in detail below.

Box 16.2

Postural muscle assessment sequence

NAME .....

01. Gastrocnemius E L R
02. Soleus E L R
03. Medial hamstrings E L R
04. Short adductors E L R
05. Rectus femoris E L R
06. Psoas E L R
07. Hamstrings:
    a. upper fibres E L R
    b. lower fibres E L R
08. Tensor fascia lata E L R
09. Piriformis E L R
10. Quadratus lumborum E L R
11. Pectoralis major E L R
12. Latissimus dorsi E L R
13. Upper trapezius E L R
14. Scalenes E L R
15. Sternocleidomastoid E L R
16. Levator scapulae E L R
17. Infraspinatus E L R
18. Subscapularis E L R
19. Supraspinatus E L R
20. Flexors of the arm E L R
21. Spinal flattening:
    a. seated legs straight LL LDJ LT MT UT
    b. seated legs flexed LL LDJ LT MT UT
    c. cervical spine extensors short? Yes/No

KEY: E = Equal (circle if both are short)
L or R should be circled if left, or right, is short
Spinal abbreviations indicate areas of flatness and therefore reduced ability to flex – short erector spinae involving: LL = low lumbar; LDJ = lumbo-dorsal junction; LT = low-thoracic; MT = mid-thoracic; UT = upper thoracic.

Palpatory assessment (Baldry 1993, Beal 1983, DiGiovanna 1991, Seffinger & Hruby 2007, Travell & Simons 1986, 1993)

By assessing for changes in the skin elasticity, and ability to glide on underlying structures, the tissues below it can be evaluated (Lewit 1992). After localizing any changes in this way, deeper periaxial structures can be assessed by means of the application of greater pressure, although in cases involving fibromyalgia, pressure should always be minimal.

There are a number of specific changes to be sought in light palpatory examination; this applies to both acute and chronic dysfunction:

1. Skin changes (Lewit 1992)

- Over an area of acute or chronic dysfunction, skin feels tense, and moves or glides over the underlying structures less freely than normal, i.e. there is increased adherence between the skin and the underlying fascia (Fig. 16.4).
- The skin overlying reflexively active areas such as trigger points produces a sensation of 'drag' as it is lightly stroked, due to increased hydrosis associated with increased sympathetic activity (Fig. 16.5).

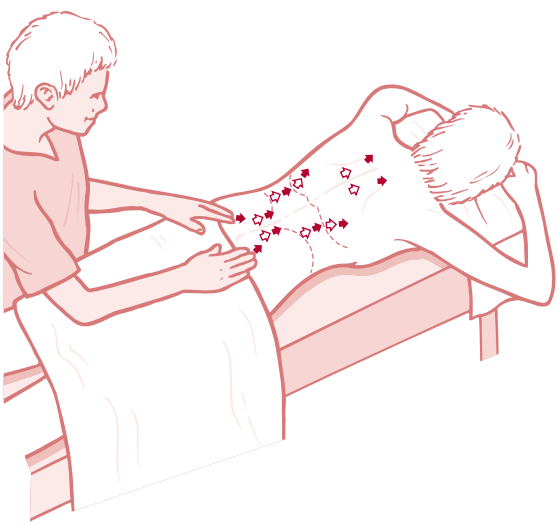


Figure 16.4 • Testing tissue mobility by bilaterally 'pushing' skin with the fingertips. (Reproduced with permission from Chaitow & Fritz 2006a.)

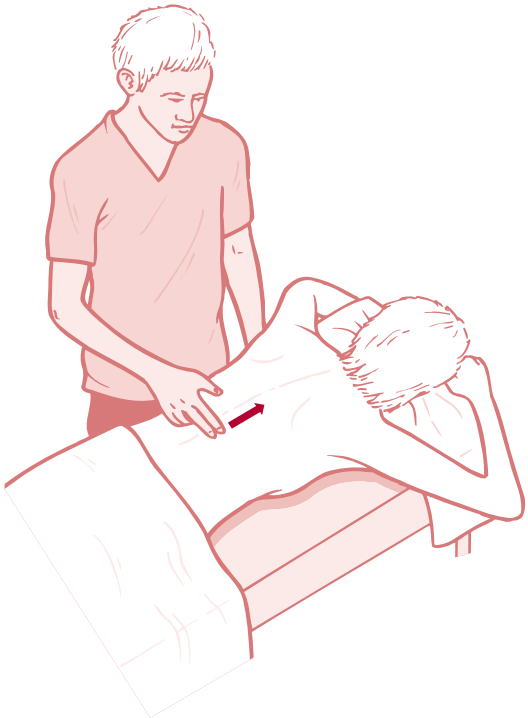


Figure 16.5 • Assessing variations in skin friction (drag, resistance). (Reproduced with permission from Chaitow & Fritz 2006a.)

- The skin loses a degree of its elastic quality, so that on light stretching it is less elastic than neighbouring skin (Fig. 16.6).

Research has demonstrated a clear difference in skin temperature and skin blood flow, when different tender points were measured in 20 patients with fibromyalgia (FMS) and 20 healthy controls (Jeschonneck et al 2000). Blood flow was measured by laser Doppler flowmetry and skin temperature was measured with an infrared thermometer. The conclusion of the researchers was that vasoconstriction occurs in the skin above tender points in FMS patients.

2. Induration

When chronic dysfunction exists, the superficial musculature demonstrates a tension and immobility, within and below these structures. An increase in diagnostic pressure will ascertain whether or not the superficial musculature has an increased indurated feeling (Fig. 16.7).

These changes are further discussed in the text dealing with the application of basic spinal and abdominal NMT in its assessment mode, later in this chapter.

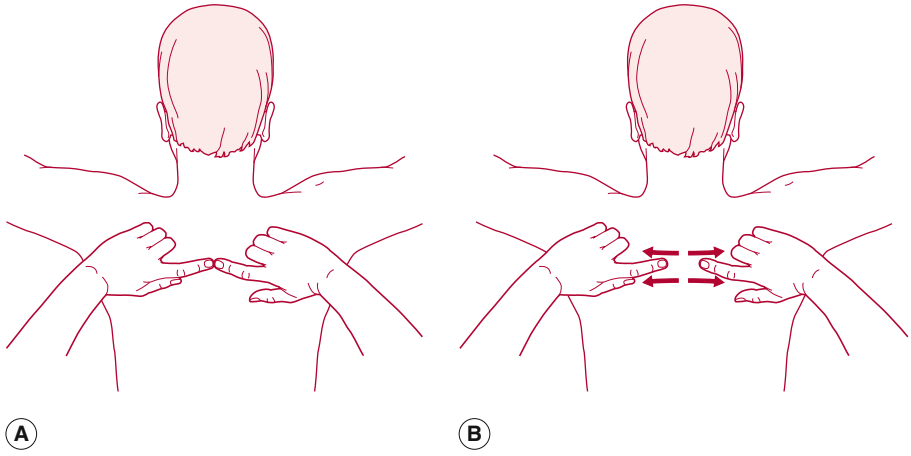


Figure 16.6 • Fingers touch each other directly over skin to be tested – very light skin contact assesses degree of skin elasticity – compared with neighbouring skin area. (Reproduced with permission from Chaitow & Fritz 2006b.)

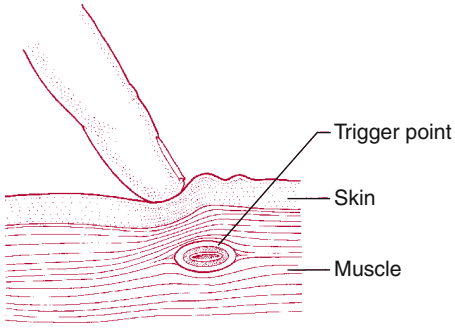


Figure 16.7 • Trigger points are areas of local facilitation which can be housed in any soft tissue structure, most usually muscle and/or fascia. Palpation from the skin or at depth may be required to localize these.

3. Temperature changes

In acute dysfunction a localized increase in temperature may be evident.

A 'scan' of the tissues being investigated, keeping the hand approximately 1 inch (2.5 cm) from the skin surface, is used by some practitioners (manual thermal diagnosis) as a means of establishing areas which apparently differ from each other in temperature. Using sophisticated equipment, French osteopath Jean-Pierre Barrell (1996) established that areas that scan (non-touching) as 'hot/warm' are only truly warmer/hotter than surrounding areas 75% of the time. It seems that scanning for hot and cold areas results in the perception of greater heat being noted whenever a *marked difference* occurs in one area compared to a neighbouring one.

This means that scanning over a 'normal' then a cold area will often (usually) result in a perception that greater heat is being sensed. This does not nullify the usefulness of such approaches in attempting to identify dysfunctional tissues without being invasive, but does mean that what seems hot may actually be cold (ischaemic?). Where there is chronic soft tissue dysfunction there may be, because of relative ischaemia, a reduced temperature of the tissues.

4. Tenderness

Tenderness of palpated tissues requires investigation:

- Is the tissue inflamed?
- Is the local area reflexively active (are there active trigger points present)?
- What is the nature and cause of the sensitivity?
- Is it worse when passively or actively moved?

5. Oedema

An impression of swelling, fullness and congestion may be noted in the overlying tissues in acute dysfunction. In chronic dysfunction this is usually absent, possibly having been replaced by fibrotic changes.

Questions that need to be asked via palpation include:

- What am I feeling?
- What significance does it have in relation to the patient's condition/symptoms?

- How does this relate to any other areas of dysfunction I have identified?
- Is this a local problem, or part of a larger pattern of dysfunction?
- What does what I am feeling mean?

Deeper palpation

In deep palpation the pressure needs to increase sufficiently to make contact with deeper structures such as the periaxial (paravertebral) musculature, without provoking a defensive response.

Among the changes that might be noted may be immobility, tenderness, oedema, deep muscle tension, fibrotic and interosseous changes. Apart from fibrotic changes, which are indicative of chronic dysfunctions, all these changes can be found in either acute or chronic problems. All trigger points, tender points, connective tissue zones, etc. are characterized by hyperalgesia, increased sensitivity, in the overlying tissues, allowing for easy identification by means of changes (discussed above) in skin elasticity and adherence (Lewit 1992).

Palpation exercise (suggested time 20 minutes)

Select a local area and identify local soft tissue distress, especially trigger points, utilizing the following approaches, charting what is found:

1. Scan: Using the palm or back of the hand, approximately 1 inch (2.5 cm) from the surface, scan steadily across the tissues, starting 'off' the body, to establish a 'norm'. Move steadily – too slow and the chance for discrimination is lost, and too fast precludes anything meaningful being assessed. Remember that cold may suggest ischaemia; hot/warm may indicate irritation/inflammation.

2. Evaluate skin adherence to underlying fascia using light but firm 'pushing'. Place fingerpads of each hand, bilaterally alongside the spine, 1–2 inches (2.5–5 cm) away from it, applying light pressure, to move the skin on the fascia superiorly, to its elastic barrier (see Fig. 16.4). Sequentially test the entire thoracic area in this way. Asymmetry is being evaluated. Any skin-on-fascia glide that appears resistant, compared with the opposite side, or in which both glides seem restricted, suggests the underlying tissues deserve further investigation. Do such areas correspond with information gained from the scanning exercise?

3. Evaluate for reflexively active areas (trigger points for example) by means of light, single digit palpation, seeking the phenomenon of 'drag'. By simply touch of skin-on-skin, moving gently along a line to be evaluated, try to sense either slight degrees of hesitation, 'roughness', 'drag', suggesting increased levels of hydrosis in the tissues directly below the sensation (see Fig. 16.5).

4. Next assess variations in local skin elasticity (Lewit's 'skin stretch') by placing two digits (both index fingers usually) so that they touch and, by separating the fingers, take the skin to the elastic barrier (see Fig. 16.6). Repeat this in a steady sequential series (approximately one stretch every 2 seconds), so that one stretch is compared with the previous one. Any area where the stretch is reduced, compared to the previous stretch, is likely to be directly over an active trigger point. Lewit (1992) reports that loss of elastic quality indicates a hyperalgesic zone and probable deeper dysfunction (e.g. trigger point) or pathology.

Do findings from these different palpation methods support each other? They should.

Non-invasive therapeutic possibilities emerging from this exercise

A number of important therapeutic possibilities of particular value in FMS emerge from this assessment exercise:

1. In areas where the skin seems less elastic than that previously assessed, experiment by holding the skin at its elastic barrier (unforced) for 10–15 seconds. The skin should slowly release, stretch and lengthen. This is a miniature example of myofascial release, and can be effectively used on very sensitive areas/patients to begin the process of deactivating myofascial trigger points. Having established that holding skin at its barrier (unforced), changes its length/elasticity, test this on larger areas (e.g. paraspinal muscle mass).

2. Place two or three finger pads onto the skin surface, over an area where the skin did not seem to glide freely on underlying fascia. Test for the preferred directions of glide of the skin on the fascia. Take it superiorly and then inferiorly (Fig. 16.8). In which direction was glide 'easier'? Which was the direction of tissue preference? Ease

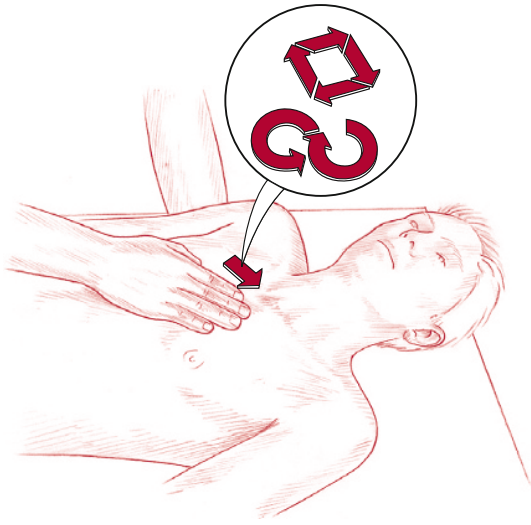


Figure 16.8 • Release of traumatized fascial structures. In this figure, the practitioner's left hand lies between the patient's scapulae while the right hand lies on the sternum. The hands independently assess the 'tissue preference patterns' (Dickey 1989). These positions of ease are held in order to allow distorted fascial patterns to modify or normalize.

the skin towards that direction, and then test a different plane of movement – say lateral and medial. Having established which way the skin travels more easily between these two directions, hold it there. You will now have 'stacked' one position of ease onto another. Now, while holding the tissues in their combined ease position, test a third possibility. Does the tissue 'rotate' clockwise or anticlockwise more easily? Whichever it is, take it in that direction and hold for not less than 20 seconds. Release the held tissues and go back to the start and re-evaluate.

Has anything changed? Almost certainly one or more of the directions that were previously restricted will now test as being more normal, with a more symmetrical facility of gliding available of skin on fascia. You will have positionally released the tissues, to an extent. A repeat of the whole exercise would give additional freedom of movement to these superficial tissues, with an influence on underlying structures as well. The mechanisms involved will be explained when we examine positional release phenomena later in this chapter. This is a superbly gentle approach to tissue normalization and is ideal for FMS.

3. If, instead of seeking the combined position of ease, as in the previous example, you take the tissues to their 'combined position of bind' (restriction), you will identify a barrier that can usually be released, either by simply leaning against it (just as in the examples of holding skin at its elastic barrier, or the 'C' and 'S' bends described above) or by introducing an isometric contraction for 5–7 seconds, following which the barrier will almost always retreat, and the tissues will be more symmetrically relaxed.

Try this by identifying the tight directions as you glide the skin on fascia first in one plane, then while holding the tissues towards the restricted direction, then another plane, and finally a third plane. In this way you will move in precisely the opposite directions to those you would choose if you were performing the previous exercise (3) above. Having found this 'bound' or 'restricted' barrier, ask the patient with a minimum of force to contract the tissues you are holding for 5–7 seconds. On releasing, retest and compare the release you have achieved using muscle energy technique (MET) in this way with that you achieved using directions of ease.

4. Introduce a 'C' or 'S' bend – ease a muscle (or part of it) into a 'bent' position and hold the tissue at its elastic barrier without force for 15–20 seconds and note how it gradually lengthens without additional force (Figure 16.9).

Whether you take tissues to a barrier and wait, or take them away from a barrier into an ease position and wait, or take them to the restriction barrier and use isometric activity to induce a release, you will achieve a reduction in hypertonicity, enhancement of local circulation, and some degree of neural resetting of resting muscle length. These possibilities will be referred to later in the treatment protocol segment of this chapter (Fryer 2000, Greenman 2003).

Patterns of dysfunction: 'crossed syndromes'

When a chain reaction evolves in which some muscles shorten and others weaken, predictable patterns involving imbalances develop. Czech researcher Vladimir Janda MD (1982) describes the so-called 'upper' and 'lower crossed' syndromes as follows:

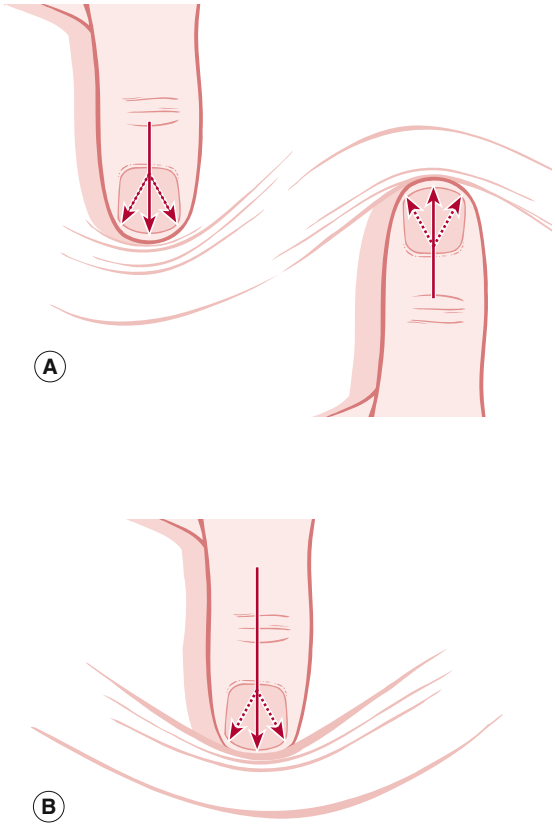


Figure 16.9 A,B • C and S bends – 'mini-myofascial release' – as in treatment of scar tissue or for local tissue stretching/ (Reproduced with permission from Chaitow & Fritz 2006b.)

Upper crossed syndrome (Fig. 16.10)

This involves the following basic imbalance:

Pectoralis major and minor
Upper trapezius
Levator scapulae
Sternomastoid
} all tighten and shorten

while

Lower and middle trapezius
Serratus anterior and rhomboids
} all weaken

As these changes take place they alter the relative positions of the head, neck and shoulders as follows:

- The occiput and C1/2 will hyperextend, with the head being pushed forward.
- The lower cervical to fourth thoracic vertebrae will be posturally stressed as a result.
- Rotation and abduction of the scapulae occur.

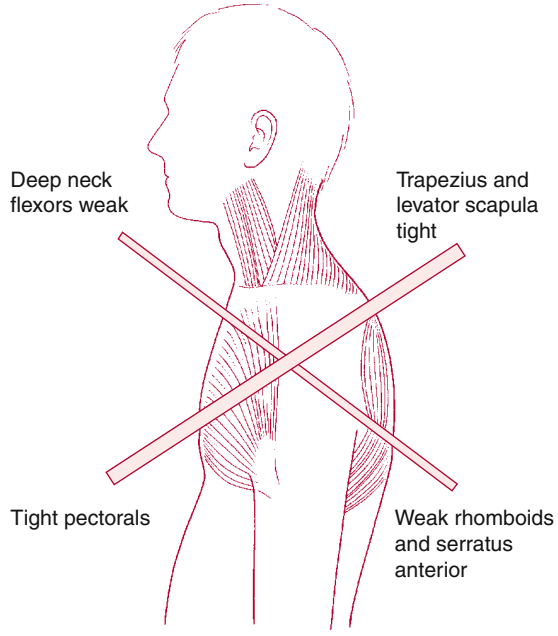


Figure 16.10 • The upper crossed syndrome, as described by Janda (1982).

- An altered direction of the axis of the glenoid fossa will develop, resulting in the humerus needing to be stabilized by additional levator scapula and upper trapezius activity, with additional activity from supraspinatus as well.

The result of these changes is greater cervical segment strain, plus referred pain to the chest, shoulders and arms. A decline in respiratory efficiency may result.

The solution is to be able to identify the shortened structures and to release (stretch and relax) them, followed by re-education towards more appropriate function (Janda 1982, Liebenson 1996, 2006).

Lower crossed syndrome (Fig. 16.2)

This involves the following basic imbalance:

Hip flexors
Iliopsoas, rectus femoris
TFL, short adductors
Erector spinae group of the trunk
} all tighten and shorten

while

Abdominal and gluteal muscles all weaken

The result of this chain reaction is to tilt the pelvis forward, flexing the hip joints and producing

lumbar lordosis and stress in L5–S1 with pain and irritation.

A further stress commonly appears in the sagittal plane in which:

Quadratus lumborum tightens

while

Gluteus maximus and medius weaken

When this 'lateral corset' becomes unstable, the pelvis is held in increased elevation, accentuated when walking, resulting in L5–S1 stress in the sagittal plane. One result is low back pain. The combined stresses described produce instability at the lumbodorsal junction, an unstable transition point at best.

The piriformis muscles may also be involved. In 20% of individuals these are penetrated by the sciatic nerve, so that piriformis syndrome can involve direct sciatic pressure and pain, as well as sacroiliac dysfunction and pain in the hip. Arterial involvement of piriformis shortness results in ischaemia of the lower extremity.

Solutions for these all too common patterns require identification and normalization of the shortened structures, using variations on the theme of muscle energy techniques (MET), followed by re-education of posture and use (Fryer 2000, Greenman 2003, Liebenson 1996, 2006).

Hypertonicity: implications

What does hypertonicity – all too common in FMS – actually represent? Janda notes that the word 'spasm' is commonly used without attention to various functional causes of hypertonicity, and he has divided this phenomenon into five variants (Janda 1989a):

1. Hypertonicity of limbic system origin which may involve psychological stress, and be associated with, for example, tension-type headaches.

2. With hypertonicity of a segmental origin, involving interneuron influence, the affected muscle is likely to be spontaneously painful (particularly on stretch) and will have weak (inhibited) antagonists.

3. With hypertonicity due to uncoordinated muscle contraction involving myofascial trigger point activity, the muscle will be painful spontaneously. There may be increased tone in only part of the muscle.

4. When there is hypertonicity resulting from direct pain irritation, such as might occur in torticollis, the muscle will be painful at rest, not only when palpated. This can be described as reflex spasm due to nociceptive (pain receptor) influence.

5. Overuse hypertonicity results in muscles becoming increasingly irritable, with reduced range of motion, tightness and pain only on palpation.

Thus, increased tone of functional origin may be the result of pain itself, involving trigger point activity, or may derive from higher centres, or CNS influences, or from overuse.

Liebenson (1990) suggests that each type of hypertonicity requires different therapeutic approaches, ranging from adjustment (joint manipulation), through use of soft tissue and rehabilitation and facilitation approaches. The many different MET variations described below offer the opportunity to influence all stages of dysfunction – the acute, the chronic and everything in between.

Inappropriate breathing as a cause of soft tissue distress

Garland (1994) has described the somatic changes which follow from a pattern of upper chest breathing (which at its extreme becomes hyperventilation); these were summarized in Chapter 3.

As we consider soft tissue dysfunction in this chapter, in particular its relationship with overuse and misuse, the outline given by Garland should be borne in mind (see also Fig. 3.6). The direct influence on the upper fixator muscles of the shoulders (accessory breathing muscles), and their influence on the cervical and cranial structures, are of particular relevance to people with FMS.

Garland points to counselling (for associated anxiety or depression for example) and breathing retraining being far more likely to be successfully initiated if the structural component(s) are dealt with in such a way as to minimize the effects of the somatic changes described.

Assessment and treatment of soft tissue dysfunction

Functional assessment

The following simple observation and palpation tests allow for a rapid gathering of information with

a minimum of effort for the patient. They are based on the work of Dr Vladimir Janda (1983) and interpretations of these by Liebenson (1996, 2006).

Prone hip extension test

The patient lies prone and the practitioner palpates the lower erector spinae on both sides with one hand and gluteus maximus and the hamstrings with the other (see Fig. 16.11). The patient is asked to extend the leg at the hip.

The normal activation sequence is gluteus maximus and hamstrings, followed by erector spinae (contralateral then ipsilateral). If the hamstrings and/or the erectors fire first, they are working inappropriately, and will demonstrate shortness (see discussion of postural and phasic muscles earlier in this chapter).

Trunk flexion test: for psoas shortness

The patient lies supine without a pillow, arms folded across the chest. The patient is asked to slowly raise the head, the shoulders and the shoulder blades from the table (see Fig. 16.12).

Normal: Ability to raise trunk until scapulae are off table without feet lifting off the table or low back arching.

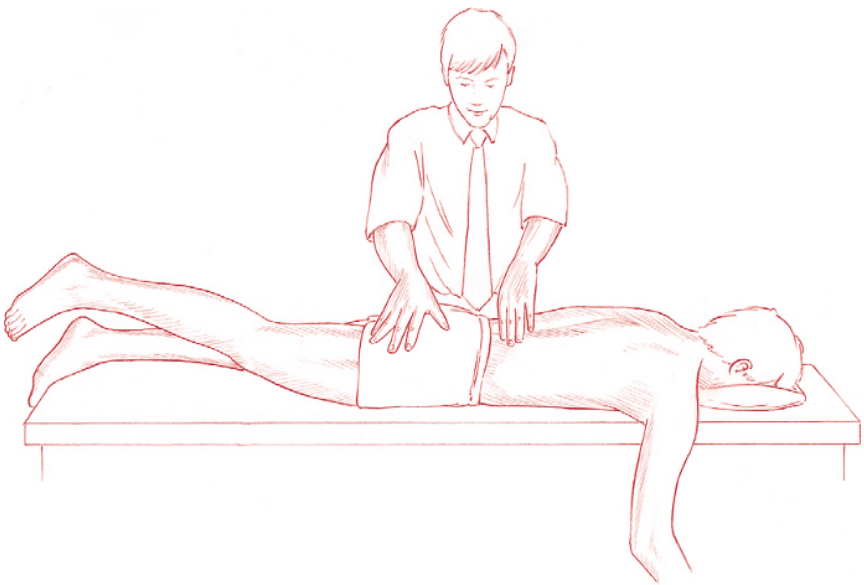
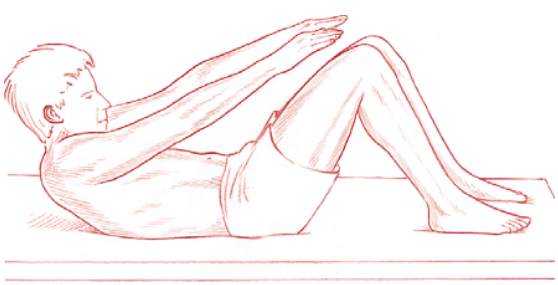
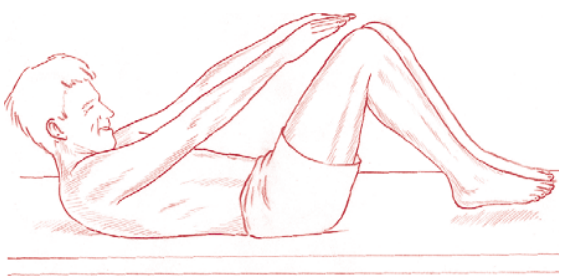


Figure 16.11 • Hip extension test. The normal activation sequence is gluteus maximus and hamstrings, followed by erector spinae (contralateral then ipsilateral).



A

Figure 16.12 A • Trunk flexion test. Normal – ability to raise trunk until scapulae are off table without feet lifting off or low back arching.



B

Figure 16.12 B • Trunk flexion test. Abnormal – when feet rise up or low back arches before scapulae are raised from the table.

Abnormal: If the feet rise, or low back arches, before the scapulae leave the table, psoas overactivity and weak abdominals are indicated (lower crossed syndrome, see above).

Hip abduction test

The patient should be sidelying, with lower leg flexed and the upper leg in line with trunk (see Fig. 16.13). The patient is asked to abduct the leg slowly as the practitioner observes.

Normal: Hip abduction to 45°.

Abnormal: If hip flexion occurs TFL shortness is indicated; if the leg externally rotates piriformis shortening is indicated; if 'hiking' of the hip occurs at the outset of the movement quadratus lumborum is overactive and probably shortened.

For direct palpation rather than observation, a fingerpad is placed on the lateral margin of quadratus lumborum. If quadratus fires strongly and first (before gluteus medius), this indicates overactivity and probable shortness of quadratus lumborum (observed as a 'hip-hike').

Scapulohumeral rhythm test

This helps identify the status of the upper fixators of the shoulder. The patient is seated with the arm at the side, elbow flexed (see Fig. 16.14).

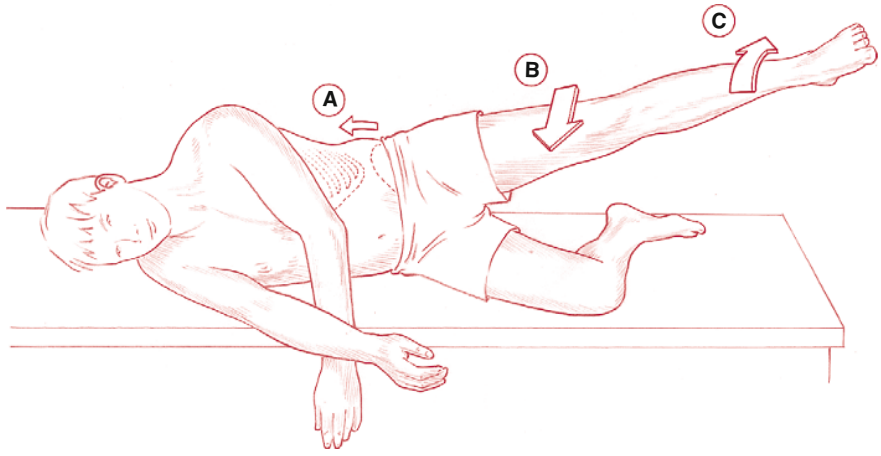


Figure 16.13 • Normal – hip abduction to 45° **(B)**. Abnormal – if hip flexion, external rotation or 'hip-hiking' **(A)** occurs, or pelvic rotation takes place during hip abduction. (Reproduced with permission from Chaitow & DeLany 2008.)

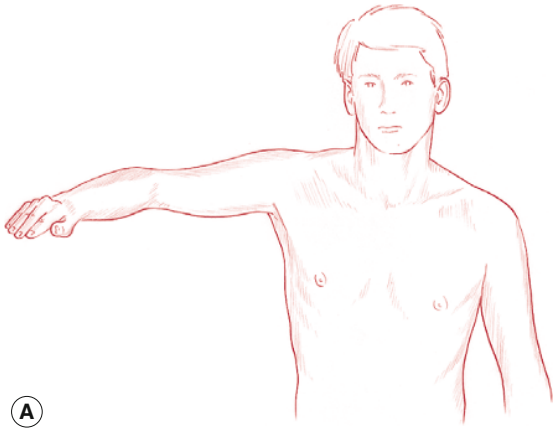


Figure 16.14 A • Scapulohumeral rhythm test. Normal – elevation of shoulder after 60° of arm abduction.

Figure 16.14 B • Scapulohumeral rhythm test. Abnormal – if elevation of the shoulder or winging of the scapulae occurs within the first 60° of shoulder abduction.

The practitioner observes as the patient is asked to abduct the elbow towards the horizontal.

Normal: Elevation of the shoulder after 60° of abduction.

Abnormal: If obvious 'bunching' occurs between shoulder and neck, or winging of the scapulae occurs before 60° of abduction, this suggests levator scapulae and upper trapezius overactivity/shortness, and lower and middle trapezius and serratus anterior weakness – characteristics of the upper crossed syndrome (see above), commonly associated with respiratory dysfunction.

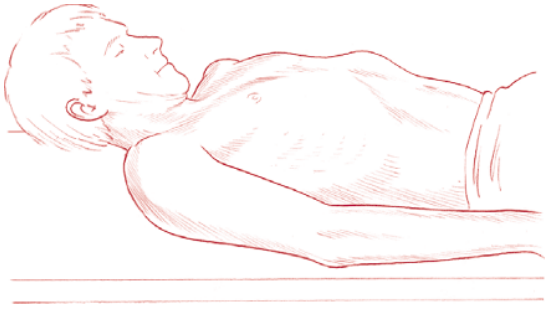
Neck flexion test: Chin-Poke Assessment

The patient lies supine without a pillow. Practitioner kneels to one side at the level of the patient's chin as the patient is asked to 'lift your head and put your chin on your chest'.

Normal: Ability to comply with the request without chin-poking, and to hold chin tucked while flexing the head/neck for 10–15 seconds (see Fig. 16.15).

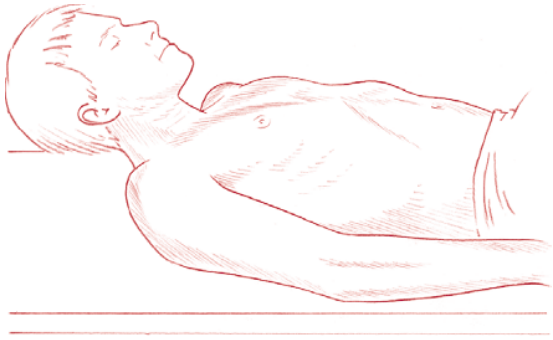
Abnormal: If the chin pokes during neck flexion, or while maintaining this position for 10–15 seconds. The indication is of sternocleidomastoid and scalene tightness, with weakness of the deep neck flexors (see Fig. 16.9).

There are many methods for gathering information by palpation and introduction of specific testing movements and activities. The skin palpation methods listed above and the functional assessments developed by Janda, however, offer very easily applied, non-invasive and non-stressful methods suitable for use in conditions such as FMS. Neuromuscular technique, in its assessment mode (below), offers another choice.



A

Figure 16.15 A • Neck flexion test. Normal – ability to hold chin tucked while flexing the head/neck.



B

Figure 16.15 B • Neck flexion text. Abnormal – if the chin pokes forwards while attempting head flexion.

Neuromuscular technique (Chaitow 1996)

In Europe, neuromuscular technique (NMT) refers to a method of assessment and treatment developed in the 1930s by Stanley Lief DC DO, and its evolution since that time. In the USA, the method known as neuromuscular therapy (also NMT) refers to the method first promoted in the 1950s by Raymond Nimmo DC in treating myofascial dysfunction (trigger points) (Nimmo 1969). In recent years the European and American versions of NMT have acquired elements of each others methodologies.

NMT aims to produce modifications in dysfunctional tissue, encouraging a restoration of normality, with a primary focus of deactivating focal points of reflexogenic activity such as myofascial trigger points. An alternative focus of NMT application is towards normalizing imbalances in hypertonic and/or fibrotic tissues, either as an end in itself or as a precursor to rehabilitation. The technique utilizes physiological responses involving neurological mechanoreceptors, golgi tendon organs, muscle spindles and other proprioceptors, in order to achieve the desired responses.

Insofar as they integrate with NMT, other means of influencing such neural reporting stations, including positional release (SCS – strain/counterstrain, see below) and muscle energy methods (MET, see below) form a natural set of allied approaches. Traditional massage methods which encourage a reduction in the retention of metabolic wastes and which enhance circulation to dysfunctional tissues are also included in this category of allied approaches.

NMT can usefully be integrated in treatment aimed at postural reintegration, tension release, pain relief, improvement of joint mobility, reflex stimulation/modulation or sedation. NMT can be applied generally or locally and in a variety of positions (sitting, lying, etc.). The methods described are in essence those of Stanley Lief and Boris Chaitow (personal communication 1983).

In the description of NMT below only selected regions of particular importance in FMS will be used as examples.

NMT thumb technique

For balance and control the hand should be spread, tips of fingers providing a fulcrum or 'bridge' in which the palm is arched in order to allow free passage of the thumb towards one of the fingertips as the thumb moves in a direction that takes it away from the practitioner's body. During a single stroke, which covers between 2 and 3 inches (5–8 cm), the fingertips act as a point of balance, while the chief force is imparted to the thumb tip via controlled application of body weight through the long axis of the extended arm (Fig. 16.16).

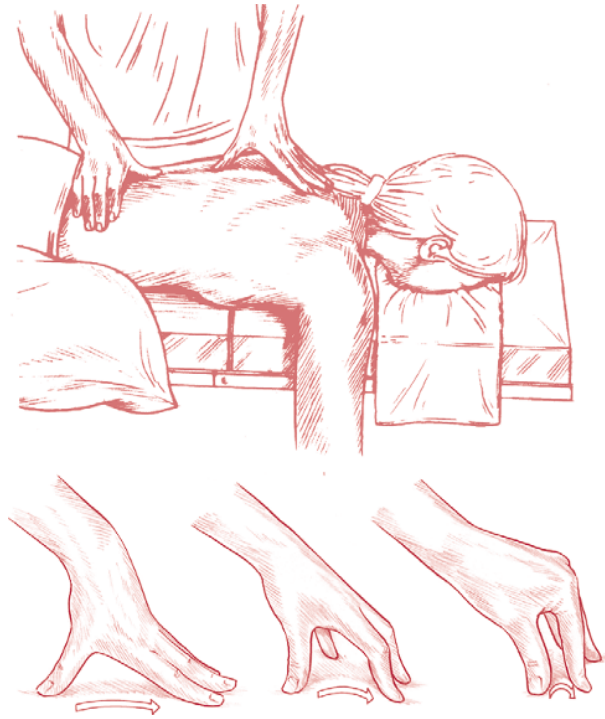


Figure 16.16 • NMT thumb sequence.

The thumb never leads the hand but always trails behind the stable fingers (the tips of which rest just beyond the end of the stroke) and, applying variable pressure, moves through its pathway of tissue. The thumb and hand seldom impart their own muscular force except in dealing with small localized contractures or fibrotic nodules.

In order that pressure/force be transmitted directly to its target, the weight being imparted should travel in as straight a line as possible, i.e. the arm should not be flexed at the elbow or the wrist by more than a few degrees. The positioning of the practitioner's body facilitates economy of effort and comfort (Fig. 16.17).

The degree of pressure imparted depends on the nature of the tissue resistance being met. The usual degree of pressure is sufficient to 'meet the tissue' precisely, taking out available slack, without any invasive degree of force. When being treated, the patient should not feel strong pain but a general degree of discomfort is usually acceptable. A stroke or glide of 2–3 inches (5–8 cm) will usually take 4–5 seconds.

If reflex pressure techniques or ischaemic compression are being employed, a longer stay on a point will be needed, but in normal diagnostic and therapeutic use the thumb continues to move as it probes, decongests and generally treats the tissues. The firmer and more tense the tissues, the lighter the pressure, since the degree of 'slack' will be minimal. Conversely, the more relaxed and 'soft' the tissues, the greater the penetration possible as slack is taken out.

In subsequent or synchronous (with assessment) treatment of whatever is uncovered during the evaluation stage of NMT application, greater degrees of pressure may be used, depending upon the objective – i.e. to inhibit, to produce localized stretching, to decongest and so on.

Attention should always be paid to the relative sensitivity of different areas and different patients. The thumb should become an intelligent extension of the practitioner's diagnostic sensitivities so that the contact feels to the patient as though it is sequentially assessing all accessible soft tissues.

Hypermobile thumbs

For practitioners with hypermobile joints a knuckle or even the elbow may be used to achieve deep pressure in very tense musculature. Alternatively,

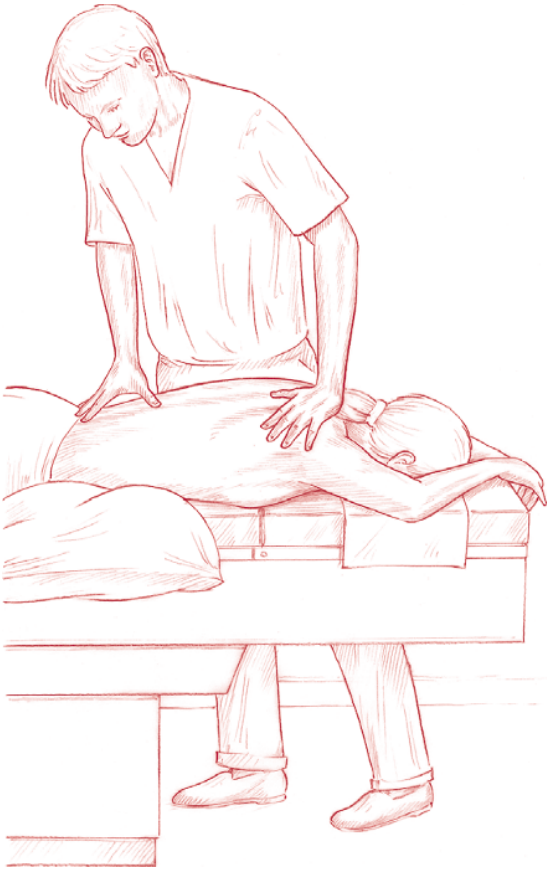


Figure 16.17 • NMT – operator's posture should ensure a straight treating arm for ease of transmission of body weight, as well as leg positions that allow for the easy transfer of weight and the centre of gravity. These postures assist in reducing energy expenditure and ease spinal stress.

the finger stroke as described below can take over from a hypermobile thumb.

NMT finger technique

In certain localities the thumb's width prevents the degree of tissue penetration suitable for successful assessment and/or treatment and the middle or index finger can usually be suitably employed in such regions. The most usual area for use of finger rather than thumb contact is in the intercostal musculature and in attempting to penetrate beneath the scapula borders in tense fibrotic conditions.

The middle or index finger should be slightly flexed and, depending upon the direction of the stroke and density of the tissues, supported by one

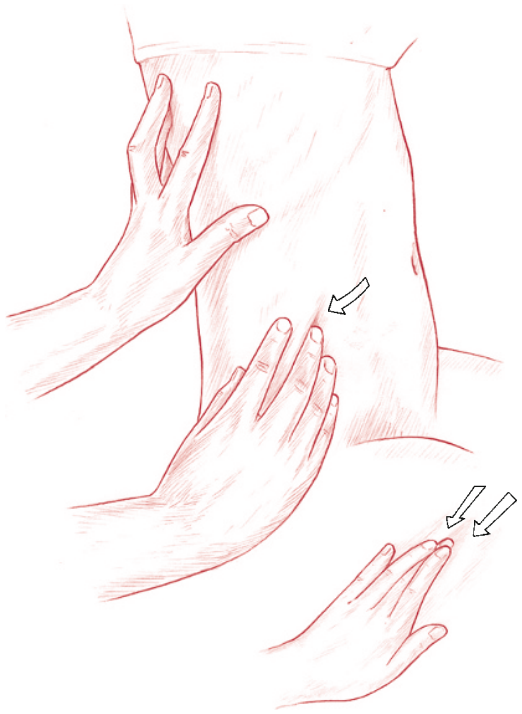


Figure 16.18 • NMT finger technique.

of its adjacent members (Fig. 16.18). The ideal angle of pressure to the skin surface is between 40° and 50° (see Fig. 16.7).

The fingertip should never lead the stroke but should always follow the wrist, the palmar surface of which should lead as the hand is drawn towards the practitioner. Unlike the thumb technique, in which force is largely directed away from the practitioner's body, in finger treatment the motive force is usually towards the practitioner. The arm position therefore alters and a degree of flexion is necessary to ensure that the pull or drag of the finger across the lightly lubricated tissues is smooth. The treating finger should always be supported by one of its neighbours.

Application of NMT

Contact may commence with superficial stroking in the direction of lymphatic flow, or direct pressure along the line of axis of stress fibres, or deeper alternating 'make and break' stretching and pressure, or traction on fascial tissue.

As variable pressure is being applied, the practitioner needs to be constantly aware of diagnostic

information being received, and this is what determines the variations in pressure and the direction of force being applied. Changes in direction, or degree, of pressure should take place gently and smoothly, to avoid irritation of the tissues.

Lief's basic spinal treatment followed the same pattern at each, offering a framework and a useful starting and ending point. However, since the degree of emphasis applied to the areas of dysfunction was based on the information the palpating hands picked up, each treatment was unique.

Lief's basic assessment/treatment

Lief's basic NMT treatment starts with the patient prone, forehead ideally resting in a split headpiece or face-hole. The whole spine from occiput to sacrum, including the gluteal area, would be lightly oiled or creamed. In many instances a full assessment would be given without treatment interrupting the flow of the sequence, from neck to mid-thigh, yielding a great deal of information.

The treating hand would be offered assistance by the other hand gently rocking, or stretching, tissues to distract tissues that are 'mounding'. When changing from one side to the other side of the table, one hand always maintains light contact. It is suggested that once treatment has commenced no breaks in contact be allowed.

What the treating thumb feels

The movement of the thumb through the tissue should be slow, deliberately seeking and feeling for 'contractions' and 'congestions'. Variable pressure can relatively painlessly carry the thumb tip across or through restricted tissue, decongesting, stretching and easing these.

Practitioner's posture

Optimal transmission of weight is best achieved with a relatively straight arm. This demands that the practitioner ensures table height is suitable. With weight evenly spread between the separated feet, by slightly altering weight distribution, the practitioner can exert an accurate, controlled, degree of pressure with minimum arm or hand effort.

The hand should be in a relatively relaxed state, moulding itself to the contours of the tissues. The thumb's glide is stabilized so that the stroke is delivered by the tip of the extended thumb being brought slowly across the palm towards the fingertips. The fingers maintain their stabilizing position as the thumb performs its diagnostic/therapeutic glide.

During NMT treatment special notice should be given to the origins and insertions of the muscles of the area. Wherever these bony landmarks are palpable by the thumb tip they should be treated by the slow, variably applied pressure technique.

NMT application to cervical region using Lief's method

The area to be treated should be lightly oiled or creamed. The practitioner stands half-facing the head of the couch, on the left of the patient with the hips level with the mid-thoracic area.

The first stroke involves a gliding, light-pressured movement of the medial tip of the right thumb, from the mastoid process along the nuchal line to the external occipital protuberance. This is then repeated with deeper pressure. The practitioner's left hand rests on the upper thoracic or shoulder area as a stabilizing contact.

After the first two strokes of the right thumb – one shallow and diagnostic, the second, deeper, imparting therapeutic effort – the next stroke is half a thumb-width caudal to the first. A degree of overlap occurs as these strokes, starting on the belly of the sternocleidomastoid, glide across and through the trapezius, splenius capitus and posterior cervical muscles (see Fig. 16.19). A progressive series of strokes is applied in this way until the level of the cervicodorsal junction is reached. If underlying fibrotic tissue appears unyielding, additional slow, deep glides may be necessary. For appropriate attention to trigger points found during the assessment, see below.

A series of strokes are then applied by the left thumb, upward from the left of the upper dorsal area towards the base of the skull. The fingers of the left hand rest (and act as a fulcrum) on the front of the shoulder area. The treating thumb tip is angled to glide cephalad, applying direct pressure against the left lateral aspects of the upper dorsal and the lower cervical spinous processes. Subsequent strokes are applied in the same direction placed slightly more laterally.

Finger contact is the made on the head at about the temporo-occipital articulation. The left thumb

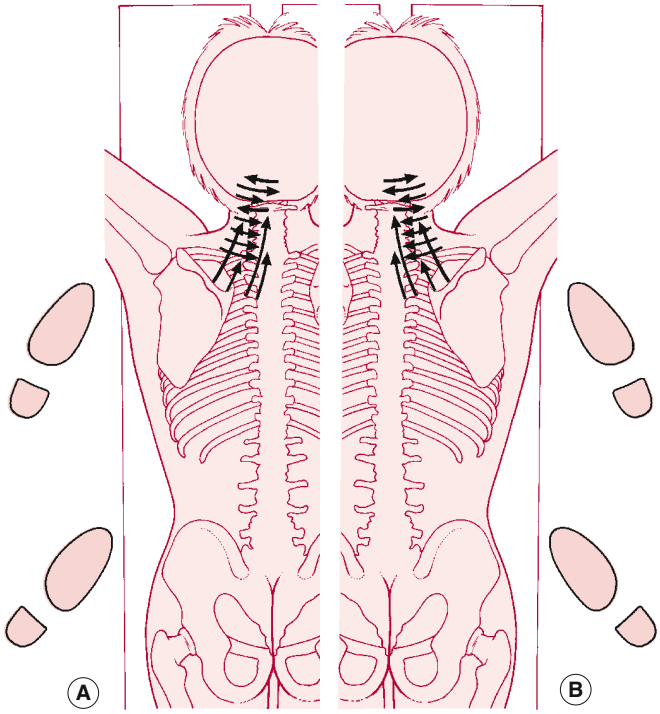


Figure 16.19 A,B • First two positions of suggested sequence of applications of NMT, to ensure optimal thumb and/or finger contact with primary trigger point sites and with the origins and insertions of most muscles. Note foot positions.

then treats the mid and upper cervical soft tissues, finishing with lateral strokes across the insertions on the occiput. The same procedures are repeated on the right.

In this way, working from the first two positions, common trigger point sites will have been evaluated and/or treated.

The next position

The practitioner moves to the head of the table (third position). Resting the tips of the fingers on the lower, lateral aspect of the neck, the thumb tips are placed just lateral to the first dorsal–spinal process.

Downward (towards the floor) pressure is applied via the thumbs which are drawn cephalad along the lateral margins of the cervical spinous processes, attempting to contact the bony contours of the spine, all the way to the occiput, where a bilateral stretch is introduced laterally, across the fibres of the muscles inserting into the base of the skull (see Fig. 16.20).

A series of moderate pressure thumb strokes are made laterally, culminating at the occipito-parietal junction. Several strokes are then performed, running caudad directly over the spinous process from the base of the skull towards the upper dorsal area. The thumbs are then placed on the lateral aspects of the first dorsal vertebra, and a series of strokes are performed caudad and laterally, as well as diagonally towards the scapula. A series of bilateral strokes, from T1 to about T5, are applied laterally towards the scapula and across the upper trapezius fibres and the rhomboids.

By stepping slightly to one side it is possible to apply a series of sensitively searching contacts into the area of the thoracic outlet on each side. Strokes start in this triangular depression, move towards the trapezius fibres and onwards towards the upper margins of the scapula. Strokes are applied directly over the spinous processes, caudad, towards the mid-thoracic area. Trigger points sometimes lie on the attachments to the spinous processes or between them.

NMT assessment and treatment can, and should, be usefully applied to the entire spine. In this chapter only these first basic positions are described.

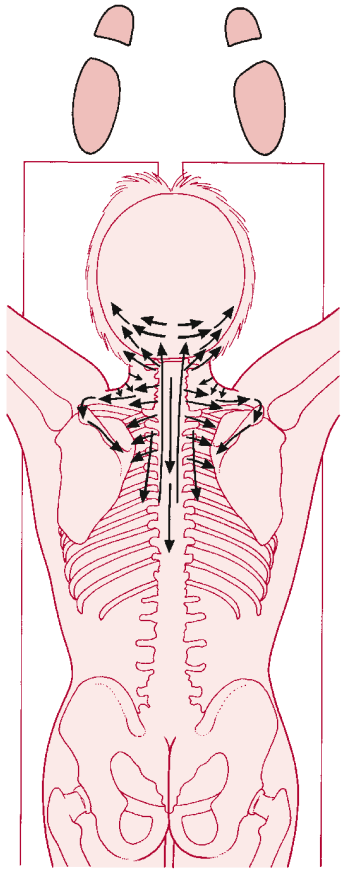


Figure 16.20 • Third position of suggested sequence of application of NMT.

Lief's spinal and general neuromuscular techniques are fully described and illustrated in the following texts:

- Chaitow L 2003 Modern neuromuscular techniques, 2nd edn. Churchill Livingstone, Edinburgh
- Chaitow L, DeLany J 2008 Clinical application of neuromuscular techniques, 2nd edn. Churchill Livingstone, Edinburgh.

Muscle energy techniques

Muscle energy techniques (MET) are amongst the easiest to apply, the most successful and widely researched, manual modalities (Chaitow 2006, DiGiovanna 1991, Greenman 1989, Janda 1989b, Lewit 1986, Liebenson 1990, 1996, 2006, Mitchell 1967, Travell & Simons 1992).

> *Every patient with symptoms involving the locomotor system, particularly symptoms of pain and/or constrained movement, should be examined to assess joint and muscle function. If examination shows joint play to be normal, but reveals shortened muscles or muscle spasm, then treatment by stretching [and by implication MET] is indicated. (Evjenth & Hamberg 1984)*

Summary of variations

There are many variations on the use of MET; however, two will be detailed here as being most appropriate for use in FMS – isometric contraction of affected muscles (or of their antagonists) and pulsed MET.

How does MET work?

The effects of MET are now known to involve the following mechanisms and changes, not all of which are fully understood. MET has been shown to have the ability to:

- relax muscular spasm and/or contractions
- prepare soft tissues for subsequent stretch
- mobilize restricted joints
- reduce pain levels.

The means whereby these benefits are achieved have previously focused on mechanisms described as 'post-isometric relaxation' and 'reciprocal inhibition' (DiGiovanna 1991, Greenman 1989, Janda 1989b, Liebenson 1990). It has now been conclusively demonstrated that these mechanisms do not explain MET effects (Fryer 2000, Magnusson et al 1996).

- By lightly contracting a short, tight muscle (described as the agonist) isometrically, for approximately 5–7 seconds, an effect occurs (see below for possible explanations) that allows the muscle to be stretched more comfortably than would have been the case without the contraction.
- By lightly contracting the antagonists to tight/short muscles, an almost identical effect is noted, allowing virtually painless stretch of the tight muscle(s).

- A process known as 'increased tolerance to stretch' (ITS) is produced following isometric contractions (as used in MET) of the muscle(s) needing lengthening, or their antagonists.
- Increased tolerance to stretch is considered to result from an as yet unidentified neurological sequence that reduces the sensitivity of the patient (Ballantyne et al 2003, Rowlands et al 2003).
- It is also understood that MET produces an increase in release of endogenous (self-produced) analgesic substances, such as endorphins and endocannabinoids. This may account for the increased tolerance to stretch following MET (McPartland et al 2005).

MET: key points, common errors and contraindications

Greenman (1996) summarizes several of the important elements of MET as follows. MET involves a patient-active muscle contraction:

1. from a controlled position
2. in a specific direction
3. met by the therapist, who applies distinct counterforce
4. involving a controlled intensity of contraction.

Patient errors during MET usage

Errors are commonly based on inadequate instruction from the therapist.

1. Contraction is too strong (*remedy*: give specific guidelines, e.g. 'use only 20% of strength', or whatever is more appropriate).
2. Contraction is in the wrong direction (*remedy*: give simple but accurate instructions).
3. Contraction is not sustained for long enough (*remedy*: instruct the patient to hold the contraction until told to ease off, and give an idea ahead of time as to how long this will be).
4. The patient does not relax completely after the contraction (*remedy*: have them release and relax, and then inhale and exhale once or twice, with the suggestion 'now relax completely').

Therapist errors in application of MET (Greenman 2003)

1. Inaccurate control of position of joint or muscle in relation to the resistance barrier (*remedy*: have a clear image of what is required and apply it).
2. Inadequate counterforce to the contraction (*remedy*: meet and match the force).
3. Counterforce is applied in an inappropriate direction (*remedy*: ensure precise direction needed for best results).
4. Moving to a new resting length too hastily after the contraction (*remedy*: take your time to have the patient relax completely before moving the muscle to a new resting length).
5. Inadequate patient instruction is given (*remedy*: get the instructions right so that the patient can cooperate).
6. The therapist fails to maintain the stretch position for a period of time that allows soft tissues to begin to lengthen – approximately 5 seconds.

Contraindications and side-effects of MET

1. If pathology is suspected, no MET should be used until an accurate diagnosis has been established.
2. Pathology (osteoporosis, arthritis, etc.) does not rule out the use of MET, but its presence needs to be established so that dosage of application can be modified accordingly (amount of effort used, number of repetitions, stretching introduced or not, etc.).
3. There are no other contraindications except for the injunction to cause no pain, which in FMS may mean that no active or passive stretching is applied – so that MET is used mostly to release hypertonicity.

Pulsed MET

There is another MET variation, which is powerful and useful: pulsed MET (Ruddy 1962). This simple method has been found to be very useful since it effectively accomplishes a number of changes at

the same time, involving the local nerve supply, improved circulation and oxygenation of tissues, reduction of contraction, etc.

This method depends for its effectiveness on the 'pulsed' efforts of the person producing them being very light indeed, with no 'wobble' or 'bounce', just the barest activation of the muscles involved.

An example of self-applied pulsed MET

- Sit at a table, rest your elbows on it, and tilt your head forwards as far as it will go comfortably and rest your hands against your forehead.
- Use a pulsing rhythm of pressure of your head pushing against your firm hand contact, involving about two pulsations per second (against your hands) for 10 seconds.
- After 20 pulsations, re-test the range of forward bending of your neck. It should go much further, more easily than before.
- This method will have relaxed the muscles of the region, especially those involved in flexion, and will have produced 20 small reciprocal inhibition 'messages' to the muscles on the back of your neck which were preventing easy flexion.
- Pulsed MET may be used for restricted muscles or joints in any part of the body.
- The simple rule is to have the patient engage the restriction barrier, while you provide a point of resistance (with your hands) as the patient pulses toward the barrier rhythmically. No pain should be felt.
- After 20 contractions in 10 seconds the barrier should have retreated and the process can be repeated from the new barrier.
- The pulsing method should always be against a fixed resistance, just as in other MET methods.

Note: MET methods for key muscles that have been identified as short are given below.

Shortness of upper trapezius

If the scapulohumeral rhythm test, as described earlier in this chapter (see Fig. 16.14), is positive, upper trapezius requires treatment to release hypertonicity.

Lewit (1992) has observed: 'The upper trapezius should be treated if tender and taut.' Since this is an almost universal state in modern life, it seems that everyone requires MET application to this muscle. He also notes that a characteristic mounding of the muscle can often be observed when it is very short, producing the effect of 'Gothic shoulders', similar to the architectural supports of a Gothic church tower.

MET treatment of shortened upper trapezius

The patient lies supine, head/neck sidebent, away from the side to be treated, just short of the restriction barrier, with the practitioner stabilizing the shoulder with one hand and cupping the ear/mastoid area of the same side of the head with the other (Fig. 16.21).

In order to bring into play all the various fibres of the muscle, the muscle needs to be treated with the neck in three different positions of rotation, coupled with the sidebending as described, obviously with an isometric contraction in each of the positions:

- With the neck sidebent and fully rotated, the posterior fibres of upper trapezius are involved in any contraction.
- With the neck fully sidebent and half rotated, the middle fibres are treated.
- With the neck fully sidebent, and slightly rotated back to the side from which it is sidebent, the anterior fibres are treated.

The patient introduces a firmly resisted effort to gently take the stabilized shoulder towards the ear, and the ear towards the shoulder. This effort towards movement introduces a contraction of the muscle from each end. The degree of effort should be mild and no pain should be felt.

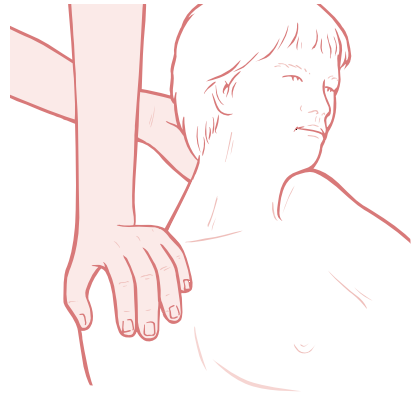


Figure 16.21 • MET treatment of right side upper trapezius muscle, middle fibres (the head is in half-turned position) in this example – see text for explanation regarding head positions. (Reproduced with permission from Chaitow & Fritz 2006b.)

After the 5–7 seconds of contraction, and complete relaxation of effort, the practitioner gently eases the head/neck into an increased degree of sidebending, before stretching the shoulder away from the ear while stabilizing the head. No stretch is introduced from the head end of the muscle as this could stress the neck unduly.

Lewit (1992) suggests the use of eye movements to facilitate initiation of postisometric relaxation before stretching as an ideal method for acute problems in this region. This is recommended for those with FMS. The supine patient's shoulder and sidebent neck are stabilized at the restriction barrier. The patient is then asked to look (eyes only) towards the side, away from which the neck is bent. This eye movement is maintained, as is a held breath, while the practitioner resists the slight isometric contraction that these two factors will have created. On exhalation – and complete relaxation – the head/neck is taken to a new barrier and the process repeated.

Assessment and MET treatment for levator scapulae

Levator scapula, because of its influence on the cervical spine (attaching to transverse processes of C1 to C4), can disrupt the mechanics of the area. The stretch suggested below influences many of the smaller posterior neck muscles which attach to the cranium.

The assessment position described below is used for treatment. Assessment is via the scapulohumeral rhythm test (see Fig. 16.14), which, if positive, implicates levator scapula as being overactive and therefore probably short.

- The patient lies supine with the arm of the side to be tested stretched out, with the hand and lower arm tucked under the buttocks, palm upwards, to help restrain movement of the shoulder/scapula (Fig. 16.22).
- The practitioner's arm is passed across and beneath the neck to stabilize the shoulder of the side to be treated, with the forearm supporting the neck; the practitioner's other hand supports the head.
- The neck is moved into full flexion, and turned fully towards sidebending and rotation, away from the side to be treated.
- An isometric contraction is introduced (patient is asked to gently 'shrug shoulder' and to take the head and neck 'back to the table', against sustained resistance, for 5–7 seconds). Following this, the muscle is taken to its new resting length by means of a slight increase in the flexion, sidebending and rotation of the head/neck.
- Actual stretching is avoided during acute phases, allowing MET to release hypertonicity and restore more normal range of motion

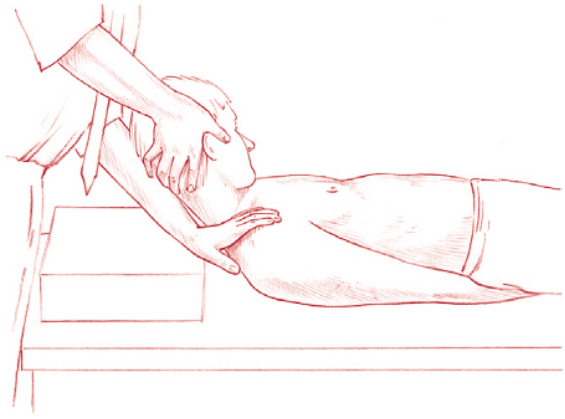


Figure 16.22 • MET test and treatment for levator scapula (right side).

Assessment and MET treatment of shortness in scalenes

There is no easy test for shortness of the scalenes, apart from observation, palpation and assessment for trigger point activity/tautness, and a functional observation as follows:

- The scalenes are accessory breathing muscles. Therefore anyone who uses the upper chest inappropriately during breathing will stress these muscles. These muscles seem to be excessively tense in many people with chronic fatigue symptoms.
- The observation assessment consists of the practitioner placing relaxed hands over the shoulders, so that fingertips rest on the clavicles. The seated patient is asked to inhale moderately. If the practitioner's hands noticeably rise during inhalation then there exists inappropriate use of scalenes, indicating that they are stressed, and by definition they will be hypertonic.
- The patient should be asked to place one hand on the abdomen, just above the umbilicus, and the other flat against the upper chest (see Fig. 16.23). On inhalation the hands are observed, and if the

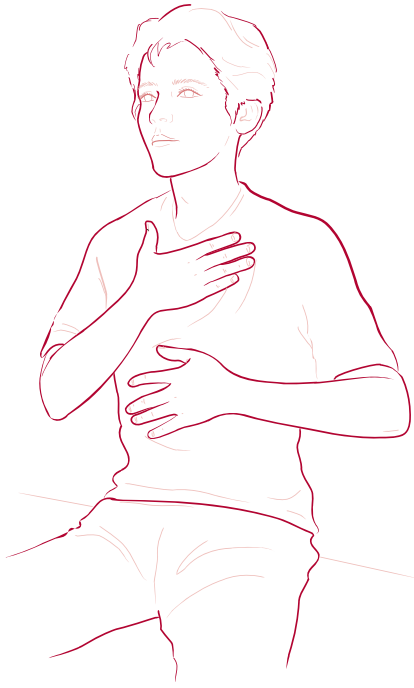


Figure 16.23 • The 'Hi–Lo' test to assess locus of first (and most) movement of inhalation. (Reproduced with permission from Chaitow & DeLany 2000.)

upper one initiates the breathing process, and rises significantly towards the chin, rather than moving anteriorly, a pattern of upper chest breathing can be assumed, indicating hypertonicity if the scalenes and other accessory breathing muscles, notably sternomastoid.

Treatment of short scalenes by MET

- Patient lies supine with a cushion of folded towel under the upper thoracic area so that, unless supported by the practitioner's hand, the head would fall into extension. The head is rotated away from the side to be treated.
- As with upper trapezius, there are three positions of rotation required: a full rotation producing involvement of the more posterior fibres of the scalenes on the side from which the turn is being made (Fig. 16.24A); a half turn involves the middle fibres (Fig. 16.24B); and a position of only slight turn involves the more anterior fibres (Fig. 16.24C).
- The practitioner's free hand is placed on the side of the patient's face/forehead to restrain the isometric contraction which will be used to initiate the release of the scalenes. The patient's head is in one of the degrees of rotation mentioned above, supported by the practitioner's contralateral hand.

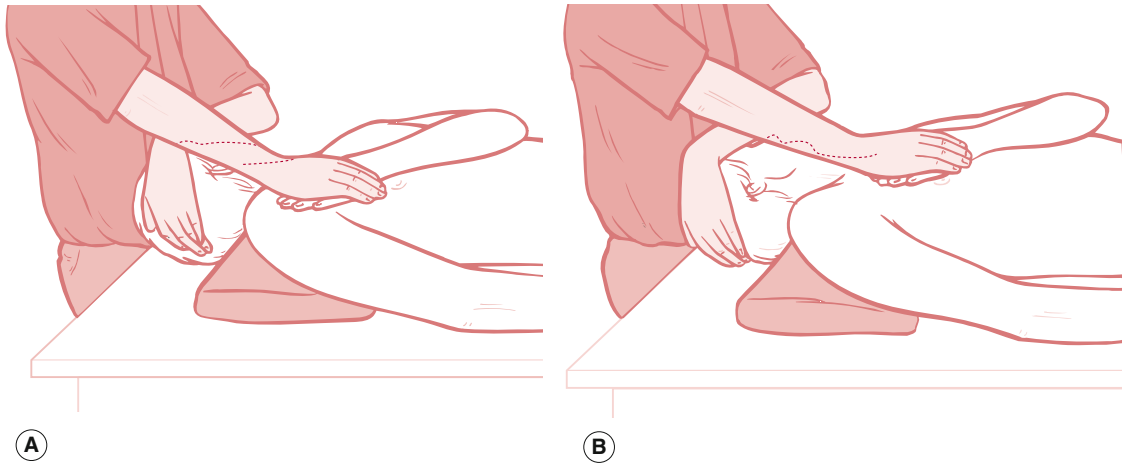
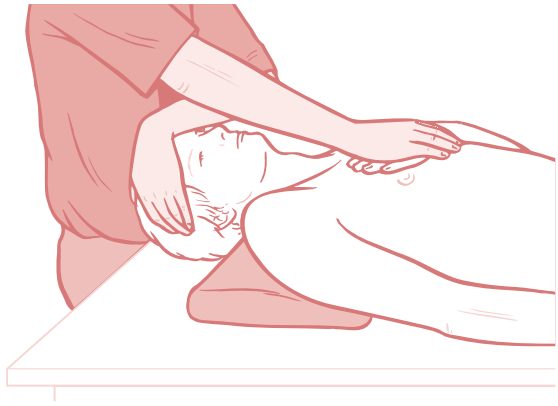


Figure 16.24 • **A** MET for scalenus posticus. On stretching, following the isometric contraction, the neck is allowed to move into slight extension while a mild stretch is introduced by the contact hand which rests on the second rib, below the lateral aspect of the clavicle. **B** MET treatment for the middle fibres of scalenes. The hand placement (thenar or hypothenar eminence of relaxed hand) is on the second rib below the centre of the clavicle.

(continued)



C

Figure 16.24—Cont'd. **C** MET treatment of the anterior fibres of the scalenes; hand placement is on the sternum. (Reproduced with permission from Chaitow 2006.)

- The patient is instructed to attempt to lift the head a fraction, and to attempt to turn the head towards the affected side, resisted by the practitioner's hand, for 5–7 seconds. Both the effort and the counter-pressure should be modest and painless at all times.
- After the contraction, the head/neck is placed into extension, and one hand remains on it to prevent movement during the scalene stretch. This hand should ideally be placed so that it restrains ('fixes') that part of the neck where scalenes attach.
- For the posterior scalene stretch, the patient's contralateral hand is placed (palm down) with the thenar eminence just inferior to the lateral end of the clavicle, on the affected side. The practitioner's hand which was acting to produce resistance to the isometric contraction is now placed onto the dorsum of the patient's 'cushion' hand.
- As the patient slowly exhales, the practitioner's contact hand, resting on the patient's hand on the upper thorax, pushes obliquely away and towards the foot, on that same side, following the rib movement into its exhalation position, so stretching the attached musculature and fascia. This stretch is held for approximately 5 seconds before repeating the process at least once more.
- The head is then rotated 45° contralaterally and the 'cushion' hand (thenar eminence) contact, which will apply the stretch of the middle scalenes, is placed just inferior to the middle aspect of the clavicle.
- When the head is in the side flexed and virtually upright facing position, for treatment of the anterior scalenes, the 'cushion' hand contact lies on the upper sternum itself. In all other ways the methodology is as described for the first position above.

Note: Eye movement can assist scalene treatment (a process known as visual synkinesis). The patient should look (eyes only) downwards (towards the feet) and towards the affected side during the isometric contraction in order to increase the degree of contraction in the muscles (Lewit 1992).

Assessment for shortness of sternocleidomastoid (SCM)

There is no absolute test for shortness of SCM, but observation of posture (hyperextended neck, chin poked forward), and palpation, can all alert to its probable shortness.

- This too is an accessory breathing muscle and, like the scalenes, will be shortened by inappropriate breathing patterns which have become habitual.
- Since SCM is usually not observable when normal, if the clavicular insertion is easily visible, or any part of the muscle is prominent, this can be taken as a clear sign of hypertonicity of the muscle.
- If the patient's posture involves the head being held forward of the body, often accompanied by cervical lordosis and dorsal kyphosis, weakness of the deep neck flexors and tightness of SCM can be assumed (upper crossed syndrome; see notes earlier in this chapter).
- A functional test for shortness is observable by asking the supine patient to very slowly 'raise your head and touch your chin to your chest', as described in the functional evaluation methods earlier in this chapter (see Fig. 16.15).

Treatment of shortened sternocleidomastoid using MET

- Patient lies supine with a cushion of folded towel under the upper thoracic area so that, unless supported by the practitioner's hand, the head would fall into extension. The head is rotated away from the side to be treated, as in treatment of posterior scalenes, described above.
- The instruction to the patient is to attempt to lift the head from the table, against resistance offered

by the patient, for 5–7 seconds. After this the head/neck is allowed to return to a resting position on the table.

- One hand is placed onto the dorsum of the patient's 'cushion' hand resting on the sternum, applying oblique pressure/stretch to the sternum to take it away from the head towards the feet, on exhalation. This is held for 5–7 seconds. The hand not involved in stretching the sternum away from the head restrains the tendency the head will have to follow this stretch.
- The degree of extension of the neck should be slight, 10–15° at most.

Suboccipital muscle release using MET

General (MET enhanced) stretches for the suboccipital muscles, including splenius capitis, semispinalis capitis, rectus capitis posterior major and minor, obliquus capitis inferior and superior.

Treatment

- The neck of the supine patient is flexed to its easy barrier of resistance or just short of this and the patient is asked to extend the neck (take it back to the table) using minimal effort, on an inhalation, against resistance. The practitioner's hands are placed, arms crossed, so that one hand rests on each upper anterior shoulder area, while the patient's head rests on the crossed forearms.
- After the 5–7 second contraction, the neck is flexed further to the new barrier of resistance, for 5–7 seconds.
- Repetitions of the stretch should be performed until no further gain is possible, or until the chin easily touches the chest on flexion. No force should be used, or pain produced, during this procedure.

Ruddy's 'pulsed MET' variation

Ruddy's (1962) MET variation calls for a series of muscle contractions, against resistance, at a rate a little faster than the pulse rate. This approach can be applied in all areas where more sustained isometric contractions are suitable. Pulsed MET is also particularly useful in acute conditions where a sustained contraction may be painful or difficult to perform – as in FMS.

Pulsed MET involves the dysfunctional tissue/joint being held at its resistance barrier, at which time the patient, against the resistance offered by the practitioner, introduces a series of rapid (two per second), very small efforts towards (or sometimes away from) the barrier. The barest initiation of effort is called for with, to use Ruddy's term, 'no wobble and no bounce'.

The use of this 'conditioning' approach involves contractions that are short, rapid and rhythmic, that condition the proprioceptive system by rapid movement. This is ideal for the FMS patient where deconditioning is common.

If reducing joint restriction, or if elongation of a soft tissue is the objective, then, following each series of 20 minicontractions, the slack should be removed, the new barrier engaged and a further series of contractions should be commenced from this new barrier, possibly in a different direction. The pulsing efforts should never exceed the barest beginning of an isometric contraction.

The effects are likely, Ruddy suggests, to include:

- improved oxygenation
- enhanced venous and lymphatic circulation through the area being treated.

Ruddy's method offers a useful means of modifying the use of sustained isometric contractions in MET, and has particular relevance to acute, and painful, problems. These methods can be easily taught to patients for self-application.

Example of instructions to patient for self-applied pulsed MET

- Sit at a table, rest your elbows on it, and tilt your head forwards as far as it will comfortably go, and rest your hands against your forehead (see Fig. 16.25).
- Use a pulsing rhythm of pressure of your head, pushing against your firm hand contact, involving about two pulsations per second (against your hands) for 10 seconds. After 20 pulsations, re-test the range of forward bending of your neck. It should go much further, more easily than before.
- Using your hands to resist movement, choose another direction – say side-bending – and pulse your head against your hand 20 times in 10 seconds in that direction. Test to see if your range has increased.
- Pulsed MET may be used to comprehensively release restrictions of the head/neck, in all directions – and can also be used for relief of restricted muscles or joints in other parts of the body.

Figure 16.25 • The head and neck are flexed to their end of range as the hands offer resistance while the head is 'pulsed' 20–30 times in the direction of restriction, against the firmly fixed hands. These pulsing contractions release the tight muscles at the back of the neck, allowing further flexion afterwards. (Reproduced with permission from Chaitow 2004b.)

- The simple rule is to engage the restriction barrier, while you provide a point of resistance (with your hands), and then pulse toward the barrier rhythmically – no pain should be felt.
- After 20 contractions in 10 seconds, the barrier should have retreated, and the process can be repeated from the new barrier.
- The pulsing method should always be against firm resistance.

Positional release variations (strain/counterstrain and functional)

The positional release technique (PRT) is itself made up of a number of different methods, but the ones that are most suitable for use in a fibromyalgia context are functional technique and strain/counterstrain (SCS). In order to understand these, some explanation is needed (Chaitow 2003, D'Ambrogio & Roth 1997, Deig 2001).

Strain/counterstrain

Jones (1981) described the evolution of strain/counterstrain as depending upon identification of 'tender' points found in the soft tissues associated with joints that have been stretched, strained or traumatized. These tender points are usually located in soft tissues shortened at the time of the strain or trauma (i.e. in the antagonists to those that were stretched during the process of injury or strain) – for example, in spinal problems following on from a forward-bending strain, in which back pain is complained of, the appropriate 'tender' point will be found on the anterior surface of the body.

Tender points are exquisitely sensitive on palpation, but are usually painless otherwise. Once identified, such points are used as monitors (explained below) as the area, or the whole body, is repositioned ('fine tuned') until the palpated pain disappears, or reduces substantially.

Tissue tension almost always eases at the same time as the easing of pain in the palpated point, making it possible to 'palpate' the person, or part, into an ease position. If the 'position of ease' is held for between 30 and 90 seconds, there is usually an easing of hypertonicity and pain.

Strain/counterstrain exercise

- Identify a painful local area ('tender point') that is either:
  - **a.** in soft tissues that would be active in performing the precisely opposite movement to one that is restricted or uncomfortable.
  - **b.** any localized, unusually tender area.
- Apply sufficient pressure to that point to cause mild discomfort, and then slowly position the tissues (joint, muscle) in such a way as to remove tenderness from the point. (Creating 'ease' in the tissues housing the point usually involves producing some degree of increased slack in the palpated tissues.)
- Hold this position for 30–90 seconds, and then slowly return to a neutral position and re-palpate.
- The tenderness should have reduced or vanished, and functionality (movement previously restricted) should be improved.

Main features of PRT

- All movements should be passive (therapist controls the movement, patient does nothing), and movements are painless, slow and deliberate.

- Existing pain reduces, and no additional or new pain is created.
- Movement is usually away from restriction barriers.
- Muscle origins and insertions are brought together, rather than being stretched.
- Movement is away from any direction, or position, that causes pain or discomfort.
- Tissues that are being palpated, relax.
- Painful tissues being palpated (possibly trigger points) reduce in pain.

SCS rules of treatment

The following 'rules' are based on clinical experience and should be kept in mind, especially if the patient is fatigued, sensitive and/or distressed:

- Try not to treat more than five tender points at any one session.
- Warn patients that, just as in any other form of bodywork, there may be a 'reaction' (soreness, stiffness) following even this extremely light form of treatment.
- If there are multiple tender points, select those most proximal, and most medial, for primary attention, i.e. those closest to the head and the centre of the body.
- Of these, select those that are most painful for initial attention.
- If self-treatment is advised, inform the patient of these 'rules'.

Guidelines for SCS use

1. For treatment of tender points on the anterior surface of the body, flexion, side-bending and rotation will usually be *towards* the palpated point, followed by fine-tuning to reduce sensitivity by at least 70%.

2. For treatment of tender points on the posterior surface of the body, extension, side-bending and rotation will usually be *away from* the palpated point, followed by fine-tuning to reduce sensitivity by 70%.

3. The closer the tender point is to the midline, the less side-bending and rotation should be required, and the further from the midline, the more side-bending and rotation should be required, to achieve ease and comfort in the tender point (without any additional pain or discomfort being produced anywhere else).

The SCS process, step-by-step

1. To use the strain/counterstrain (SCS) approach a painful point is located (this can be a 'tender' point, or an actual trigger point).
2. Sufficient pressure is applied to the point to cause some pain (if it is a trigger point, ensure that just enough pressure is being applied to cause the referred symptoms).
3. The patient is told to give the pain being experienced a value of '10'. (*Note*: This is not a situation in which the patient is asked to ascribe a pain level out of 10, instead it is one in which the question asked is: 'Does the pressure hurt?' If the answer is 'Yes', then the patient is told: 'Give the level of pain you are now feeling a value of 10, and as I move the area around and ask for feedback, give me the new pain level – whatever it is.')
4. It is important to ask the patient to avoid comments such as 'The pain is increasing' or 'It's getting less', or any other verbal comment, other than a number out of 10. This helps to avoid undue delay in the process.
5. For this exercise, imagine that the tender, or trigger, point is in the gluteus medius. The patient would be prone, and the therapist would be applying sufficient pressure to the point in the gluteus medius to register pain which he/she would be told has a value of '10'.
6. The supported leg on the side of pain would be moved in one direction (say extension at the hip) as the patient is asked to give a value out of 10 for the pain.
7. If the pain reduces, an additional direction might be introduced (say adduction) and the question is repeated; if the pain increases, a different movement direction would be chosen.
8. By gradually working through all the movement possibilities, in various directions, and possibly adding compression and distraction, a position would be found where pain drops by at least 70% (i.e. the score reaches '3', or less).
9. Once this 'position of ease' has been found, after all the careful slow-motion fine-tuning, it is maintained for 30–90 seconds – and sometimes more – after which a slow return is

made to the starting position. Range of motion and the degree of previous pain should have changed for the better.

In different tissues, the possible directions of movement might include:

- flexion, extension
- rotation one way or the other
- side flexion one way or the other
- translation (shunting) anterior–posterior, as well as side to side compression or distraction

to eventually find the position of maximum ease.

What happens when tissues are at ease?

When tissues are at ease, pain receptors (nociceptors) reduce in sensitivity, whether this involves trigger points or not (Bailey & Dick 1992, Van Buskirk 1990).

In the comfort/ease position there is a marked improvement in blood flow and oxygenation through the tissues. Sensitized areas (spinal or trigger points) will be less active, less irritable and less painful.

Positional release is also used as part of the integrated neuromuscular inhibition (INIT) sequence, described later in this chapter, for trigger point deactivation.

Functional technique (Bowles 1981, Hoover 1969)

Osteopathic functional technique relies on a reduction in palpated tone in stressed (hypertonic/spasm) tissues as the body (or part) is being positioned or fine-tuned in relation to all available directions of movement in a given region. One hand palpates the affected tissues (avoiding invasive pressure). This 'listening' hand assesses changes in tone, as the practitioner's other hand guides the patient, or part, through a sequence of positions which enhance ease, and reduce 'bind'.

A sequence is carried out involving different directions of movement (e.g. flexion/extension, rotation right and left, sidebending right and left, etc.), with each movement starting at the point of maximum ease revealed by the previous evaluation, or combined point of ease of a number of previous evaluations. In this way one position of ease is 'stacked' on another until all movements have been assessed for ease (Fig. 16.26).

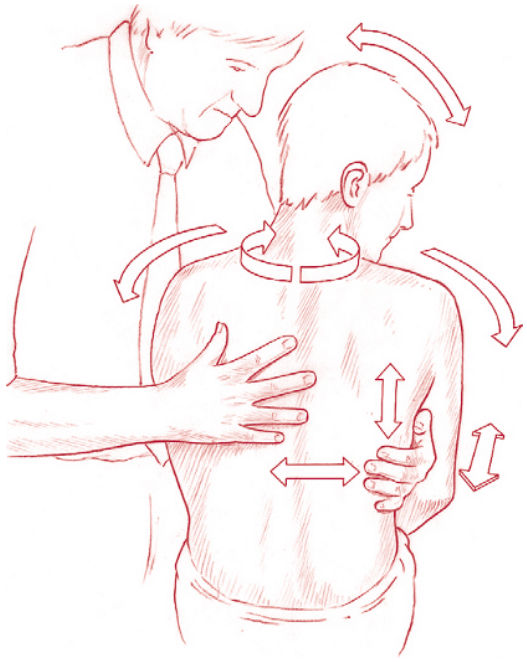


Figure 16.26 • Functional palpation (or treatment) of a spinal region/segment during which all possible directions of motion are assessed for their influence on the sense of 'ease and bind' in the palpated tissues. After the first (sequence is irrelevant) position of ease is identified each subsequent assessment commences from the position of ease (or combined positions of ease) identified by the previous assessment(s) in a process known as 'stacking'.

Example

Imagine someone with hypertonic muscles relating to low back pain. Following a sequence of flexion/extension, sidebending and rotating in each direction, translation right and left, translation anterior and posterior, and compression/distraction, involving all available directions of movement of the area, a position of maximum ease ('dynamic neutral') would be arrived at, in which (if the position were held for 30–90 seconds) a release of hypertonicity and reduction in pain should result.

The precise sequence in which the various directions of motion are evaluated is irrelevant, as long as all possibilities are included, and the most relaxed response of the tissues being palpated identifies the 'position of ease' for each direction being evaluated.

Example: Functional release atlanto-occipital region

- The practitioner sits slightly to the side of the head of the supine patient (facing the corner of the

table). The caudad hand (forearm fully supported by the table) cradles the upper neck so that the atlas is either lightly held between finger and thumb, or rests on the webbing between finger and thumb. The cephalad hand cradles the base of the head with fingers spreading over the crown facing anteriorly.

- The caudad hand is a 'listening', diagnostic contact, feeling for changes taking place in the soft tissues ('ease' and 'bind') with which it is in contact, as the other hand slowly moves the head on the atlas, in various directions.
- As the head is slowly flexed and then extended (slightly in each direction until a sense of tension or 'bind' is noted), variations in tissue response to the movement will be noted by the listening hand. When the most easy, 'softest', most relaxed, preferred position is noted, this is maintained (this is the 'first position of ease'), at which time a second range of motion is introduced – for example, sidebending right, and then left.
- When the second position of ease (the combined first and second position) has been identified, this is used as the starting point for a third range of motions to be assessed, possibly rotation right and left, or translation ('glide') right and left, or anterior/posterior glide.
- By moving from one assessment to another, always commencing the new testing directions from the combined position of previous 'ease' positions, the practitioner is in effect 'stacking' positions of ease on to each other.
- Eventually, when all options (all directions of motion) have been tested, a point of balanced dynamic neutral will be reached, where the local tissues are at their most relaxed (Bowles 1981). This position is held for around 90 seconds during which time increased circulation through the tissues, as well as neurological resetting (muscle spindle response), creates a sense of 'softening', a sense of warmth and increased relaxation of the tissues.
- Following this the neck/head is returned slowly to its starting position and the atlanto-occipital junction will usually display a greater freedom of movement and comfort.

The same principles can be applied to any tissues in the body. The approach will be recognized as essentially the same as that used when skin on fascia was 'slid' to its combined position of ease in the palpation exercise earlier in this chapter.

This is an ideal approach in treating FMS, especially if there is any history of trauma to the area or of head/neck tension, and pain is a feature (see whiplash, Ch. 3).

Induration technique

Morrison (1969) suggested very light palpation, using extremely light touch, as a means of feeling a 'drag' sensation alongside the spine (as lateral as the tips of the transverse processes). As discussed earlier in this chapter in relation to skin assessment, once drag is noted, pressure into the tissues normally evinces a report of pain.

- The practitioner stands on the side of the prone patient opposite the side in which pain has been identified in the paraspinal tissues.
- Once located, tender or painful points (lying no more lateral than the tip of the transverse process) are palpated for the level of their sensitivity to pressure.
- Once confirmed as painful, the point is held by firm thumb pressure while, with the soft thenar eminence of the other hand, the tip of the spinous process most adjacent to the pain point is very gently eased towards the pain, crowding and slackening the tissues, until pain reduces by at least 75% (Fig. 16.27).
- If it does not do so, the angle of pressure on the spinous process towards the painful spot should be varied so that, somewhere within an arc embracing

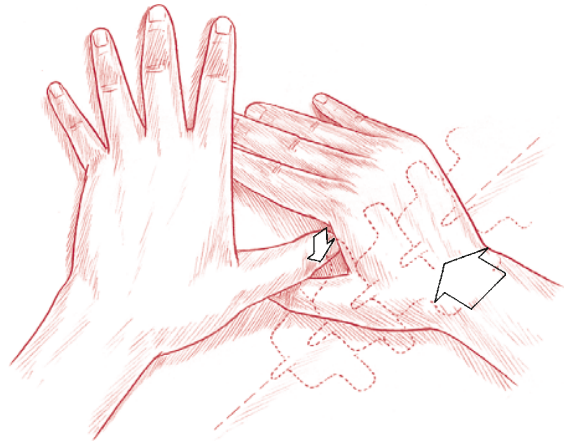


Figure 16.27 • Induration technique hand positions. Pressure used on the spinous process is measured in ounces (grams) at most.

a half circle, an angle of push towards the pain will be found to abolish the pain totally, lessening the objective feeling of tissue tension. This position is held for 20 seconds, after which the next point is treated.

This gentle approach incorporates the same principles as SCS and functional technique, with easing of hypertonicity and pain reduction as the treatment objectives.

Integrated neuromuscular inhibition technique (INIT) (Chaitow 1994)

INIT involves using the position of ease as part of a sequence which commences with:

- location of a tender/pain/trigger point
- application of ischaemic compression (optional – avoided if pain is too intense or the patient too sensitive)
- introduction of positional release (as in SCS methodology).

After an appropriate length of time, during which the tissues are held in 'ease', the patient introduces an isometric contraction into the affected tissues for 5–7 seconds. After this, the local tissues housing the trigger point are stretched. The whole muscle is then contracted and subsequently stretched (Fig. 16.28).

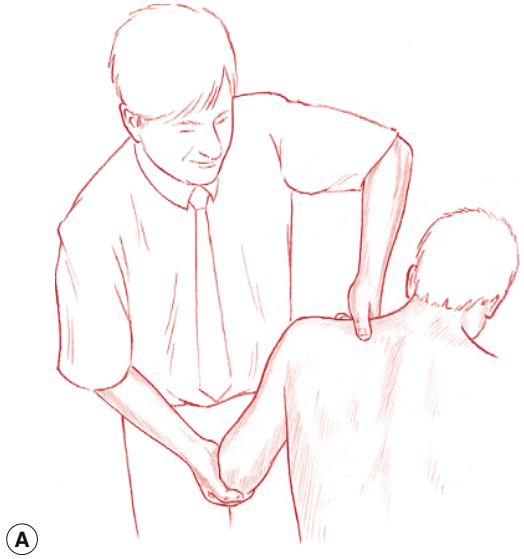


Figure 16.28 A • First stage of INIT in which a tender/pain/trigger point in supraspinatus is located and ischaemically compressed, either intermittently or persistently.

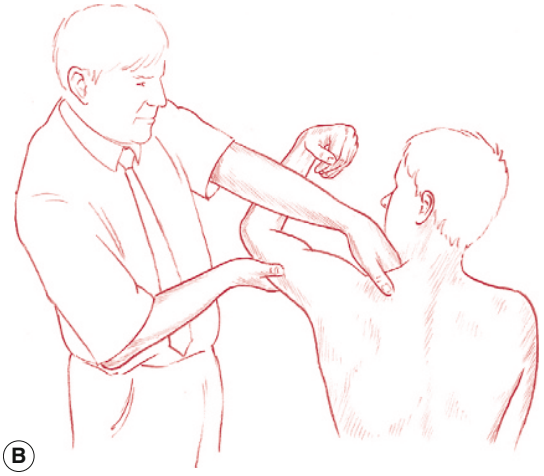


Figure 16.28 B • The pain is removed from the tender/pain/trigger point by finding a position of ease which is held for at least 20 seconds, following which an isometric contraction is achieved involving the tissues which house the tender/pain/trigger point.

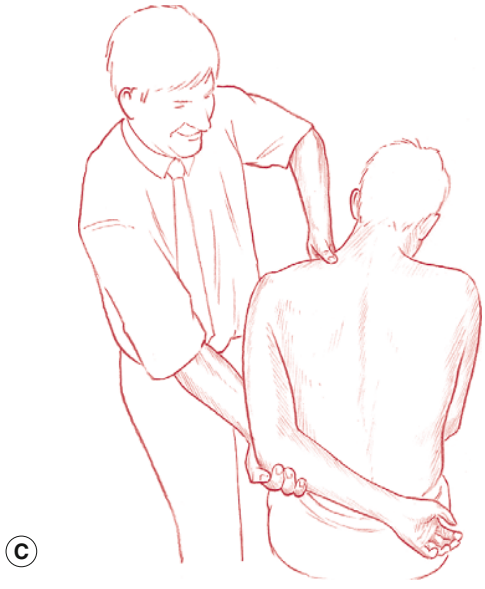


Figure 16.28 C • Following the holding of the isometric contraction for an appropriate period, the muscle housing the point of local soft tissue dysfunction is stretched. This completes the INIT sequence.

INIT rationale

When a trigger point is being palpated by direct finger or thumb pressure, and when the very tissues in which the trigger point lies are positioned in such a way as to take away the pain (entirely or at least to a

great extent), then the most (dis)stressed fibres in which the trigger point is housed are in a position of relative ease.

At this time the trigger point would be under direct inhibitory pressure (mild or perhaps intermittent) and would have been positioned so that the tissues housing it are relaxed (relatively or completely).

Following a period in this position of ease and inhibitory pressure (constant or intermittent), the patient is asked to introduce an isometric contraction into the tissues and to hold this for 5–7 seconds – involving the precise fibres that had been repositioned to obtain the positional release.

The effect of this would be to produce (following the contraction) a reduction in tone in these tissues. The hypertonic or fibrotic tissues could then be gently stretched as in any muscle energy procedure so that the specifically targeted fibres would be stretched, after which the whole muscle would be stretched following an isometric contraction.

Stretching and chilling offers another way of deactivating trigger points.

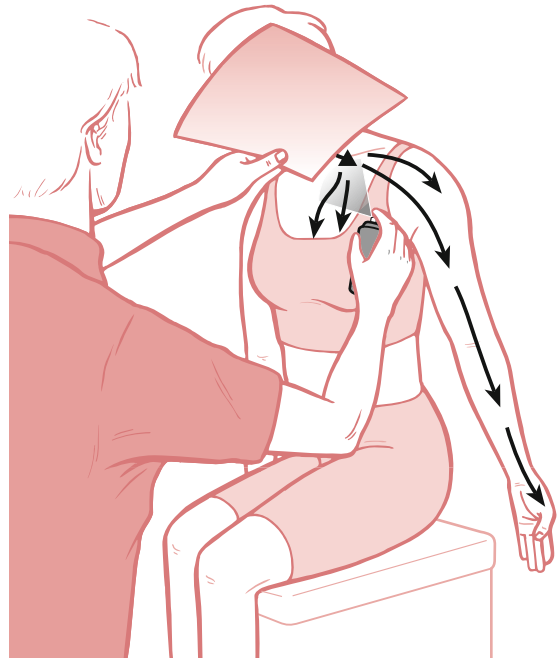


Figure 16.29 • Use of cold spray to chill the area between the scalene trigger point and the referral area in the arm. (Reproduced with permission from Chaitow & Fritz 2006b.)

Spray-and-stretch methods (Travell & Simons 1993)

An effective method for deactivation of trigger points, and also for easing pain and releasing chronic muscle spasm, is use of spray-and-stretch methods (Mennell 1974). A container of vapocoolant spray with a calibrated nozzle that delivers a fine jet stream, or a source of ice, is needed. The jet stream should have sufficient force to carry in the air for at least 3 feet (90 cm). A mist-like spray is less desirable (Fig. 16.29).

Box 16.3

Bodywork choices: summary of soft tissue approaches to FMS

General initial assessments:

- Overall evaluation of adaptive status, e.g. using Zink & Lawson's methods described above
- Evaluation of respiratory function, as described in Chapter 17
- Evaluation of postural status (Figs 16.12–16.15).

1. Identification of local dysfunction, possibly involving:

- — Off-body scan for temperature variations (cold may suggest ischaemia, hot may indicate irritation/hypertonia/inflammation)
- — Evaluation of fascial adherence to underlying tissues, indicating deeper dysfunction (Fig. 16.4)
- — Assessment of variations in local skin elasticity, where loss of elastic quality indicates hyperalgesic zone and probable deeper dysfunction (e.g. trigger point) or pathology (Fig. 16.6)
- — Evaluation of reflexively active areas (triggers, etc.) by means of very light, single-digit palpation-seeking phenomenon of 'drag' (Fig. 16.5)
- — NMT palpation utilizing variable pressure, which 'meets and matches' tissue tonus
- — Functional evaluation to assess local tissue response to normal physiological demand (e.g. as in functional tests as described, see Figs 16.11–16.15).

Box 16.3—Cont'd

2. Assessment of short postural muscles and muscular imbalances:

- Sequential assessment and identification of specific shortened postural muscles, by means of observed and palpated changes, using functional evaluation methods and specific muscle shortness tests, etc. (see Box 16.2)
- Subsequent treatment of short muscles by means of muscle energy technique (MET) or self-stretching will allow for regaining of strength in antagonist muscles which have become inhibited, after which additional gentle toning exercise may be appropriate (Figs 16.22, 16.24).

3. Identification of joint restrictions:

- Mobilization (not described in this text).

4. Treatment of local (i.e. trigger points) and whole muscle problems utilizing:

- Tissues held at elastic barrier to await physiological release (skin stretch, 'C' bend, 'S' bend (Fig. 16.9), gentle neuromuscular technique (NMT) etc.) (Fig. 16.17)
- Use of positional release methods – holding tissues in 'dynamic neutral' (strain/counterstrain, functional technique, induration technique, fascial release methods, etc.) (Fig. 16.26)
- Myofascial release methods (not described in this text)
- MET methods for local and whole muscle dysfunction (involving acute, chronic and pulsed (Ruddy's) MET variations as described above) (Fig. 16.25)
- Vibrational techniques (rhythmic/rocking/oscillating articulation methods; mechanical or hand vibration)
- Deactivation of myofascial trigger points (if sensitivity allows) utilizing INIT (integrated neuromuscular inhibition technique – see Fig. 16.28) or other methods (acupuncture, ultrasound, etc.)
- Facilitation of strength in inhibited muscles using gentle exercise, such as rhythmic pulsations (Ruddy).

5. Whole body approaches such as:

- Wellness massage and/or aromatherapy
- Hydrotherapy
- Cranial (craniosacral, sacro-occipital) techniques
- Therapeutic touch, Reiki
- Lymphatic drainage.

6. Re-education/rehabilitation/self-help approaches:

- Postural (Alexander, etc.)
- Breathing retraining as described in Chapters 15 and 17
- Cognitive behavioural modification (Ch. 7)
- Aerobic fitness training (Ch. 14)
- Yoga-type stretching, Tai chi
- Deep relaxation methods (autogenics, etc.)
- Pain self-treatment (e.g. self-applied SCS – see Ch. 18).

7. Improve nutrition (Chs 14 and 15)

- The container is held about 2 feet (60 cm) away from the area to be sprayed, so that the jet stream meets the body surface at an angle, not perpendicularly. This lessens the shock of the impact.
- The stream of cold spray is applied in one direction, not back and forth. Each sweep is started at the trigger point, and is moved slowly and evenly outward over the reference zone. The direction of chilling should be in line with the muscle fibres towards their insertion.
- The optimum speed of movement of the sweep should be about 4 inches (10 cm) per second. Each sweep is started slightly proximal to the trigger point, and is moved slowly and evenly through the reference zone, to cover it and extend slightly beyond it. These sweeps are repeated until all the skin over trigger and reference areas has been covered once or twice.
- If aching or 'cold pain' develops, or if the application of the spray sets off a reference of pain, the interval between applications is lengthened. Care must be taken not to frost or blanch the skin.
- During the application of cold or directly after it, the taut fibres should be stretched passively. Steady, gentle stretching is usually helpful. As relaxation of the muscle occurs, continued stretch should be maintained.
- The entire procedure may occupy 10–15 minutes, and should not be rushed.

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Chapter Seventeen

17

Respiratory function assessment and responses

CHAPTER CONTENTS

Tests of respiratory function

See also notes on respiration, hyperventilation, etc. in Chapters 15 and 16.

Test 1 (Hi-Lo test)

Have the patient place a hand on the upper abdomen and another on the upper chest. Observe the hands as the patient inhales several times. If the upper hand (chest) moves superiorly rather than anteriorly, and moves significantly more than the hand on the abdomen, a first clue is noted as to a dysfunctional pattern of breathing. If this is the case, breathing retraining is called for (Fig. 17.1).

Test 2

Stand behind and place both hands gently on upper trapezius area and have the patient inhale – note whether the hands move towards the ceiling significantly. If they do, the scalenes are overworked, indicating stress and therefore probable shortening. MET treatment as described in Chapter 16 will be appropriate.

Test 3

Stand to the side and observe the spinal contour as the patient fully flexes. Is there evidence of 'flat' areas of the spine (unable to flex fully), especially in the thoracic region, which would imply rib restrictions at those levels? The paraspinal muscles in the 'flat' areas should receive appropriate treatment (MET, NMT, induration technique, etc., and/or possibly spinal joint manipulation as in Ch. 16).

Test 4

Observe breathing pattern. Does the abdomen move forwards on inhalation as it should? Or does the upper chest move forwards on inhalation while the abdomen retracts? If it does, breathing retraining is called for, as this is a paradoxical pattern. Is there an observable lateral excursion of lower ribs? There should be.

Test 5

Assess for shortness in pectoralis major and latissimus dorsi (arms extended above head). If the patient's arms cannot lie flat on the table, touching along the whole length, there is pectoral shortness; if the elbows deviate laterally significantly there is usually latissimus shortness. If either of these is short, appropriate lengthening procedures should be carried out using MET, etc. (not described in these notes).

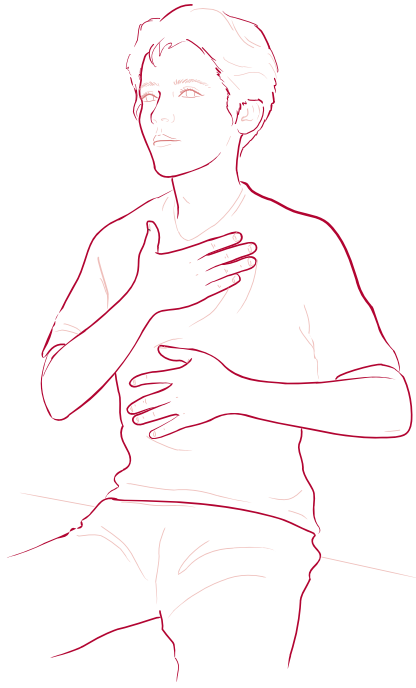

Figure 17.1 • The 'Hi-Lo' test to assess locus of first (and most) movement of inhalation. (Reproduced with permission from Chaitow & DeLany 2000.)

Test 6 (see video clip "Chin-poke assessment")

Observe for chin protrusion on neck flexion test (Ch. 16). If this is positive, sternomastoid is short and MET treatment as described will be appropriate (see Fig. 16.15).

Test 7

Check psoas using trunk flexion test (Ch. 16). Psoas merges with the diaphragm and requires attention (MET or self-stretching techniques – not described in these notes) if overactive or short, in order to facilitate normal respiration (see Fig. 16.12).

Test 8

Assess quadratus lumborum (QL) using hip abduction test (Ch. 16). QL attaches to the diaphragm as well as the twelfth rib. If short/overactive, re-education and stretching are required (not described in these notes) (see Fig. 16.13).

Test 9

Observe the 'breathing wave' – the movement of the spine from sacrum to base of neck on deep inhalation when prone on a firm surface. There should be a continuous wave from the base of the spine to the neck. Movement either starts above the sacrum and moves down and up (common), or regions of the spine move as a 'block', commonly involving areas that are 'flat' as in Test 3, above. As improvement occurs (via bodywork, mobilization, relaxation, exercise, breathing retraining, etc.), the pattern should normalize (Fig. 17.2).

Breathing rehabilitation

It has been well established that disturbed breathing patterns have a negative effect on core stability, motor control and balance, as well as on pain perception (Balaban & Thayer 2001, Hodges 2007, Hodges & Richardson 1999, Smith et al 2006). Learning better breathing can enhance better spinal function (the diaphragm is a major part of the spinal support system) (Loeppky et al 2001).

Breathing pattern disorders affect large numbers of people, mainly female (Hodges et al 2001), partly because of progesterone, a respiratory accelerator.

Evidence suggests that a combination of retraining exercises, education and appropriate bodywork (see suggestions below) can help normalize the

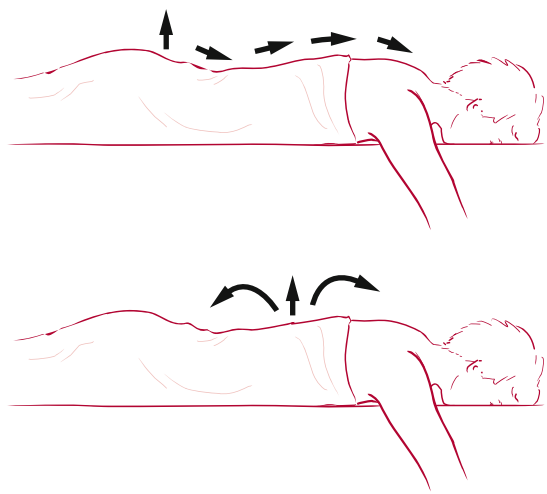

Figure 17.2 • Functional (top) and dysfunctional (lower) breathing wave movement patterns.

majority of such problems, over a period of months (Aust & Fischer 1997, Han et al 1996, O'Sullivan & Beales 2007).

Retraining essentials

Breathing retraining requires a combination of elements that also seem to operate in postural retraining (such as the Alexander technique):

- *Understanding* the processes: a cognitive, intellectual, awareness of the mechanisms and issues involved in breathing pattern disorders
- Retraining exercises that include aspects that operate *subcortically*, allowing replacement of currently habituated patterns with more appropriate ones
- Biomechanical *structural modifications* that remove obstacles to desirable and necessary functional changes
- *Time* for these elements to merge and become incorporated into moment-to-moment use patterns.

Pursed lip breathing

Pursed lip breathing (Faling 1995, Tisp et al 1986), combined with diaphragmatic breathing, enhances pulmonary efficiency.

- The patient is seated or supine with the dominant hand on the abdomen and the other hand on the chest.
- The patient is asked to breathe in through the nose and out through the mouth, with pursed lips, ensuring diaphragmatic involvement by means of movement of the abdomen against the hand on inhalation.
- Exhalation through the pursed lips is performed slowly, and has been shown to relieve dyspnoea, slow the respiratory rate, increase tidal volume and help restore diaphragmatic function.
- Thirty or more cycles should be repeated morning and evening as part of the anti-arousal exercise, see below.

Anti-arousal breathing

Patient's instructions for anti-arousal breathing (Cappo & Holmes 1984, Grossman et al 1985) are as follows:

1. Sit or recline comfortably, and exhale slowly and fully *through pursed lips*.
2. Imagine a candle flame about 6 inches (15 cm) from your mouth and blow a thin stream of air at it.
3. As you exhale, count silently to establish the length of the outbreath.
4. When you have exhaled fully, without strain, pause for a count of 'one', then inhale through the nose. Full exhalation creates a 'coiled spring', making inhalation easier.
5. Count to yourself to establish how long your inbreath lasts.
6. Without pausing to hold the breath, exhale slowly and fully, through pursed lips, blowing the air in a thin stream, and pause for a count of one.
7. Repeat the inhalation and exhalation for not less than 30 cycles (morning and evening).
8. After some weeks of daily practice, you should achieve an inhalation phase which lasts 2–3 seconds, and an exhalation phase of 6–7 seconds, without strain.
9. Exhalation should always be slow and continuous; there is little value in breathing the air out in 2 seconds and then simply waiting until the count reaches eight before inhaling again.
10. Practise twice daily, and repeat the exercise for a few minutes (6 cycles takes about 1 minute) every hour if you feel anxious, or when stress or pain increases.
11. Practise on waking, and before bedtime, and if at all possible before meals.
12. Always incorporate methods that reduce overactivity of neck/shoulder muscles, as described below.

Inhibiting shoulder rise during breathing retraining (see video-clip: Pursed lip breathing)

When applying breathing retraining it is important to teach tactics that restrict over-activity of the accessory breathing muscles, in order to reduce 'shoulder rising' on inhalation. The methods might include:

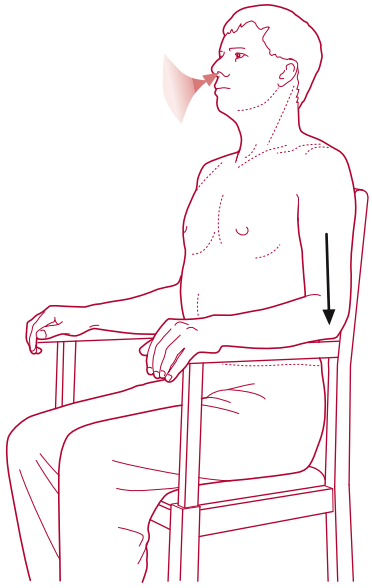

Figure 17.3 • Restricting shoulder movement by pressing forearms downward on inhalation. (Reproduced with permission from Chaitow 2004.)

- pushing elbows/forearms onto arms of chair, on inhalation (Fig. 17.3)
- arms behind back, grasping wrist with other hand and pulling down, on inhalation (Fig. 17.4)
- reclining with hands behind head ('beach pose') to open the chest and reduce shoulder movement (Fig 17.5)
- interlocking hands on lap and applying fingerpad pressure to dorsum of hands, on inhalation, to inhibit shoulder movement
- adopting Brügger's relief position throughout breathing exercises (see below).

Brügger's relief position

Brügger's relief position for postural and breathing rehabilitation (Brügger 1960, Lewit 1999) reverses many of the stresses caused during long periods of sitting, facilitating muscles that tend to inhibition, and inhibiting muscles that tend to shorten.

The following instructions should be given to the patient (Fig. 17.6):

1. Sit close to the edge of a chair ('perch'), with your arms hanging down, palms facing forward.

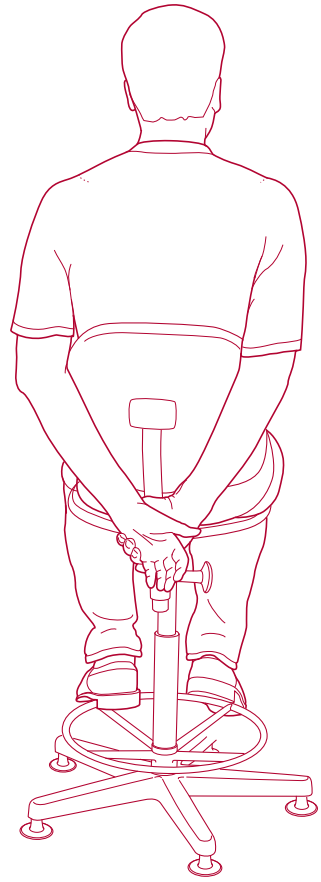

Figure 17.4 • Seated with arms behind back allows restriction of shoulder movement on inhalation (after Bradley). (Reproduced with permission from Chaitow 2004.)

2. Place your feet directly below knees, which are apart and lower than the hips (your feet should be turned slightly outward, with ankles directly below the knees).
3. As you slowly exhale, let your pelvis roll back and allow the spine to fall into 'C'-shape (the neck and head should follow the spinal curve).
4. As you inhale, roll your pelvis slightly forward to produce a *small* degree of arching of the lower back.
5. As the spine slightly extends, easing the sternum slightly forward and up, allow your neck, head and eyes to follow the spinal curve, chin in.
6. At same time, turn your arms outward, until the thumbs face slightly backwards.

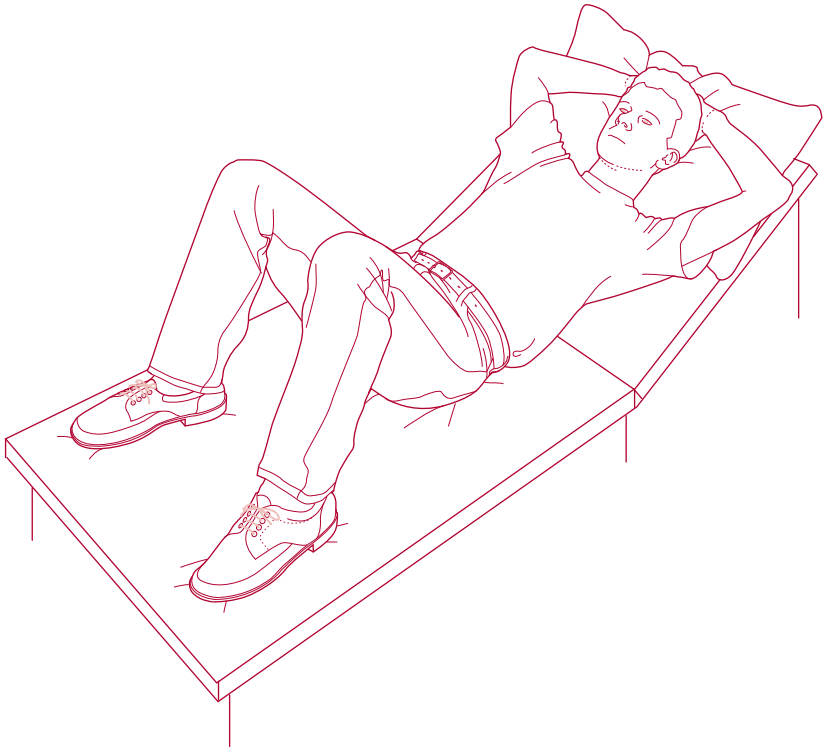

Figure 17.5 • 'Beach pose' for breathing retraining (after Bradley). (Reproduced with permission from Chaitow 2004.)

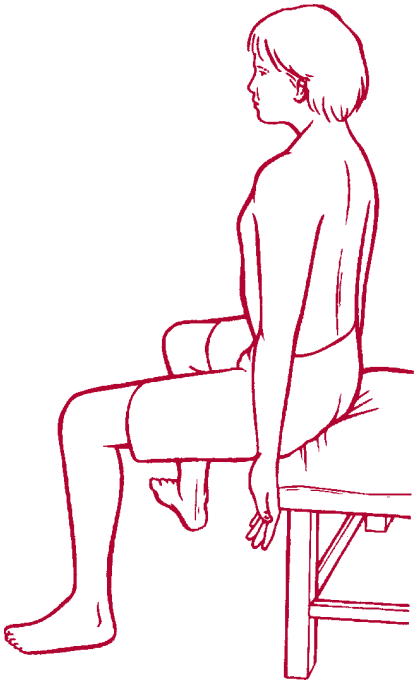

Figure 17.6 • The Brügger relief position (after Liebenson). (Reproduced with permission from Chaitow 2004.)

7. Exhale as you repeat the process, slightly rounding your back, and inhale as you slightly arch your back and turn the arms outward.

Repeat the entire process several times a day at least, and whenever you sense muscle tension or feel a need for deeper breathing.

Suggested manual treatment sequence for breathing pattern disorders

Treatment and retraining commonly involve 12 weekly sessions, followed by treatment sessions every 2–3 weeks, to approximately 6 months. An educational component should be included at each session.

First two sessions (not less than weekly)

- Upper fixators/accessory breathing muscle (upper trapezius, levator, scalenes/SCS, pectorals, latissimus dorsi) release/stretch, plus attention to trigger points.

- Diaphragm area (anterior intercostals, sternum, abdominal attachments costal margin, quadratus lumborum, psoas) release/stretch, plus attention to trigger points (see Ch. 16).
- Retraining: pursed lip breathing/control pause/restricting tendency for shoulder rise with upper chest pattern (see above).

Sessions 3 and 4 (weeks)

- As above, plus mobilization of thoracic spine and rib articulations (plus lymphatic pump).
- Address fascial and osseous links (cranial, pelvic, lower extremity).
- Retraining: anti-arousal breathing pattern, plus specific relaxation methods (autogenics, visualization, meditation, etc.), stress management.

Sessions 5 to 12 (weeks)

- As above, plus other body influences (ergonomics, posture).
- Retraining: additional exercises as appropriate.

Weeks 13 to 26

- Review and treat residual dysfunctional patterns/tissues.
- Plus, as indicated: nutrition, counselling, stress management.
- Adjunctive methods used throughout as applicable: hydrotherapy (see Ch. 13), Tai chi, yoga, Alexander technique, Pilates, massage.

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Chapter Eighteen

18

Strain/counterstrain self-treatment for some FMS tender points

CHAPTER CONTENTS

The text in this chapter describes self-treatment of tender points that can be used for patient education. The aim is to help patients to learn to use SCS methods by focusing on five of the key tender points used in diagnosis of FMS. In doing so, the practical 'how to' principles of SCS self-treatment should become clear and usable in first-aid self-care on any painful area of the body. The basic rules, explained more fully in Chapter 16, are:

- Find a painful point.
- Score this as 10 while pressing it.
- Slowly reposition your body, or part of the body, until the pain is reduced to a 3.
- For pain in the front of the body, movements and positions that ease the pain usually involve bending forwards and towards the side of the pain.
- For pain on the back of the body, movements that ease the pain usually involve bending backwards and away from the side of the pain.
- The further pain is from the midline the more sidebending and rotation will be needed.
- For a pain point on a leg or arm, movement of the limb, in various directions, usually suggests which way to go to ease the palpated pain.
- Hold the 'position of ease' for 1 minute at least, and slowly return to neutral.

That's all there is to SCS.

As a rule movements that 'slacken' tissues housing the painful point helps reduce the score most.

CAUTION: Do not treat more than four or five points on one day as the pain may increase for the first day or so after. If too many points are treated, pain may increase for a period.

Try these methods on a few points. Judge the benefits several days after treating in this way. Are chronic areas less stiff and less painful? If so, treat sensitive areas in this way whenever the pain gets excessive.

Using the tender points

Patient information should include the fact that the diagnosis of FMS depends on there being at least 11 tender points present out of 18 tested, using a set amount of pressure. Five of the diagnostic points for FMS have been used in this chapter to learn self-use of SCS, because they are almost universally painful in FMS:

1. Either side of the base of the skull where the suboccipital muscles insert
2. Either side of the side of the neck between the fifth and seventh cervical vertebrae (anterior aspects of inter-transverse space)

3. Either side of the body on the midpoint of the muscle which runs from the neck to the shoulder (upper trapezius)
4. Either side of the body, origin of the supraspinatus muscle which runs along the upper border of the shoulder blade
5. Either side, on the upper surface of the rib, where the second rib meets the breast bone, in the pectoral muscle.

Note: Self-treatment is described in the first person, so that the text and pictures can be copied for patients' use.

Suboccipital muscles (Fig. 18.1)

Lie down on your side with your head on a low pillow. The painful points lie at the base of your skull, in a hollow just to the side of the centre of the back of the neck.

- Feel for the tender point on the side lying on the pillow with the hand on that same side. Press just hard enough to register pain and score the level of pain as a '10' (where 10 is severe and 0 is no pain at all).
- To ease the pain, take the head backwards slightly, and usually lean it and slightly turn it towards the side of pain.
- First, take the head slightly backwards slowly, as though looking upwards. If the pain changes, give it a score. If it is now below 10 you are on the right lines.
- Test the response with slightly more backward bending of the neck, until you find a position which reduces the pain to around a 6 or 7.
- Now allow the head to turn and lean a little towards the pain side, until the score drops some more.
- Keep 'fine-tuning' the position as you slowly reduce the pain score. You should eventually find a position where the score is 3 or less.
- If the directions of movement of the head described above do not produce pain reduction, you may need to turn the head away from the side of pain, or find some other slight variation of position, to achieve 'ease'. The directions given above are the most likely to help to bring the score down to a 3 or less.
- Once the score is 3 or less, relax in that position. You do not need to maintain pressure on the tender point all the time.
- It is important that the position that eases the pain should not produce any other pain.
- Stay in the ease position for at least 1 minute and then slowly return to a neutral position, turn over and treat the other side in the same way.

Side of neck tender points (Fig. 18.2)

These points lie near the side of the base of the neck, directly below the lobe of your ear.

- You can locate the tenderness by running a finger very lightly down the side of your neck, starting just below the ear lobe. As you do so you should be able to feel the slight 'bump' as you pass over the tips of

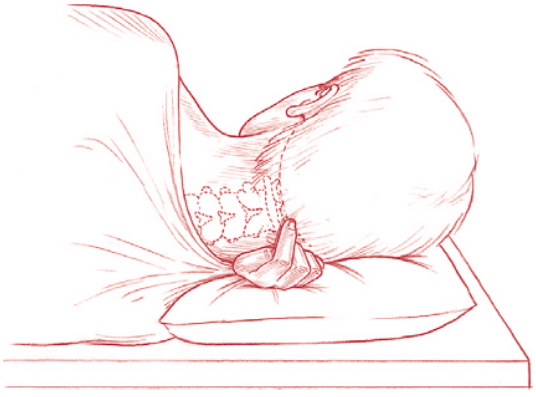

Figure 18.1 • Strain/counterstrain self-treatment for suboccipital tender point.

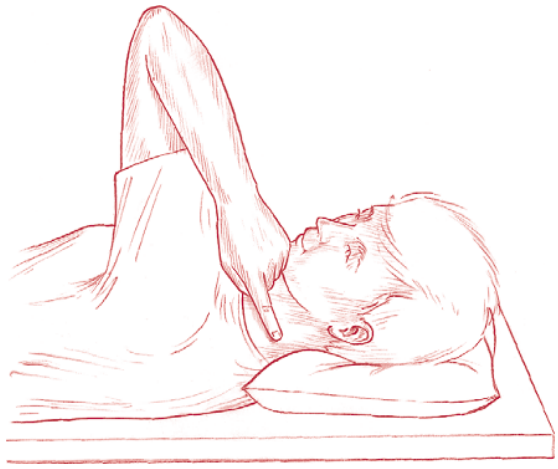

Figure 18.2 • Strain/counterstrain self-treatment for lateral cervical tender point.

the transverse processes – the parts of the vertebrae that stick out sideways.

- When you get to the level of your neck that is more or less level with your chin, start to press in lightly after each 'bump', trying to find an area of tenderness on one side of your neck which, when pressed, allows you to give it a score of 10.
- Once you have found this, lie down and allow your head to bend forwards.
- As with the first point treated (above), you will find that tenderness will be reduced as you take your head forwards. Find the most 'easy' position by experimenting with different amounts of forward bending.
- The tenderness will be reduced even more as you fine-tune the head/neck position by slightly sidebending and turning the head, either towards or away from the pain side, whichever reduces the 'pain score' most.
- When you achieve a score of 3 or less, stay in that position for at least 1 minute and then slowly return to neutral, and seek out a tender point at the same level, on the other side of the neck, and treat it the same way.

Midpoint of upper trapezius muscle (Fig. 18.3)

The trapezius muscle runs from the neck to the shoulder.

- You can access tender points by using a slight 'pinching' grip on the muscle, using your thumb and index finger of (say) the right hand to gently squeeze the muscle fibres on the left, until something *very* tender is found.
- If pressure is maintained on this tender point for 3 or 4 seconds it might well start to produce a radiating pain in a distant site, probably the head, in which case the tender point is also a trigger point (the same could be true of any of the tender points you are going to palpate, but this is one of the likeliest and commonest).
- Lie down onto a pillow, on the side opposite that which you are treating.
- Lightly compress the point between finger and thumb (using the hand on the non-treated side) to produce a score of 10.
- Try altering the position of your other arm, perhaps taking it up and over your head, to 'slacken' the muscle you are palpating, or alter your neck position by sidebending it slightly towards the painful side, possibly by adding an additional pillow.
- Fine-tune these positions until you reduce the score to 3 or less. Stay in that position for not less than 1 minute.
- Slowly return to a neutral position, turn over and seek out and treat a tender point on the other side.

Origin of the supraspinatus muscle above the shoulder blade (Fig. 18.4)

- Lie on your back, head flat on the floor/bed/surface and, resting your elbow on your chest, ease your hand over your opposite shoulder to feel for the upper surface of your other shoulder blade.

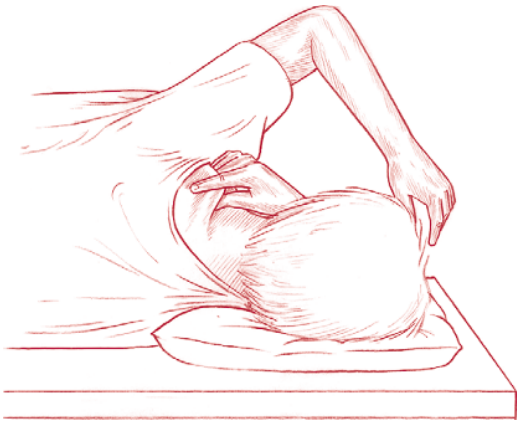

Figure 18.3 • Strain/counterstrain self-treatment for tender point in middle fibres of upper trapezius muscle.

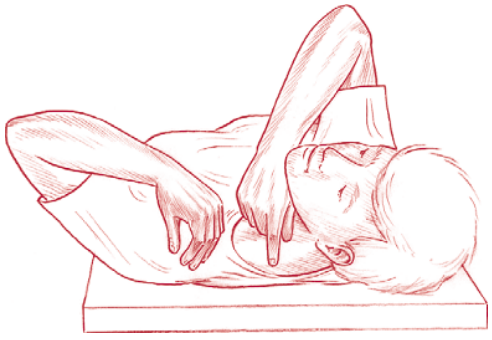

Figure 18.4 • Strain/counterstrain self-treatment for supraspinatus tender point.

- Run your fingers along this upper surface, towards the spine, until you come to the end of the shoulder blade, and there press into the muscles a little, seeking a tender area. You may need to press a little down, or back towards the shoulder, until you find what you are looking for, and can score the sensitivity as a 10.
- With your affected side arm resting at your side, and with a finger of the other hand in contact with the tender point, bend the arm on the affected side so that your fingertips rest close to your shoulder.
- Now bring the elbow on the affected side towards the ceiling – very slowly – and let it fall slightly away from the shoulder about half way to the surface on which you are lying. Does this reduce the score?
- Now start to use 'fine-tuning' of the arm position, by rotating the bent arm gently at the shoulder, twisting so that the elbow comes towards the chest and the hand moves away from the shoulder, until the pain is down to a score of 3 or less. (The score may also drop if you turn your head towards or away from the treated side.)
- Hold the final 'position of maximum ease' (score 3 or less) for at least 1 minute, and then slowly return to neutral and do the same on the other side.

Second rib tender points (Fig. 18.5)

- Sitting in a chair, rest your middle finger on the upper surface of your breast bone, and move it slowly sideways until you touch the end of your collar bone where it joins your breast bone.
- Now run the finger towards your shoulder for not more than 1 inch (2.5 cm) along the collar bone, and then down towards the chest for a half an inch (1 cm) or so. You should feel a slight 'valley', after which you will come to the second rib (you cannot easily touch the first rib because it is hidden behind the collar bone).
- Press the upper surface of the second rib firmly and it should be tender.
- Search until you find a place where the pressure allows you to score a 10.

Figure 18.5 • Strain/counterstrain self-treatment for second rib tender point.

- Now bend your head and your upper back forwards, slightly towards the side of the pain point, until you feel the pain reduce.
- Find the most 'easy' position of forward and slight sidebending, and then see whether tilting the head one way or the other helps to reduce the score even more.
- Take a full deep breath in and then slowly let the breath go, and see which part of your breathing cycle eases the tenderness most.
- Once you have the score down to a 3 or less, add in that most 'easy' phase of the breath (hold the breath at that phase which eases the pain most) for 10–15 seconds.
- Then breathe normally but retain the position of ease for at least 1 minute, before slowly returning to neutral and seeking out the tender point on the other side for similar attention.

After treating these 10 points (five on each side) you can now use SCS to treat any painful point or muscle, using these same methods. The relief will be variable, lasting for a short or long period depending on what caused the pain.

You now have a practical first-aid measure for reducing pain, often considerably, and often for a long period.

Appendix

Keeping a record

CONTENTS

Among the many areas of concern to people with FMS, poor memory is often a feature. It is therefore frequently a problem when attempting to plot the course of treatment when questions are asked such as:

- What has happened to your pain levels since we last met?
- When did it (particular change in a symptom pattern) happen?
- Which symptoms were improved, or worsened, when a particular therapeutic strategy was introduced?
- Were digestive symptoms lessened when wheat was excluded? Or was there no change?
- Did pain or fatigue, or any other symptom improve (or worsen) when exercise or hydrotherapy was introduced?

. . .and so on.

Trying to extract such information from a patient, weeks or even months after the event, can be confusing and stressful, for both parties.

A diary, or 'symptom score sheet' (below) or some such instrument, offers a way of reducing the stress, and maintaining a coherent record of events, in sequence.

Starlanyl & Copeland (1996) suggest:

> *At the beginning of treatment, encourage the patient to keep a daily log or journal chronicling their symptoms, function, and activities. This can be an invaluable tool. The patient can and should refer to this journal to gain insight into the symptoms, perpetuators, stressors, and triggers. It can also be used to assist in problem solving, tracking treatment effects, and mood changes. The patient should devote a section of the journal to diet and medication. He should keep track of any changes, side-effects, and benefits. The journal also provides a source of information to identify behaviour patterns which may be symptom perpetuators.*

The patient may usefully be given a printout with an example of a 'symptom score sheet' (Chaitow et al 2002) and/or notes such as the following:

> *Your pain diary/symptom record can become a valuable part of the process when you are testing the benefits or otherwise of dietary and other changes, either prescribed or introduced, including those conducted at home, such as exercises or hydrotherapy measures. By regularly recording what changes you are making, and what effects these have on your pain and other symptoms (better? worse? no change?), or in your functioning (walking or sleeping better, doing everyday tasks with less effort, for example), or by ascribing values to the symptoms ('scores'), you might begin to make connections between particular foods, supplements, medications, activities etc. and some symptoms, allowing you to make informed choices about what helps and what aggravates your overall condition, or particular symptoms.*

This is also very useful information for the practitioner(s) treating and advising you as they may be able to evaluate patterns of change over time, relating to particular therapeutic changes. Relying on memory alone is not always a good idea. The diary, or symptom score-sheet, with data recorded daily (ideally same time of day) forms a reliable record from which to work.

Measuring pain 1: visual analogue scale

Another useful approach is to have the patient periodically record pain levels using a visual analogue scale (VAS).

Pain is personal and can only be measured in terms of what it means to each person, individually. It is not possible to say 'how much' a particular pain hurts, only that it is mild, moderate, severe or agonizing, disabling (or some other choice of words which mean much the same thing). What is mild to one person may be severe for another ... it all depends on the interpretations of the pain, and the value given to it.

By marking a straight line which has 10 divisions, where the start of the line represents '0' (no pain at all), and the other end represents '10' (the most severe pain imaginable), it is possible to get a reasonable sense of a person's pain levels (or severity of other symptoms), at a particular time (see Fig. A.1). By marking such a line periodically, and recording the date and any other significant associated events or changes, a check can be kept on how pain is changing over time, or its response to different treatments.

Measuring pain 2: algometer

A basic algometer is a hand-held, spring-loaded, rubber-tipped, pressure-measuring device that offers a means of achieving standardized pressure application (see Fig. A.2). Using an algometer, sufficient pressure to produce pain is applied to preselected points, at a precise 90° angle to the skin. The measurement (how many pounds or kilos of pressure) is taken when pain is reported.

Baldry (1993) suggests that algometers should be used to measure the degree of pressure required to produce symptoms 'before and after deactivation of a trigger point, because when treatment is successful, the pressure threshold over the trigger point increases'.

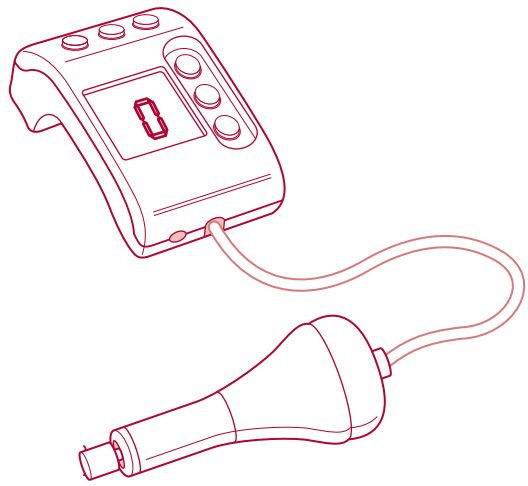

Figure A.2 • Mechanical algometer used to measure applied pressure. (Reproduced with permission from Chaitow & Fritz 2006.)

0_____3_____5_____7_____10

Figure A.1 • Visual analogue scale to 'score' current pain level.

Instructions
0 = no pain
3 = mild pain
5 = moderate, bearable pain
7 = severe but tolerable pain
10 = agonizing, unbearable pain

Mark the line at the level of your pain right now, put a date alongside, and record anything you can think of that may have aggravated or eased your pain.

Personal monthly symptom score sheet

Name _____ Date _____

Symptom scoring: 0 = no symptoms, 1 = mild, 2 = moderate, 3 = severe

Fill in your scores at the end of the day

Symptoms Date																															
1																															
2																															
3																															
4																															
5																															
6																															
7																															
8																															
9																															
10																															
11																															
12																															
Total score																															
Weight																															
Comments																															

How to use the symptom score sheet:
List your key symptoms in the left-hand column. Each day, at the same time if possible, estimate a value for each symptom. Write the date in the appropriate box and score: 0 if there was no symptom; 1 if it was mild; 2 if it was moderate to severe; and 3 if it was as bad as you can imagine. The score sheet can be used for any modification, but is ideal for dietary change. The weight box is optional and the 'comments' box is for entering key words, such as 'stopped wheat' or 'period started' or 'started taking X supplement or medication', or to note anything else that might reflect the scores of the key symptoms. The total symptom score and the individual scores provide a record of change, or non-change, and can therefore be used to evaluate the efficacy of different strategies. The score sheet may, over a period of a month or two, show a pattern, and can be used specifically to monitor what happens to all or some symptoms when a particular intervention such as a food exclusion or a new medication is being evaluated.

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