Manual of Osteopathic Technique

By: Alan Stoddard

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CONTENTS

PREFACE TO THE SECOND EDITION

It is with considerable pleasure and not a little pride that I write this preface to the second edition of my manual. The fact that there is a demand for the book shows there is still need for a description of the manipulative techniques used by osteopaths.

Only a few minor points have been altered in the techniques themselves, but the theoretical description of the lesion written by Dr Louisa Burns thirty years ago has been omitted. I was advised by medical colleagues to do this, because so little is known about the histological and morbid anatomy changes which follow trauma to spinal joints, and the observations made by Dr Burns were on animals. Such changes do not necessarily occur in human spines, and moreover the chronological sequence of those changes is bound to be fallacious.

The description of the osteopathic spinal lesion in Chapter 2 is a description of a clinical entity based on observation rather than on experimental evidence, and there is no doubt that the syndrome is a reality. The reason why I prefer to retain the special epithet 'osteopathic' for this condition is that the osteopaths were the first to attempt the description of this elusive entity and they deserve the credit for this. It might well be called an internal derangement of a vertebral joint, but such a term is really no better except that it would be more acceptable to opponents of the osteopathic concept.

When and by what process the osteopathic spinal lesion merges into the disc syndrome is debatable, but as I say in Chapter 4 I believe that much antecedes the advent of symptoms in disc lesions, and such processes merit close study. Those of us who are interested in the subject must keep our eyes open for new knowledge—in whatever field—if it has any bearing on the subject.

In the meantime a description of techniques of manipulation which have been found to have practical value, even though empirically performed, is desirable. It would be wonderful to be able to explain exactly what happens when a joint is manipulated, but the details may always remain obscure. If the techniques do work, as in fact they do, using methods based on anatomical and mechanical considerations, we are achieving our objective. If the practitioner develops a keen sense of tissue tension and palpation, and learns to co-ordinate the various components in any manipulation however simple, he will achieve success. Many patients will be grateful, and provided he does not forget the contra indications to manipulation he will raise the status both of himself and of the art of manipulation as a whole. I would, however, urge the practitioner not to concentrate exclusively on the details of techniques, nor to limit his horizon to the single and isolated spinal joint, but always to bear in mind that one joint is just a part of the skeletal framework. The whole spine, the whole body, the whole man has to be adjusted to his environment.

PREFACE TO THE FIRST EDITION

The purpose of this book is to set down and illustrate the main techniques of manipulation used in osteopathic practice. There are numerous techniques and many more of them are in constant use than I have described, but I have included only those which I personally have found to be most effective. The art of manipulation is a very individual matter and certain techniques are more appropriate for some practitioners than others. The techniques may all have to be modified to the needs of both practitioner and patient. The details of procedure are clearly somewhat personal, but while these may vary between one practitioner and another, the underlying method should be based upon the same principles. These principles I have elaborated in the first chapter, but the practitioner may well find that he has to adapt the finer details to himself and his patient. The reader will find that the principles of techniques here enunciated are somewhat different [illegible] submit that they are based upon anatomical and mechanical facts and are supported by the practical experience of many years of active practice in the osteopathic field.

The manual is merely an outline and is not an attempt to be comprehensive. Nor is the book written just for beginners, and, while it is primarily directed to the osteopathic student and graduate, it is hoped that all practitioners, of whatever school of thought, will find something of value in its pages. I have written it for all those who aspire to perfection in the art of manipulation, and although the osteopathic profession has contributed more than any other to the elaboration of techniques, the art of manipulation is not the sole prerogative of the osteopath. Rather it is the prerogative of the patient. The patient has a right to expect a high degree of skill in all those who purport to practise manipulation. It is desirable, therefore, to disseminate as widely as possible the available knowledge of this work so that the maximum numbers of suffering humanity may derive benefit. As far as I know, no purely osteopathic technique textbook has been published in this country though several excellent ones have been written in America.

A great deal more could have been written, and probably will be later, on the wider aspects of Osteopathy, but I have restricted myself primarily to practical matters in this book.

It must not be thought, however, that because the manual is limited to technique procedures that osteopathic treatment is so limited. The underlying principle of Osteopathy is that structure governs function, that disturbances of structure in whatever tissue within the body will lead to disturbances of functioning in that structure and, in turn, of the function of the body as a whole. The objective, therefore, in the osteopathic approach is the complete restoration of the structural integrity in the body. This high aim may not be achieved but that is the goal, and whatever means are used to restore harmonious structural integration, these fall within the ambit of osteopathic practice. Within this framework of osteopathic treatment, our chief agency is manual manipulation of joints, but also of importance are the improvement of posture, the encouragement of good lymphatic and venous drainage, the improvement of the arterial blood flow, the removal of mechanical obstructions by surgical means if necessary, the reposition of viscera, the use of exercises for strengthening muscles or the stretching of contracted tissues. The theme is that given a structurally sound framework, the bodily functions will proceed harmoniously and healthily. The elaboration of these osteopathic measures belong rather more to a textbook of Principles in Osteopathy, but suffice it here just to enumerate some of the methods.

The techniques of manipulation described here are limited to the vertebral column and pelvis, partly in order to keep the book within reasonable limits but also because the osteopathic influence upon the art of manipulation is much more significant in spinal than in other joint manipulations—but the reader must not assume that osteopathic treatment is limited to the spine. Every joint, every tissue, every cell in the body influences every other structure in that body. There are stimulatory and inhibitory treatments to viscera and soft tissues; treatment may be directed to normalizing the autonomic nervous system, affecting visceromotion and vasomotion and so on. Osteopathic treatment, then, has a much wider significance than merely joint techniques and, therefore, this manual is but a small part of the larger subject of Osteopathy itself.

There are four main sections to the book. The first chapter deals with the principles of manipulative technique; the second with a description of the osteopathic spinal lesion, its significance in the overall pattern of the osteopathic concept of health and disease, followed by a detailed account of the diagnosis of the osteopathic spinal lesion. In the third section the chief substance of the manual is to be found. It is an atlas of techniques, with illustrations adjacent to the descriptions. It was thought desirable to arrange the matter thus so as to make the procedure more readily understood. It is notoriously difficult to describe the details of technique and, without the help of illustrations, it is almost impossible. Ideally, techniques should be demonstrated rather than be read about, but, even with the best teachers in the world, textbooks are invaluable for the student to dwell upon and refer back to time and again. It will be seen that there are three subdivisions in this chapter, viz. soft-tissue techniques, articulatory techniques and specific techniques, and they are dealt with regionally so that all the techniques of each region are in a convenient sequence for teaching and treatment purposes. The final chapter is devoted to the manipulative techniques which are applicable to the various stages of intervertebral disc lesions, and in this section traction techniques are described in detail because they play such an important role in the treatment of disc lesions.

During the preparation of this manual I have been much indebted to my secretary, Gillian Wright, for her painstaking and patient typing and retyping, to my radiographer, Edith Knott, for the help she gave in making the X-ray films, to Mr. A. E. Sait for the photography, also my daughter and Mrs. B. Shearer for being such excellent models, to Drs. W. Hargrave-Wilson, B. H. Pentney and D. Turner for reading and criticizing the script, but most of all I have been indebted to Dr. Andrew Taylor Still who in 1874 started the first school in Osteopathy at Kirksville, Missouri, U.S.A. Without Dr. Still's pioneering work in Osteopathy, the art of manipulation would never have achieved the place of importance which it holds today. Steadily and continuously since then thousands of osteopaths have made it their life's work to use this method of treating the injured and the sick. Some may have failed lamentably in having inadequate knowledge of the instrument they were using but the majority have succeeded in rendering invaluable service to mankind in their efforts to advance the art and science of Osteopathy.

The medical profession has lagged far behind the osteopathic profession in developing and teaching the art of manipulation and it has sadly neglected the mechanical causes of disease and disability. It is because of this that a separate school of thought had to be maintained in the past and still has to be maintained; but when the true importance of the structural factor has been fully recognized, and when the medical profession has modified its thinking on these lines and added mechanical derangements to their list of etiological factors in disease, then there will no longer be any need for a separate organization and the world will be a healthier and happier place to live in. Already the recognition of the intervertebral disc lesion by orthodox medicine has focused attention on the spinal column; its local and remote effects are better understood and it is being recognized that these lesions cause disturbances of the autonomic nervous system as osteopaths have claimed for many years. At present there is a keen and awakening interest in manipulation and many doctors are trying different techniques without sufficient knowledge and without a proper analysis of the joint mechanics. The techniques here outlined are the outcome of something like eighty years of development in manipulation and are, therefore, worthy of the attention of all who desire to excel in this method of practice.

1

PRINCIPLES OF OSTEOPATHIC TECHNIQUE

IN OSTEOPATHY we are concerned with the establishment and maintenance of the normal structural integrity of the body and to achieve this end we use diverse methods. These methods may be classified in three groups:

(1) The techniques of joint manipulation, i.e. the normalization of mobility and position, and the relief of abnormal tension in muscles, ligaments, capsules and fascia.
(2) Manipulative techniques other than joint corrections directed, for example, to improve circulation, venous and lymphatic drainage, the repositioning of viscera, and soft tissue treatments.
(3) Other methods which have as their aim the improvement or restoration of normal mechanics in the body, such as the correction of posture, the surgical removal of abnormal tissues which are impeding nature's attempts at returning the body to normal, and exercises and activities which help to maintain and improve normal mechanics.

All these come within the broader aspect of the osteopathic approach, but in this book we are mainly concerned with the first heading. Let us deal then with the principles of the technique of joint manipulation. Our immediate purpose is the restoration of normal conditions in the joints we are dealing with. It is clearly unnecessary to manipulate normal joints. Therefore, before describing the details of manipulative techniques, it is necessary to know and understand what abnormal state is present.

THE FIRST PRINCIPLE, then, is the *making of a diagnosis.* As the establishment of a diagnosis is of paramount importance I have devoted a whole chapter (Chapter 2) to this problem. In it are described techniques of diagnosis—mainly mobility tests—which are of great value and must of necessity be used prior to any techniques of manipulation.

In arriving at a diagnosis of the joint fault we must first exclude pathological changes. That is to say we must exclude those changes due to disease which lead to local structural alteration in the various components of the joint; changes which may mislead us into thinking that a simple osteopathic lesion is present. I do not propose to deal with the diagnosis of pathology in joints. For the present, our objective is the diagnosis of faulty mechanics in the joint or group of joints we are presented with, and we are concerned with the manipulation of joints which, though functioning poorly, are yet not actually diseased. The function of a joint is movement and it is disturbances of joint mobility which command our attention. Clearly a joint may have restriction of movement or it may have an abnormal range of movement, i.e. it may be hypomobile or it may be hypermobile. Both of these states cause disability to a greater or lesser extent.

In *hypomobility* there is subjective stiffness and often pain, particularly when the joint is forcibly moved. Such restriction often forces adjacent joints to become hypermobile to compensate and enable a full range of movement to take place in the area. The *combination of hypo- and hypermobility in the spine is very common*, and the lack of realization of this important diagnostic point is a frequent cause of failure to achieve good results by manipulation. It is so easy to stretch the already freely mobile joint without materially affecting the restricted joint. The standard technique of orthopaedic manipulation of the spine disregards this type of case. The method used is to free the spine in every direction without the object of ensuring movement to the full range in all the joints manipulated. The method may work quite well in, say, a knee joint where only one articulation is involved, but in the complicated series of joints in the spine the method is inadvisable and may well be harmful by the very fact that the hypermobile joints are forced still further into a state of hypermobility while the hypomobile ones may fail to yield. All the skill and art of the operator is required to localize the manipulative forces to the one joint which requires the forced movement, while protecting and preventing undue movement in the hypermobile joint. The differential diagnosis of hyper- and hypomobility will be discussed at length in the chapter on diagnosis. The methods whereby forces are localized to one joint are described later, together with details of localizing devices to protect adjacent joints.

Having excluded pathological conditions and established a diagnosis of hyper- or hypomobility, we must ascertain if there is any positional change in case malalignment is also a factor in the faulty mechanics of the joint. If the positional relationships of adjacent bones are altered as well as the mobility, then we must note it down and attempt later to restore the normal anatomical relations. If there are altered positional relationships and yet normal mobility, then the position is not of material significance—it is due to anomalous shapes or soft-tissue thickenings and we can ignore them. An astonishing amount of time and study has been wasted upon the positional question because this rule has been ignored. Much of the osteopathic and chiropractic literature abounds with the idea of 'the bone out of place' and manipulations have been devised to replace the displaced bones. This is a misconception. The fault is a joint lesion not a bone lesion. We are not concerned with, say, the 3rd lumbar vertebra being in a faulty position but with the 3rd–4th lumbar joint which is not moving properly.

THE SECOND PRINCIPLE OF TECHNIQUE is to aim at the *restoration of normal mobility*—and all subsequent treatment is subservient to this objective. As it is the joint of restricted movement which needs manipulating, all the following principles of technique appertain to the treatment of hypomobility, but before proceeding to these principles, let us consider in more detail the question of hypermobility.

The Hypermobile Joint

The diagnosis of hypermobility rests upon the tests of passive movements. Difficulties arise immediately in stating what is the normal mobility in a given joint, because the range of passive movements in a joint is a very individual matter. It depends upon the length and elasticity of the ligaments of that person. Some people are naturally stiff and some are 'double-jointed'—the term lay people give to individuals who have excessive ranges of movement in certain joints. The child has a much greater range of movement than the adult who in turn has a greater range than the elderly person. Ligaments may be lengthened by exercises, the remarkably free range of movement in childhood can be maintained throughout adolescence and early life by diligent daily exercise designed to stretch ligaments. This is how the acrobatic dancer achieves such weird and wonderful positions, though such people are born with long ligaments anyway. Equally so, ligaments may be allowed to shorten by inactivity and the avoidance of exercise. Yet we cannot say that either condition is abnormal. The range of movement is essentially an individual matter and there is a wide range of normality, so wide is it that it would be difficult to state what is the average normal range for a particular joint in the spine. It is a much easier matter to compare the range of adjacent joints and to obtain a general impression of the normal mobility of the individual we are dealing with. The degree of movement varies in different sections of the spine, but this variation is fairly gradual as we move from one section to another so that any pronounced difference in mobility of adjacent vertebral joints can be considered abnormal. A description of the normal movements of the spine is given in the Appendix.

The hypermobile joint must be considered abnormal when it gives rise to *pain of ligamentous origin*—that is, the type of pain which develops when the part is under continuous stretch. The pain develops gradually after assuming some posture in which the joint is held at the limit of its range, as for example the pain which develops in the lumbar spine after the patient has been sitting curled up in an armchair without any support for the lumbar spine. Ache develops in the supraspinous and interspinous ligaments and possibly in the posterior longitudinal ligament of the spine. Another example of ligamentous ache is that which develops in the planter fascia and ligaments of the feet in 1st degree pes planus, after the patient has been standing for a long time. The ache tends to go when the stretch is released, though it may take several hours of complete rest before this happens. Ligamentous ache as above described is in marked contrast to the type of *pain caused by adhesions and tightened capsules*, which is the basis of most hypomobility. The pain of adhesions occurs at once when the capsule is stretched, and if adhesions are stretched further, a sharp pain ensues, leaving the joint and surrounding muscles in a 'limp' condition. The intensity of the pain varies according to the site and size of adhesions, but it is momentary and leaves a dull ache which usually goes off in a few minutes. The pain of a tight capsule is not intense. It just hurts to stretch the joint beyond a certain point and consequently the patient avoids the painful range.

Faulty ligaments, either over-stretched or tight ones, cause local tenderness and, where they are accessible to pressure, as for example the supraspinous ligaments and the posterior sacro-iliac ligaments, we have further evidence of the site of lesion. All ligaments when sprained give rise to pain locally and where the ligaments are on the surface the diagnosis is easy, but with deep ligaments the pain may be segmental in pattern—referred pains which can cause difficulty in diagnosis. A valuable contribution to this subject was made by G. S. Hackett,[1] although he fails to discriminate between 'relaxed' ligaments and 'tight' ones. *His criteria for 'relaxed' ligaments* are:

(1) Pain localized to the area of the ligament.
(2) There is often referred pain of a particular pattern.
(3) The pain is aggravated by activity which puts a strain on the ligament.
(4) At rest or relief from strain, the pain is no longer present.
(5) Tenderness can be elicited by pressure over the ligament.
(6) The pain is reproduced by insertion of a needle and the injection of fluid into the ligament.
(7) The diagnosis is confirmed by injecting an anaesthetic solution into the ligament and abolishing the pain.

The hypermobile joint has had its ligaments stretched unduly, not just once, for this produces a sprain, but repeatedly; the ligaments are longer and weaker than they should be and therefore in *treating such joints*:

[1] HACKETT, G. S., M.D., F.R.C.S., *Joint Ligament Relaxation* (C. C. Thomas, 1956).

(1) Further stretching must be avoided. The hypermobile joint must therefore not be manipulated. No harm will arise from gentle controlled stretching of such joints, but very little is achieved in this way, and they are best left alone. The patient must be warned to avoid movements and activities which stretch the joint further.
(2) Support must be given to enable the ligaments to regain their normal strength. This is a slow process and often requires months of support.
(3) The other supporting structures—in particular the muscles which move the affected joint—must be strengthened and greater control achieved in doing a job that they are not primarily designed to do.
(4) The adjacent hypomobile joints must be rendered more mobile so that a more uniform distribution of movement in the area can occur. Instead of, say, 80 per cent of the movement in a group of three joints occurring in one joint and only 10 per cent in the adjacent joints, the range becomes equally divided and 33 per cent occurs at each joint. The methods whereby the hypomobile joints can be manipulated without straining the hypermobile joint are described later. When an osteopath can do this in practice he has indeed reached a high degree of skill in manipulation.
(5) A sclerosing fluid can be injected into the relaxed ligament after the manner described by Hackett.
(6) The stage of hypermobility in intervertebral disc lesions is discussed in Chapter 4.

In achieving the second principle of technique, which is the restoration of mobility in the hypomobile joint, we must first relax or stretch extrinsic structures. This leads to the third principle of technique.

THE THIRD PRINCIPLE OF TECHNIQUE is *the relaxation or stretching of extraneous structures*. We are concerned here primarily with the muscles which move the joint in lesion. These muscles are frequently 'on guard'—reflexly contracted and beyond the patient's control. The degree and extent of such 'guarding' depends upon the degree of trauma and the acuteness or chronicity of the lesion. There are several methods whereby contracted muscle can be encouraged to relax. Heat and rest serve this purpose admirably but manual methods are often more effective and expeditious.

(1) Approximation of the origin and insertion of the muscle combined with deep pressure over the belly of the muscle. In osteopathic terminology this deep pressure is referred to as *inhibition* and while there is no satisfactory explanation of why it works, it is certainly an effective way of relaxing moderately contracted muscle. The pressure may be applied

with the thumbs or heel of the hand. Considerable pressure has to be used and maintained until the hand feels a gradual relaxation of the muscle. Several applications of pressure are usually required for a minute or more. It is important to commence and cease pressure gradually to avoid irritation of the muscle.

(2) Separation of the origin and insertion of the muscle combined with kneading of the muscle belly at right angles to the direction of the muscle fibres. This is of value in moderately contracted muscles though simple stretching of the muscle is very effective in cramp—the severest contraction of muscle.

(3) Transverse frictions. This technique has limited value but may well be useful in chronically contracted fibrotic muscle.

It is a reasonable view that the condition of the muscle is almost always secondary to the state of the joint. It is from the joint (in its ligaments, articular cartilage, synovial membranes and capsule) that the abnormal afferent impulses arise. These impulses reflexly influence the tone of the muscles which move the affected joint. Treatment, therefore, if directed to the muscles alone, would be merely palliative, but if relaxation of muscles is necessary prior to the correction of joint mobility, then it forms an essential step. Sometimes the muscle condition can be ignored—some lesions are amenable to specific manipulation alone, in which case the muscles can be left to normalize themselves. This they will do if normal joint mobility and position is restored in acute or subacute joint lesions. In chronic lesions, however, lasting changes may have occurred in the surrounding muscles and special attention may have to be directed to such muscles before the whole lesioned area can be considered normal. Details of treatment to soft tissues are to be found in Chapter 3.

THE FOURTH PRINCIPLE OF TECHNIQUE is the restoration of mobility by *passive movements to intrinsic structures* by slow and rhythmical methods rather than sharp quick movements, as in subsequent methods. The objective here is to stretch the ligaments and capsule of the joint and to stretch adhesions which may be present but which are too recently formed to yield to snapping techniques.

There are several ways in which these passive movements can be performed:

(1) Using long leverages—the 'articulation' of joints in osteopathic terminology, details of which will be found in Chapter 3.

(2) Using short leverages—e.g. the pull or push technique against spinous processes to articulate adjacent vertebrae.

(3) Using sustained traction. This technique may have additional value

besides merely stretching, namely, the separation of articular surfaces which may be inflamed and the widening of intervertebral foramina.

(4) Intermittent sustained traction. This has as its objectives the same as sustained traction, but it is a method often of more practical value. Many times it is possible to give intermittent sustained traction when sustained traction is impracticable.

More details of traction will be found in Chapter 4.

THE FIFTH PRINCIPLE OF TECHNIQUE for the restoration of mobility is the use of *indirect specific adjustment*, with the object of releasing fixation in a joint by using long levers working upon a fixed point. For example, using the leverage of the femur and anterior thigh muscles to move the innominate bone upon a fixed sacrum at the sacro-iliac joint. This method sometimes produces an audible click at the joint but less frequently than subsequent methods.

THE SIXTH PRINCIPLE is in the use of *direct specific adjustment* with the object of sudden release of joint fixation, using short leverages and faeet-locking of adjacent joints, the accurate positioning of the patient and using a high velocity movement of short and powerful amplitude. The direction of the movement may be:

(*a*) Along the plane of the joint surfaces.
(*b*) At right angles to the joint surfaces.

In these movements we are concerned with the snapping of adhesions and the release of fixation. If there is a positional fault, such release of movement usually enables the normal resting position to be restored.

THE SEVENTH PRINCIPLE OF TECHNIQUE is the one of *specific thrust* upon one vertebra without adjacent locking, with the object of altering the relationship of one vertebra with the one above or below. This method is used mainly by the chiropractic school of manipulation. A high velocity thrust is directed against a spinous or transverse process with all surrounding tissues relaxed, rather like moving one brick in a column of bricks without moving any of the others, or the use of a hammer with a short sharp movement and recoil, a 'riveting' blow instead of a 'nail-driving' blow.

In applying a thrust, we have to consider its direction, timing, velocity and amplitude. We have to consider the position and relaxation of the patient. We have to consider protective devices to ensure that the thrust does not go too far, and to avoid the locking which is used in direct specific movements. While there is no complete locking, we require some degree of stabilization. We must use the minimum of leverage—in fact, the leverage of the spinous process or transverse process we are thrusting upon. We must position ourselves so that all slack is taken up before we apply the thrust. We must find our position of thrust and stick to it, avoiding the slightest variation while the thrust is applied. By 'taking up the slack' I mean that the normal elasticity of the tissues has been absorbed, rather like tightening the guy ropes of a tent, to take up the slack in the rope. The rope is not by this means excessively taut—it would be possible to tighten the rope still further, but the sag has been taken out of it. The same idea can be applied to a joint. It is stretched by positioning the patient so that a slight feeling of tension is present, and yet with more force it is possible to stretch the ligaments further during the thrust.

In the thrust technique, we are not concerned with the breaking down of adhesions, rather the release of articular fixation. There is something curious about an intervertebral joint; it can get 'hitched' as it were for no apparent reason; it can feel in faulty position, then it can be 'clicked' and the position and movement restored. It is difficult to believe that this 'hitching' or 'binding' is due to adhesions[1]—for they are not painful to break, nor can one envisage a synovial fringe getting into the joint or a loose body or any other completely satisfactory explanation.

It is a phenomenon with which all osteopaths and chiropractors are abundantly familiar. Furthermore, patients are vaguely aware of a 'hitch' and are immediately relieved by the manipulation. It is not a painful manipulation when expertly done. How or why the joint gets 'hitched' is a mystery. It is, of course, easy enough to 'pop' a normal joint and we achieve nothing by doing it. It is only where there is restriction of movement present that 'popping' the joint achieves any result.

Adjustive manual traction is a special type of technique which is of particular value in herniated discs but it is also of great value in breaking down fixation in the longitudinal direction of the spine (*see* Chapter 4).

In restoring mobility to a joint, we are concerned not only with restoring active movements, i.e. with those movements which are under the control of the patient's own muscles, but also with accessory movements, i.e. with movements which are not under active muscle control. For example, a patient may well be able to flex, extend, rotate and circumduct his shoulder to the full range and yet the shoulder movements are painful because of limited gliding movements up and down or forward and backward within the glenoid cavity. Similarly in the spine, a joint may have apparently full active range yet hurt because of longitudinal adhesions which are only broken by adjustive manual traction. Again in the elbow,

[1]MENNELL, J., *Joint Manipulation*, Vol. II (J. & A. Churchill Ltd., 1952), p. 6.

adhesions in the lateral ligament, often responsible for tennis elbow, can only be released by adducting the elbow at the radio-humeral joint. Adduction at this joint is not under the control of the patient. Only by passive testing of the joints can we obtain the information we need about movements which are not under voluntary control. The operator who wishes to excel in manipulation must learn to detect these passive ranges of movement and be aware when they are normal or abnormal, and he must be able to manipulate the joints to restore those movements.

We cannot leave the question of principles of technique without indicating important aspects relative to body stance of both patient and operator, and to their relaxation; to the rhythm of movement and to the timing of specific manipulations.

We might call these *rules of procedure.*

(1) The part of the patient being held should be held firmly but not rudely. Gripping should be light and the skin not screwed up or unduly stretched by the gripping. The limb should be held as closely as possible to the operator's body so that the limb of the patient becomes temporarily part of the operator, as it were.

(2) Where possible, make use of the patient's own weight to do the work of moving rather than using the operator's muscles. The patient's weight must be carefully poised against the operator's so that at all steps of the manipulation the movement is under full control. To slip from one's balance is a sign of faulty technique.

(3) Obtain relaxation in the patient by suggestion, entreaty, distraction or any other method so long as it is achieved. The objectives in manipulating joints are lost by resistance on the part of the patient. If the condition is too painful or the patient too nervous to relax, a general anaesthetic may be necessary, but this is only rarely indicated. In my own practice, I find only about 1 per cent of patients require an an aesthetic. Much resistance to manipulation arises from fear on the part of the patient. Very often this fear can be overcome by gaining the patient's confidence. The attitude of confident assurance helps enormously and such confidence as the operator has in himself is imparted immediately there is contact between the operator and the patient—it is a subtle thing which the patient can sense at once. No amount of verbal reassurance will be effective
outcome of the treatment, and it is virtually impossible for the operator to disguise his own attitude. There is something about physical contact of the operator and the patient which registers very quickly. The patient 'knows' whether he can trust you the moment you put your hands on him. This aspect of manipulation has received scant attention in the past. It is surprising the difference

between two operators even though they are apparently performing the same movement.

While an operator is manipulating a patient, the patient feels the pressure of the operator's hands, gentle and firm or rough and harsh or soft and flabby. The patient senses the smooth rhythm of the movement or the jerkiness of disconnected unpurposeful manipulation; he feels the localizing effects of tension created by the positioning of limbs and the 'taking up' of slack before an adjustive movement is done. If it were possible for an operator to appreciate what the patient feels as a result of his manipulation, the operator would learn very quickly the right and wrong ways of applying treatment, but unfortunately this is impossible. The nearest approach to this method of learning technique is to have a colleague as a patient who will describe faithfully the 'receiving' end of the treatment.

By continuous practice and 'thinking hard' through the fingers, in other words concentrating upon the sensations of tissue tension observed from the finger-tips and arms, in contact with the patient, it is possible to acquire an understanding and working knowledge of that elusive quality of the manipulator's skill, *tissue-tension sense*. This sense is the operator's 'sixth' sense and without it no operator will ever achieve real success in manipulation.

Tissue-tension sense is not merely palpation, though a highly developed palpating sense is a prerequisite to tissue-tension sense; for palpation merely feels stationary tissue, bone, ligament, muscle, connective tissue, fascia, fat—all of these have their own quality perceived by palpation alone, but tissue tension sense is the appreciation of the amount of stretch there is in moving tissues, an interpretation of such tension during the process of movement in a limb, joint or muscle. It is dynamic rather than static.

An understanding of the condition in which you find a joint depends upon history-taking, inspection and palpation of the joint, observing the range of active movements but particularly in sensing the restrictions on passive movements—this observation is dependent upon the practitioner's tissue-tension sense. I am not here referring to gross restrictions of movement, which are obvious to the eye, but rather the more subtle restrictions of those movements which are not normally under the patient's control.

Again, tissue-tension sense is of paramount importance in treatment. By practice and experience, one develops a sense of the amount of force which can safely be applied to any tissue (it is the disregard of tissue-tension sense or the absence of such sense which leads to the inexcusable complications of manipulation in inexperienced hands). Tissue-tension sense enables the operator to choose the precise moment at which the thrust should be applied. It enables the operator to co-ordinate the component parts of a manipulation and to mould them into a smooth rhythm which looks so easy to the onlooker and feels so effective to the patient.

A keen tissue-tension sense will enable the operator to make all his movements purposeful. So often manipulation is carried out on a rule of thumb basis or even in a haphazard way without a specific purpose in view. Such manipulation may be pleasant enough to receive but it is virtually a waste of time.

Proper and effective manipulation requires continuous concentration on the part of the operator and that is why it is such a tiring occupation, using up not merely physical energy in applying the treatment but concentrated mental effort. Performing a series of movements in an automatic fashion while carrying on an animated conversation with the patient is rarely of much value. By all means let the patient talk, it may help him to relax better, but do not yourself chatter away unless you are content to waste the treatment time.

The rhythm and timing of manipulative techniques are important, and much practice should be performed in an attempt to obtain smoothness of rhythm and accuracy in timing. Ideally, the positioning of the patient and operator, the taking up of slack, the protective guarding of adjacent joints, the combination of flexion, extension, sidebending and rotation, and the final thrust should all be done in one cycle of movement. At first, all these aspects of technique will have to be done separately and precisely, but with practice the whole may be smoothed out into one harmonious movement. The technique may be compared with driving a car. The learner driver has to perform all the movements separately with individual thought for the brakes, clutch, gears and accelerator and the resultant motion of the car is jerky and unpleasant, but the expert driver performs all the phases in a continuous motion so that the car glides away from rest beautifully in a gradual acceleration of motion to the satisfaction and comfort of his passengers.

THE EIGHTH PRINCIPLE OF TECHNIQUE is that we should use the *minimum of force consistent with achieving our objective*. There is no place in skilled osteopathic technique for brute force. There should be no need for undue force if we obtain first the confidence of the patient, and thereby his or her relaxation, and then apply our force whether it is traction or articulation or thrust in the proper direction. Careful application of this principle will save the patient a lot of unnecessary reaction after treatment, and will earn for the practitioner the reputation of gentleness and skill which is so eminently desirable all round. The idea of gentleness can, of course, be carried too far and in this case our manipulations become ineffectual, and we may just as well treat by 'the laying on of hands'. No doubt this has its place but it is not osteopathy. If relaxation cannot be obtained for any reason at all, it is far safer and more desirable to manipulate under anaesthesia than to have a tug of war with the patient. It is the use of undue force against resistance which brings manipulation into disrepute. With anaesthesia the principle of gentleness applies even more so, because of the complete absence of resistance from the muscles.

2

THE DIAGNOSIS OF THE OSTEOPATHIC SPINAL LESION

DEFINITION

AN OSTEOPATHIC spinal lesion is a condition of impaired mobility in an intervertebral joint in which there may or may not be altered positional relations of adjacent vertebrae. When altered position is present, it is always within the normal range of movement in that joint.

The moment when irreversible pathological changes take place in the joint, it ceases to be a purely osteopathic lesion. Similarly when the altered position is such that articular facets are not in apposition, it is no longer an osteopathic lesion, it is a dislocation, and this is outside the meaning of the term.

The definition here is deliberately limited because this is the condition which responds to manipulation, and the normalization of which gives such satisfactory results. It indicates that the essential feature of the joint fault is limitation of movement. In the previous chapter we have stated how difficult it is to define the normal range of movement in an intervertebral joint because it is such an individual matter, but an attempt is made in the Appendix to describe what we consider to be the normal movements of each section of the spine. It was pointed out earlier that the criterion of most value clinically is the comparison of adjacent joint mobility. Any one of the various ranges of movement—flexion, extension, rotation, sidebending—may be restricted or there may be a combination of restrictions.

Now the definition does not state what the limitation of movement is due to, except that the limitation is not due to disease. Limited motion in joints, excluding pathology, can only arise from tight capsules, ligaments and fascia, from shortened muscles, from adhesions (intra- or extra-capsular) and from the so-called 'hitching' of a joint.

The *characteristics* of the spinal lesion, apart from the restricted movements and abnormal bony relations, are pain, tenderness, swelling of surrounding soft tissues (though this is rarely palpable), muscular contraction and skin changes. There may be hyperesthesiae and sometimes itching in the related segment.

The *pain* of an osteopathic lesion may be local or referred. Patients frequently indicate the site of pain with a fair degree of accuracy but more commonly they feel a diffuse pain in the region of the lesion. They point vaguely to the area with the whole hand rather than with the tip of the finger. This is understandable, of course, because when the origin of pain is deeply seated the localization of pain is poor and segmental in distribution. We know from the researches of Lewis and Kellgren (*Clin. Sci.* 1939, 4. 36 and 47) that irritation of sensory nerves in deep structures gives rise to a uniformly distributed and segmentally localized pain. The pain, therefore, may be felt in the region of the vertebral spines or transverse processes or it may be referred to the dermatome, sclerotome or myotome segmentally connected with the lesion.

Further *pain arises in the muscles* surrounding the joint. We know that the muscles which move a joint are reflexly contracted when that joint is injured. In addition we know that sustained contraction of muscle will lead to inadequate circulation in that muscle and the accumulation of waste products like sarcolactic acid and P. substances (Lewis, *Arch. int. Med.*, 1932, 49, 713). These cause pain in the muscle. It is unusual to have real cramp round the lesion and, therefore, it is unusual to have severe pain, but it is common for the muscles to be in sufficient spasm for the muscles to ache and be tender to touch. This muscular ache is in addition to the pain from the joint sprain and should not be confused with it. When the muscles have remained in a contracted state for prolonged periods internal changes take place in their structure; there is a process of replacement fibrosis and the muscles become hard and stringy and are tender to the touch even when relaxed, though not so acutely tender as when they were contracted.

Then there is the *pain due to direct impingement* upon nerve roots at the intervertebral foramen. This pain is felt in the distribution of the nerve root itself, and is not segmental as in referred pain. Now nerve-root irritation is unlikely in the uncomplicated spinal lesion, though it cannot be ruled out entirely. Root irritation is more likely to occur in prolapsed discs and osteoarthritic lipping, but it must be remembered that the posterior component of the intervertebral foramen is the capsule of the apophyseal joint, and sprains of these joints will cause swelling inside and outside the joint capsule and this may well be sufficient to cause root pressure, at least temporarily. Furthermore, such swelling may accentuate disc lesions and arthritic lipping. In this era of disc lesions, it must be remembered that the disc is but a single component of the whole intervertebral joint, and many of the faults occur in the apophyseal joint independently of the disc component.

The *tenderness* of the osteopathic spinal lesion is located in the spinous processes, supraspinous ligaments and over the transverse processes.

Sometimes tenderness of these bony points is difficult to differentiate from tenderness of contracted muscle, especially when such muscle overlies the transverse processes.

The apophyseal joints and discs are too deep for *swelling* round them to be palpable, except in the cervical region where the articular processes are quite superficial. Here it is possible to palpate swelling in the capsules of the apophyseal joints. In other places the only swelling possible to detect is in the muscles, and this is not easy to feel.

It is easier to detect *muscular contraction*. This is an almost constant feature in the osteopathic spinal lesion. The muscles involved are normally the small, deep ones such as the multifidus, interspinous and intertransverse muscles. Only when a severe sprain occurs in the intervertebral joint will the more superficial spinalis or semispinalis muscles become involved. It is important to realize that the severe muscular cramp-like spasms of whole groups of the erector spinae muscles, such as are seen sufficient to immobilize the patient or create a severe scoliosis, are not normally due to osteopathic spinal lesions, rather are they due to disc propulsions, fractures or more serious pathology in the bone or joint.

Muscular contractions are palpable and their site can be determined by a knowledge of the anatomy of the spinal muscles, the whole of the muscle belly is rarely wholly contracted, rather do we feel groups of muscle fibres; they are firm and very tender. Later, when the acute contraction has given way to a more chronic contraction, the muscle fibres feel more like cords and are hard and slightly tender.

These localized muscular contractions are the so-called 'fibrositis' of the physiotherapist's terminology, and they are palpable in many superficial muscles besides the local deep ones round the lesion itself. Any muscle which is reflexly connected with the segment involved can develop this group of contracted muscle fibres, as in the trapezius from 3–4 C. lesions, supra and infra spinatus from 5–6 C. lesions, gluteus maximus and medius from 5 L.–1S lesions. To treat these 'fibrositic' muscles alone by heat and massage, without dealing with the faulty joint causing them, is a waste of time; it merely provides temporary relief and that is why so many hours of the physiotherapist's time are wasted rubbing away 'fibrositis'. The muscular contraction will relax for a time with the help of heat and massage, but it returns rapidly because the source of the muscle irritability is not tackled. Sometimes it is necessary to deal with muscular contractions by heat and massage but rather is this preparatory for the manipulation of the affected joint. Occasionally the fibrotic muscle has undergone changes in itself, so that even if the source of irritation is removed the muscle remains a focus of pain and irritation. Then and then only is it desirable to treat this muscle by local frictional massage and infiltration with novocaine. It is possible for a vicious cycle to be established—muscle irritability maintaining the joint fault which in its turn maintains the muscle irritability. Both components may have to be treated to break the cycle permanently. Where lesions have been present for years, the changes in the muscle may be so established that they cannot be reversed. In this case we have a 'chronic osteopathic lesion' which requires mobilizing at intervals to retain as much movement there as possible and to stop any further deterioration in the joint. A chronic osteopathic lesion, if untreated, will almost certainly undergo degenerative changes eventually and spondylosis supervenes. No doubt the lack of movement and consequent decrease of blood supply to the joint is responsible for the degenerative changes.

The *ligamentous changes* which occur in the osteopathic spinal lesion must depend upon positional factors. If a faulty position is established, it means that some ligaments will be permanently stretched and some permanently shortened. Ligaments were never designed to take continuous stretching. When they are, they become weaker and longer. The ligaments unfortunately are not palpable apart from the supraspinous ligaments and there we notice they are long and thin in the hypermobile intervertebral joint, while they are short and thick in the hypomobile joint.

The *skin* changes surrounding the lesion depend somewhat on its acuteness or chronicity. There is an increase in warmth and perspiration and sometimes hyperesthesiae to touch in the acute lesion, but in the chronic lesion these changes are less obvious, hyperesthesiae giving place merely to itching.

The sudomotor changes can best be felt by running the finger very lightly and quickly over the suspected site both from above and below. The fingers experience an increase of friction at the level of the lesion. The hyperesthesiae can be detected by means of a pin, and the area corresponds approximately with the posterior primary ramus of the related spinal nerve. Another useful test, though it is by no means always positive, is the skin rolling test. This is done by picking up a lump of skin and subcutaneous tissue well away from the lesion between the thumbs and index fingers, and rolling upwards or downwards to the level of the lesion. At that level the patient experiences an increase of tenderness in the subcutaneous tissues when the test is positive. In spite of the test not being always positive, when this increased tenderness is present it corresponds accurately with the level of other abnormal findings and is a useful confirmation of the other findings.

TYPES OF LESIONS: ETIOLOGICAL

(1) *Traumatic Lesions*

(*a*) Acute joint sprains.

(*b*) Chronic joint sprains—usually a sequel to (*a*).

(2) *Compensatory Lesions*

In these, the lesion is compensating for other adjacent and remote lesions, normally at a lower level. Compensation to hypomobility is hypermobility, so that the hypermobile lesion is included here. Compensation may be due to the faulty positioning—the vertebral joint above trying to reverse the faulty position of the one below. Compensatory lesions may well be single ones, but more often they are multiple and, as in scoliosis, there are *group* lesions.

(3) *Group Lesions*

Very often we find flattening or accentuation of the normal curves of the spine, e.g. thoracic lordosis and thoracic kyphosis. These may be compensatory, as indicated above, but yet they may be a sequel to an initial single osteopathic lesion and again they may arise from postural faults. All such postural faults come under the heading of group lesions.

(4) *Reflexly Produced Lesions*

These joint fixations are a sequel to constant and repeated bombardment of the spinal segment closely connected with some diseased viscus. It has been repeatedly pointed out by observers outside the osteopathic school of thought (Mackenzie, Lewis[1]) that in diseases of the heart, for example, there are tender areas in the upper thoracic spine, or in gall bladder disease tender places in the lower thoracic spine. These tender sites are found to be identical clinically with the chronic traumatic osteopathic lesions. The viscero-somatic reflex is responsible not only for pain and tension in muscles in the abdomen or thorax but also in the spine and paravertebral muscles. There can be no doubt about the existence of such lesions which produce local signs and symptoms in the spine. We, as osteopaths, will go further than this and state that such lesions act reflexly in the reverse way so that abnormal somatico-visceral[2] impulses are produced much to the further detriment of the already diseased viscus. Medical opinion is veering in this direction. Samson Wright states:

> 'The sharp distinction which is customarily drawn between the autonomic and somatic nervous systems, though useful for purposes of description, is to a considerable extent misleading. *Afferent impulses from somatic structures may reflexly influence*
> of the central end of a skin or muscle nerve may reflexly affect the heart rate or blood pressure. Conversely afferent impulses from viscera may influence the activity of the ventral horn cells. Both sets of results illustrate the phenomenon of irradiation.'[3]

[1] MACKENZIE, SIR JAMES, *Symptoms and Their Interpretation* (1920); LEWIS, SIR THOMAS, *Pain* (1942).
[2] HARGRAVE-WILSON, W., *Journal of American Osteopathic Association* (1936).
[3] WRIGHT, SAMSON, *Applied Physiology* (Oxford Med. Publications, 1952), p. 765.

The present conception of the osteopathic spinal lesion is well summarized by Willis Haycock in his lecture 'The Expanding Concept of Osteopathy', October, 1955. He states:

> 'the lesion is not merely a positional disturbance of vertebrae to be adjusted by an appropriate mechanical procedure. It is an entity, produced and maintained in being by a wide variety of factors—paravertebral stress, hyper-irritability of spinal cord cells, viscera and other tissues, and mental and emotional strain—all of which the practitioner must take into consideration when planning the campaign of treatment.
>
> *It is the realization,* (a) *that there are a wide variety of factors, from every part of the body, and from its environment, which may contribute to the setting up of an osteopathic spinal lesion;* (b) *that the lesion may result in the facilitation of related neural segments; and* (c) *that, through the medium of these facilitated segments, all operative factors may react detrimentally on each other, even after the original source of irritation has been eliminated; that has led to the osteopathic concept of the unity of disease, of the paramount importance of the osteopathic spinal lesion in the development of disease processes and of osteopathic adjustive technique in the disintegration of the disease-producing pattern.*'

TYPES OF LESIONS: CLINICAL

The osteopathic spinal lesion has been named and classified in the past according to its faulty position, e.g. the flexion lesion, the rotation sidebending lesion, the posterior innominate, etc. *I consider that positional faults are of secondary importance and that movement restrictions are the vital feature of the osteopathic lesion*, and consequently I have classified lesions and named them according to the type of restriction present in the joint. The older nomenclature referred to the flexion lesion as one in which the vertebra was held in a relative position of flexion and there was limited extension in the joint below. Such a lesion now we should call an 'Extension restricted' lesion, or better still 'Backward bending restricted' lesion (B.B.R.). (I would rather use the term 'backward bending' than 'extension' because of the confusion over the terms flexion and extension. By definition the term extension means 'a separation of the parts which a joint connects'. In the cervical area this would mean forward bending of the head on the trunk, yet most people call this movement 'flexion'.) Now any or all ranges of movement may be restricted so that there are the following types of lesions:

(1) Backward bending restricted. (B.B.R.)
(2) Forward bending restricted. (F.B.R.)

(3) Rotation restricted to the right or left. (R.R.)
(4) Sidebending restricted to the right or left. (S.R.)
(5) Combined restrictions.

Where there is a positional fault in addition to a mobility fault, we should describe the position in such a way as to avoid confusion and to imply position rather than movement. For example, the 4th lumbar vertebra may be described as tilted to the right or left, tilted backwards or forwards, shifted backwards or forwards (as in spondylolisthesis), or it may be posterior right or posterior left. The term posterior refers to the position of the transverse processes of one vertebra relative to the transverse process of the vertebra below. If the transverse process on one side is posterior it implies a position of rotation to the right, but it is desirable to avoid using rotation in this positional terminology because rotation implies movement and not position.

In previous osteopathic textbooks there are described first degree and second degree lesions; a first degree lesion being one in which a vertebra is first in a position of rotation and sidebending to the same side—the rotation of the vertebral body being to the concavity of the curve; the second degree lesions being a fixation of a vertebra where the rotation has gone to convexity of the curve.

These types of positional faults undoubtedly occur, but they are by no means invariable. Furthermore, they imply the conception that the vertebra has been 'displaced' into that position, and that such positions are the result of forces acting upon the apophyseal joints. When examining spines clinically and looking at X-rays of spines, I find it impossible to fit all the varieties of altered positions into these categories, and while it is much easier to call a lesion a first degree lesion than it is to describe it as tilted to the right and posterior right, I think the latter description is better because it merely states the fact of the position, and does not imply a preconceived idea of how the positional fault arose.

It is my view that most of the positional faults found to occur are the result of internal structural derangements within the disc substance itself; or else the position is a positional compensation to positional faults below. There are, of course, positional faults due to defects of the pars interarticulares, and very marked tilts occur in disc herniations and disc prolapses.

It will be seen from the above use of terms I have tried to avoid confusion. Osteopathic literature has in the past been full of words and terms having special meaning, and, although familiar to the osteopaths, have been unfamiliar and misleading to the medical profession. This is a pity and unnecessary because there are sufficient common or garden medical words to describe all that Osteopathy has discovered. As MacBrain said:

'The older terminology in which common medical terms are qualified by the word "osteopathic", as in "osteopathic lesions", "osteopathic pathology", and "osteopathic diagnosis and treatment", requires orientation and explanation for those not accustomed to thinking osteopathically. The "osteopathic" terms have served us well in focussing our own thoughts, but have added to the difficulties of communication with other scientific groups. They may, in a minor way, have delayed a broader understanding and acceptance of our contribution to medicine.'[1]

DIFFERENTIAL DIAGNOSIS OF BACKACHE

The subject of backache is dealt with here not with the object of attempting to be comprehensive but rather to illustrate the method which is used in arriving at a diagnosis. Nor is it intended to go into a detailed description of all the conditions in which backache is a factor, but a list is worth setting down so that the less common causes are not forgotten or ignored.

It is our primary concern when a patient presents with backache to make a diagnosis, firstly by excluding pathological causes and, when we are satisfied on that score, to make a detailed diagnosis of the mechanical fault.

Causes of backache can broadly be divided into:

(1) General diseases in which backache can occur.
(2) Referred backache from visceral disease.
(3) Diseases of the vertebral column and nervous system.
(4) Muscular conditions.
(5) Mechanical faults other than the simple osteopathic lesion.
(6) Psychogenic backache.
(7) The osteopathic lesion.

(1) Any acute fever can cause backache, most common, of course, influenza. Backache often persists after the fever has subsided. This may be due to muscular toxins formed during the course of the disease or the backache may arise from ligamentous strain through faulty posture in bed or a badly sagging mattress or from the loss of muscular tone through inactivity or from local oedema of the disc from retention of intra-cellular fluid.

(2) Backache and local tenderness commonly arise during the course of certain visceral diseases. This has been well recognized since Sir James Mackenzie wrote *Symptoms and Their Interpretation* in 1920. We would

[1] MacBrain, R. N., *Journal of the American Osteopathic Association* (November, 1956).

go so far as to say that all disease shows evidence of spinal joint irritability in the segments closely connected reflexly with the viscus involved, but the diseases most likely to cause backache are pleurisy, peptic ulceration, kidney disease, pancreatitis, cholecystitis, visceroptosis, retroperitoneal neoplasm, aortic aneurisms, pelvic inflammatory disease, uterine misplacements, pregnancy. Though backache may be considerable in any of the above conditions, it is not often the presenting symptom. The backache is not well defined, nor is it related to activity or posture and there are no localizing signs in the vertebral column. When a patient presents with such backache, it is especially important first to exclude visceral disease.

(3) A list of diseases of the vertebral column and nervous system in which backache occurs is as follows: osteoarthritis, spondylitis ankylopoetica, primary and secondary neoplasms, vertebral and sacro-iliac tuberculosis, osteomyelitis, Paget's disease, osteochondritis, senile osteoporosis and kyphosis, tabes dorsalis, syringomyelia, Friedreick's ataxia, subacute combined degeneration of the cord, spinal cord tumours.

Most of the above bone conditions are excluded by X-ray evidence. They must always be thought of because many are dangerous conditions of the spine in which manipulation is absolutely contra-indicated. Unfortunately, early secondary carcinoma is not always seen radiologically so that it becomes especially important to withhold manipulation in suspected carcinoma of the breast, thyroid, prostate, lung and stomach.

In tuberculosis of the vertebral column, even before a gibbus is present, the careful practitioner will immediately sense something is seriously wrong because of the intense localized muscle spasm and the constitutional signs. Further details of differential diagnosis are obtainable in standard textbooks of orthopaedics.

Diseases of the nervous system rarely present primarily with backache and differential diagnosis should be straightforward.

(4) Muscular conditions. Rareties like trichinosis and gouty rheumatism must be excluded, but localized 'fibrositic' muscular contractions and inflamed 'fatty nodules' are common sources of backache. They are rarely, however, the basic cause of the backache and are merely a manifestation of deeper joint faults.

(5) Mechanical faults other than the simple osteopathic lesion are—spondylolysis, spondylolisthesis, scoliosis, kyphosis, lordosis, sway posture, short leg, congenital asymmetry and anomalies and the various intervertebral disc lesions.

All the above are demonstrable radiologically except the intervertebral disc lesion. As this is such an important subject and as there are special osteopathic techniques appertaining, a separate chapter is devoted to this.

(6) Psychogenic backache. This hardly needs a separate heading. It ought to be in very small print because the incidence of psychosomatic backache is very small indeed. It is customary in medical practice to say a condition is 'functional' when no organic basis can be found for the symptoms complained of. Ordinary cursory examinations of the back will fail to indicate the source of many backaches, but this is more often the fault of the examiner than that of the patient. Detailed analysis of the spine as indicated later will demonstrate many mechanical faults which are a potential cause of backache hitherto missed. The best indication of the psychogenic backache is excessive reaction to the usual tests in the spine.

(7) When all the above causes of backache have been excluded there remain an enormous number of backaches which are due to altered mobility and position of the intervertebral joints. These are the osteopathic lesions which are considered elusive by the medical profession. They are elusive because few doctors have taken the trouble to examine the spinal column with the care that it deserves; few have a knowledge of the normal anatomy, physiology, mechanics, and still fewer have spent the time necessary to acquire the palpatory skill necessary to appreciate minor changes in muscles, ligaments, tendons and joint mobility. The veriest tyro can diagnose a large ovarian cyst, an established carcinoma of the breast or a raging lobar pneumonia, but it requires skilled palpation and wide experience to diagnose salpingitis, early appendicitis and early spinal tuberculosis. Similarly, it is easy enough to diagnose a scoliosis, an angular kyphosis, a spasmodic torticollis, but it requires skilled palpation and wide experience to detect individual vertebral joint fixations, sacro-iliac lesions and occipito-atlantal lesions. Just because a new student cannot feel a soft mass in the right iliac fossa, it does not mean that the experienced surgeon is wrong when he says he can. Similarly, just because a 'raw' doctor to spinal joint examination cannot feel restricted sidebending to the right in the 3-4 C. joint, it does not mean that the osteopath is wrong when he says that he can. It may be perfectly obvious to him.

DIAGNOSTIC PROCEDURE

In arriving at a diagnosis of a mechanical fault in the vertebral column, there are two main avenues open to us clinically, that of inspection and that of palpation. An absolute prerequisite, before inspection and palpation can be used intelligently, is a vivid mental picture of the anatomy of all structures below the skin. This mental picture should be carried the whole time in the mind's eye of the student, particularly while palpating. He should be able to say which structures are under his fingers in whichever part of the body he is palpating, not merely being able to state the names of the structures but also the shape and direction of the structures. Surface anatomy is almost as important a subject to the osteopath as it is to the surgeon. He should familiarize himself repeatedly with normal living anatomy. His fingers should be trained to pick up at once any abnormal tissue condition. It is only practice and experience which will teach the student these important qualities. Some of the important landmarks of surface anatomy are dealt with in the Appendix.

Palpation

Palpation requires varying depths of pressure to reveal all the information available in a given area, and, as a working rule, the heavier the pressure the deeper the structure which becomes palpable, but the lighter the palpation the better, particularly from the patient's point of view. Many areas of the body are normally tender to deep palpation, and any tissue is tender when pressed hard enough, so that one must not be misled into assuming that there must be something wrong at a tender site. A useful comparison, using equal pressures on both sides of the body, can be made as a rule, to avoid making mistakes. There is a tendency for students to have a mental conception of what to expect, and they often find what they are looking for, but this may be wishful thinking or self-deception. It is easy to press harder on the site you expect or want to find tenderness and so elicit it from the patient. Some students will find their thumbs most useful for palpation, others perhaps will find the index or middle fingers more sensitive. It is an individual matter, and is best found by trial and error. Establish a habit and stick to it. When palpating for movement between adjacent bones, try and arrange for the two bony points to be covered by one finger so that the separation and approximation is easily felt. It is not a good idea to have a lot of fingers on the site at once—too many sensory impressions are received by the brain, making it more difficult to interpret your findings. Never palpate casually while thinking of something else. Make sure you are making the most use of the tactile impressions being received by your fingers or thumbs. It is easy to palpate in a slipshod or automatic fashion and, after a few minutes' palpation, find that you have no more information about your patient than you had before. Always say to yourself, 'What information am I obtaining from palpating this structure—is it normal or otherwise?'

The clinical signs obtained from inspection and palpation are invaluable and often tell you more than the recital of the patient's symptoms. Given an experienced practitioner, his findings are often more reliable than the patient's testimony. It is most advisable to establish a routine of physical examination so that important points are not missed. The order or sequence of the examination does not matter but it should be an established routine, not that it is desirable or necessary always to do a complete examination of all the structures in the body. Further, it is not desirable to have an inflexible scheme starting, say, from the head and working down to the toes, especially when a patient comes in complaining of pain in his big toe. It is politic to have a look at the big toe first and then, if you like, start at the head and work down through your own scheme of examination.

Further, it is important that the examinations carried out are purposeful; that is to say, a certain test is designed to give certain information, the test should be such as to clarify the diagnosis and not to confuse it. A physical sign elicited should have some meaning to the examiner. The examiner should know exactly what he is testing for and how to interpret the abnormal physical signs he elicits. In the early stages of acquiring diagnostic skill it is necessary to put down your findings in writing. It is only the exceptionally experienced who can detect faults, collate them and synthesize them into a comprehensive diagnosis without the help of recording them on paper. An exact interpretation of all physical signs is not possible in our present state of knowledge, and, while it is particularly important to record findings which have a clinical meaning, it is still worth while recording abnormal physical signs and symptoms even though they cannot be integrated into a single simple diagnosis. It may be that other diagnostic signs and symptoms will come to light later and will explain the previously inexplicable ones.

Confirmatory evidence of your palpatory findings by X-rays is desirable and invaluable. The type of X-ray films required here are not the static views of the standard method though these may be of more value in excluding organic disease. We need what I term '*mobility*' *X-rays*—films taken in full flexion, full extension and full sidebending. The films so taken should be done in the horizontal position because we are testing the passive range of movement at each joint. Frequently it is useful to have both mobility views and ordinary non-weight-bearing standard views for comparison. There is some value in taking mobility views in the vertical weight-bearing positions but it is not easy to obtain clear pictures, and such X-ray findings will not tally with your clinical tests which are done passively in the horizontal position.

Individual mobility films are of little value, but if we examine lateral views of the cervical spine in flexion and in extension, placing them side by side on the viewing box we can compare the ranges of movements. We have visual evidence of the mobility obtainable in these joints (*see* Figs. 5, 6, and 9 (pp. 48, 49, 52 and 53).

Further confirmatory evidence of joint lesions in the absence of disease can be obtained by the use of local anaesthcsia. By our history-taking and clinical observations of the joint lesion, we should be in a good position to say from which structure the patient's pain is arising, whether it is from ligament, muscle, bone, cartilage or nerve. By the infiltration of the painful site with a local anaesthetic we confirm or refute our suppositions, and, where this method is applicable, it can be an invaluable aid to diagnosis.

As explained earlier, previous osteopathic books and articles on technique used a positional notation for the description of osteopathic spinal lesions and they have been named, for example, flexion-sidebending-rotation lesions (F.S.R.) because it was considered that the vertebra above was relatively flexed, sidebent and rotated compared with the vertebra below. While this system has merit and has been excellently expounded by H. H. Fryette, D.O., in his book *Principle of Osteopathic Technique*, 1954, it has, in my opinion, the disadvantage of emphasizing the positional fault of the lesion, whereas the mobility fault is the all-important one.

Inspection of the Patient

In all instances, for convenience and to assist in clarity, it is assumed that the patient is a woman and the operator a man. This enables the writer to use 'his' to mean operator and 'her' to mean patient and so avoid the constant repetition of operator and patient. (It is, of course, not implied that the operator is always male nor that the patient is always female!)

The purpose of inspection is to obtain a general impression of the type of patient to be dealt with and to assess her mechanical state broadly. General impressions will often lead to examination in greater detail of certain areas which appear on general inspection to be faulty.

Observe the patient's posture in all the positions of examination, noting any tendency to avoid weight-bearing or pressure, noting the manner in which she moves from one position to another. As the patient walks into the room, one can sometimes tell at a glance, for example, that the patient is suffering from pain in the right lower extremity, or when a patient sits and avoids pressure on one thigh, suggesting sensitivity of the sciatic nerve or hamstring muscles. Having taken a comprehensive history and obtained a general impression of the patient, the next step is to examine the patient in the *standing position.* Ideally, the patient should remove all garments so that nothing can impede the inspection of all parts of the body, but a convenient garment is one divided at the back, tied and untied with tapes.

In observing the posture of the standing patient we are concerned with the central gravity line of the body—deflections of the body contours about the central gravity line indicate the type of postural fault which is present.

The central gravity line passes through the occipital condyles, posterior to the cervical bodies, then through the body of 1 T., anterior again to the thoracic spine and on through the body of 3 L. Weight is then divided through the two legs and the central gravity line passes posterior to the hip joint, anterior to the knee and ankle joints, and finally passes through the astragalo-scaphoid joint of the foot.

For normal balance there must be an equal weight in front of the central gravity line as well as behind or, in more accurate mechanical terms, the moment of the forces anterior to the central gravity line must equal the moment of the forces posterior to the central gravity line. If more weight is displaced forwards of the central gravity line, as for example the flexion of the head forwards on the trunk, there must be an equal shift backwards of the torso, sufficient to
placed forwards exactly. If the body is kept rigid and the head flexed forwards, there is a sensation of forward movement of the body which can be checked by the firmer pressure of the toes on the ground. Body weight can be carried forwards so that the central gravity line passes anterior to the astragalo-scaphoid joint, but this is not an easy position to hold. Similarly, the central gravity line can be made to move backwards, but there is a sense of insecurity about the position, and muscles are placed on guard, as it were, to check a further shift of the central gravity line, otherwise balance would be lost and the individual would fall.

When balance is good, it is easily maintained because the spine and joints of the lower extremity have been designed to maintain the normal erect posture without undue muscular effort. The anterior and posterior muscles are at the ready to counter any shift of the central gravity line but in the easy erect position the postural muscles are not in a state of contraction. This has been shown to be so, using electrodes in the muscles and recording their electrical discharge with an electromyograph.[1]

Alterations of normal antero-posterior balance are seen in the female patient who wears high heels, in 'sway' posture, during pregnancy and in the obese. Usually such alteration leads to an exaggeration of the normal curves of the spine, lumbar lordosis, thoracic kyphosis and cervical lordosis with backward tilting of the head. This all leads to a state of strain, particularly in the joints where maximum leverage occurs, e.g. the lumbo-sacral joint, 2–3 L., 7–10 T., 5–6 C., and occipito-atlantal joints.

Body weight similarly must be equally divided between the two legs and in the normal posture an equal weight is supported by each foot. Quite a considerable margin of lateral shift of the central gravity line is possible

[1] JOSEPH, J., and NIGHTINGALE, A., *Journal of Physiology* (Lond. 126 (3), 28.9.54), p. 85; BASNAJIAN, J. V., and BENTZON, J. W., *Surgery Gynaecology and Obstetrics* (Chicago 98.6., January, 1954), p. 662.

because each leg can take the whole of the body weight at any time. As body weight is transmitted from one foot to the other, elaborate muscular co-ordination and balance must be performed to maintain equilibrium. By shifting body weight almost entirely on to one leg and resting on the ilio-tibial band in the manner of the mannequin, the pelvis is allowed to drop on the other side so that weight distribution is completely altered, a lateral curve is created in the lumbar spine to the opposite side from the weight-bearing leg and a compensating convexity to the same side higher up in the spine. A somewhat similar picture occurs in the Trendelenburg's test, when the weight is taken on the leg with a congenitally dislocated hip on that side or when the gluteus medius is paralysed on the same side—the pelvis, instead of tilting upwards, tilts downwards on the non-weight-bearing side. Such lateral shifts of parts of the body away from the central gravity line must inevitably have their compensatory shifts to the opposite side in order that equilibrium is maintained.

When one leg is shorter than the other, even if body weight is equally shared, it leads to lateral shifts away from the central gravity line to compensate. From the point of view of spinal mechanics it is the sacral base which matters most. If this is horizontal then there will be no lateral curves unless some complicating factor is present above. It is possible, for example, for a torticollis to cause a curvature and this has its compensations further down, but it is more usual for compensations to take place above for tilting and for lateral shifts below. It has been shown[1] that in a random series of fifty cases of patients presenting with conditions other than backache 28 per cent of them had ¼ inch or more of shortening of one leg, but in a consecutive series of 100 patients presenting with backache 60 per cent of them were found to have ¼ inch or more shortening of one leg; indicating that backache is frequently due to the strain created by the pelvic tilt and consequent alteration of the central gravity line. In order to compensate for the shorter leg, alterations occur above. The first compensation takes place in the sacro-iliac joint on the shorter side. Sometimes this is sufficient and sacral levels are normal. If the sacro-iliac joints cannot compensate enough then the lumbo-sacral joint or the 4–5 L. joint must serve the same purpose. Occasionally these two joints compensate enough, but more often than not a gradual compensation occurs with a uniform curvature, convex to the short side in the lumbar area, and convex to the long side in the thoracic area. Compensation may spread as far as the cervical area and occasionally to the occipito-atlantal joint. (For further reference to the short leg *see* Chapter 3, 'The Pelvis', p. 211.)

Lateral asymmetry may occur in combination with antero-posterior asymmetry, producing various combinations like kypho-scoliosis.

[1] STODDARD, A., 'The Short Leg and Low Backache Syndrome'. Paper presented at the International Congress of Physical Medicine, 1952.

When inspecting the spine, such lateral shifts must be observed and recorded, noting the carriage of the head, the shoulder levels, scapular levels, levels at the crests of the ilia, and gluteal folds. It must be noted later in the examination if such lateral or antero-posterior faults are maintained or lost when the patient sits or lies down. If faults persist, it suggests an established and fixed deformity, but if they disappear then it indicates that corrective measures will more readily achieve success in restoring the normal body outlines.

In making this initial inspection the feet must not be forgotten. Faults in the feet and the footwear frequently give rise to mechanical disturbances at higher levels.

General Mobility Tests

Our next step is to ascertain the range of the gross movements of flexion, extension, sidebending and rotation of the spine as a whole.

Ask the patient to bend forwards to touch the toes without straining and note the approximate distance her fingers are away from her feet; observe at which level of the spine that most flexion takes place; notice if there is limitation at the hip joints. When limited on one side the pelvis will tend to rotate forwards on the free hip side and this can be confused with a unilateral contraction of the erector spinae muscle. It is quite possible for a patient to be able to touch the toes and yet have very little flexion in the spine. In this case flexion takes place at the hip joints. Measurement of the degree of flexion by noting the distance between fingers and feet, therefore, is only a very rough indication, but it is useful for comparison at a later date to observe progress or otherwise.

Ask the patient to sidebend to each side, noting any area of limited movement. The freely mobile spine will have a uniform 'C' curve, whereas the restricted spine will have a 'straight' section on the 'C' curve at whichever level the stiffness is present. Ask the patient if movement causes any pain, noting which, whether compression or stretching, is responsible for increasing the pain. For example, the pain may be referred to the right loin and it may be accentuated by compression when sidebending to the right and relieved by stretching in sidebending to the left. The reverse may hold true.

Ask the patient to place her hands behind her head and to rotate the trunk to the right and to the left, in each case noting restrictions and whether or not pain is increased. It is necessary to hold the pelvis stationary, otherwise it is difficult to see if rotation is free or not. Finally, ask the patient to bend backwards, noting limitation and increased pain.

It is useful to record an approximate percentage range of movement in the case notes, realizing it is essentially an approximation only and its main use is comparison for future reference. Each movement may be recorded separately and, of course, it is a more valuable record, but a comprehensive approximate figure can be made for general spinal movements and this may be sufficient in some cases.

While each movement is being performed, to ascertain the range of active movement, a further piece of useful information can be obtained by giving the patient an extra *passive* stretch to see if the spine yields a little more, noting if the resistance to further flexion is strongly blocked or only loosely so.

Quite apart from mere limitation of movement, sometimes the patient will show a scoliosis which was not obvious in the erect position; it may show rotation of the vertebral bodies to one side, 'the high side', where the transverse processes are more prominent than on the other side. Compensation for a pelvic tilt may not cause a scoliosis, but merely a rotation of vertebral bodies. Such compensation is normally more readily seen in flexion than in the erect position.

In addition to passive stretching during the general mobility tests, the state of tone in the erector spinae muscles should be observed and palpated. This helps to differentiate mere stiffness from 'guarding'.

Unilateral erector spinae muscle spasm often occurs, as for example in sacro-iliac lesions, and asymmetrical erector spinae muscle spasm occurs in intervertebral disc lesions, so that during flexion the pelvis tends to shift laterally or forwards on one side. All these points require noting because they indicate broadly the area of spinal fixation. Such areas will require special attention when making the more detailed palpatory examination later.

Sitting.

The next position of examination is sitting on a level table, to note the posture and any alteration in spinal contours from the standing position. If a lateral shift of the pelvis or a short leg or a scoliosis has been noticed in the standing position, it is important to know if the defect persists in the sitting position. Obviously a short leg cannot have any bearing on the position assumed while sitting, and there ought to be some alteration in positioning if observations have been accurate while standing.

If the patient's symptoms and signs point to some faulty posture in sitting, it is necessary to enquire further into this point and ask the patient to assume her usual posture in an appropriate chair.

While seated, the superficial muscles of the neck and shoulders, thoracic and lumbar areas may be palpated before making a more detailed palpation with the patient lying down. Many practitioners rely on the sitting position for detailed palpation, but the position is not entirely satisfactory because weight-bearing of necessity alters the state and tone in the weight-bearing muscles.

The Neck

PALPATION IN DETAIL

When palpating the neck, ask the patient to lie supine with a single medium-sized pillow under her head. The head should be sufficiently raised to enable the operator's fingers to move freely in all areas of the neck.

Tension should be noted in the suboccipital area and posterior cervical muscles, then laterally in the lateral group of muscles. If localized muscle tension can be detected and confirmed by the patient's responses, the area of tension should be delineated, its size and length noted and the direction of the fibres. The transverse processes of the atlas are noted between the mastoid process and the ramus of the jaw. The relation of the transverse process to the tip of the mastoid is important positionally and later for comparison of range in movement. It should be remembered that the atlas transverse processes are normally slightly tender and no undue significance should be attached to this.

The articular processes of the cervical column are then palpated, noting undue tenderness and prominence. More information is obtainable from the articular processes than is obtainable from the transverse or spinous processes because the transverse processes are almost always tender and difficult to feel while the spinous processes are so irregularly variable even in the normal subject that no positional fault can be detected in this way. Spinous processes in the cervical area are useful for detecting the range of flexion and extension but they are entirely eclipsed by the importance and value of palpating the articular processes. It must be noted that the articular processes are normally most regular, and prominence in one articular process is a reliable sign of a positional fault.

The articular processes are then carefully palpated, first with the neck slightly flexed and then with the neck fully flexed. For this, a good method is to rest the patient's head on your abdomen, thus holding the head flexed, leaving the two hands free for palpation. The full flexion position of the neck sometimes enables you to palpate prominences of the articular processes more easily.

Having noted positional faults, our next step is to detect limitation or exaggeration of movement in any direction.

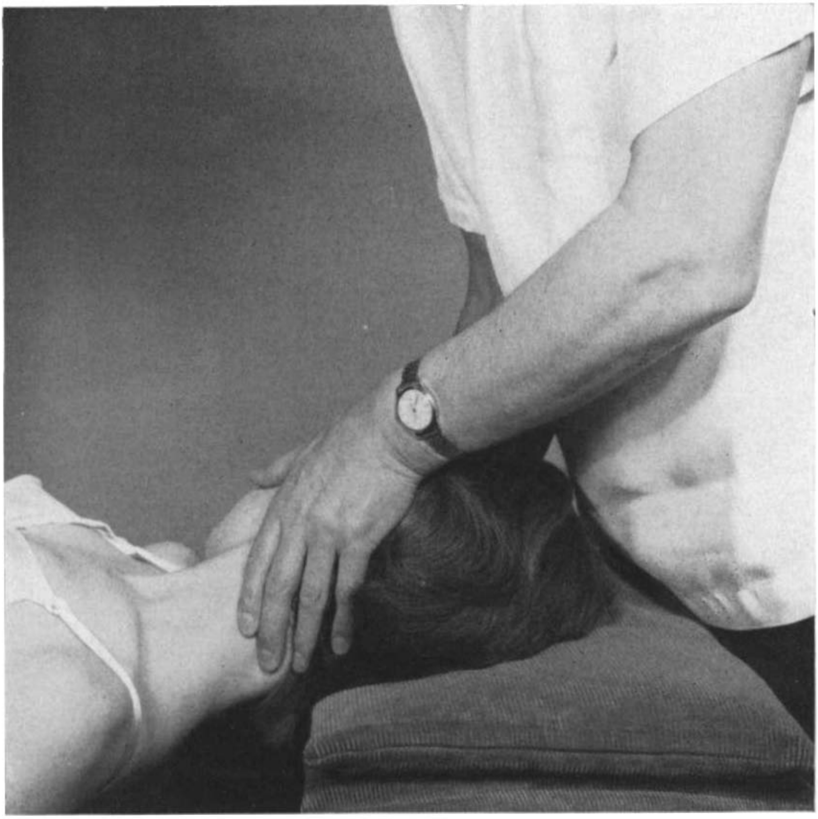


FIG. 1

MOBILITY TESTS IN THE CERVICAL AREA

Testing Rotation. FIG. 1

With the patient supine, place the palms of your hands over each side of the patient's head, lightly covering the ears. Use the pads of the index and middle fingers to check the facet margins of the articular processes and then *rotate* the head and neck until the vertebra to be felt is included in the rotation. As the vertebra begins to rotate, the margins of the articular facets can be felt to move. The range of movements must be compared with the range of movement in the segments above and below. If difficulty is experienced in doing this, use the spinous processes as landmarks for testing rotation.

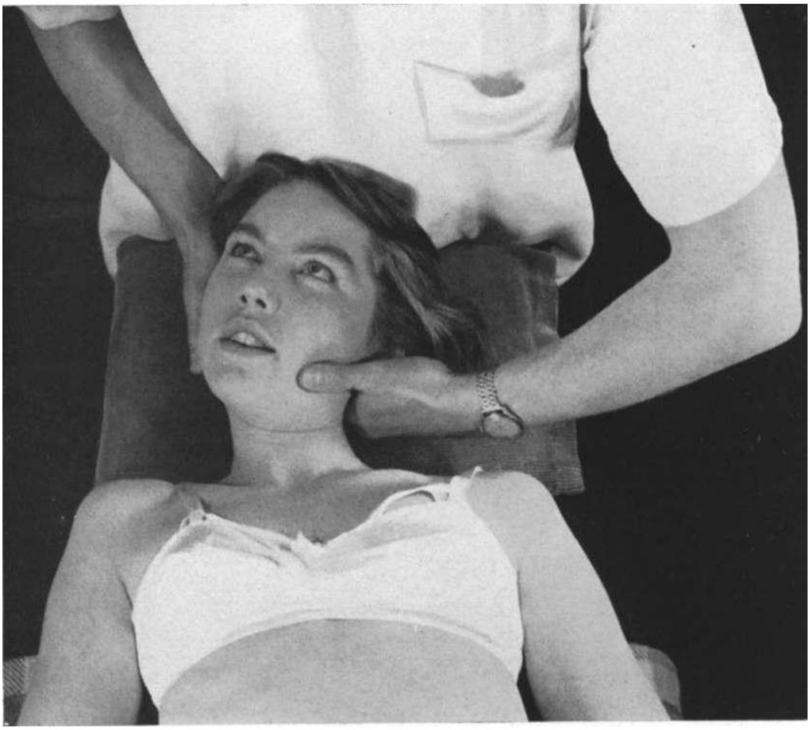


FIG. 2

Test for Sidebending. FIG. 2

The same position is used as in Fig. 1, taking care to ensure that sidebending is confined to the individual articulation to be tested and that the neck is not sidebent as a whole. For this reason it will be found helpful to rest the patient's head on your abdomen. Sidebend the neck over your fingers, keeping the vertex of the patient's head in the mid line the whole time. Some practitioners will find it useful to use the lateral aspect of the index fingers to push on the articular processes. A sense of resistance develops under the finger when there is restriction of sidebending and it is quite different from the resistance felt in adjacent joints.

Test for Forward and Backward Bending. FIG. 3

When testing forward bending and backward bending of the cervical joints it will be found easier to feel individual movements between spinous processes rather than articular facets. With the index finger or thumb of the left hand placed over the spinous processes, support the occiput with

FIG. 3

the right hand and flex or extend the neck while palpating each cervical joint.

Occipito-Atlantal Joints

Radiographic studies of the occipito-atlantal articulation indicate that these joints possess only a small range of movement which takes place at or near the extreme excursion of the head and neck in any direction. The characteristic movement which occurs there is a shift of the occipital condyles on the superior atlantal articular facets. As the head and neck approach the point of full rotation a slight rotary movement of the occiput on the atlasoccurs. Similarly forward bending, backward bending and sidebending take place when all other joints of the neck approach their full excursion of movement. Thus, in tests for occipito-atlantal mobility, the head and neck must be carried through a full range of movement.

MOBILITY TESTS

With the patient sitting and the operator standing behind her, place a finger lightly on either side of the patient's neck so that the finger-tips contact the atlantal transverse process and the tip of the mastoid process. Then instruct the patient slowly to rotate, flex, extend and sidebend the head as fully as possible whilst the operator notes any change in the relative positions of the atlas transverse process and mastoid.

Next, test for passive movement. This may be carried out with the patient sitting, but the supine position is usually easier and more convenient.

Test for Rotation. FIG. 4

With the patient on her back, the head is placed in an easy position midway between forward and backward bending, using one thin pillow. To test for rotation, grasp either the chin or the vertex of the patient's head in one hand and cradle the occiput in the fingers of the other hand, letting the distal phalanx of the thumb lie across the tips of the atlantal transverse process and the mastoid bone. Carry the head round carefully into full rotation, avoiding any heavy pressure or gripping which may cause the patient discomfort. Assuming that rotation to the right is being tested, the operator's left thumb will be palpating the patient's left atlantal transverse process and, if mobility is normal, full rotation of the head to the right will cause the left mastoid tip to become approximated to the left atlantal transverse process. This approximation will be palpable under the operator's thumb. It must be pointed out that some practice is necessary before the test can be used effectively and, in some necks, it is very difficult to feel both the mastoid and the atlas at the same time.

The occipito-atlantal movement on the right must now be tested, still rotating the head fully to the right. Instead of using the thumb of the left hand to test the left occipito-atlantal joint, shift the left hand across so that the left middle finger palpates the right mastoid process and transverse process of the atlas. At the limit of rotation the mastoid tip is found to move away from the transverse process of the atlas.

Similar tests may be used to test for limitation of rotation to the left in both occipito-atlantal joints.

Backward bending in the occipito-atlantal joint may be tested with the patient on her back, the operator supporting the head with his hands placed so that the fingers support the occipital region and the thumbs touch the

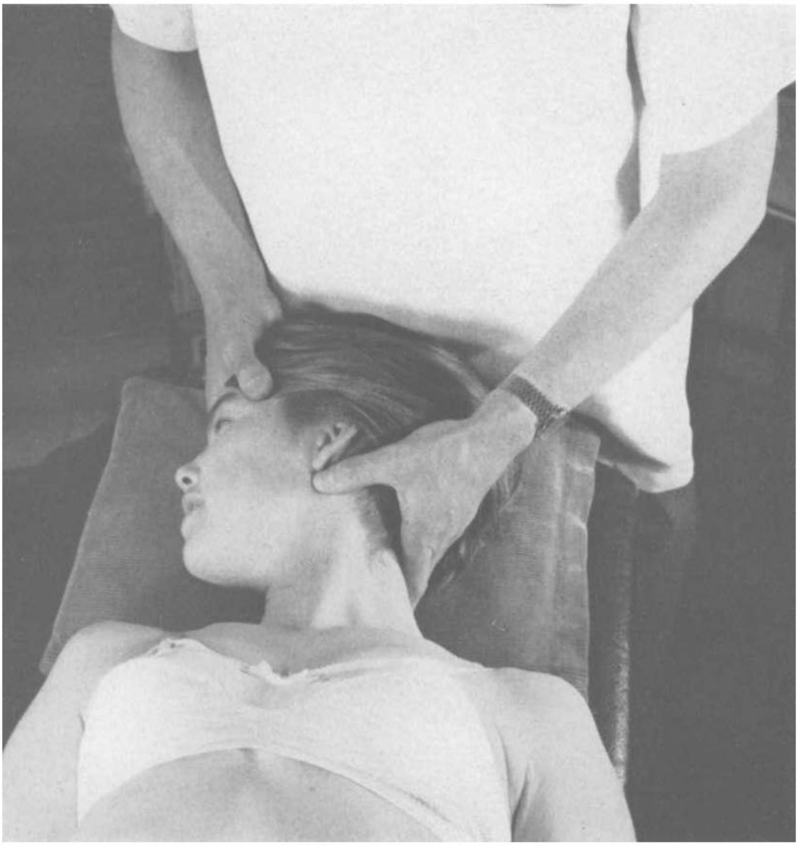
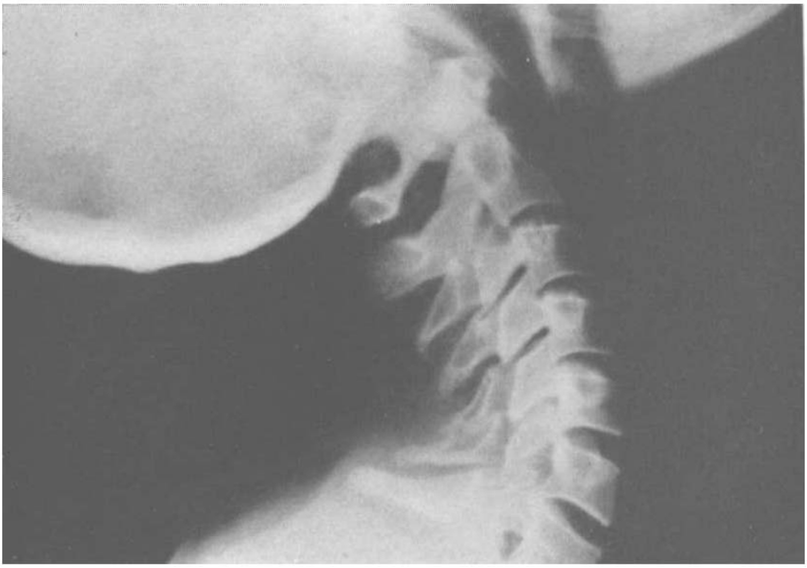


FIG. 4

atlantal transverse process and mastoid processes. The occipito-atlantal region is then fully extended. If mobility is normal, the mastoid processes will become approximated to the atlantal transverse processes. It should be pointed out here that very little forward and backward bending occur at the occipito-atlantal joint. More occurs in the atlanto-axial joint. The mobility X-rays shown here are normal (Fig. 5) and restricted movements at the occipito-atlantal joint are shown in Fig. 6.

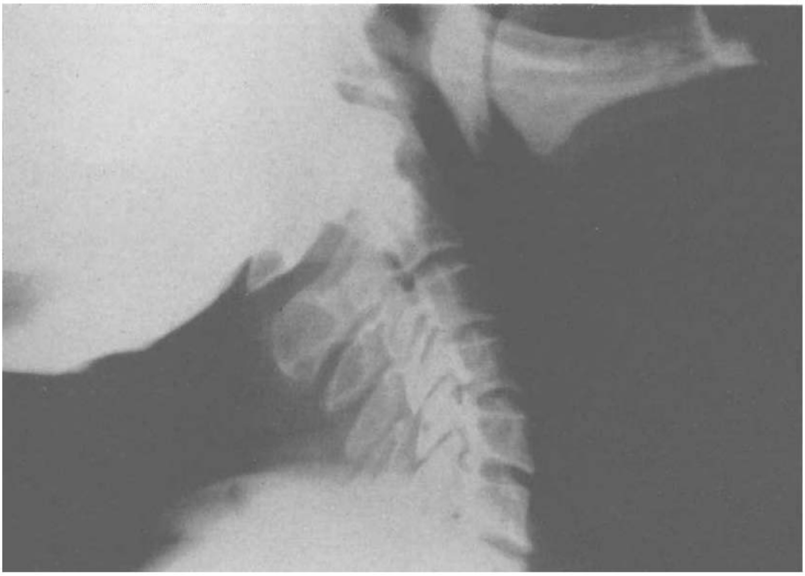
Forward bending may be tested with a similar grip, the vertex of the patient's head resting on the operator's abdomen. A firm downward pressure with the hands will throw the occiput into flexion, when the mastoid processes will become more separated from the atlantal transverse processes.



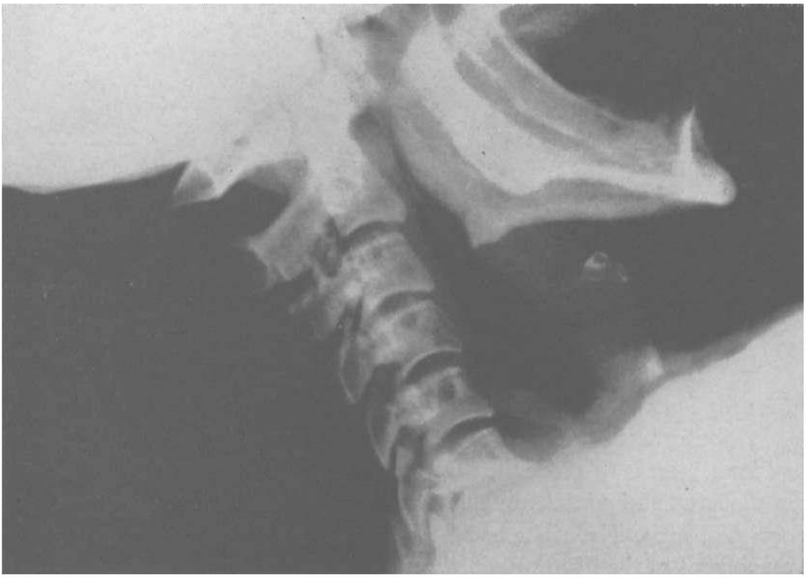
a

b

FIG. 5. *Normal mobility X-rays of the cervical spine*



a



b

FIG. 6. *Mobility X-rays showing restricted occipito-atlantal movement*

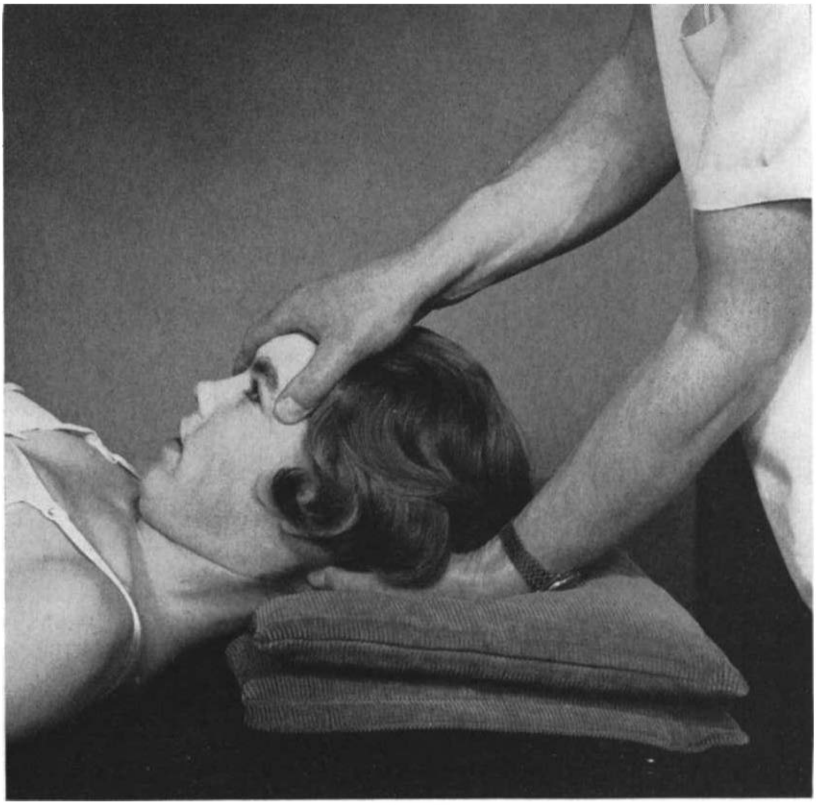


FIG. 7

Test for Forward and Backward Bending. FIG. 7

Another test sometimes advocated for forward bending at the occipito-atlantal joint is to place the patient supine, on a pillow, cradle the occiput in the left hand so that the left thumb and middle finger palpate the sub-occipital area. The right hand is placed on the forehead and a rocking movement of the head obtained on the occipito-atlantal joint. When done effectively, the whole torso moves up and down with the test. This test is of limited value because one is attempting to palpate the arch of the atlas through the thick muscle mass of trapezius, splenius capitis and semi-spinalis capitis, and only on thin patients can it be used.

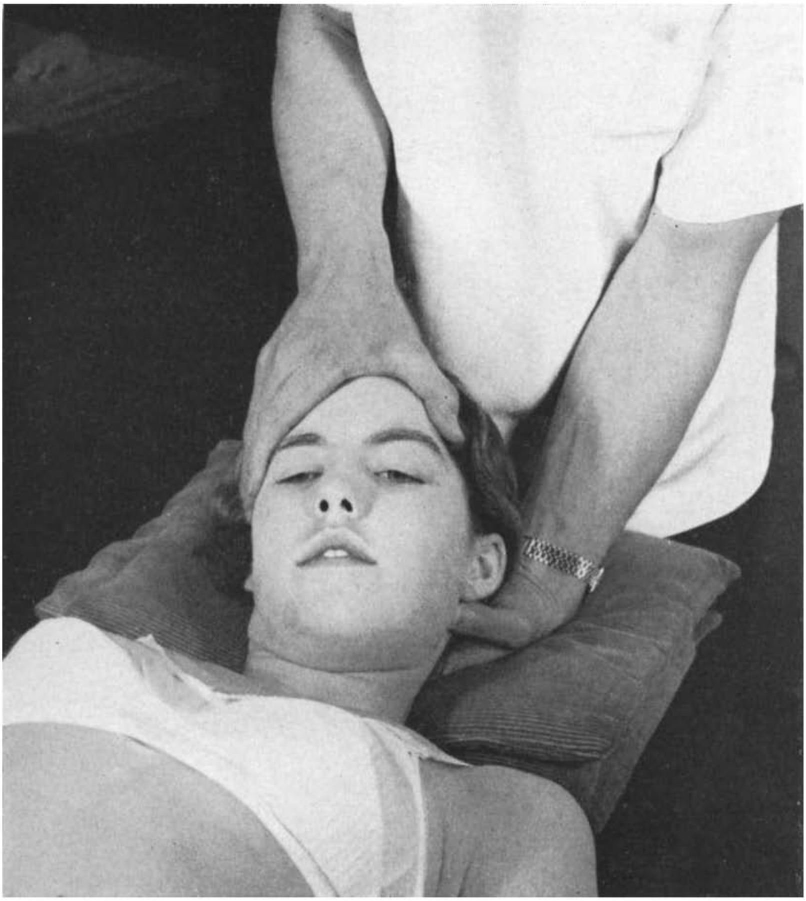


FIG. 8

Test for Sidebending. FIG. 8

Again utilizing the same grip, sidebending may be tested for by palpitating the atlas and mastoid bone on one side, whilst maintaining the vertex of the patient's head in the mid line. As the head sidebends to the right, the left atlantal transverse process will become less prominent laterally and separated from the mastoid process. The separation can be quite readily felt—in fact, it is greater and more easily palpated than the range of rotation.

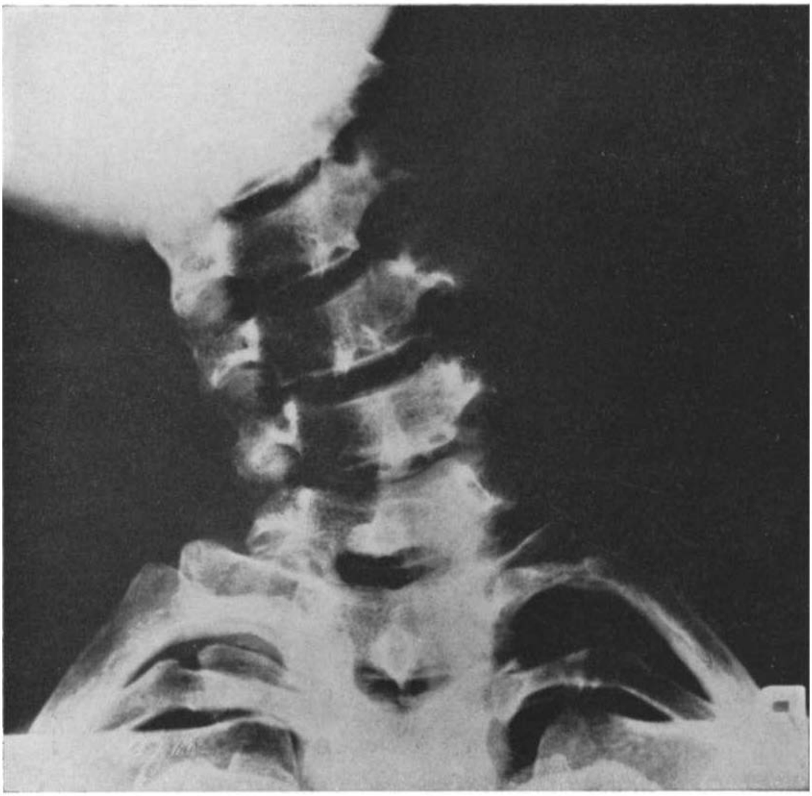


FIG. 9a. *Hypermobility at 6-7 C.*

The Cervico-Thoracic Area

Although the cervical and thoracic regions of the spine are anatomically separated by virtue of the ribs, nevertheless, both from the diagnostic point of view and the treatment, the area 6 C.–3 T. is conveniently considered as one area. Similar tests and techniques apply to 6 and 7 C. as to 1, 2 and 3 T. There is no firm reason why one should include 6 C. and 3 T., but certainly it is useful to group these joints together. There is a gradual alteration in the range of movements from one joint to the next, but the advent of the 1st rib does reduce rather sharply the forward and backward mobility of the 1–2 T. joint compared with the 6–7 C. joint.

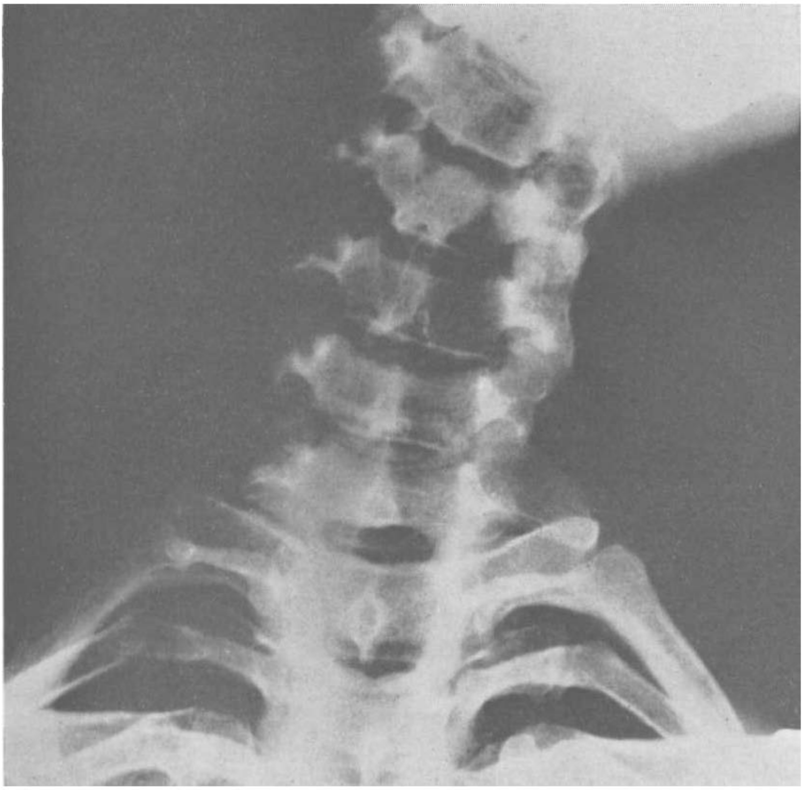


FIG. 9b. *Hypermobility at 6–7 C.*

Considering normal mobility of this area, full forward and backward bending decreases in range as we proceed down the thoracic spine. The spine of 6 C. tends to disappear behind 7 C. during extension, mainly because the 6 C. spinous process is so much shorter than 7 C. This is a useful pointer in surface anatomy and for counting purposes. Sidebending is also quite free, decreasing from above downwards, but rotation is poorly represented in this area. However, at 6–7 C. and to a certain extent 7 C.–1 T. joints, sidebending produces a surprising amount of rotation. In a hypermobile 6–7 C. joint, using mobility X-ray views of sidebending, the amazing range of $\frac{5}{8}$ inch of movement between the spinous processes of 6 C. and 7 C. was recorded (*see* Figs. 9 *a* and *b*).

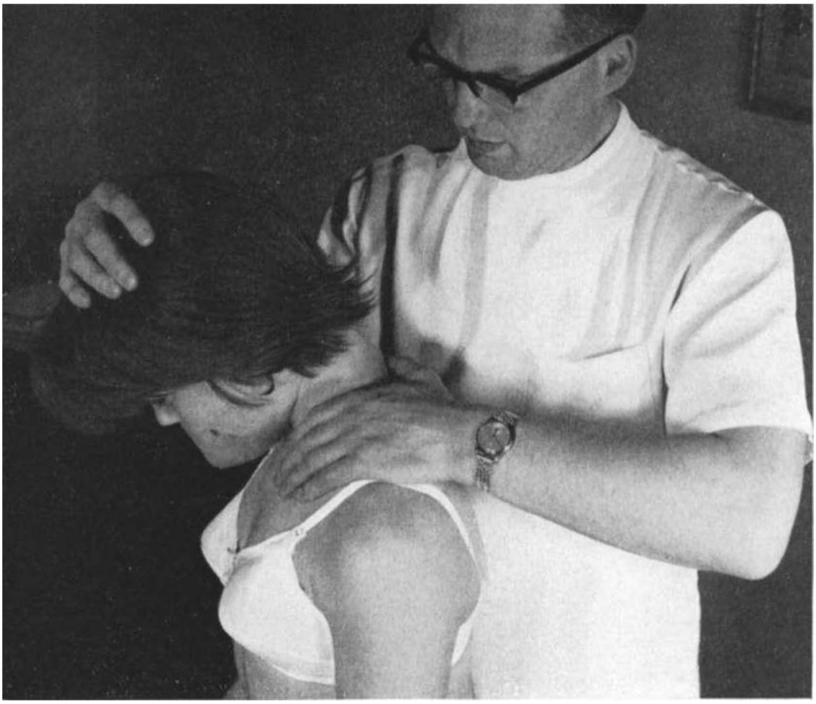


FIG. 10

MOBILITY TESTS

In this area mobility tests are best carried out in the sitting position. Every range can be tested, whereas when lying supine only forward- and sidebending can be tested easily.

Forward Bending. FIG. 10

The patient is seated at a convenient height. The operator stands facing the patient's back and slightly to the right, supporting her torso against his own, to give her an added sense of security. This affords the patient the maximum opportunity for relaxation which is so essential for testing mobility and passive movements. The operator then places the flat of his right hand on the top of the patient's head. The left thumb then palpates between the spinous processes. The patient's head is flexed almost to the limit and then, with a slight increase of flexion and release, the movement causes separation of the spinous processes which is detected by the thumb.

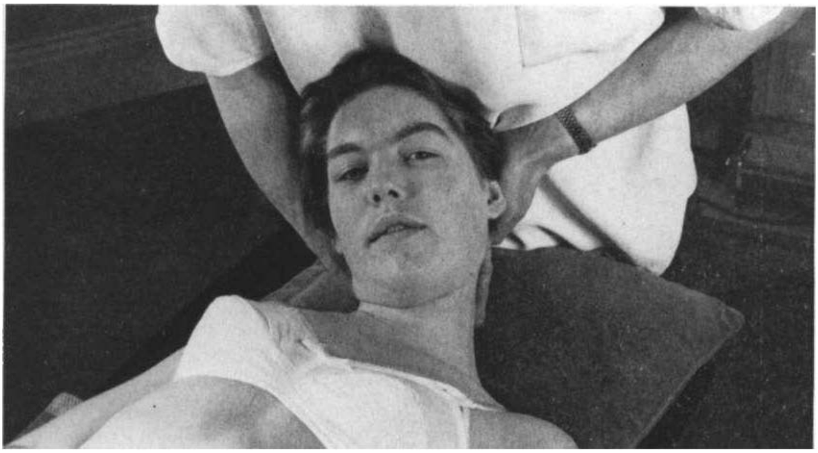


FIG. 11

Backward Bending. In this area backward bending is tested in exactly the same way as forward bending, this time extending the head to the limit before rocking to and fro.

Rotation of the upper thoracic area is very limited by the ribs but in the lower cervical it is almost unobtainable except with sidebending. The test can be performed in the same manner as above but now using a pure rotatory movement. Most cervical rotation, of course, occurs at the 1–2 C. joint with a decreasing amount down to the 1–2 T. joint. The head must again be rotated to the full before any movement can be detected.

Sidebending is tested for in the same position but with the right hand for sidebending to the right, still palpating spinous processes with the left thumb, and reversing, using the left hand on the patient's head to test sidebending of the neck to the left.

Supine Position

The mobility tests used with the patient supine are for forward- and sidebending. In testing forward bending, support the patient's head in the right hand, pushing upwards from the occipital area and using the left thumb to test the gapping of the spinous processes.

In testing sidebending to the right, place the right thumb against the right side of two adjacent spinous processes. The palm of the right hand and the whole of the left hand are used to support the head and neck, then move the whole cervical area sideways as a unit (Fig. 11).

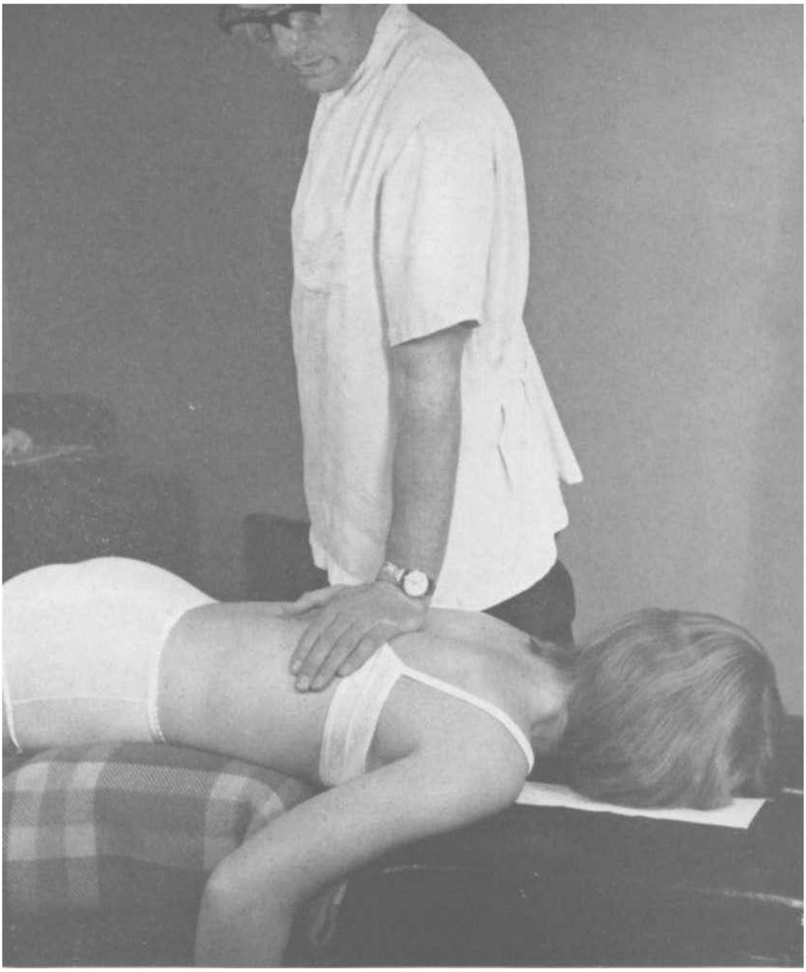


FIG. 12

The Thoracic Area

This area is considered for the purpose of technique to be from 3 T. to 10 T. The chief movements here are forward and backward bending, for both sidebending and rotation are strictly limited by the ribs. Forward bending is limited by apposition of the vertebral bodies anteriorly as well as tension in the interspinous ligaments. Backward bending is limited by contact between the adjacent spinous processes.

Sidebending, using cervical leverage, decreases from above downwards to about 5 T. In full sidebending of the trunk in a flexible subject there should be an even convexity throughout the whole of the thoracic spine, but more often than not sidebending commences about 7 T. and increases downwards to the lumbar area.

Rotation in this area follows much the same pattern as sidebending but mostly occurs at the lower thoracic and upper lumbar sections of the spine.

MOBILITY TESTS

Springing Test. FIG. 12

A most valuable guide to local joint fixations in the thoracic spine is the 'springing' method. With the patient prone, place the heel of the hand on the spinous processes of the thoracic area and press vertically downwards, using momentary pressure only to obtain an impression of the 'springiness' of the joint. The test is virtually a test of extension, but it gives more information about the joint than this, for it gives an impression of the elasticity of the tissues there, and if pain is present the patient will reflexly guard against the movement, giving us further information about the sensitivity of the joint to movement. Extreme sensitivity and muscle-guarding in this test are a serious warning that pathology is present under the hand.

In order to perform the test effectively, the table should be low and the patient completely relaxed, preferably with the head in the mid line. Ideally, the table used should have a divided headpiece so that the patient's nose can rest in the groove, enabling the patient to breathe in comfort and to relax fully without turning the head to one side or the other. The operator needs to lean well over the patient and keep his arm rigid at the elbow in full extension and then the operator should lean his weight on the patient through the rigid arm so that he obtains an impression with his whole body rather than with just the heel of his hand.

The test is not intended for accurate localization, but it is an extremely valuable preliminary to more accurate tests of individual vertebral joint movement. The operator soon learns to distinguish normal from abnormal springiness and one frequently notices a rigid 6–10 T. group which may be entirely asymptomatic, but this rigidity ought not to be ignored. It should be mobilized by articulation and specific manipulations. Any rigid group of vertebrae puts an additional strain on the joints above and below the area. So often we find symptoms arise at the junction of the rigid and the mobile joints where there is often compensatory hypermobility.

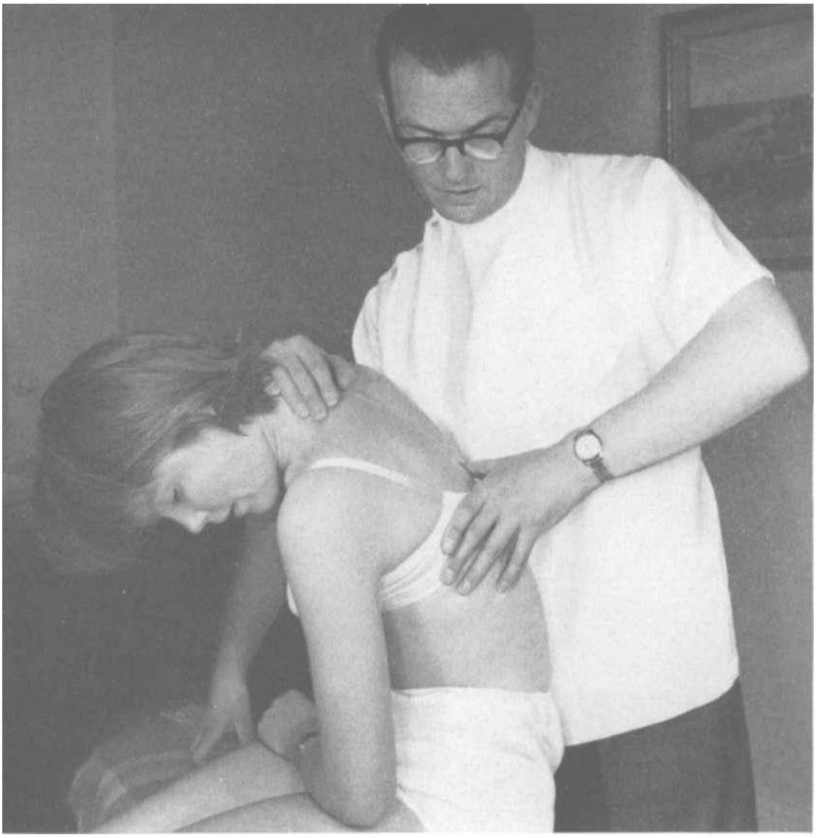


FIG. 13

Test for Forward and Backward Bending. FIG. 13

Forward and backward bending can readily be tested for in the thoracic area with the patient sitting and the operator flexing or extending her neck with his right hand, all the while palpating the interspaces between adjacent spinous processes with his left hand. As we descend further into the thoracic area it may be necessary to use more powerful leverage by pressing on the cervico-thoracic area, using the right hand curled under the patient's right axilla and placed on her cervico-thoracic area. Well-controlled flexion can be obtained in this position.

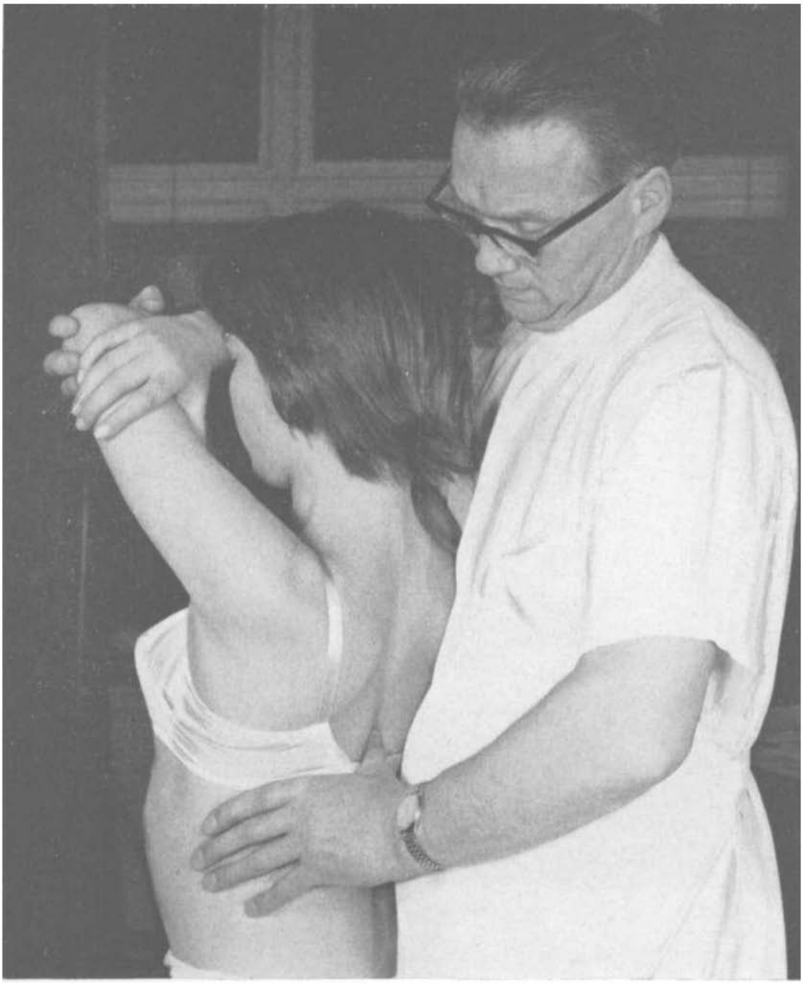


FIG. 14

Test for Backward Bending. FIG. 14

For backward bending in the lower thoracic area, it is sometimes necessary to ask the patient to fold the arms above and in front of the forehead. These folded arms serve a convenient hold by the operator in extending the whole thoracic area.

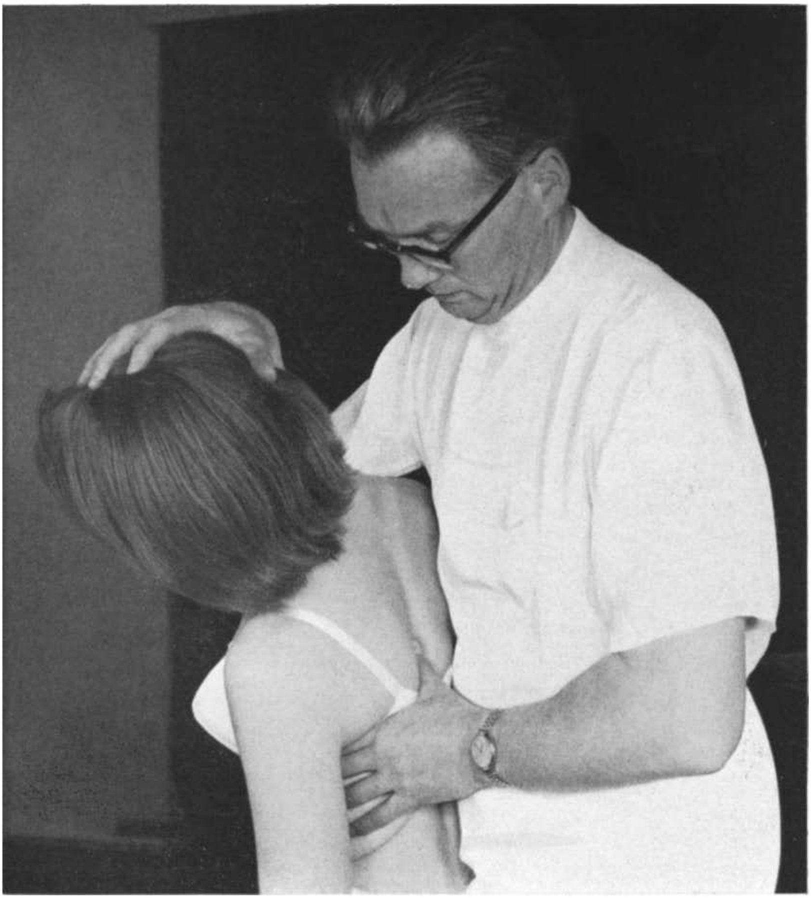


FIG. 15

Test for Sidebending. FIG. 15

Sidebending is tested in the sitting position. Looking at the patient's back and standing a little to the right, place the right hand on the vertex of the patient's head, force the head well into sidebending to the left, place the left thumb on the left side of adjacent spinous processes and give an extra sidebending push with this left thumb to test the resistance and springiness of the sidebending movement.

For the lower thoracic, it may be necessary to place your right axilla over the patient's right shoulder, reaching round across her chest with your right arm so that your right hand is in the patient's left axilla, a forced sidebending to the right using shoulder leverage is then easily achieved, all the while using the left thumb to detect interspinous movement.

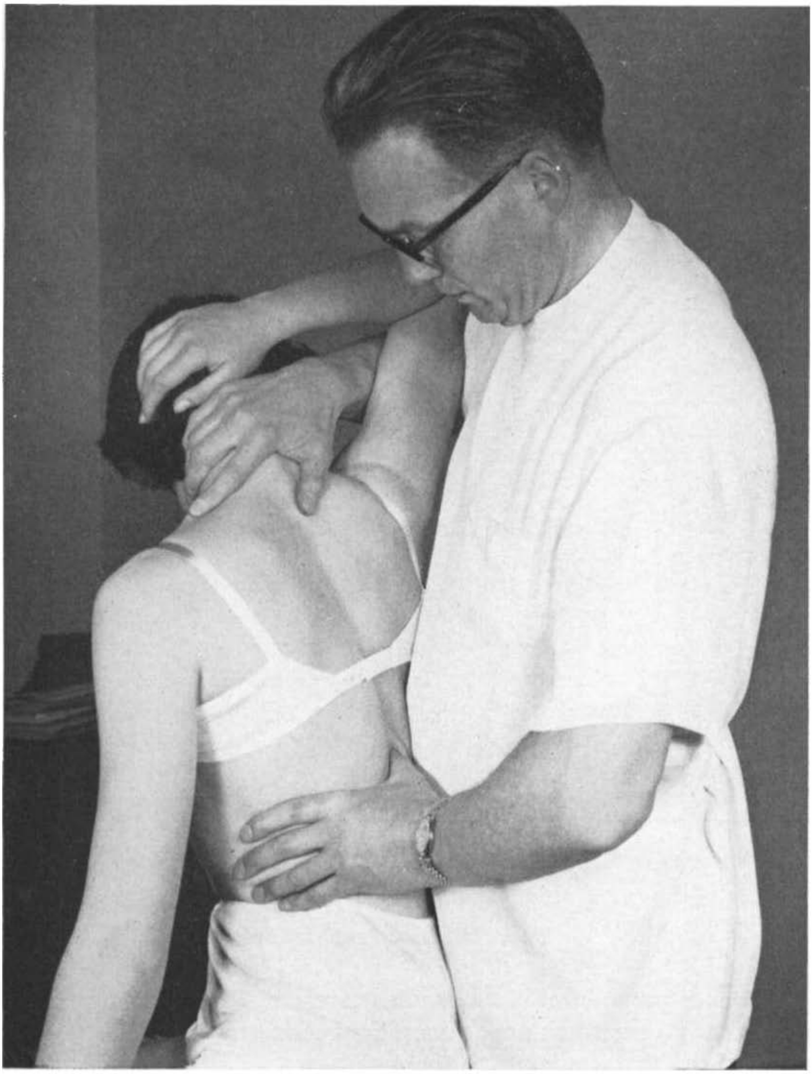


FIG. 16

Test for Rotation. FIG. 16

Rotation is tested with the patient sitting. Ask her to place her right hand behind her head, thread your right arm through the triangular space this makes, so that your hand enters from in front and then curls round to rest on the patient's cervico-thoracic area. A good leverage is thus obtained to rotate the torso to the right while feeling for interspinous movement down the whole thoracic and thoracico-lumbar areas.

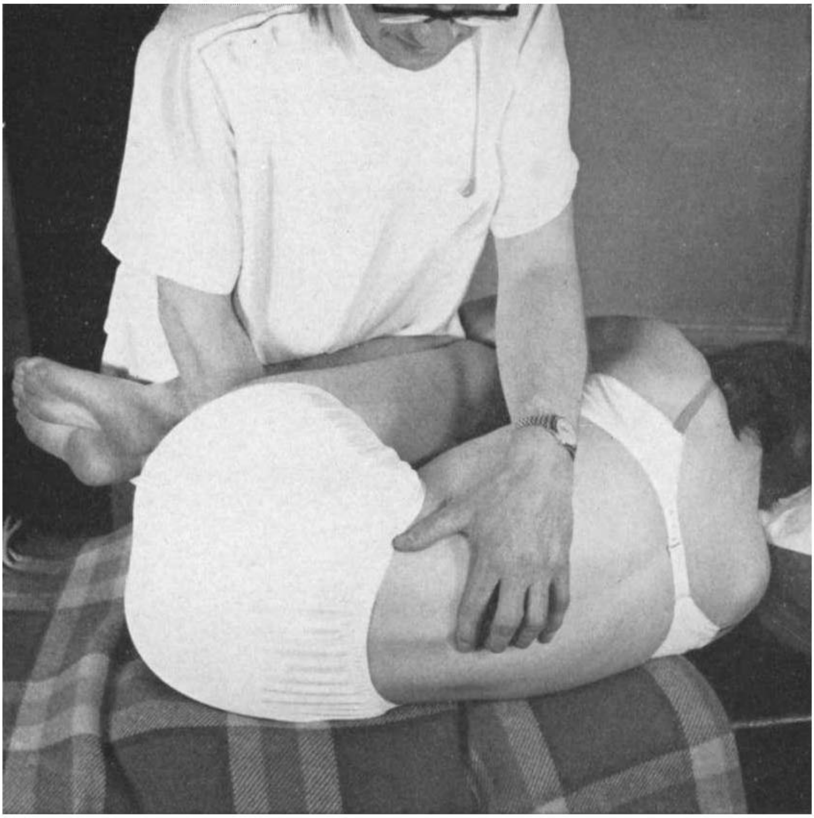


FIG. 17

The Thoracico-Lumbar Area

For the purposes of technique this covers 10 T. to 1 L. intervertebral joints. It is a transition area from the somewhat restricted and stabilized area of the thoracic joints to the mobile yet solid lumbar joints. Here all movements are comparatively free, with maximum rotation of the torso occurring in these joints. Because of the direction of the articulating facets, it is not possible for pure rotation or pure sidebending to occur for anything but the first few degrees of movement. Sidebending to the right with the spine in the erect position or in extension causes the vertebral bodies to rotate to the left, that is, to the convexity of the curve, whereas in flexion and full sidebending to the right the vertebral bodies rotate to the right, that is, to the concavity of the curve. These points must be borne in mind when performing the mobility tests of this area.

Test for Forward Bending. FIG. 17

Forward bending is most conveniently tested for with the patient on the side, flexing the knees, hips and lumbar spine right up to the thoracico-lumbar area. With the patient on her right side, support her flexed knees in your right arm and use the pressure of your own abdomen against the patient's knees to increase the flexion. Then place the left index finger over the insterspinous ligaments to palpate gapping at each joint.

A useful annotation of the range of movement in a given direction is by the figures 0–4.

0 meaning ankylosis.
1 meaning a trace of movement.
2 meaning reduced movement.
3 meaning a normal range of movement.
4 meaning an increased range of movement, i.e. hypermobility.

By recording the figures, we can assess progress when testing mobility at a later date. Obviously these numbers are an approximation just as the numbers used for recording muscle power are an approximation—yet they are useful for clinical records. I have used these annotations myself particularly in recording forward bending, but they can equally well be used in recording other directions of movement.

Test for Backward Bending. FIG. 18

Backward bending is best done with the patient prone, elevating both lower extremities with the right arm under the patient's thighs, and using the left hand to palpate for movement at the T.-L. areas. A similar test can be used, working from above down this time, elevating the torso with the left arm to support the body weight. The patient's arms are folded high so that the patient's forehead can rest on her crossed forearms. This arrangement makes a convenient hold for the operator's left arm.

Sidebending is best tested in the sitting position as for thoracic side-bending (Fig. 15).

Rotation can be detected in the sitting position, the operator facing the patient's back (Fig. 16). The patient places her right hand behind her neck so that the operator can thread his arm through the patient's right arm, from before backwards so that the operator's hand rests on the patient's C.-T. area. Rotation of the lower T. can now be effectively achieved by forcing the patient's right shoulder region backwards. Forward bending or backward bending can be utilized at the same time to test rotation.

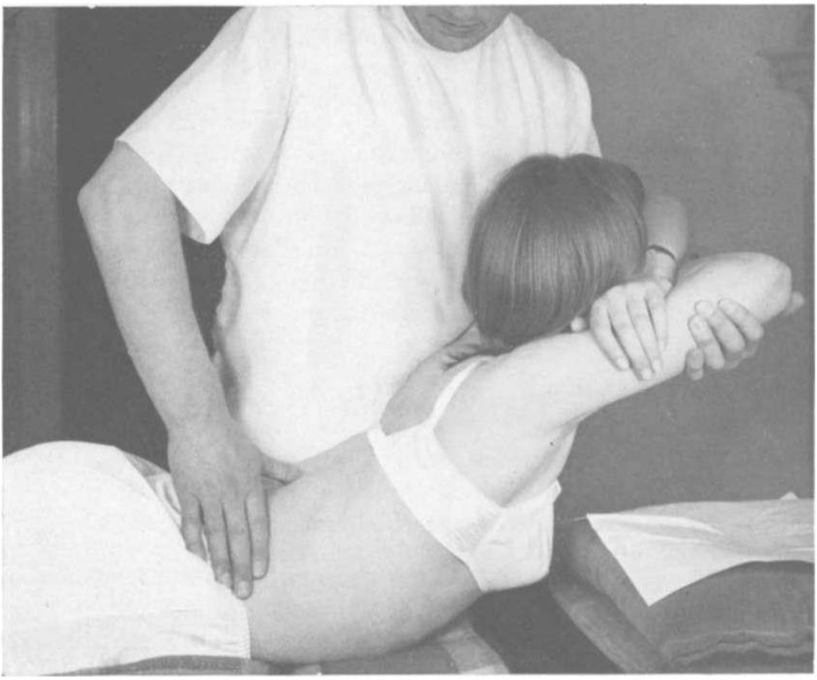


Fig. 18

The Ribs

The thoracic cage moves as a unit during respiration. There is a central position for the ribs when no muscle effort is required, from which forced expiration recoils and to which forced inspiration returns. From a position of forced expiration to one of forced inspiration the ribs alter their position in three different ways. (1) The sternum as a whole rises during inspiration and the anterior ends of the ribs rise with it—executing what is called a 'pump-handle' type of movement. This, together with the descent of the diaphragm, enables the vertical diameter of the thoracic cage to increase. In order that the horizontal diameter of the chest be increased, two other types of rib movement occur: (2) a 'bucket-handle' movement, which as the name indicates implies a raising of the shaft of the rib with relatively fixed anterior and posterior points; and (3) a 'lateral' movement, in which the sternal end of the rib moves laterally. In this movement there is a stretching of the costal cartilages and the costal angle becomes wider. This lateral movement is confined to the 6th to 10th ribs.

Considering the ribs individually, the 1st and 2nd ribs rise and fall with the sternum so that only pump-handle movements occur. From the 3rd to the 6th ribs combined pump- and bucket-handle movements occur, and from the 6th to the 10th bucket-handle and lateral movements occur. The floating ribs move very little as they are tethered by the quadratus lumborum muscles, but, as they are not fixed anteriorly, they do enable the lower thoracic vertebrae to sidebend and rotate more freely than they otherwise would.

LESIONS OF RIBS: INSPIRATION AND EXPIRATION RESTRICTIONS

In the older textbooks of Osteopathy two types of rib lesion are described—pump-handle and bucket-handle lesions, which may in turn be either expiratory or inspiratory, that is to say, the rib may be fixed in a position of inspiration or one of expiration and the faulty position may be of a pump-handle type or a bucket-handle type. This view is difficult to reconcile with fact because it is clearly impossible for a rib to be fixed in a position of inspiration or of expiration unless the whole cage is also fixed in a position of inspiration or expiration. This latter state of affairs does occur, as for example in emphysema (fixed inspiration) and poliomyelitis involving the intercostals (fixed expiration), but the single osteopathic rib lesion does not envisage such profound changes; rather is the *relative* movement of two adjacent ribs restricted. The majority of rib lesions are due to intercostal muscle spasm which diminishes the normal expansion and contraction between the two ribs. The commonest cause is a sneeze or unexpected cough. After the sneeze, all except one group of intercostal muscles relax. These muscles stay contracted in a semi-cramp-like state and they prevent normal movement between the ribs. Pain occurs along the course of the intercostal space and the pain is aggravated by forced respiration or coughing. If the muscle spasm persists, adhesions form and the muscle undergoes fibrosis, leading to a chronic rib lesion.

For this spasm to occur at all it is very probable that some predisposing reason exists for the muscular irritability. The intercostal muscle may be irritated from a central source, that is, an intervertebral joint lesion may cause nerve irritation and muscle contraction, which leads to the restricted rib mobility. Intervertebral disc herniations undoubtedly occur in the thoracic area and these too give rise to referred pain round the chest wall or just at the anterior division of the thoracic nerve—too often a source of confusion with cardiac, lung, gall-bladder and gastric pain. Intercostal pain without a rib lesion often occurs, the pain being merely referred, but in these cases there are no localizing mechanical faults to be found in the ribs. Intercosto-vertebral joint fixations from adhesions occur and cause restricted mobility. By releasing these joints we can relieve the intercostal pain—this has been done innumerable times and in one case even after the lapse of twelve years, the patient having had vague intercostal pain on and off during the whole of that period.

The *1st and 2nd ribs* are peculiar in that their normal movement is pump-handle in type. They are also unusual in that the scaleni muscles are attached to them. Any undue contraction of the scaleni would have an elevating effect on these two ribs so that although the normal movements are pump-handle, the lesions are mainly bucket-handle in type. One important clinical significance of this lesion apart from any irritation of the 1st and 2nd intercostal nerves is that the size of the costo-scalene triangle is reduced, so that any of the roots of the brachial plexus may be irritated by such lesions.

The 11th and 12th ribs are also unusual in that they have a poor range of movement and are only in lesion as a result of quadratus lumborum spasm or secondary to 11th and 12th T. intervertebral joint lesions.

There are still three more types of rib lesion—*fixation of the sternal joint*—mostly due to increasing age, by which the normal antero-posterior movement at the lower end of the sternum hinging at the sternal joint is stopped. The second lesion is a *sprain of the costo-chondral junction.* This is common enough and is due to direct violence or muscle inco-ordination. The patient complains of a well-localized pain at the exact site of the costo-chondral junction. The third lesion is a *slipping of the cartilaginous ends* of the lower ribs as they join each other to form the costal angle. Sometimes these cartilages become detached, and each time they slip over each other they can cause pain.

TESTS FOR ACTIVE RIB MOBILITY

General mobility in ribs can be observed by watching the respiratory range anteriorly and posteriorly. As one would expect, inspection of the thoracic cage anteriorly gives more information than when viewed posteriorly, though the lower ribs of the thorax can best be observed posteriorly. An overall measurement of chest expansion can be made with a tape measure round the region of the 6th and 7th ribs. In an adult, a 3-inch expansion is average, 4 inches is very good and anything over 5 inches is exceptional. One must look for asymmetrical rib movement—greater expansion on one side than the other suggests pathology or mechanical faults in the lesser expansible side. Note whether expansion is mainly costal or diaphragmatic. Observe especially if inspiration is arrested suddenly or not—this, of course, suggests a painful phase at the point where the inspiration ceases abruptly. The patient will usually indicate the site of pain when this occurs and it will help in the detailed examination later. Respiration is best observed in the sitting position though it can equally well be done in the supine position.

Individual rib movements can often be inspected as well as palpated. Palpation is conveniently carried out with the patient supine. Place the index fingers into corresponding anterior interspaces and feel for approximation or separation. It is possible to place the tips of the fingers in several interspaces at once, but it is difficult to make several observations at the same time and the single finger method is more satisfactory, comparing the range all the time with the other side and with adjacent interspaces. Next palpate the range of separation and approximation at the mid axillary line of each of the ribs. In addition, palpate the range occurring over the angles of the ribs—the range of movement posteriorly is very small indeed and is correspondingly difficult to palpate.

Next palpate for positional alterations. The most obvious alteration is an eversion of the rib—relative approximation to the rib above so that the lower rib margin becomes more prominent. The flat of the hand should be placed on the lower part of the chest wall and moved upwards, then the prominent rib margins can be felt most readily, both in the mid axillary line and over the angles of the ribs. Follow the course of the rib from its angle forwards to its sternal end. This is not always easy in the obese and, of course, the scapulae and breasts increase the difficulty. The scapulae can be moved forwards to some extent and the breasts pushed aside but sometimes it is necessary to count the ribs anteriorly and posteriorly to be sure of palpating the same rib and interspace. Having located the rib anteriorly and posteriorly, apply a thrust over the rib anteriorly and feel for a corresponding movement posteriorly. If you are on the same rib anteriorly and posteriorly, it should be possible to detect a slight movement posteriorly imparted by the thrust anteriorly. Palpate the suspected rib during the full range of separation both anteriorly and posteriorly and note any lack of mobility. The ribs may be compressed antero-posteriorly to test their springiness and it is, of course, a valuable test when a fracture is suspected.

The 1st and 2nd ribs are best palpated with the patient sitting and the operator standing behind, placing the flat of the hand over the angles and spreading the fingers forwards along the course of the ribs. It is difficult to feel the ribs through the mass of trapezius but comparing the two sides enables any discrepancy to be noted.

The thoracic cage must never be examined separately from the thoracic spine because, of course, any limitation of movement of the thoracic spine is bound to cause corresponding limitation of movement in the ribs. Thoracic scolioses invariably affect the positioning and shape of the ribs.

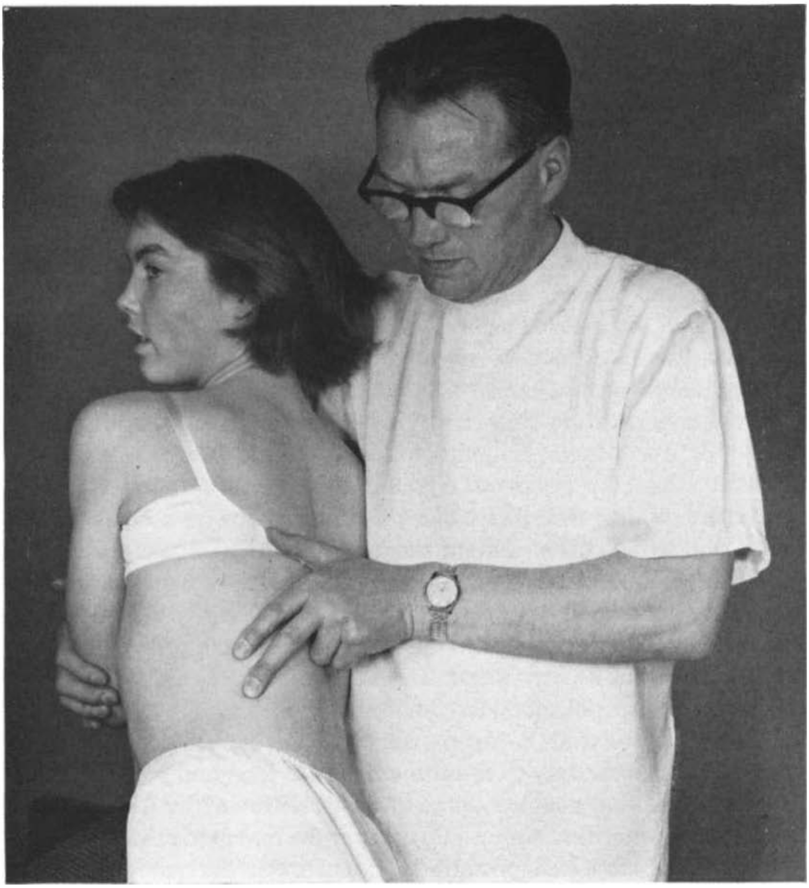


FIG. 19

TESTS FOR PASSIVE RIB MOBILITY

The object of these tests is to assess the amount of separation and approximation which takes place between two adjacent ribs while the torso as a whole is moved. The ribs move in relation to one another when the thorax is fully flexed, extended, rotated or sidebent. Passive movements are employed in order to take advantage of this mechanism for the purpose of palpation.

Test Using Rotation. FIG. 19

With the patient sitting and the operator standing behind her, the

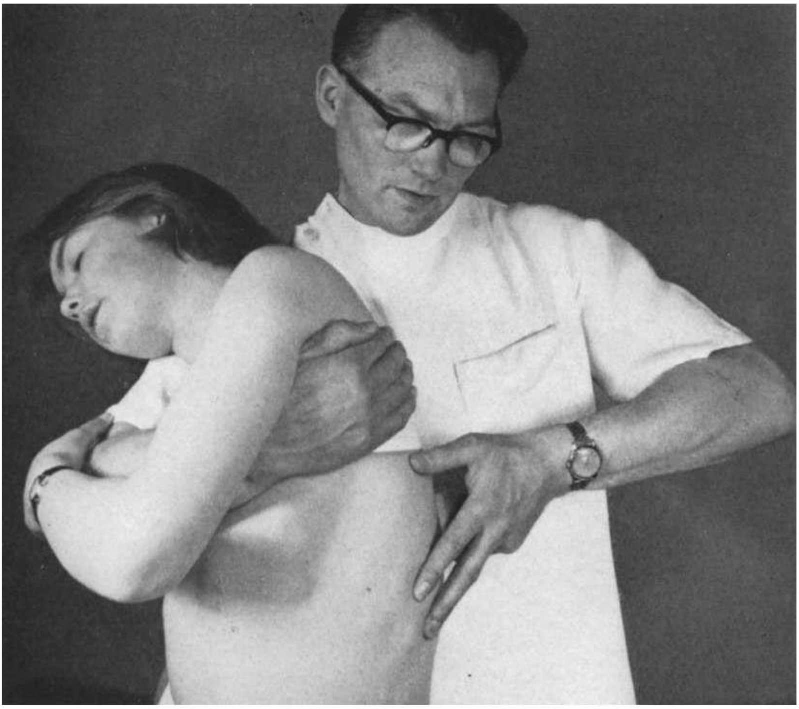


FIG. 20

operator places one or two fingers of the left hand in one of the patient's left intercostal spaces and passes his right hand across the patient's chest to grasp her left elbow. Then by pulling gently on the patient's elbow the operator rotates her trunk fully to the right. This movement pulls the left scapula away from the field of palpation and at the same time causes a slight separational movement of the ribs. The manœuvre is reversed in order to palpate the right side.

Test Using Sidebending. FIG. 20

With the patient sitting, the operator stands behind, turns slightly to the left and passes his right arm over the patient's right shoulder, rests his axilla on her right shoulder and passes his right hand round her chest. He then palpates the left interspaces with his left hand while pressing down on the patient's right shoulder with his right axilla and pushing gently on to the patient's right side with his chest. This will cause the thorax to sidebend to the right so that the intercostal spaces will separate on the left.

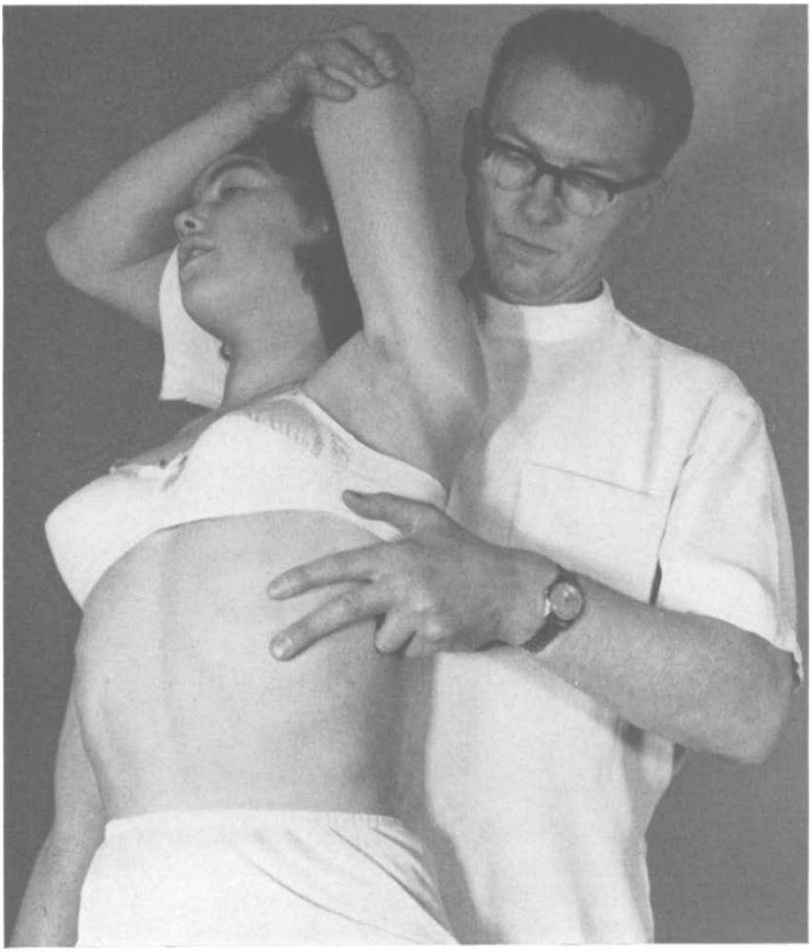


FIG. 21

Test Using Backward Bending. FIG. 21

Again standing behind the seated patient, the operator palpates the anterior intercostal spaces on the left side with his left fingers. The patient places her left hand on the back of her neck so that the elbow points upwards. The operator grasps this elbow in his right hand and gently pulls it backwards while pushing on to the patient's back with his chest. This throws the thorax into extension, exerts strong traction on the pectoral muscles and separates the anterior intercostal spaces on the left.

The Lumbar Spine

More than half the weight of the whole body has to be transmitted through the lumbar spine, and as the facets are almost vertical the whole of the weight must be taken through the vertebral bodies and the discs between them. No wonder that these single weight-bearing surfaces have to be supported with powerful ligaments and muscles, and small wonder is it that when the vertebrae become tilted or the sacrum tilted that the strains set up give rise to backache. The discs are quite thick in this region to facilitate movement and each nucleus pulposus acts as a fluid ball in the socket of the vertebral body and annulus fibrosus. The weight of the body was designed to be transmitted vertically and it is not surprising that the discs and other components give way when subjected to prolonged shearing forces as in sitting or rather sagging in an armchair with the lumbar spine kyphosed. The low bucket seats of cars are even worse because the jolting and foot pressure against brakes and clutches force the lumbar area still more into kyphosis. Ligaments will react well to intermittent stretching, but badly to continuous stretching, and in time will give way.

The normal lumbar movements consist mainly of forward bending, backward bending and sidebending. Forward bending is the freest movement. The range of such movement is fairly consistent throughout the lumbar spine. In full forward bending the normal lordosis is straightened out, but a convexity backwards is unusual. Backward bending is a very variable movement, ranging from the excessive movement in the acrobatic dancer to virtually none in many adults over fifty years. The movement is limited by tension in the strong anterior longitudinal ligament and sometimes by bony apposition of adjacent spinous processes. Sometimes a false joint is formed between these spinous processes (kissing spines). Sometimes the interspinous ligaments become inflamed from mechanical irritation and sclerosis develops in the spinous processes where there is apposition. Forced extension beyond the apposition of spinous processes virtually levers the vertebral bodies apart and gaps the discs anteriorly. Where the spinous processes are not specially large, backward bending is limited by the inferior articular facet margins coming into apposition with the pars interarticulares of the vertebral arch. Sometimes forced extension will drive the facets into the bone below and cause a crack in the pars interarticularis, the condition known as *spondylolysis.* When both pars interarticulares are damaged, the body weight forces the vertebral body forwards on the one below to give rise to the condition known as *spondylolisthesis.*

Sidebending is quite free in the lumbar spine; it is at a maximum at

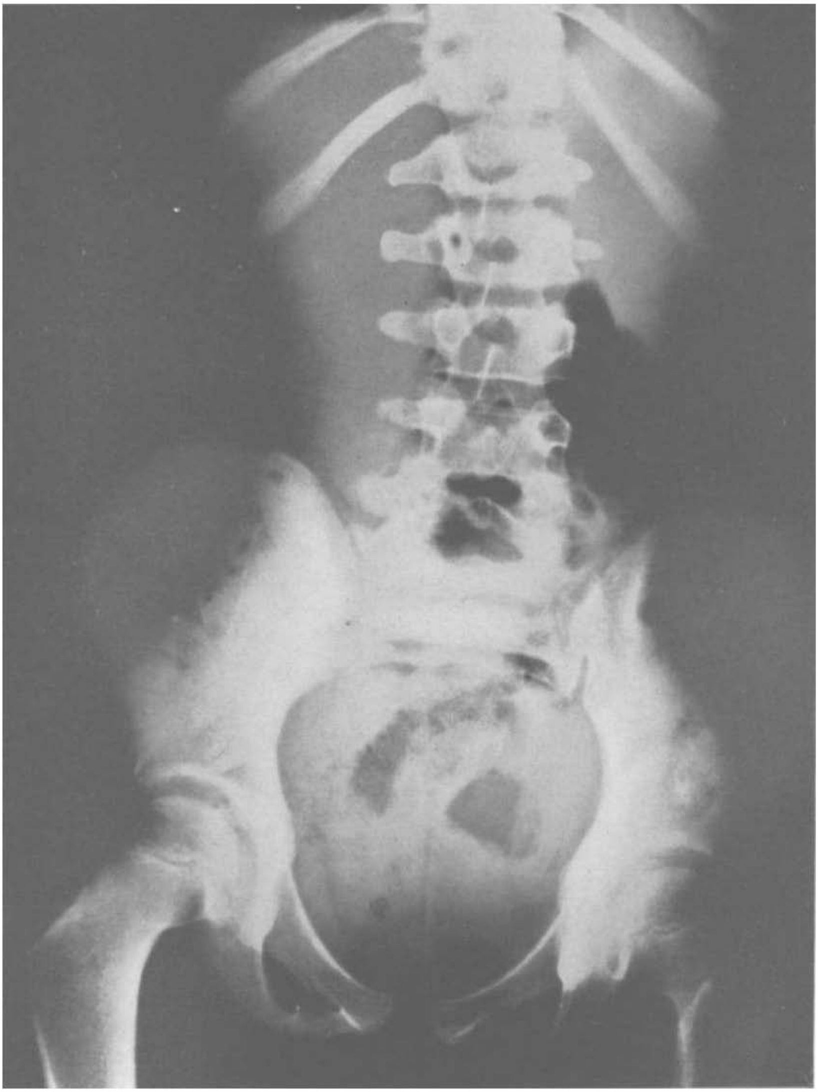


FIG. 22

3–4 L. but there is little sidebending at the lumbo-sacral joint. When carried beyond a certain point, it no longer remains a pure sidebending movement but combines with rotation. Such rotation may be either to the convexity or to the concavity of the curve, depending upon whether the spine is in forward bending or backward bending. If the spine is sidebent to the right from a flexed position, the bodies of the lumbar spine rotate towards the same side (to the concavity), but in the erect position and in extension the bodies will rotate to the left (to the convexity). The lumbar area is obliged to rotate if sidebending is forced because of the direction of the articular facets. The pivotal point for such rotation has its centre posterior to the spinous processes, because the facets form an arc of a circle whose centre is posterior to the spinous processes. Knowledge of these points is important when we come to the question of locking adjacent vertebrae (*see* facet apposition and ligamentous tension locking, Chapter 3, p. 101).

Pure rotation is almost impossible in the lumbar spine because during rotation the articular processes lock into each other if the centre of rotation is considered to be through the discs, but if the rotation is part of a sidebending movement then it occurs as above with the centre of the axis of rotation posteriorly. Rotation certainly occurs as a compensation in the lumbar spine as, for example, for a short leg. If the right leg is short, the pelvis and sacrum are tilted down on the right, this carries the lumbar spine laterally so that a convexity to the right occurs and, to compensate, the bodies of the vertebrae rotate towards the convexity and a 'high side' appears on the right (*see* Fig. 22).

At the lumbo-sacral joint, the main movement is forward and backward bending with sidebending and rotation almost nil. However, there are wide variations in angles of the articular facets and this may enable false movements to take place there—another reason why the lumbo-sacral joint is more subject to strain than other lumbar joints.

MOBILITY TESTS OF THE LUMBAR SPINE

Forward bending is best carried out with the patient on her side. Flex both her knees and hips, supporting her legs against your body and palpating interspinous spaces with the fingers (*see* Fig. 17, p. 62).

Test for Backward Bending. FIG. 23

Backward bending can be tested with the patient prone and springing the spine downwards or it may be reinforced by elevating the two legs, lifting them upwards with one arm under the thighs and palpating the movement with the other hand.

Tests for Sidebending

Sidebending can be tested for with the patient sitting. Stand behind the patient and a little to her right. The patient folds her arms. Thread your right arm over her right shoulder, across her chest and under her left

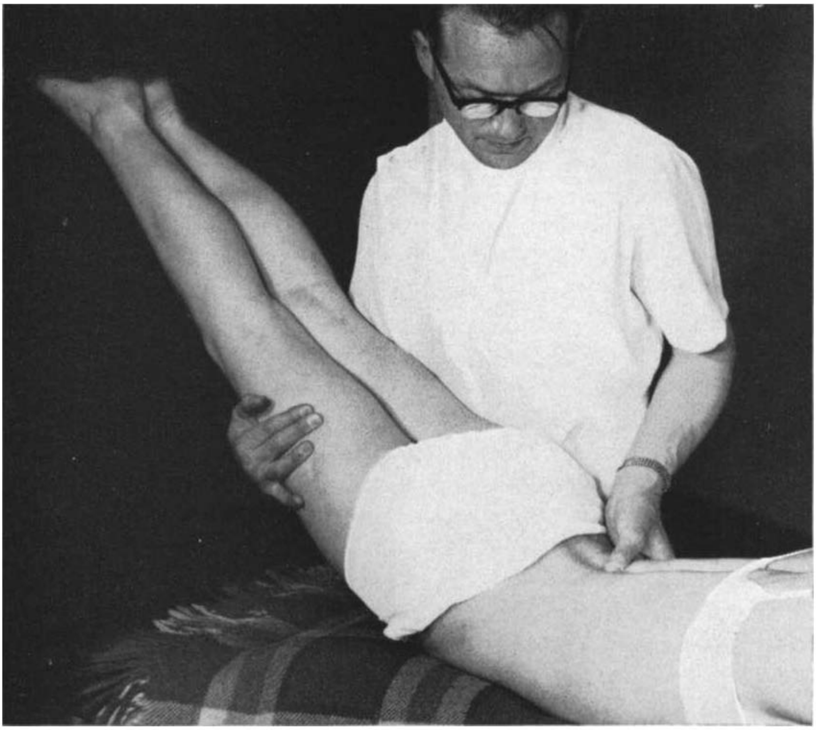


Fig. 23

axilla, then force the torso sideways towards the left while tilting the right shoulder downwards, as it were buckle the patient so that a convexity to the left forms in the lumbar spine and palpate this movement with the left thumb.

Sidebending can also be done with the patient prone, using the leverage of the legs and pelvis to create the sidebending or it may be done with the patient on the right side (*see* Fig. 24). The operator faces the patient whose legs are flexed at the knees and hips, and holds these flexed lower extremities with the right arm well under the legs and buttocks. Next elevate so that the buttock is raised. This is only used when the patient's weight is moderate!

Rotation can be detected with the patient on the side fixing her pelvis and rotating the torso down to the joint you are testing. Rotation can also be tested with the patient sitting, arms crossed, the operator reaching through the right axilla across the chest to the left shoulder, and using torso leverage to rotate downwards to the joint in question.

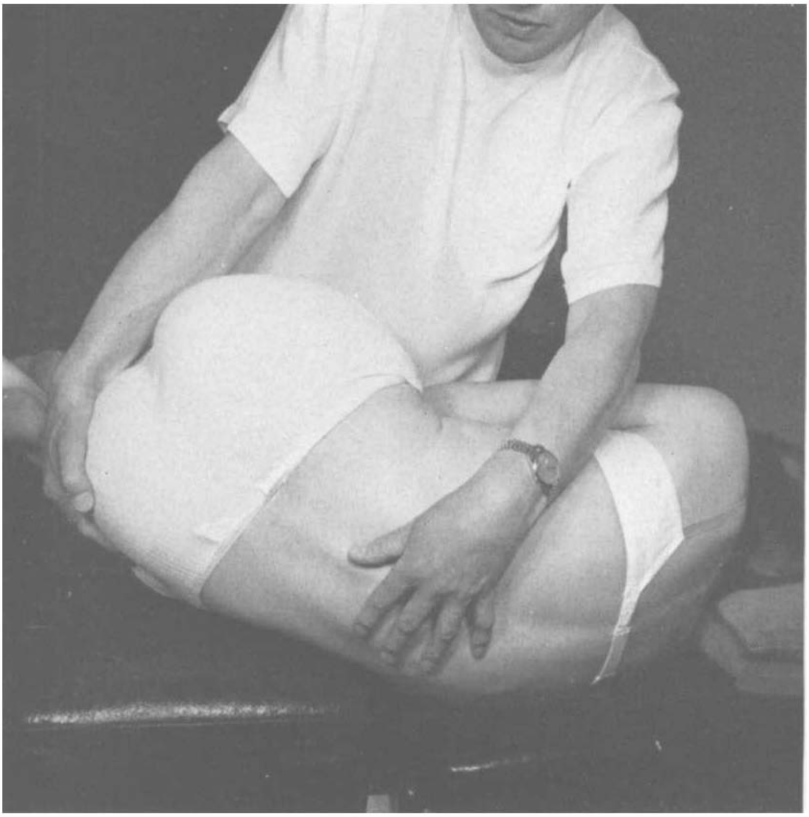


FIG. 24

The Sacro-Iliac Joints

MOBILITY TESTS

There are four tests for detecting the range of movement in the sacro-iliac joints and none is easy to feel because the range of movement in the normal joint is so small. Furthermore, it is difficult to avoid moving the lumbar spine during the tests, thus giving rise to a false impression that the sacro-iliac joints are moving. A detailed account of normal sacro-iliac mobility will be found in the Appendix. Two subjective tests for hyper-mobility are also used.

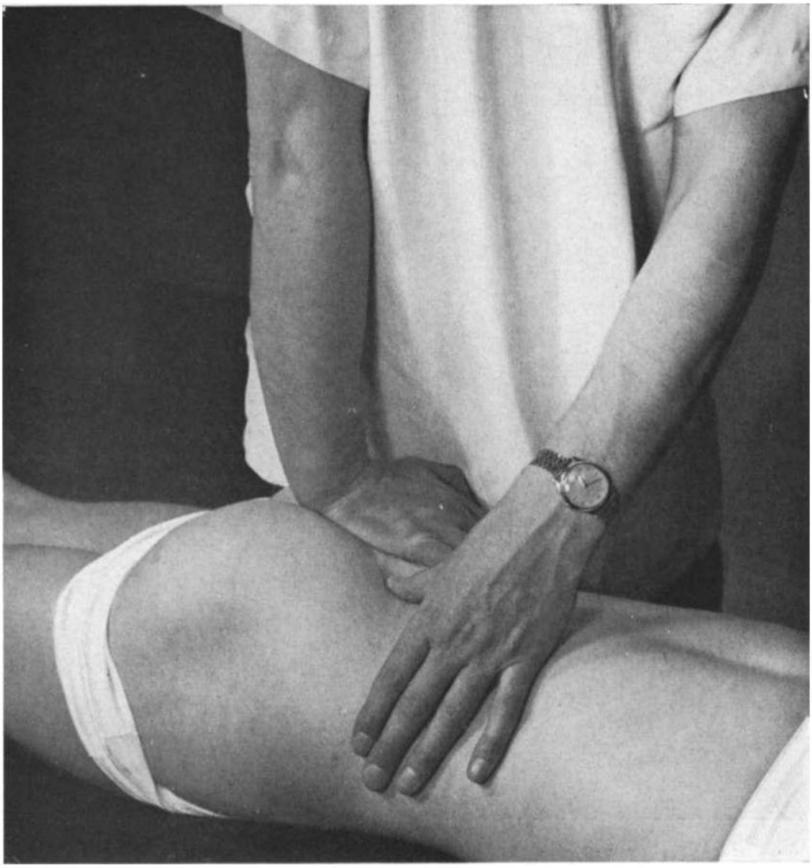


FIG. 25

(1) *Springing Test.* FIG. 25

The first test relies on springing the joint. Place the patient prone on the table and, with the heel of your right hand, apply a springing pressure over the apex of the sacrum. The left thumb is applied over the sacro-iliac joint adjacent to the posterior superior iliac spine. The springing is symmetrical and moves both sacro-iliac joints. The difficulty of detecting movement is increased by the thickness of muscle overlying the joint. Even if the test is objectively unsatisfactory, it is subjectively very useful, in that if the patient refers pain to the sacro-iliac area during the test, it strongly suggests that the pain is arising in the sacro-iliac joint.

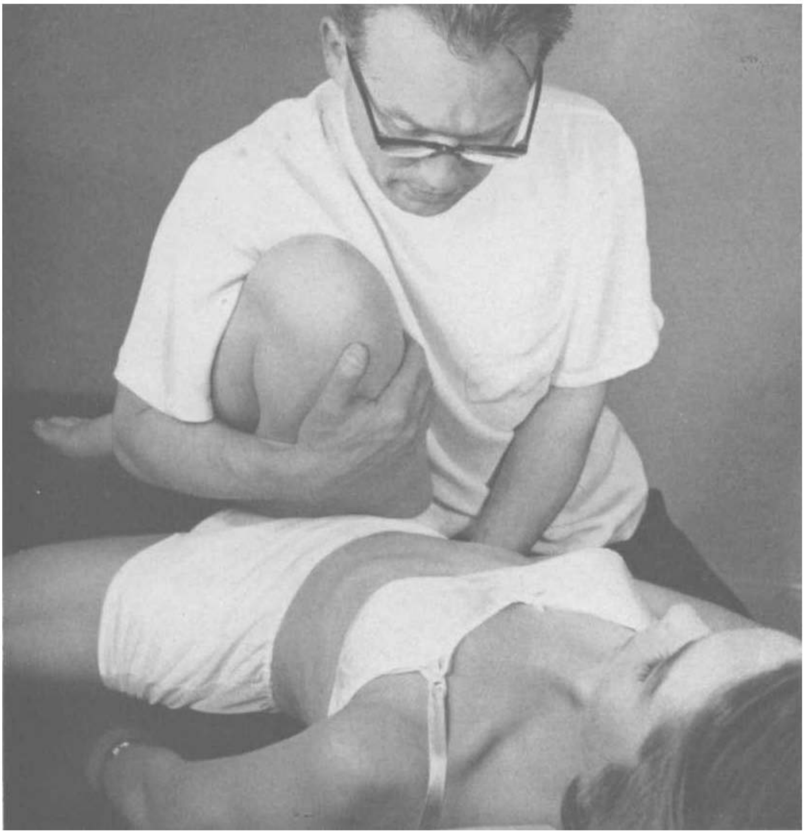


FIG. 26

(2) *Gapping Test.* FIG. 26

The second test is with the patient supine. Stand on the right side of the patient and flex her right knee and hip fully, grasping the leg and thigh comfortably with your right arm. Insert your left hand under the buttock so that terminal phalanges of your left index and middle fingers rest on the sacrum and the middle phalanges of these fingers rest on the posterior superior iliac spine. In this position the palpating hand can feel the relationship between the sacrum and the ilium. The technique now is to cause a rocking of the right ilium on the sacrum. The patient's right thigh needs to be adducted in the fully flexed position to lock the femur against the innominate. Then the locked unit can be rocked by increasing flexion and adduction of the hip. There is, of course, some tendency for the whole pelvis to move as a unit and for little or insufficient fixation of the sacrum

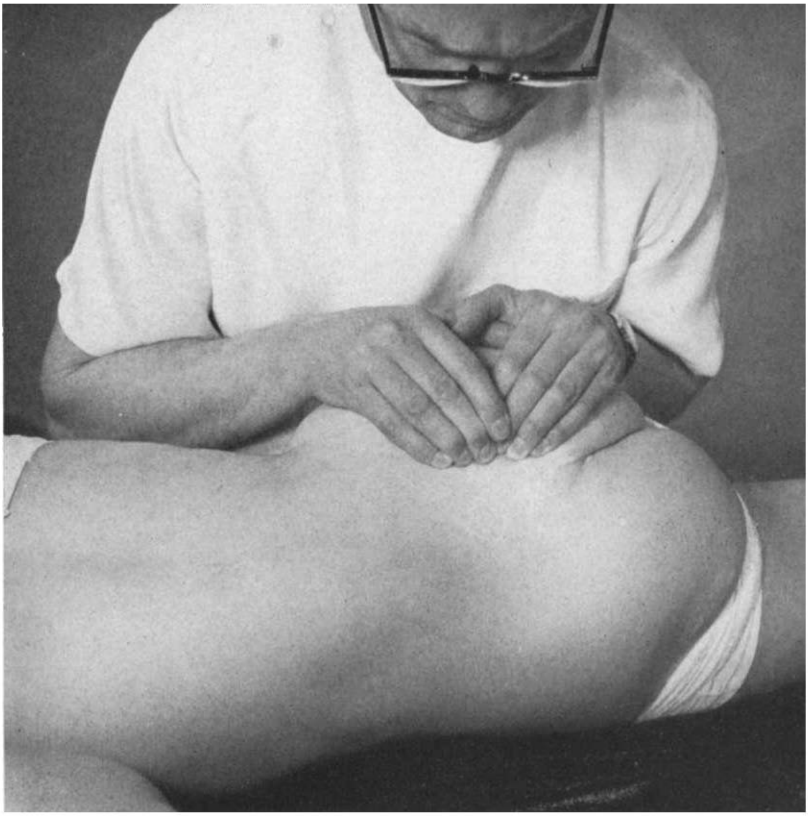


Fig. 27

to occur. *If the patient's left thigh and leg are allowed to hang over the table on the other side*, it has a stabilizing effect on the pelvis and increases the torsional effect within the sacro-iliac joint. This test enables one to detect either gapping or rotation of the sacro-iliac joint. The author is of the opinion that both of these types of movement can occur in the sacro-iliac joint, depending upon the configuration of the adjacent surfaces of the auricular facets on the sacrum and the ilium (*see* Appendix).

(3) *Gapping Test*. Fig. 27

The third test is with the patient prone. The operator stands on the right side and flexes the patient's right knee and hip well so that the knee is below the level of the table. Further flexion is controlled by the operator's right thigh. He then palpates over the right sacro-iliac area with fingers of

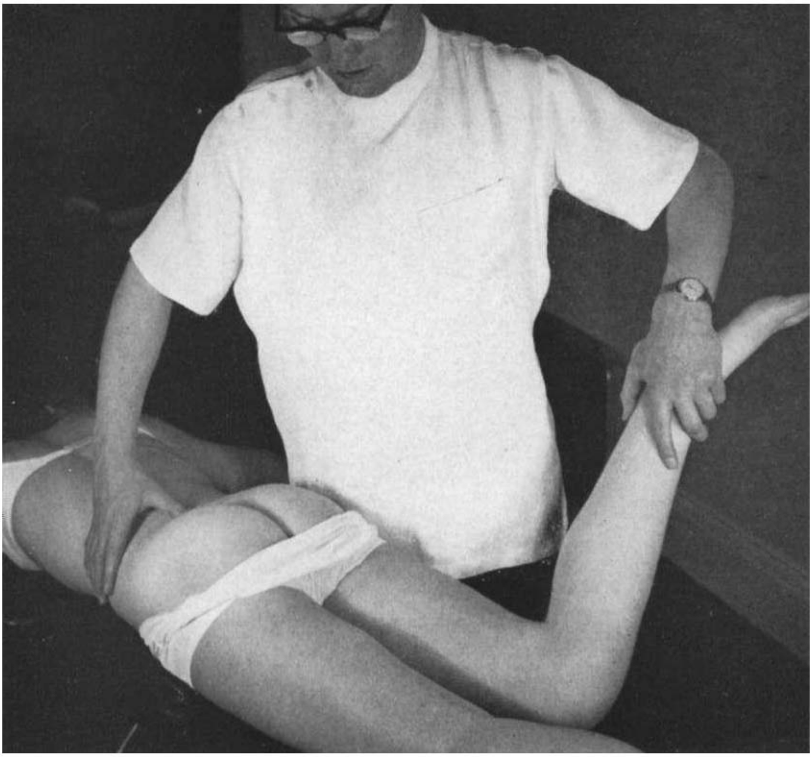


FIG. 28

both hands and curves his left forearm round the patient's right buttock and his right forearm over the patient's iliac crest. The operator's forearms can, in this way, help in the torsional strain placed upon the sacro-iliac joint, partially initiated by the flexed hip and knee. The patient's left sacro-iliac joint is restricted in motion by the fixation of the left leg against the table. This test is similar to test 2 but uses abduction of the thigh coupled with full flexion to detect rocking or gapping of the sacro-iliac joint.

(4) *Gapping Test.* FIG. 28

The fourth test is with the patient prone. The operator stands on the patient's right side, flexes her right knee and grasps her right ankle with his left hand, with the object of internally rotating the femur. At the point of full internal rotation (provided that the knee and hip joints are normal) the pelvis begins to lift up on the left and a gapping strain occurs at both

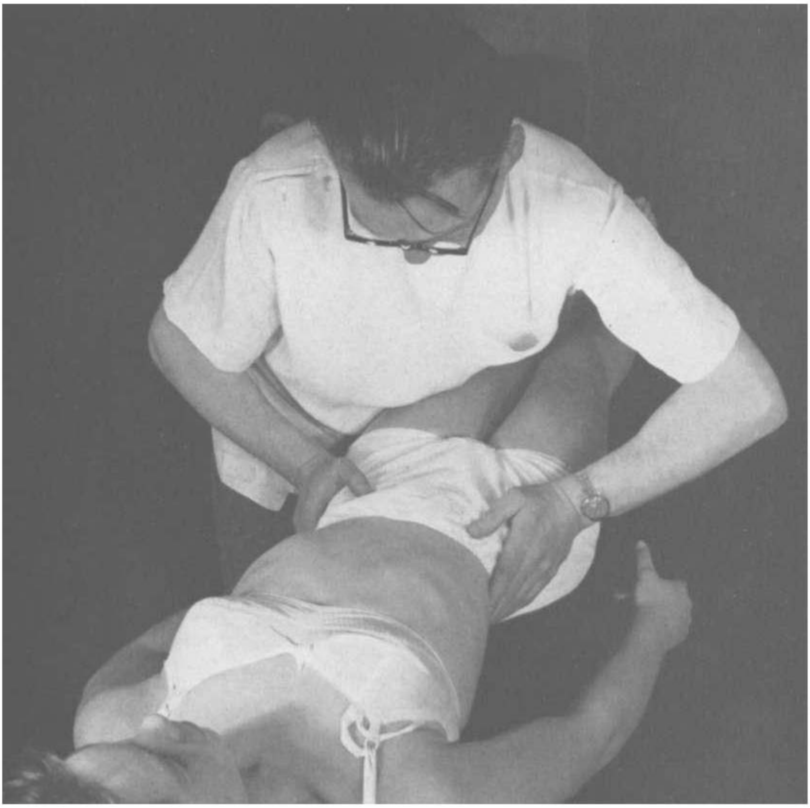


FIG. 29

sacro-iliac joints. This movement can be palpated with the right thumb.

The second, third and fourth tests use hip leverage and can only be relied upon when we have first proved the hip joint to be normal.

Compression Test. FIG. 29

With the patient supine, apply compression to the pelvis by pressing on the innominates at the anterior end of the crests in a direction towards the umbilicus. This has a gapping effect on the sacro-iliac joints and is a subjective test only. If the patient refers pain to the sacro-iliac area, then it is strongly suggestive of sacro-iliac hypermobility or sacro-iliac disease.

Separation Test. FIG. 30

With the patient supine, apply pressure with the heel of both hands to the anterior superior iliac spines in a downward and outward direction

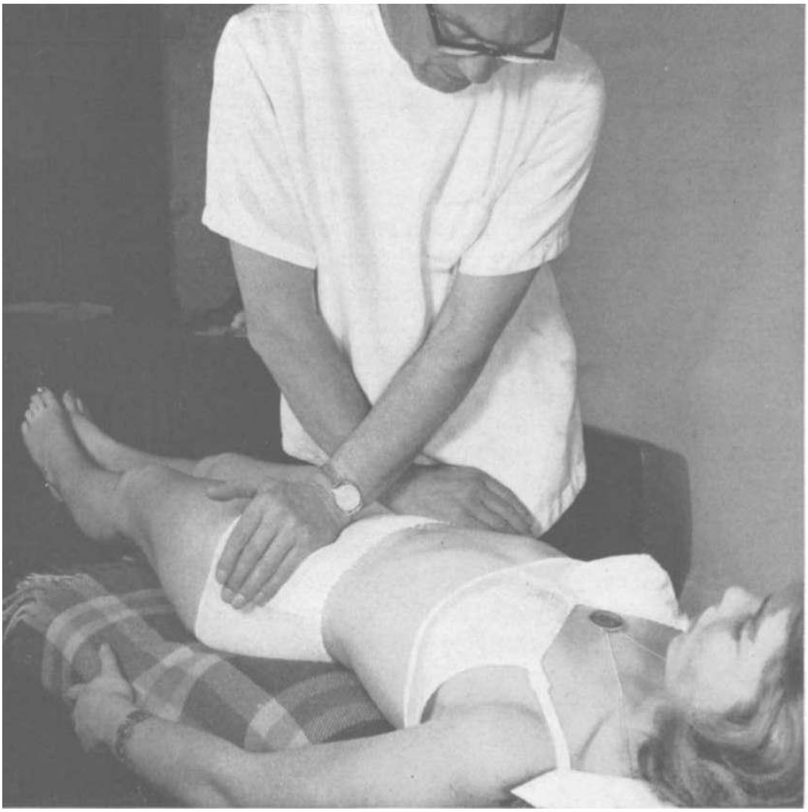


FIG. 30

and ask the patient if she feels any pain in the region of the sacro-iliac joints. It is again a purely subjective test and is of value in detecting hypermobility and sacro-iliac disease.

DIFFERENTIAL DIAGNOSIS OF SACRO-ILIAC LESIONS

At this point it would be opportune to discuss the subject of differential diagnosis of low back pain with special reference to the distinguishing features of sacro-iliac strain (sacro-iliac disease is mentioned later, p. 85). As in other joints, there may be hypermobility or there may be hypomobility. Hypermobility is found in women during pregnancy and the puerperium. It is rarely found in men and only then where severe trauma has taken place. I have seen one man with a gapping of $\frac{3}{4}$ inch at the symphysis pubis—the result of a fall from a horse while out hunting. He complained of great instability in the pelvis, pain over the symphysis and sacro-iliac joints and could only walk with a strong sacro-iliac binder. On the other hand, the configuration of the sacral and iliac auricular surfaces is so irregular that they lend themselves to becoming 'hitched' in slightly faulty alignment. Such lesions are the cause of a great deal of incapacity, and manipulation of them gives most gratifying results.

In James Young's study of Pelvic Arthropathy of Pregnancy[1] he points out that it is normal for the symphysis pubis to increase its width in the first half of pregnancy and, on an average, the increase is from the normal width of 5 mm. to about 9 mm. Greater widening of the symphysis he considers to be pathological. The width diminishes after labour and approaches the pre-pregnancy measurement by the 3rd to 6th month. Such an increase of width at the symphysis must by mechanics mean a decrease posteriorly and a pivoting round the sacro-iliac joints, but as the distance between the centre of the sacro-iliac joint and the symphysis is approximately four times the distance between the centre of the sacro-iliac joint and the posterior superior iliac spine, there cannot be more than 1 mm. approximation, i.e. ½ mm. on each side. This is an extremely small range of movement and clinically difficult to detect, particularly because of the coincident movement of overlying soft tissues. Such gapping of the symphysis as does occur would presuppose an approximation at the sacro-iliac joint in the horizontal plane but the movement of rotation is also envisaged. James Young states:

> 'A forward rotatory movement of the iliac bones of the sacro-iliac joints if called into play during labour will carry the pubes downwards and forwards and thus lead to an increase in the antero-posterior diameter at the brim or, when the rotation takes place in the opposite direction, to an increase of the antero-posterior at the outlet.'

Such rotation is likely to take place round the second sacral segment. Occasionally there is a promontory at this level, where the movement could pivot, but more than likely the movement pivots round the powerful localized concentration of interosseous sacro-iliac ligaments just posterior to the sacro-iliac joint (*see* Appendix). By taking X-rays during pregnancy of patients with very relaxed ligaments, first standing on one leg and then on the other, Young demonstrates an upward and downward movement of 2 mm. at the symphysis. That is to say, by weight bearing on the right leg, the left innominate rotates forwards and downwards and the os pubis is 2 mm. lower on the left than the right. By similar arguments to

[1] YOUNG, JAMES, 'Relaxation of the Pelvic Joints in Pregnancy', *Journal of Obstetrics and Gynaecology of the British Empire*, Vol. 47, No. 5 (October, 1940), p. 493.

the above regarding horizontal gapping, the range of rotary movement at the posterior superior iliac spine cannot be more than $\frac{1}{8}$ mm. even in the increased range during pregnancy.

Clinically, however, such a small range of movement appears to occur, and if the joint becomes 'hitched' at the limit of such range, then symptoms arise, and their differential diagnosis is discussed below. Certain techniques of sacro-iliac manipulation by their very mechanics can only influence the sacro-iliac joint and it is possible to obtain a click of this joint which, in my experience, arises without any shadow of doubt in that sacro-iliac joint. Should the patient's symptoms subside following such localized manipulation then it is legitimate to assume that the symptoms were arising in that joint and manipulation cured them.

The differential points then are:

(1) Sacro-iliac lesions are more common in women especially during and after pregnancy.

(2) The type of injury is usually a torsional one and not a compression type—the swing of the torso at golf with the feet fixed is more likely to cause sacro-iliac strain than say a fall downstairs on to the seat.

Occupational strains, as in dental surgery, where the torso is frequently twisted in one direction only, are more likely to strain the sacro-iliac joint than, say, digging in the garden.

A short leg has to be compensated for and the sacro-iliac is the joint which is primarily involved (*see* p. 213).

(3) The pain is always unilateral and never in the mid line. It is a negative point, but a useful one, that lumbo-sacral strains or disc lesions can cause pain either centrally or over the sacro-iliac joints, but a sacro-iliac lesion never causes a central pain.

(4) The site of pain arising from a sacro-iliac lesion is either over the posterior superior iliac spine or just medially over the sacro-iliac ligaments.

(5) The referred pain from sacro-iliac lesions is into the buttock and postero-lateral aspects of the thigh and calf. According to Hackett[1] the upper pole of the sacro-iliac ligament causes pain postero-laterally and the lower pole absolutely posteriorly in the thigh and calf.

(6) There are no abnormal neurological signs with sacro-iliac lesions. This again is a negative sign but a useful differential pointer from nerve-root compressions in disc lesions. The straight leg raising test may show a smaller angle than on the other side but the angle is more likely to be 60 deg. to 80 deg. than 20 deg. to 30 deg. as is so often the case with a prolapsed disc.

(7) There is unilateral tension in the erector spinae muscles. It is worth

[1] HACKETT, G. S., *Joint Ligament Relaxation* (C. C. Thomas, Springfield, Ill., 1956).

noting that there are no muscles which motivate the sacro-iliac joint, but Hilton's law still obtains and the nearest muscle to the sacro-iliac joint is the erector spinae mass taking origin from the sacrum and innominate. There is protective muscle-guarding therefore on the same side as the sacro-iliac lesion.

(8) There is local tenderness in the posterior sacro-iliac ligaments and overlying muscle. The sacro-tuberous ligament is frequently tense and tender especially where there has been a forward rotation of the sacrum on the innominate around 2 S., such that the apex of the sacrum is more prominent and the posterior superior iliac spine is more prominent (the 'posterior innominate' of osteopathic terminology). Occasionally there is tenderness over the symphysis pubis but this is limited to the pregnancy arthropathies.

(9) There is altered mobility in the sacro-iliac joint either hyper- or hypomobility, and the previous tests are designed to demonstrate this.

(10) There may be positional changes—the sacrum and innominate may be positionally altered. This point is fraught with snags and difficulties, to name just a few—the shape of the pelvic bones is subject to wide variation, there is rarely perfect symmetry on the two sides, anomalies are common, the leg lengths are frequently different, the relative position of the lumbar spine and pelvis as a whole is subject to variations from disc and other lesions, muscular guarding alters the relative position of the pelvis and lumbar spine and if the guarding is asymmetrical it can cause confusion of position.

Even so, the levels of the crests of the ilium should be noted with the patient standing and sitting; similarly with the levels of the posterior superior iliac spines and the anterior superior iliac spine, the pubic tubercle levels. Again, these levels should be noted, prone and supine, also the relative prominence of the posterior superior iliac spines comparing one with the other. All these positions help one to build up a mental picture of the shape of the pelvis; and X-rays will help still further, especially when taken in the erect position.

To make a positional diagnosis of the pelvis and call the lesion a 'posterior innominate' or an 'up anterior innominate' in my view is inadequate. The diagnosis is primarily one of mobility and only secondarily of position, and the technique of sacro-iliac manipulation is one of 'unhitching' the joint, attempting to release it by rotation or gapping. The hypermobile sacro-iliac joint, of course, should never be manipulated but should be given external support or sclerosing fluid injections after the manner of Hackett.[1]

The question of sacro-iliac disease has been purposely left out of the

[1] *Ibid.*

above discussion because, as we have said all along, our concern is with mechanical lesions only. However, stated briefly, we suspect sacro-iliitis either tuberculous or part of an ankylosing spondylitis when there is a variable backache referable to the sacro-iliac area, radiating to the buttock, postero-lateral aspects of the thigh and calf, no abnormal neurological signs, a rigid lumbar spine with muscle-guarding, a raised sedimentation rate, perhaps a history of iritis or heel pains. The X-ray appearance of the early sacro-iliitis shows some loss of the cortical line of the joint, especially of the iliac portion, some blurring, some gapping, perhaps erosions and subchondral sclerosis. If the condition is unilateral it may be tuberculous, but if bilateral is almost certainly a prelude to ankylosing spondylitis. For further differential points the reader should refer to standard orthopaedic textbooks.

Sacro-Coccygeal Joint

Coccydynia is a common-enough symptom, but in roughly half the cases there are absolutely no abnormal physical signs to account for the pain locally at the coccyx or in the sacro-coccygeal joint. Many of such cases have been considered psychogenic and some of them may well be, but most of those without physical signs are due to lower lumbar disc lesions—central disc propulsions causing irritation of the coccygeal nerve and tension in the filum terminali and thereby referred pains to the coccygeal area.

Another point worth making here is that injury to the coccyx frequently causes transmitted shock and damage to the lumbar area, and even where there are well-marked local signs of sacro-coccygeal strain, the lumbar spine should be examined most carefully in order to avoid being misled into thinking that all the pain arises locally.

When examining the coccyx we make use of a rectal examination to facilitate palpation but also to satisfy ourselves that there is no pathology in the anus, rectum or uterus. Having done so, we must test the flexion, extension and rotation of the sacro-coccygeal joint and palpate for tenderness in the ligaments. Normally only flexion and extension are possible at the sacro-coccygeal joint but rotation and sidebending is possible between the segments of the coccyx. While in the rectum, it is easy to swing the finger round to palpate the sacro-tuberous ligaments, in case there is a sacro-iliac lesion in association. Tenderness should also be palpated for in the ano-coccygeal body. If a rectal examination is not done, it is still possible to obtain a good deal of information about the coccyx by palpation externally, noting the exact site of tenderness, feeling for lateral, forward or backward displacements. Another useful test, with the patient prone, is to apply the flat of the palm over the coccygeal area, pressing upwards to obtain a sense of the prominence of the coccyx through the soft tissue mass of the glutei. Should pressure in this way elicit pain it is likely that sitting down also will cause pain at the coccyx. It is customary to examine per rectum with the patient on the side, but it is equally easy to make the examination with the patient prone and enables one the better able to judge the symmetry of the coccyx relative to the sacrum and pelvic outlet. Furthermore, if manipulation of the coccyx is decided upon, then one can proceed without a change of posture.

There are three muscle attachments to the coccyx, the coccygeus and levator ani which, when contracted, cause a slight flexion of the joint and posteriorly a few fibres of the gluteus maximus are attached to the coccyx. We can make use of this latter attachment when examining and when treating the coccyx. By flexing the hip and knee and abducting the thigh to the full, we place a stretch on the gluteus maximus and palpation of the coccyx in such a position will give information about mobility. Similar leverage of the lower extremity used against counter-pressure on the coccyx can usefully be employed to mobilize the coccyx (*see* p. 228).

3

ATLAS OF TECHNIQUES

MANIPULATIVE techniques described in this chapter are divided into three categories: soft-tissue techniques, articulatory techniques and specific techniques. Each of the methods have their role in osteopathic treatment. In the Preface it was emphasized that manipulation is but a part of the broader osteopathic or structural approach to the body, and the terms manipulation and Osteopathy are by no means synonymous. Not even the terms manipulative treatment and osteopathic treatment mean the same thing. A patient may be manipulated as an isolated procedure during medical supervision without the basic osteopathic conception of structure governing function being considered—such a patient is not having osteopathic treatment although an osteopathic physician may use the same technique as part of his treatment. No, osteopathic treatment is given by a practitioner when the whole approach is mechanico-structural. Actually it is a question of emphasis. A patient with capsulitis of the shoulder may well be manipulated by an osteopath and a surgeon in exactly the same way but the shoulder is only part of the patient's structure and the osteopath would examine and treat the whole body mechanically—there may well be a scoliosis or spondylosis which is predisposing the patient to the capsulitis and these predisposing factors must be dealt with if the patient is to achieve a complete recovery. Similarly, a patient with nervous dyspepsia may well be treated by the physician with alkaline powders and sedatives but the osteopath would examine the spine and her posture and, in particular, would look at the mid thoracic area of the spine to see if there were any mechanical lesions to predispose the patient to functional disturbances of digestion.

But to return to the question of techniques; soft-tissue techniques are similar to those used by physiotherapists and only differ in details and in their application. The role of massage assumes a different importance in the osteopathic as compared with the medical approach. Massage on the whole is considered a preparatory method, coming before the articulatory and specific techniques rather than as a separate modality of its own.

When first writing this manual in outline I planned to make separate chapters of the three types of technique but found that there was a better sequence: that of describing the methods as they are usually employed in giving osteopathic treatment. In other words, we commence treatment with soft-tissue work and then proceed to articulatory techniques and when necessary finish the treatment with specific manipulation.

ARTICULATORY TECHNIQUES

Now the second category of technique—the articulation of joints—is almost unique to Osteopathy. Other schools of manipulation—chiropractic and 'bone-setting'—make little use of it, yet it is an invaluable method and, when applied properly, frequently renders the specific type of manipulation unnecessary. Further, it is often indicated as a procedure where specific techniques are unsuitable or even contra-indicated. Most doctors, physicians and surgeons alike have no idea at all what is meant by this form of manipulation. Manipulation to the average doctor conjures up the idea of forced movements in all directions with the patient under an anaesthetic and the joint is wrenched violently. This is a frightening procedure and no wonder the doctor is opposed to it. The orthopaedic surgeons are to blame for this concept of manipulation and it is not surprising that the general practitioner is nervous about allowing his patient to be submitted to it. No wonder manipulation has a bad reputation. Vaguely the doctor imagines the osteopath does the same sort of thing to his patients. Nothing could be further from the truth. Much of the osteopathic treatment time is devoted to *articulatory techniques consisting of passive movements applied in a smooth rhythmic fashion gradually to stretch contracted muscles, ligaments and capsules.*

It is a persuasive type of treatment rather than forced. An attempt is made to stretch the joint in each of the planes of movement normal to it and to ensure that the movements which are not normally under voluntary control are also free. For example, adduction and abduction are not normal movements of the knee joint but passively a small range of such movement is possible. Without such movements, normal flexion and extension would not be full and free and it is vitally important to test for and treat such passive ranges of movements.

The purpose of articulatory techniques is not merely the stretching of soft tissues, though this is its most important aim. By alternately stretching and squeezing the muscles, ligaments and capsules we provide a powerful stimulus to circulation in the joint. Ten minutes' articulation of a knee joint will stimulate the flow of blood infinitely better than any physiotherapeutic agent. The same applies even more so to the spinal joints. In other words, articulatory techniques have an important place in osteopathic treatment and can be applied to conditions like osteoarthritis, spondylosis, spondylolisthesis, etc., where specific manipulative techniques would be contra-indicated. The osteopath is taught the indications and contra-indications for the various categories of manipulative techniques. It is indeed a pity that the medical profession knows so little about this aspect of manipulation. Even amongst doctors who have interested themselves in manipulative therapy the importance of articulatory technique has escaped them. They have become familiar with soft-tissue techniques and with specific manipulations but have little or no idea of the value of these passive, non-specific movements.

Like soft-tissue techniques, articulatory techniques are frequently preparatory to specific manipulations and an osteopathic treatment may consist firstly of attention to soft tissues, then articulation of the appropriate joint or joints (articulation is applied mainly to an area rather than one joint) and finally a specific thrust is applied to release its fixation or adjust its position. The order of these methods may well be altered to suit certain cases or conditions; one method alone may be sufficient or two of the methods sufficient, but by and large a faulty joint has its soft tissues massaged first, its capsule stretched and finally a specific manipulation applied in that order. When preparing the joint by massage and articulation prior to specific manipulation, we believe that the treatment is more effective; that there is less reaction and that the benefit is more prolonged. Frequently it is desirable or even necessary to give several soft-tissue and articulatory treatments before attempting any specific work. This applies particularly if the patient is nervous or tense or if there is any inflammatory component to the condition, and often a few such treatments make it unnecessary to use any forced movements at all.

SOFT-TISSUE TECHNIQUES

Before describing the details of soft-tissue technique, let us first consider our objectives. We are either (*a*) treating the soft tissues preparatory to further corrective work on the associated joints or (*b*) treating the soft tissues *per se* for some intrinsic fault in the muscles themselves. The occasions for which the latter treatment is required are relatively few but the methods are enumerated below:

(1) *Inhibition*

Inhibition or deep sustained pressure is applied over the belly of the muscle while the patient is as relaxed as possible. To help in the relaxation of the muscle, the origin and insertion of the muscle are approximated and the patient is placed in such a position as to achieve this. The patient must, of course, be comfortable. It is virtually impossible to relax fully when there is something digging in or too tight or pricking the patient.

Make sure she is comfortable by asking. Many patients will accept the discomfort, thinking that it is intended or it is good for them and they will not mention it! Having obtained as much relaxation as is possible within the patient's capacity, then apply pressure with the flat of the thumbs or fingers or thenar eminences. The pressure must be commenced slowly, increasing gradually until there is considerable pressure being exerted. Such pressure as the patient can take should be maintained for about a minute until there is a palpable relaxation of the muscle. The pressure must be released gradually and after a short pause pressure may be applied again in the same place or in an adjacent section of the muscle. The gradual commencement and gradual release of the pressure is important because we wish to avoid undue stimulation, particularly as we are treating muscles which are in a state of semi-contracture and arc, therefore, in an irritable condition.

For such subacute muscle states, kneading as described below would be unsuitable because it would be too stimulating—in fact, if kneading is attempted in such a state the muscles merely go into further spasm, aggravating the symptoms rather than relieving them. It is not always possible to feel the muscle fibres relax under your thumbs but it is a most gratifying feeling when it does happen. The state of contraction of muscle may be so marked that even inhibition is too irritating and then heat and rest in the optimum position for relaxation is the only treatment which will achieve a measure of relief.

(2) *Kneading*

This method is used for muscles which are chronically contracted or in which some alteration in structure has occurred. The effect desired is mainly an increase in circulation through the muscle. The treatment is stimulating in character, a pink glow develops in the skin overlying the muscles treated. Another aim with kneading is the stretching of shortened muscles and to do this the patient is placed in a position which does stretch the muscle, then in a direction transverse to the muscle fibres apply a firm, slowly moving rhythmical pressure to the muscle. It is not intended to *rub* the muscle or skin, for the skin and muscle should be made to go along with the heel of the hand or the tips of the fingers or thumbs. Sometimes a to and fro movement is used; starting with an initial straight stretch the hands may return in a circular or oval 'stroke'. It is sometimes necessary to move over the skin for a short distance but we never require to rub over the surface of the skin as such. In most instances, both hands are used together for reinforcement and to help in making the movement still more uniform and rhythmical.

Stretching

Muscles require stretching when they are shortened for any reason, as in disuse, spasticity, congenital contractures. Examples are: shortening after prolonged immobilization in splints; spasticity in hemiplegia, locomotor ataxia, Little's disease; contractures in talipes and torticollis; shortening by skeletal faults, lumbar lordosis, short leg, scolioses. Muscles may be short for no obvious reason as in tight tendo-achilles, tight hamstrings. Overlying fascia and tendons may be shortened as in Dupuytren's contractions, pes cavus. All of these conditions require slowly applied and strongly sustained stretching in the longitudinal direction of the muscle. Many of the above are chronic intractible states and limited success only may be achieved. *Localized muscle contractions* occur as in so-called fibrositis. Invariably the source of the muscle irritation can be traced to the articulation segmentally connected with the muscle and it is necessary to cope with the cause of the 'fibrositis'. However, when 'fibrositis' has been present for a long time, local changes occur in the muscle, and even after the removal of the original cause a focal point of irritation persists in the muscle. Such sites are best dealt with by deep frictions.

Deep Frictions

The localized contraction is carefully detected and transverse pressure applied to and fro over the tender site. The method is also very valuable over painful tendons, musculo-tendinous insertions, shortened ligaments. The idea of the frictions is to promote an increased blood supply to the affected tissue—such tissues are usually but poorly supplied with blood and this is a possible explanation for the frequency of trouble in the supraspinatus tendon, galea aponeurotica, tendo-achilles, extensor digitorum communis, etc.

Hammering and Squashing

This is usefully applied to fibro-fatty nodules in the gluteal area. The objective here is to break the limiting membrane of the nodule so that the fatty material can escape. Another site is the ganglion on the wrist or ankle tendons sheaths. Bursting the ganglion will often cure the condition though it does not ensure against recurrence.

Petrissage

Petrissage, or picking up and squeezing the muscles and overlying fat, is a valuable method of dealing with painful fatty deposits in and over

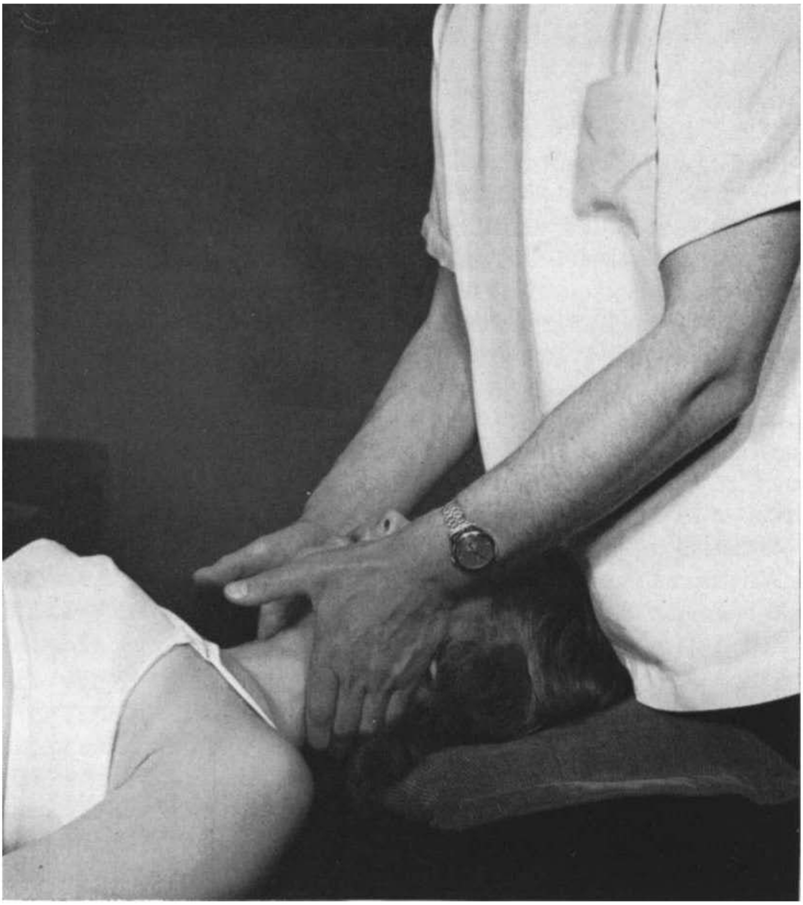


FIG. 31

muscles, the so-called panniculitis in which condition we find bands of fibres running at right angles from the skin down to fascia and muscle, thus separating the fat into sections. If the soft tissues are squeezed a '*peau d'orange*' effect is formed in the skin. Such tissue has a very poor blood supply and rough handling by squeezing, kneading, twisting pressure will cause local tissue damage, a consequent histaminic reponse thereby achieving a better blood supply. It is surprising how after a few such treatments the hard doughy irregular tissue can be broken down into soft, smooth and painless tissue.

Effleurage

Effleurage is the term used for stroking the skin to increase venous and lymphatic drainage, but the method is similar to orthodox massage. Only in some of the sites of application has the osteopathic approach a special significance. For example, effleurage may be applied in a downward and outward direction from the bridge of the nose, across the cheeks to the angle of the mandible and then on along the anterior border of the sterno mastoid. This is a valuable way of improving lymphatic and venous drainage from the eyes, nose and head and is particularly appropriate where there is congestion in these fields.

The Neck

METHODS OF SOFT-TISSUE TECHNIQUE

(1) *Kneading.* FIG. 31

The patient lies supine on the table with her head resting completely relaxed on a low pillow. A thin pillow is used so that it leaves sufficient room for the hands to work comfortably. Standing behind the patient the operator places his hands on either side of the neck with his fingers spread out over the posterior and lateral cervical muscles. The operator pulls gently upwards and outwards on these muscles, stretching and relaxing the muscles away from the spinous processes, all the while being careful not to let the fingers slip over the skin.

(2) *Kneading.* FIG. 32

With the patient lying supine, the operator stands to the left of the patient and places his right hand on her forehead, while his left hand is placed on the right side of her neck, keeping the tips of the fingers lateral to the spinous processes.

The operator pulls towards himself with the left hand while his right hand rotates the head gently away from him and maintains resistance. This movement should be done slowly and rhythmically, co-ordinating the movement of the two hands so that the right hand rotates the head away from him and, at the same time, the left hand pulls the muscles away from the spinous processes. In this movement the patient's neck is rotated slowly to each side. First the left hand applies more pull and the neck is

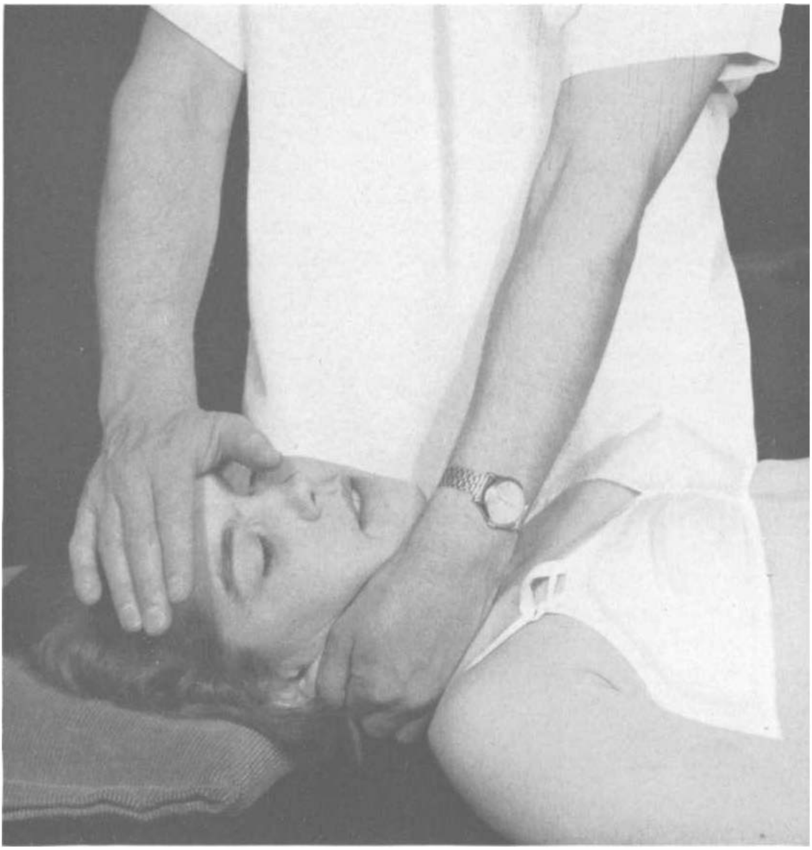


FIG. 32

rotated to her left and then the right hand applies more push and the head is rotated to her right. In effect the rhythm of the movement is created by alternating the pull and push between the two hands. While the right hand is pushing, the left should maintain some resistance; and while the left hand is pulling, some resistance should be maintained by the right hand.

(3) *Relaxing*

To relax the deep suboccipital muscles the patient assumes the same position as before. The operator, standing at the head of the table, lifts the patient's head upwards into slight extension and rests the vertex of the head against his abdomen. This position, by approximating the origin and

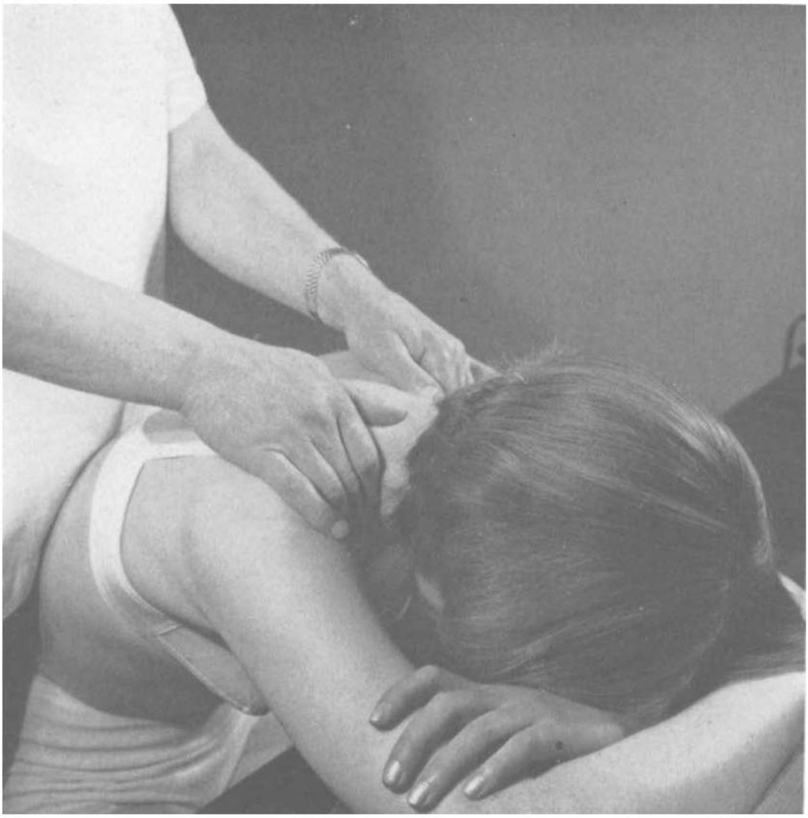


FIG. 33

insertion of the muscles, makes it easier for the operator to knead, stretch and relax them.

(4) *Kneading.* FIG. 33

With the patient sitting on a stool facing the table, she is asked to lean forward, rest her folded arms on a cushion over the table and then place her forehead on her folded arms. By standing behind the patient, or just slightly to one side, the operator is able to use his two hands to relax all the muscles from the occiput to the upper thoracic area. The thumbs may be used alone or in combination with the hands.

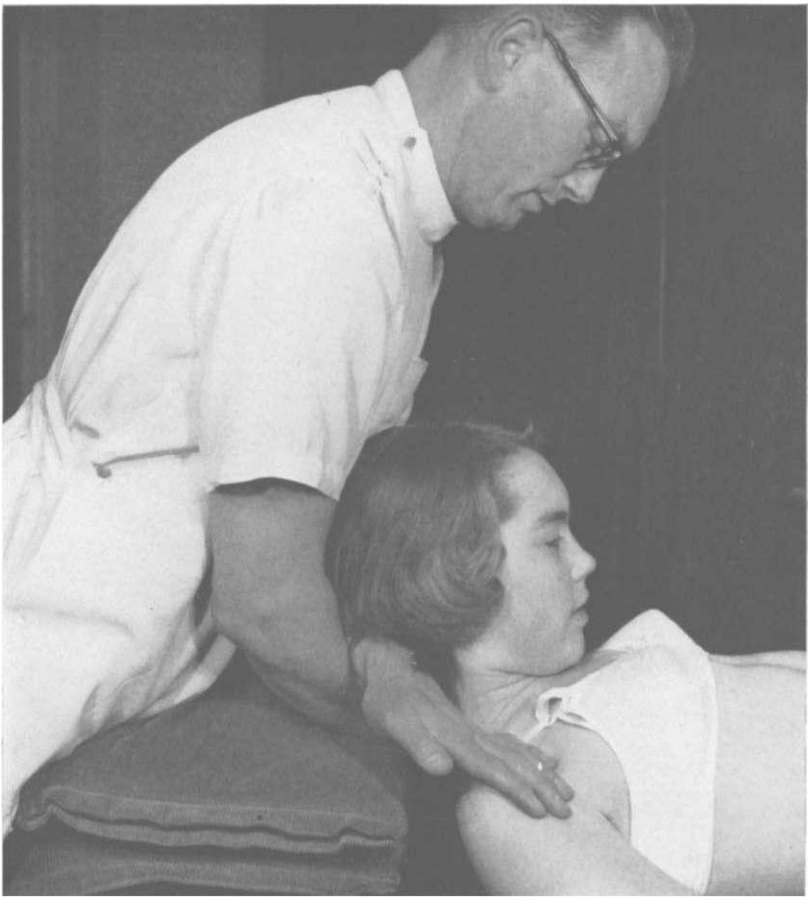


FIG. 34

ARTICULATORY TECHNIQUE IN THE CERVICAL AREA

These movements may conveniently be carried out with the patient lying supine and the operator standing at her head.

The movements used introduce forward-, backward- and sidebending, rotation and circumduction.

Forward Bending

The operator places his left hand on the patient's left shoulder and

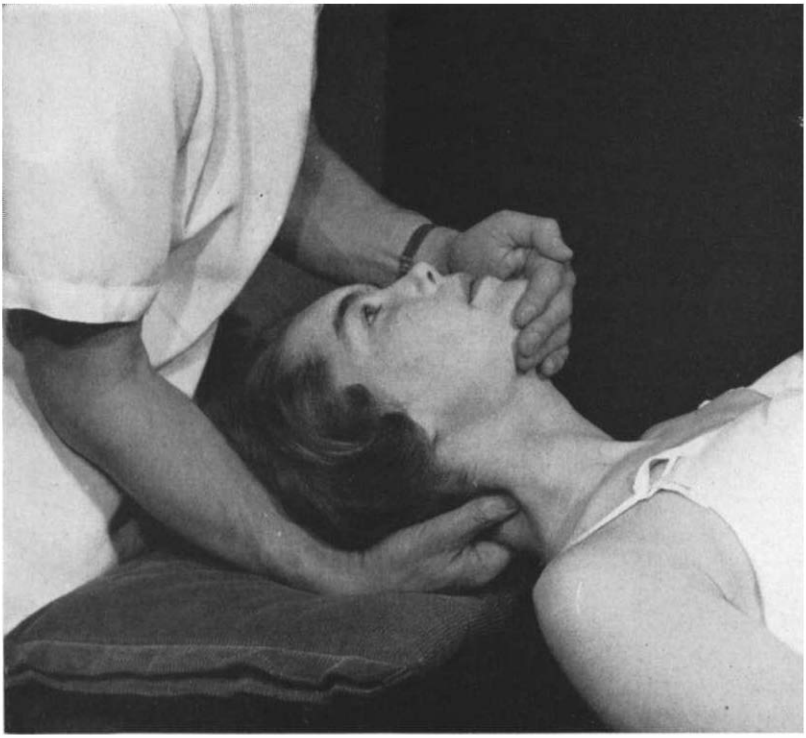


FIG. 35

cradles the occipital region in his right hand. The head is then lifted until full flexion of the neck is obtained, the movement being repeated smoothly and rhythmically several times.

Forward Bending. FIG. 34

Alternatively, the operator crosses his forearms and rests both hands on the patient's shoulders so that her head is supported on his crossed forearms. Raising the arms, the operator carries the head and neck into strong flexion using the shoulder contact as a fulcrum.

Backward Bending. FIG. 35

The operator places one hand under the patient's neck so that the thumb and forefinger press against the posterior aspect of the articular processes on either side of a given cervical vertebra. Using this contact as a fulcrum, the operator lightly grasps the patient's chin with the other hand

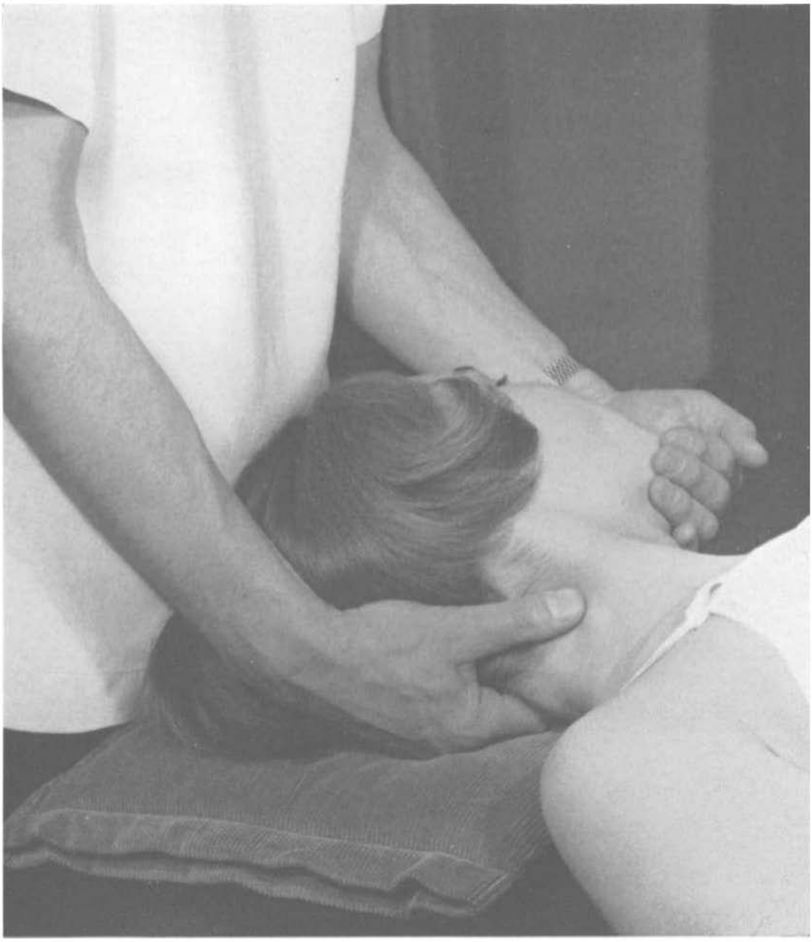


FIG. 36

and lifts the chin so that the neck is extended. By moving the fulcrum each articulation may be treated.

Rotation. FIG. 36

Lightly grasping the chin with one hand and the occipital region with the other, the operator slowly but firmly rotates the head, repeating the movement several times, tending slightly to increase the range each time.

Sidebending. FIG. 37

The operator places one hand on the patient's shoulder, cradles the

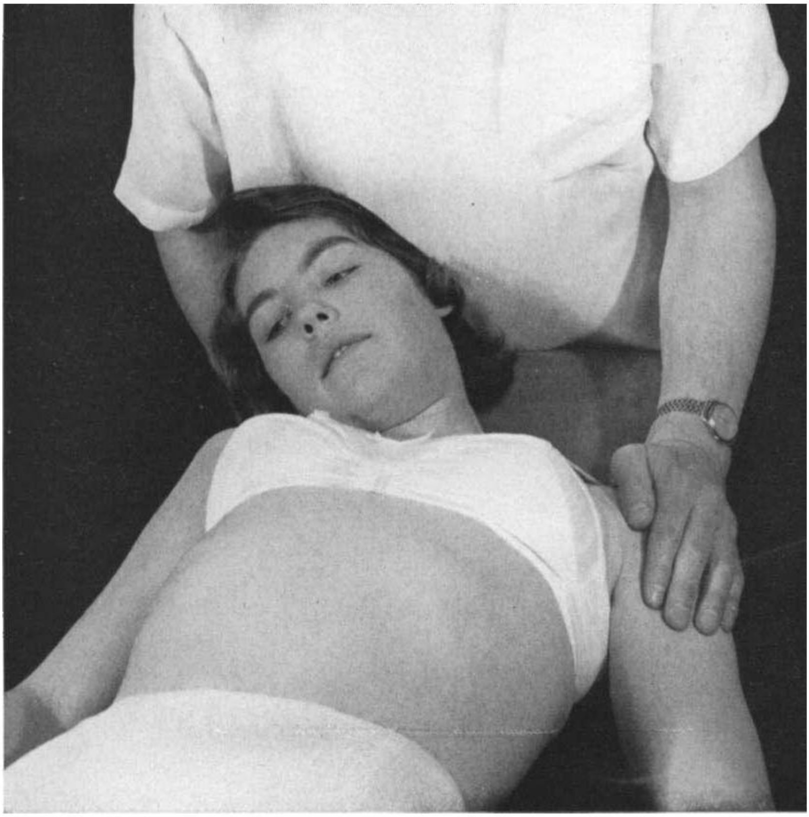


FIG. 37

occipital region in the other hand and firmly sidebends the neck away from the shoulder. The movement may be reinforced if the operator leans against the head.

In order to obtain more localized sidebending, the operator may grasp the chin and support the side of the head with the forearm and arm. Assuming this to be the right arm, the lateral side of the left index finger is pressed gently into the left side of the neck at a given vertebral level and moved firmly to the right while the operator exerts a slight pressure on the vertex of the head by pressing with his chest against the head. It is necessary to bend the knees to get sufficiently low to do this movement.

Circumduction. FIG. 38

The operator grasps the occipital region with both hands, the fingers pointing downwards and the thumbs lying over the mandible and chin.

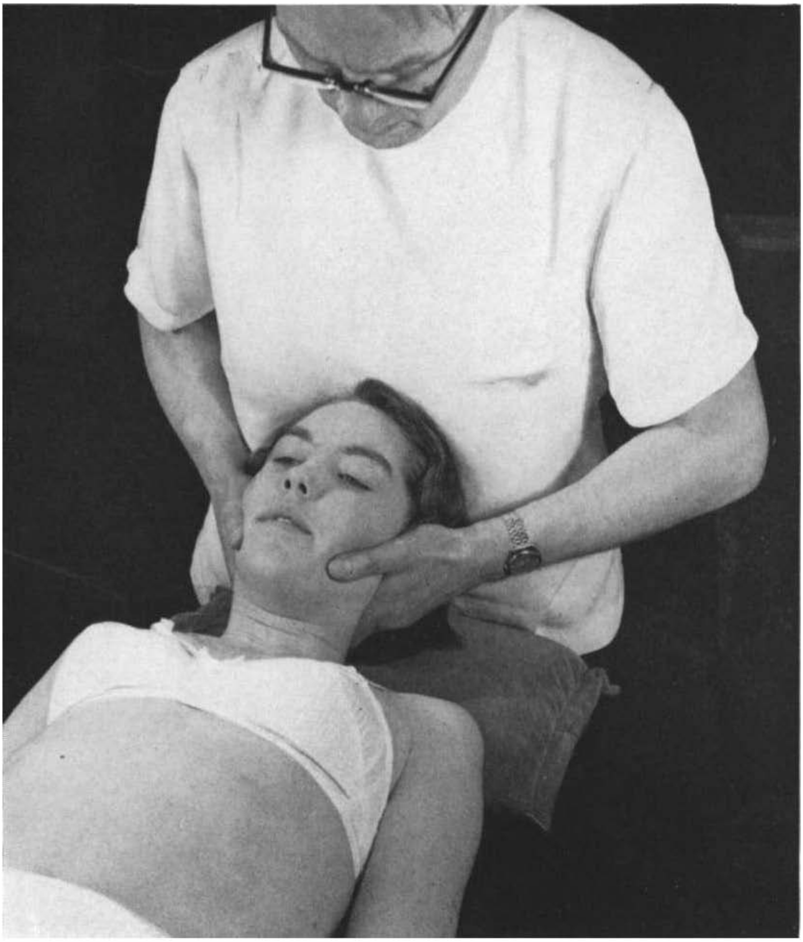


FIG. 38

Applying his epigastrium to the vertex of the patient's head, the operator exerts a slight abdominal pressure, keeping the vertex in the mid-line, while making a circular movement with the hands. This will cause the upper cervical region to pass through the movements of flexion, sidebending and extension successively.

A 'figure-of-eight' movement may be applied to the whole neck by supporting the occipito-atlantal region in the palms of both hands and carrying the head and neck through the movements of rotation and side-bending to alternate sides.

All the articulatory techniques above are non-specific in that all the joints of the area take part in the movement, but in specific techniques we wish to move one joint only. In order to achieve accuracy of manipulation there are certain rules to be observed with regard to positioning the patient prior to applying one specific thrust. The patient must be comfortable and the operator correctly poised, balanced squarely on his two feet so that the movement can be carried out in a smooth manner; but apart from these elementary points the positioning of the group of joints in the area of the spine we are dealing with must be such that the adjustive force is directed to the joint in question and that adjacent joints are not forcibly moved—in fact, ideally the adjacent joints should be protected by 'locking', i.e. locked against further movement.

Now there are two ways of achieving 'locking': one involves the apposition of articular facets (Facet Apposition Locking) and the other involves the taking up of all the slack in the soft tissues (Ligamentous Tension Locking).

Facet Apposition Locking

By this we mean that the facets are forced against each other at right angles to their normal plane of movement. If such a force is used, then there will be no 'shearing' movement round the joint and no possibility of a side-slipping of the joint while the superadded force of the specific manipulation is applied.

In order to understand and apply this principle, it is necessary for the operator to have a detailed knowledge of the planes and angles of the apophyseal joints (*see* Appendix) and to know what happens in the spine when combined movements occur. The subject is somewhat involved because movements can occur in three planes: (1) forward and backward bending, (2) rotation and (3) sidebending, but because of the ligaments and direction of the facets a limit is placed on the range in one direction and any further movement must occur in combination with a second direction of movement. That is to say, it is possible to sidebend the neck for a short distance, but quickly the facets come into apposition and any further sidebending must occur in combination with rotation; similarly, rotation cannot proceed far before sidebending is involved also.

If the vertebral column consisted of vertebral bodies separated by discs only and there were no apophyseal joints, pure rotation and pure sidebending could occur, though even then, because of the anterior and posterior curves, there would be a distinct limit to the range of pure rotation and pure sidebending. As it is, the spine has only to move a few degrees from the 'neutral' erect position (when the facets are free to move in any plane) before the facets engage with each other. Then instead of the pivot of movement being in the intervertebral disc, the pivot shifts to the apophyseal joints and further movement is governed by the plane of the facets.

In the cervical area, sidebending and rotation occur to the same side whether the neck is first in a position of flexion, extension or in the neutral position. If the neck is, say, sidebent to the right, after a few degrees of pure sidebending the facets collide and they force the vertebrae to rotate to the right and in the combined sidebending-rotation a further range of movement is possible. Similarly, if the neck is rotated to the right, in the early stages pure rotation can occur mainly in the atlanto-axial joint, but soon the facets appose each other and further rotation can only take place in combination with sidebending to the right.

Much of the early work done on spinal movement analysis was done by Fryette[1] and most of the credit for an understanding of what he calls 'physiological movements' is due to him. The work was materially helped by Halladay,[2] who prepared a vertebral column post-mortem, in which all the ligaments were intact and in a flexible state. This 'Halladay' spine has done much to increase our understanding of spinal mobility. I myself have been able to confirm Fryette's conclusions by X-ray 'mobility' films, that is, X-rays taken of areas of the spine at their limit of movement.

Although in the cervical spine rotation and sidebending must occur to the same side, this does *not* apply to the *thoracic* and *lumbar* areas of the spine. Only when these areas are in flexion does sidebending and rotation occur to the same side. If the thoracico-lumbar spine is in the neutral or backward-bending position, then rotation and sidebending occur to opposite sides.

Now all this has an important bearing on the question of facet-locking, for if we position the patient's neck with rotation and sidebending to opposite sides, then we force the facets against each other and 'lock' them. For example, by sidebending the neck to the right and rotating it to the left we force the right row of apophyseal joints together. We also gap the row of apophyseal joints on the left side of the neck, i.e. we 'facet-lock' the right side of the neck and we 'ligamentous-lock' the left side of the neck.

Another way to achieve 'facet-locking' in the cervical area is by backward bending. At the limit of backward bending the lower margins of the inferior facets come into apposition with the lower margin of the superior facets and even the spinous processes appose each other to stop further movement. We use this position of full backward bending when we wish to use the cervical column as a lever for adjusting the upper thoracic joints and upper ribs.

[1] FRYETTE, H. H., D.O., American Osteopathic Association Convention, 1918.
[2] HALLADAY, H. V., D.O., *Applied Anatomy of the Spine* (1920).

When the cervical column is locked by rotation and sidebending to opposite sides, we still need to consider the amount of each component—whether a lot of sidebending or a lot of rotation—and this is governed rather more by the type of restriction which is present, i.e. if there is a rotation restriction lesion of the 4–5 C. on the right we require to give an additional impetus to rotation as compared with sidebending—these are the refinements of technique.

There is also the question of the forward and backward range because this has a bearing on the localization of the level of joint manipulation. If we wish to adjust the 3–4 C. joint, we use the neutral position midway between flexion and extension. If the joint in lesion is lower down, we require to bend the neck forward to the appropriate amount to enable more sidebending to occur. If the lesion is at 2–3 C. we need to use a little backward bending so as to limit the sidebending to the upper joints. In other words, we require to use a combination of forward and backward bending, sidebending and rotation to localize our forces to the exact level of the lesion and to obtain the exact amount of locking, to protect adjacent joints.

Again the locking must not be too complete otherwise the adjustive force in the plane of the facets will not achieve the object of freeing the joint. In the cervical column, the superior facets face almost directly postero-superiorly and the direction of our thrust must be in this plane. A better appreciation of these points can be obtained by studying an articulated spinal column (*see* Appendix).

The amount of thrust must be of sufficient amplitude to free the joint on the right side and it must be of short range so that the force carried through does not also gap the apophyseal joints on the left side of the cervical column.

The thrust may be given either with the thumb or with the radial side of the base of the first finger but the forearm should be in direct line with the thrusting movement, in order to obtain sufficient force at short range.

Ligamentous Tension Locking

When the facets are separated from each other, the capsules of the apophyseal joints are placed under tension and further movement of the joints is prevented. A moderate amount of further separational tension will do no harm and will be taken up by the elasticity of the ligaments—it is thus possible to 'snap' the metacarpo-phalangeal joints by forcing them slightly beyond their normal range and causing a clicking sound, without doing any harm to that joint—in fact there is an added sense of freedom there. Similarly, it is possible to gap the intervertebral joints of the spine and make a clicking noise. These clicking sounds are of no practical value if the joints have a normal range of movement already, but if the joint were previously restricted and the manipulation produces a click, then something is definitely achieved. These latter clicks are usually rather soft and are more palpable than audible.

If undue force is used to gap the joint, then the capsule is forced beyond its elastic range and we 'sprain' the joint, we tear the capsular ligaments and we injure the patient.

In certain techniques we use a combination of facet-locking and ligamentous-locking. As was said earlier, if we sidebend the neck to the right and rotate to the left, we bring the right row of facets into apposition and the left row are gapped. We are, therefore, in a position to use facet-locking when releasing the right row of apophyseal joints or to use ligamentous-locking when releasing the left row of apophyseal joints. Sometimes a manipulation of, say, the 5–6 C. joint achieves both results in the same instant. It is sometimes difficult to be sure which has occurred during a manipulation and it does not greatly matter as our objective is to release restricted movement provided we do not use excessive force. To be able to manipulate, say, the 5–6 C. joint accurately and avoid moving 4-5 C. and 6–7 C. means the operator has a high degree of manipulative skill but it is the acme of perfection to limit the adjustive forces, say to the right apophyseal joint at 5–6 C., and not move the left 5–6 C. apophyseal joint.

When *using facet-locking and a thrust technique*, we require to position the patient just short of complete fixation so that a small range of movement is possible in the joint in question, but less at the joints above and below. The thrust has to be of high velocity, powerful amplitude over a very short range and in precisely the correct direction; whereas when *using ligamentous-tension-locking*, the movement is slower (the slower the safer) and the positioning forces do the gapping (not the thrust). That is, it is the exaggeration of the sidebending and rotation which gaps the joint.

When using ligamentous-tension techniques, it is desirable, in fact necessary, for localization purposes to use strong fixation with the fingers on the adjacent vertebra. For example (*see* Fig. 50, p. 117), if we wish to free restricted rotation to the right of the right 4–5 C. apophyseal joint, we apply strong fixation pressure on the 5th C. articular processes with our left index finger on the right 5 C. articular process and our left thumb on the left 5 C. articular process. We then grasp the patient's chin with our right hand to sidebend the neck to the left down to 4–5 C. and rotate to the right down to 4–5 C. A preliminary trial positioning and movement gives the operator a sense of tissue tension and by an exaggeration of the rotation the right apophyseal joint is gapped and the joint freed of its rotation restriction.

The above methods of using facet apposition locking or ligamentous-tension locking are an elaboration of the principles enunciated in Chapter 1. When using *indirect specific adjustments*, we are using ligamentous-tension locking. When using *direct specific adjustments*, we are using facet apposition locking.

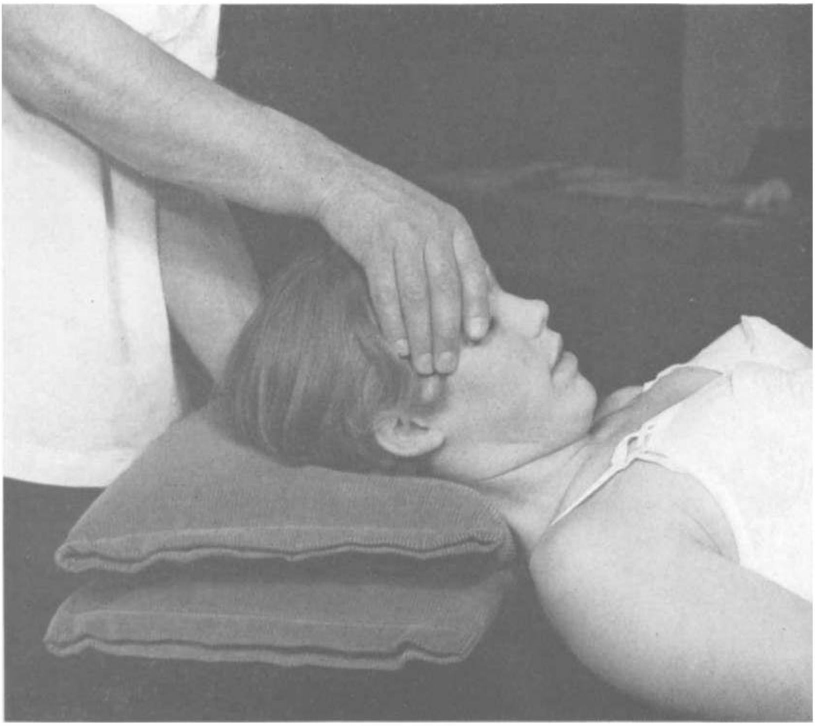


FIG. 39

SPECIFIC TECHNIQUES

Occipito-Atlantal Joints

Mobility may be restricted in each of these directions—forward bending, backward bending, sidebending and rotation.

Bilateral Technique for Forward-bending Restriction. FIG. 39

With the patient supine, the operator standing at the head of the table, and the patient's head supported by two pillows, the operator places his left hand under the occiput and pushes caudally on the forehead with his right hand; the head is thereby forcibly flexed at the occipito-atlantal joint. A rocking motion sufficient to cause a similar motion in the rest of the body can be used gently for articulatory purposes or vigorously and specifically for releasing the joint from its fixation. We are using indirect specific adjustment here with ligamentous-locking in the rest of the cervical spine.

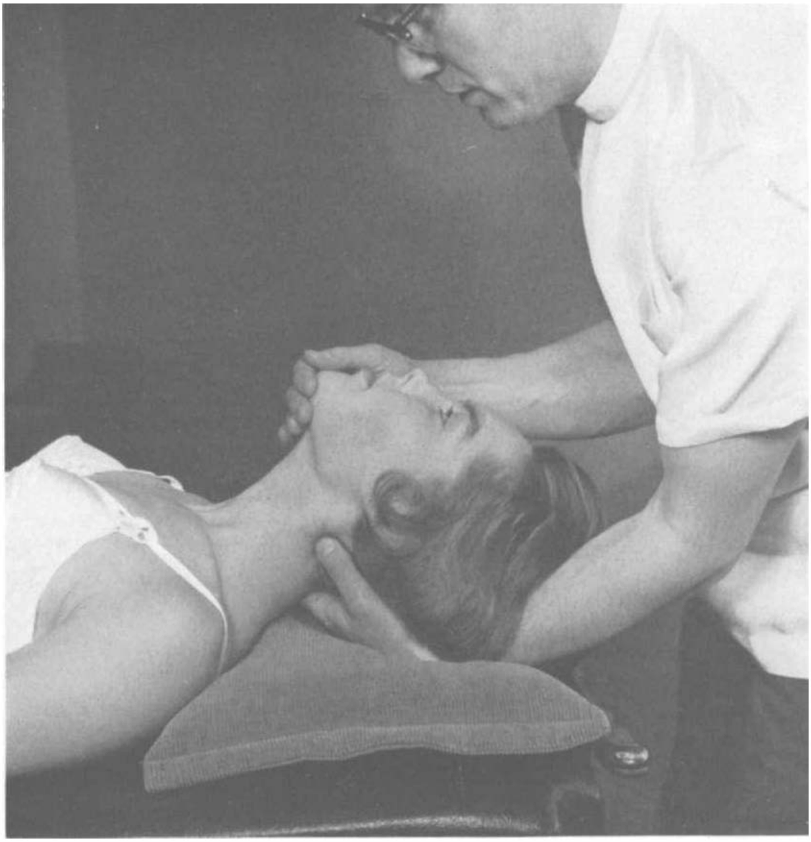


FIG. 40

Bilateral Technique for Backward-bending Restriction. FIG. 40

The patient lies supine with her head on one pillow. The operator standing at the head of the table places his left hand under the occiput, his right hand under the patient's chin, his left hand pushes upwards, creating a powerful extension movement at the occipito-atlantal joint. It requires to be done sharply to achieve sufficient separation of the articular facets.

Unilateral Techniques for the Occipito-Atlantal Joint

In these techniques if both sides are involved in the restriction each side is treated separately. Inevitably in such unilateral techniques some degree of rotation and sidebending, forward and backward bending is used. The techniques, therefore, are often of value in complicated joint restrictions.

FIG. 41

Backward-bending Restriction to the Left. FIG. 41

The patient lies supine and the operator, seated at the head of the table, grasps her chin with his right hand. The left hand is placed under the occiput so that his left thumb can fix the lateral process of the atlas on the left and his left middle finger oppose the arch of the atlas on the right. The thumb actually hooks over the transverse process of the atlas so that the left condyle of the occiput can shift forwards upon the left facet of the atlas. Now the head is tilted backwards to induce facet-locking of the lower cervical vertebrae upwards and the head rotated round to the right as far as is comfortable. Incidentally, a thin cushion only should support the head so that when the actual rotation takes place the operator's right hand comes into contact with the pillow. This is a safety measure to prevent too much rotation. The final movement is a sharp, short exaggeration of the rotation combined with fixation of the atlas by the left hand. This technique relies on the long lever of the skull against digital fixation of the atlas and therefore comes under the heading of indirect specific adjustments. It may also be used in R.R. lesions of the left occipito-atlantal joint.

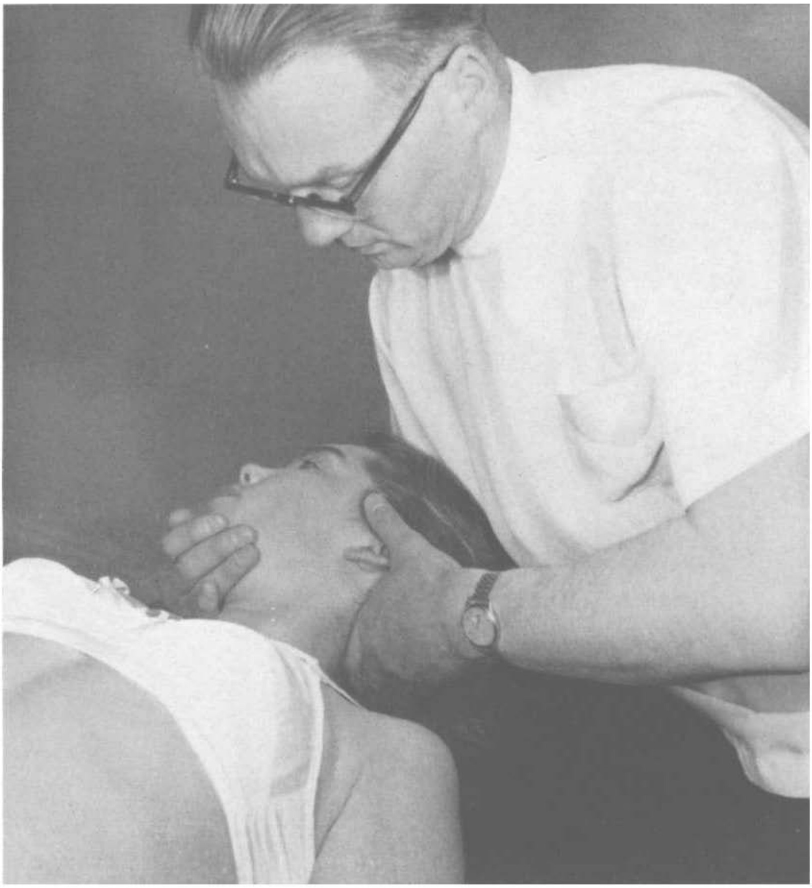


FIG. 42

Forward-bending Restriction to the Left. FIG. 42

For this technique, the skull is placed in such a position that a direct thrust on the arch of the atlas is possible to force the left atlas facet forward under the left occipital facet.

To achieve this objective place the patient supine; a small degree of extension, slight sidebending to left and rotation to the right brings the arch of the atlas prominent on the left. Then the radial side of the left index finger drives against the arch in the direction of the plane of articular facets. No real locking is possible with this technique, the principle involved here is that of the column of bricks—a sharp, sudden thrust will

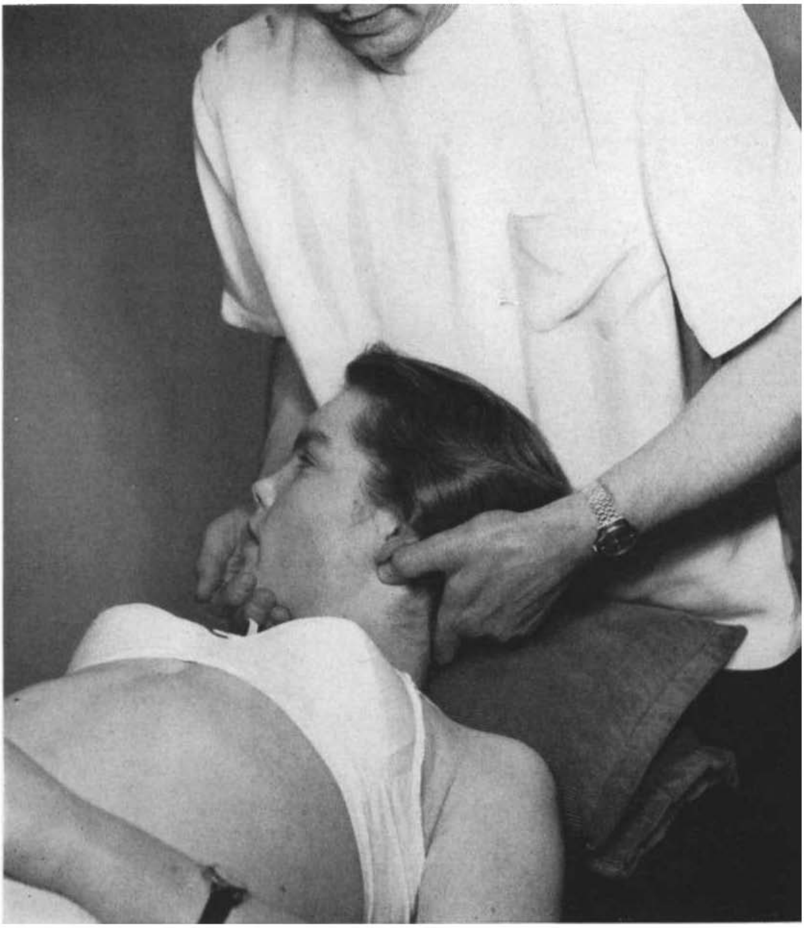


FIG. 43

shift one brick without disturbing the others. That is to say, we are using a 'specific thrust' type of technique.

Rotation Restriction to the Right. FIG. 43

Place the patient supine, flex her head fully to cause ligamentous tension locking of all the joints below, then rotate the head to the right fully by grasping the chin with the right hand and the occiput with the left hand, fixing the transverse process of the atlas on the left with the operator's left thumb. The adjustment is an exaggeration of rotation.

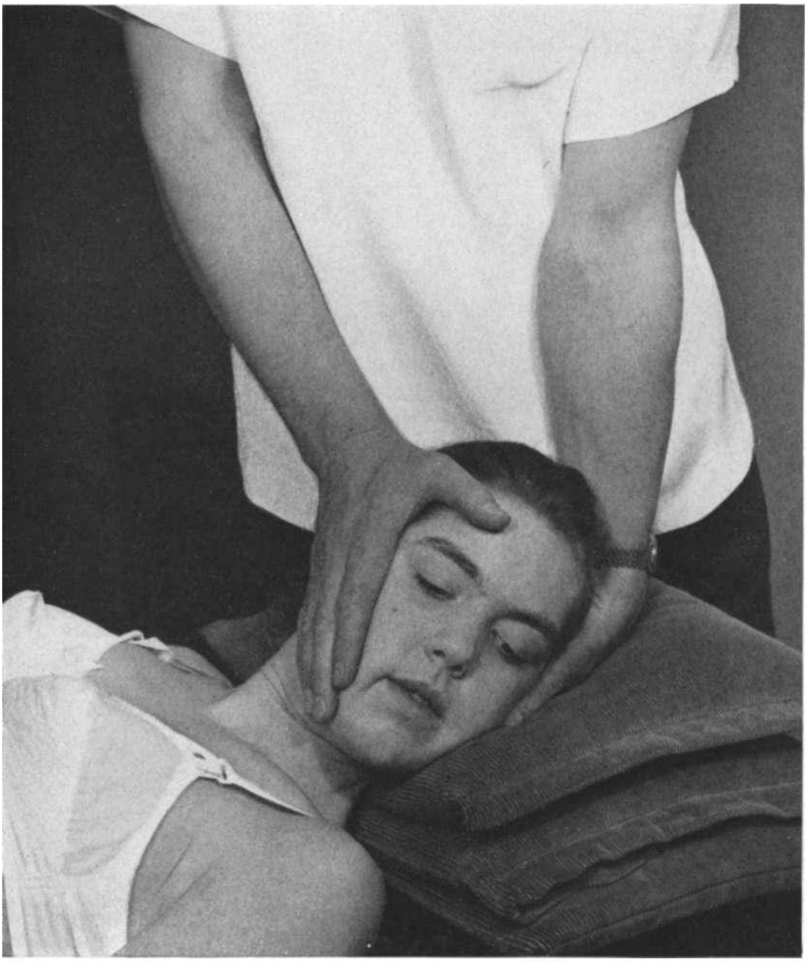


FIG. 44

Sidebending Restriction to the Right. FIG. 44

Place the patient supine with her head supported by three pillows to about 45 degrees of flexion. Stand at the head of the table, sidebend the patient's head to the right and rotate to the left to cause facet-locking of the lower cervical joints on the right. The operator's left hand rests on the pillows and supports the left temporal area of the skull, maintaining this position using a flexed wrist and fully extended elbow. Place your right hand against the patient's right cheek and exert a downward pressure with it, together with an upward pressure of the left hand, creating a sheering

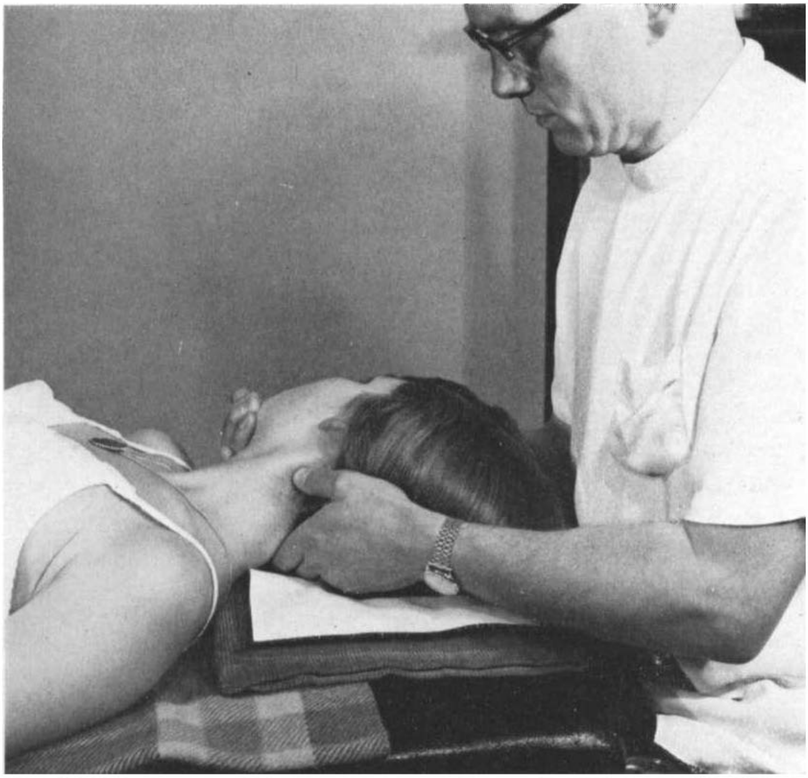


FIG. 45

force at the occipito-atlantal joints. In order to be successful with this technique it is necessary to have the table low and to get well over the patient so that the left arm is vertical. The maximum sidebending force occurs at the left occipito-atlantal joint, but some sheering force is also felt on the right. In this technique we are using direct specific adjustment —the direct force being applied to the skull itself.

Atlanto-Axial Lesions

The lesions here are rotation restrictions. It is not easy to test the restriction mainly because the transverse process of 2 C. is very small and deeply embedded under the sterno-mastoid muscle. Furthermore there is such a wide range of rotation that small restrictions are difficult to assess. The lesion is diagnosed more by exclusion than anything else. If there is a restriction of rotation when testing active movements and the other joints in the neck are normal, then by inference the restriction is in the 1–2 C. joint.

Manipulation of this joint is by pure rotation with the head in the neutral position midway between flexion and extension. No sidebending is used either.

Rotation Restriction to the Right. FIG. 45

In restricted rotation to the right with the patient supine, the operator at the head of the table grasps the chin with the right hand, the occiput with the left, rotates the head as far as possible to the right and then a short, sharp increase of rotation frees the joint. There is no attempt to lock any adjacent joints in this movement, so that the success of the manipulation depends upon speed and complete relaxation of the patient. Some stabilization of the axis with the left finger and thumb against the transverse processes of the axis is required for localization purposes. The skull and atlas move as a unit.

Lesions in Cervical Joints 2–6

Restriction of movements in this group of joints are usually a combination of restricted rotation and sidebending, and there is virtually no distinction in technique between restricted sidebending and restricted rotation except in degree. Furthermore, correction of restricted flexion or extension is usually done by unilateral techniques as for rotation-restricted lesions. These will, therefore, be described, as well as one or two bilateral techniques.

The principles involved in the manipulation of the cervical column are first to secure facet apposition locking by sidebending and rotation to opposite sides and secondly the force used as a direct thrust is in the plane of the articular facets (a direct specific adjustment). The position assumed is such that sidebending has its apex at the lesioned apophyseal joint and rotation is used to take up all the slack in the capsules on the convexity of the curve. The sidebending is not achieved by simply bending the head to the side but rather by keeping the vertex of the head in the mid line and pushing the neck to the opposite side, using the thrusting finger as a lever at the level of the lesion, thus creating a concavity on the side of the thrust. Finally, the thrust must be upwards and forwards in line with the plane of the apophyseal joint.

(1) *Technique for Sidebending Restriction to the Right.* FIG. 46

With the patient supine and the operator at the head of the table and a little to the right, grasp the chin with your left hand and support the head in your left forearm and elbow. Place the radial side of your right index

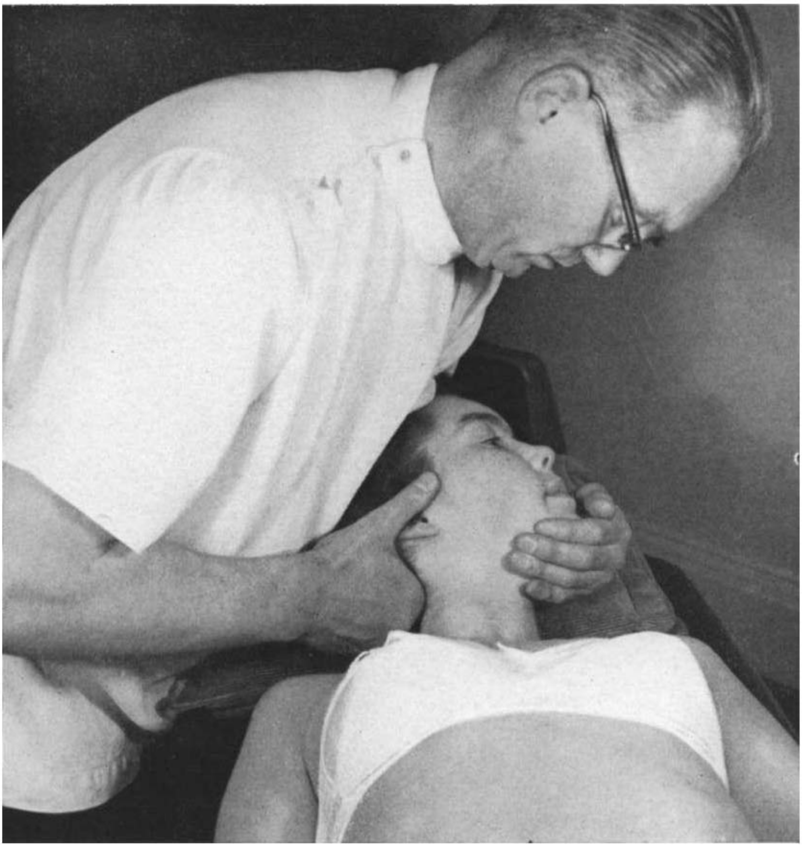


FIG. 46

finger on the articular process of the upper of the two vertebrae involved in the lesion. Gently push the patient's neck to the left to achieve a sidebending to the right as indicated above. The amount of sidebending is determined by a sense of resistance felt with the index finger, the head is then rotated until tension is localized to the joint you wish to move, then to make sure the thrust is in the correct direction the right forearm must be in line with the articular facet. It is necessary to have your right elbow almost touching the patient's right shoulder so that the thrust is upwards and forwards in the direction of the patient's left frontal area. Only by studying the spine and seeing the direction of these facets will it be possible to visualize the direction of the thrust. A common mistake is to thrust too laterally—leading to a 'jamming' of the apophyseal joints rather than a separation of them.

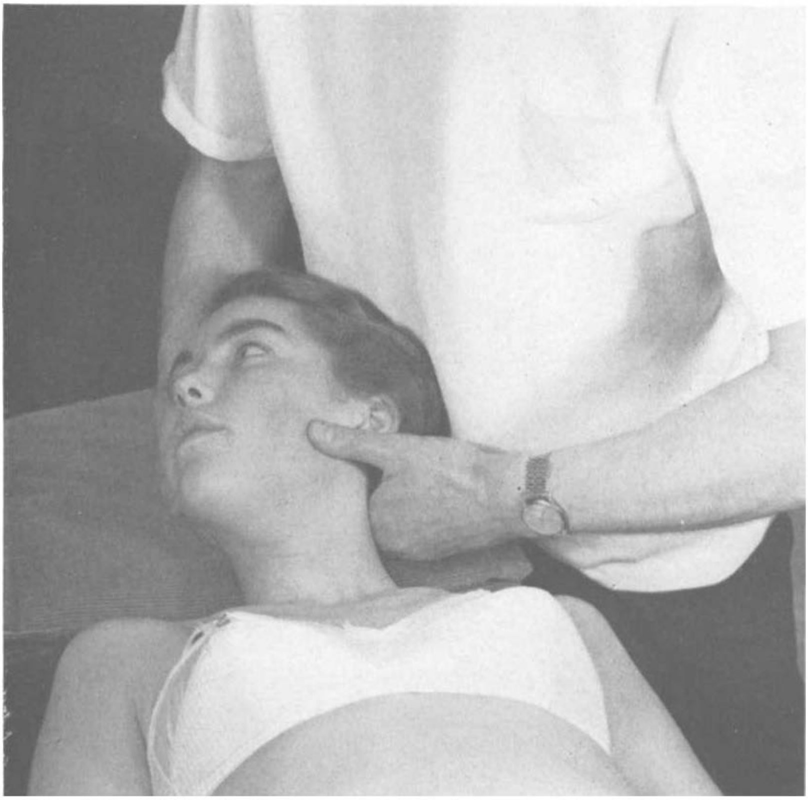


FIG. 47

(2) *Sidebending Restriction to the Right*

This method is the same as the above but the thrust is applied through the thumb instead of the index finger. The choice of method depends to some extent upon the operator's own hands. If the operator's thumbs hyperextend, they are more useful for this type of thrust than the index finger.

(3) *Technique for Sidebending Restriction to the Right.* FIG. 47

This method uses the principles of indirect specific adjustment. Instead of grasping the chin and head with the whole right hand, forearm and elbow as in Method One, grasp the right side of the patient's head fairly lightly with the right hand and the left side of the patient's head with the left hand. The two hands therefore loosely hold the head in the position of rotation to the right and sidebending the neck to the left. The

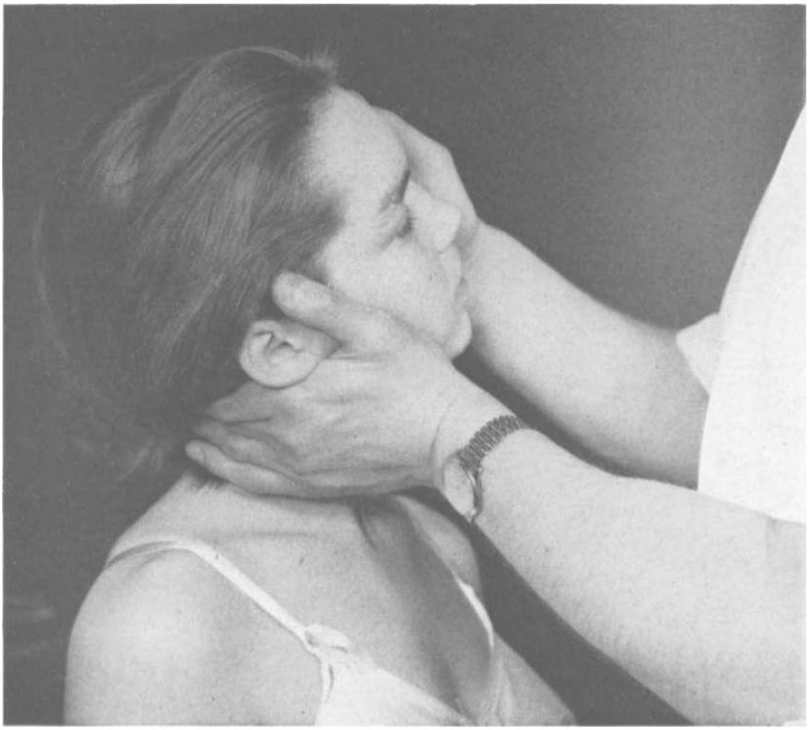


FIG. 48

left index finger is placed as in Method One, at the level of the lesion, but the main difference here is that the sidebending and rotation is used to create a lever of the upper cervical spine. The operator rolls the head about in his hands, sensing the correct position and, as a continuation of the rolling, suddenly and sharply increases the rotation and sidebending to create a capsular gapping of the apophyseal joint on the right side of the neck. Methods One and Two should be practised first. This third method is more comfortable for the patient and is, therefore, easier to obtain relaxation, but it requires precision and accurate tissue sense on the part of the operator.

(4) *Technique for Rotation Restriction to the Left.* FIG. 48

In this method, the patient is seated facing the operator. Let us visualize a lesion of restricted rotation to the left. Place your left palm against the right side of the patient's neck and your right hand across the patient's cheek and temporal area. Sidebend the patient's neck to the right and

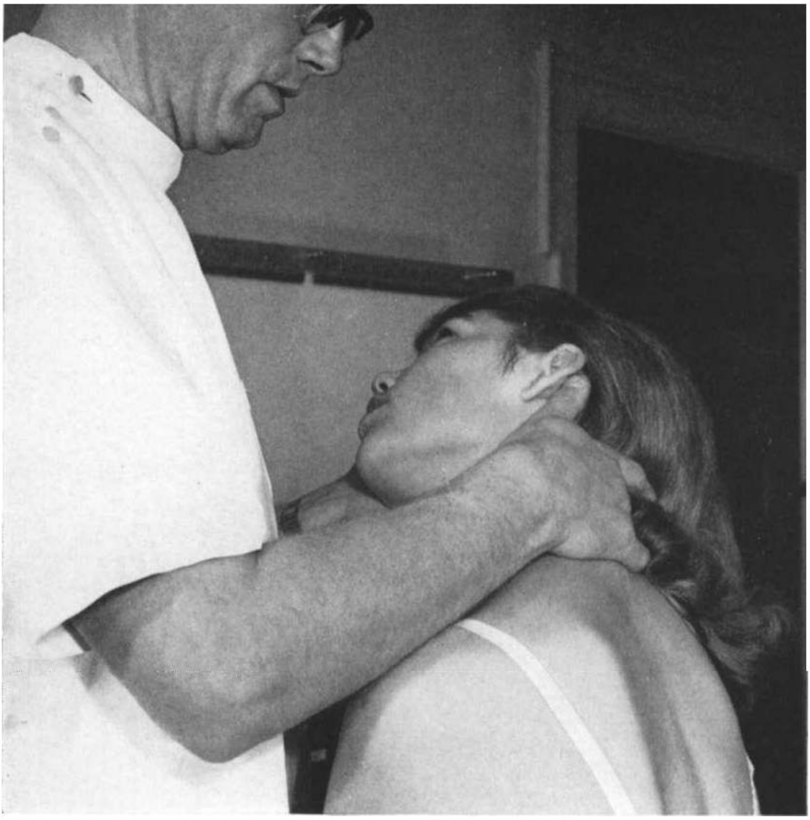


FIG. 49

rotate to the left, localizing the forces to the joint you wish to move. The head is 'flicked', as it were, increasing the rotation to the left and side-bending to the right, helping to localize the forces by applying the palmar surface of the left middle finger upon the articular process of the vertebra above. This technique uses the principle of indirect specific adjustment and causes a gapping of the capsule on the left side of the neck.

(5) *Technique for Rotation Restriction to the Left.* FIG. 49

Again with the patient sitting—with the same lesion—stand at her left side, support the patient's right cheek in your left hand, place your right hand round the patient's neck posteriorly so that the right middle finger is over the articular process on the right side of the patient's neck and your right thumb is placed against the left mastoid process. Then your left hand

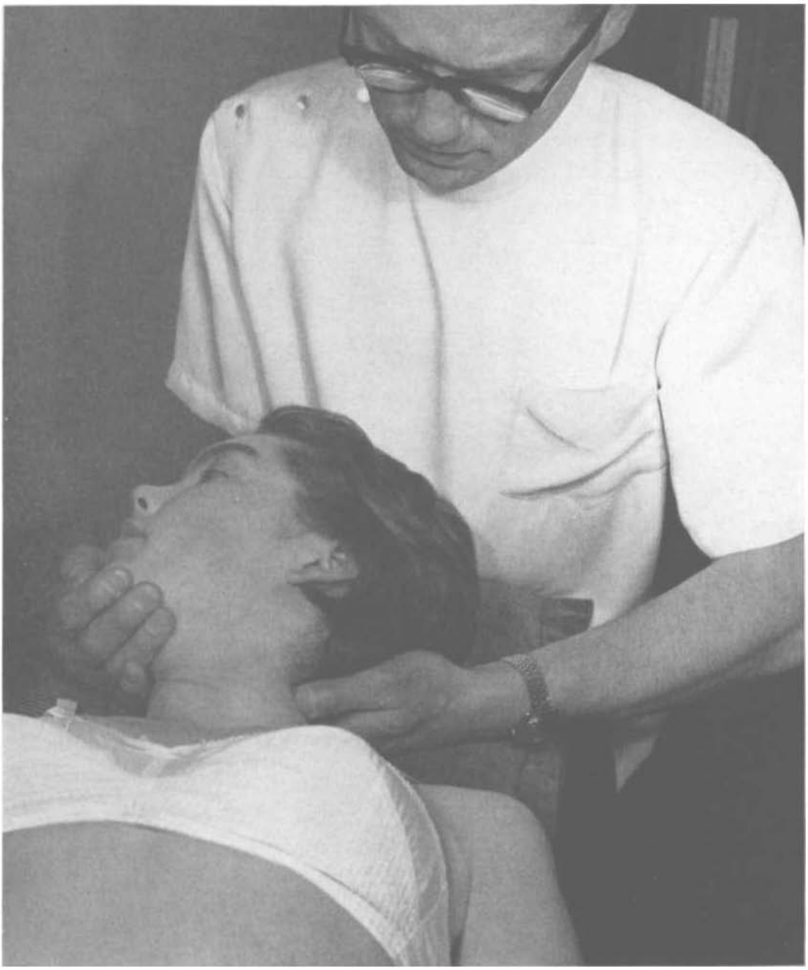


FIG. 50

can control the rotation to the left and your right the sidebending to the right. Localizing forces can be brought to bear accurately to the joint in question by this method, using the principle of indirect specific adjustment.

(6) *Technique for Rotation Restriction to the Right. 4–5 C.* FIG. 50

This method is primarily used in restricted rotation lesions. With the patient lying supine, stand at the head end of the table and grasp the patient's chin with the right hand, hold her neck with the left hand, firmly fixing, say, the 5 C. articular processes in your left index finger and thumb.

Sidebend the head to the left and rotate down to the 4 C. using a little flexion, at the same time having the head supported by pillows to about 10 deg. or 15 deg. of flexion. This technique again uses indirect specific adjustment and ligamentous-tension-locking of the upper C. joints with fixation of the vertebra below the joint which is restricted. The adjustive force is an increase of the rotation, flicking the chin round to the right. It is useful to have the pillow arranged so that the rotation cannot be carried beyond the safety limit.

Cervico-Thoracic Area

SOFT-TISSUE TECHNIQUES

From the clinical point of view, the shoulder girdle and cervico-thoracic muscle groups are particularly important because they are so often affected by 'fibrositis'. The so-called nodules in these muscles are localized groups of muscle contraction and are always secondary to some joint or nerve lesion segmentally connected with the muscle involved. While the trapezius is often an offender, I find that the levator scapulae and rhomboids are more frequently involved. This is possibly because the 3 and 4 C. nerves to the trapezius are mainly sensory whereas those to the levator scapulae and rhomboids are mainly motor (3–5 C.). The deltoid, supraspinatus, infraspinatus and teres minor are also common sites for localized muscle contractions and their nerve supply is 5–6 C. The types of articular lesions most frequently blameworthy for this muscle irritability are joint strains of theapophyseal joints and degenerative lesions of the discs and apophyseal joints. Apophyseal joint-strains are, if anything, more common at 3 to 5 C. whereas degenerative disc changes are more common at 5 to 7 C. Irritability of the scaleni muscles causes much pain in the shoulder and arm because of their close association with the brachial plexus. It is possible, as we have stated earlier, to have elevated 1st and 2nd rib lesions and these are secondary to undue tension in the scaleni muscles. Such increased tension and elevation decreases the size of the costo-scalene triangle and further irritates the brachial plexus. In other words, apophyseal joint-strains, say at 3 and 4 C., may well cause irritation of the scaleni and so, in turn, cause pain referable to the brachial plexus at 5 C. to 1 T.

When relaxing the muscle tensions of the cervico-thoracic area, we can use many of the techniques described for cervical soft-tissue work (p. 93), but there are several other methods primarily adapted for this group of muscles:

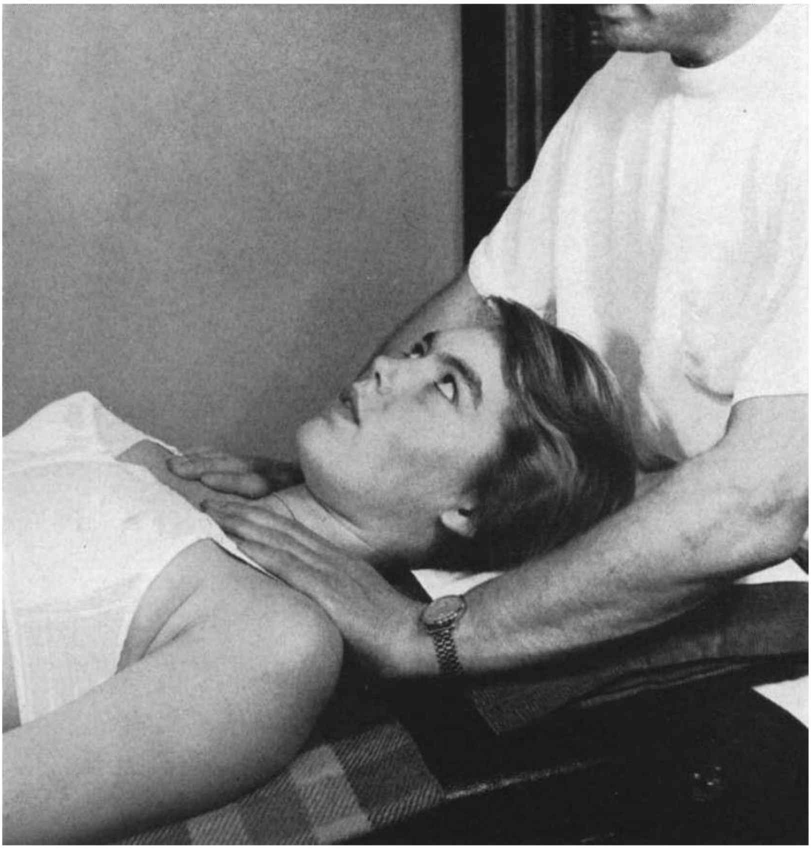


FIG. 51

(1) *Kneading the Trapezius Area.* FIG. 51

The patient lies supine with her head supported by a medium-sized pillow, leaving the neck free. The operator should be seated at the head of the plinth so that his arms can rest comfortably on the table on each side of the patient's head. His thumbs can now be conveniently placed in the C.-T. area and the fingers can rest lightly (N.B. not digging in) across the clavicular area. The two thumbs are now used to knead and rotate and smooth out the localized soft-tissue thickenings which are found here in the trapezius, levator scapulae and rhomboid muscles.

By using higher pillows, the interscapular area can be reached comfortably in this position.

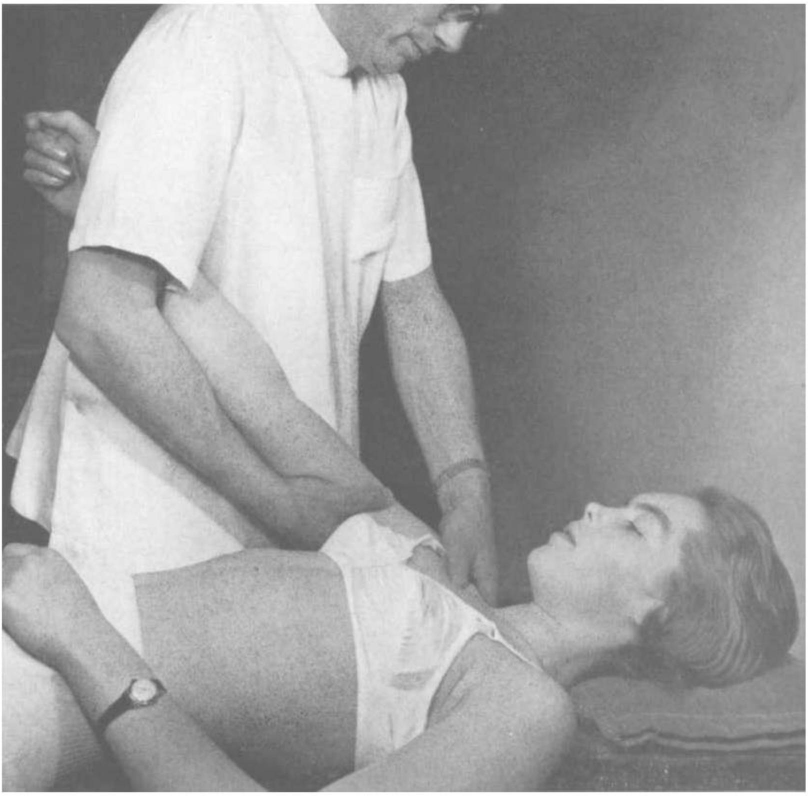


FIG. 52

(2) *Loosening the Shoulder Girdle Muscles.* FIG. 52

With the patient supine, the operator stands on her right side in order to loosen the right shoulder girdle muscles. Grasp the patient's right arm, tucking her right hand into your right axilla and supporting her right arm and forearm with your right hand and forearm. Your left hand is placed on the patient's right shoulder to steady and assist in the process, which consists of a circular motion. The relative positions of the humerus, scapula and clavicle are not altered in this movement. The motion could perhaps be best described by comparing the arm with the crankshaft on the wheel of a steam engine. By executing such a circular movement, all the muscles attached to the scapula and clavicle are alternately stretched and relaxed and it helps to free any restriction in scapulo-thoracic movement.

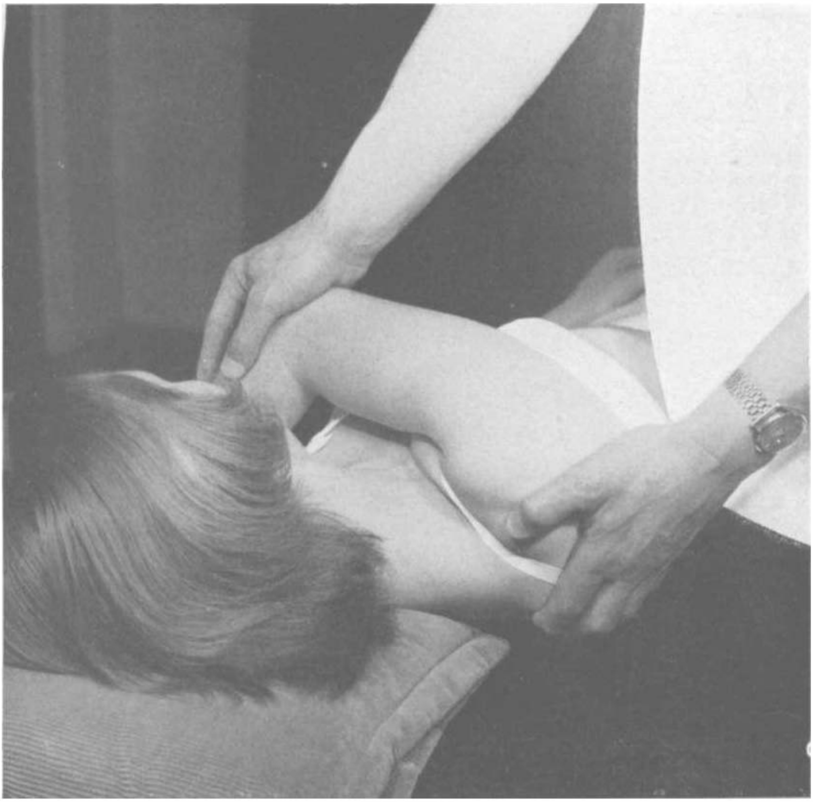


FIG. 53

(3) *Stretching the Interscapular Muscles.* FIG. 53

Another useful method for stretching the right interscapular muscles is to have the patient supine, the operator standing on her right side. He grasps her right arm just above her elbow and strongly adducts the shoulder so that her arm is forced across her chest, towards the left shoulder. The operator places his left hand on the medial border of the right scapula, further to assist in the motion of stretching the right interscapular muscles. The motion should be a slow rocking action to obtain an intermittent stretch of these muscles.

(4) *Stretching the Shoulder Girdle Muscles.* FIG. 54

The patient lies on her left side with the operator facing her, the operator then leans over the patient and supports the patient's right flexed

FIG. 54

elbow with his own flexed left elbow, his left forearm underneath her right arm and reaching with his left hand to the medial border of her right scapula. The operator's right hand grasps the upper part of her right scapula. In this way the right shoulder girdle can be moved as a unit in an upward and downward movement or in a circular movement; or the medial border of the scapula can be pulled away from the chest wall—all these actions being designed to stretch and relax the shoulder girdle and interscapular muscles. This side-lying position is also useful for applying direct kneading or frictions to the trapezius and interscapular muscles, using the thumbs to press deeply into these muscles.

(5) *Stretching the Pectoral Muscles.* FIG. 55

Sometimes one has occasion to treat the pectoral muscles and, although the previous stretching movements do have some effect on the pectoralis major and minor, they do not specifically stretch them. A good method for this is to have the patient supine, the operator standing on her right side grasping her right wrist with his left hand and strongly

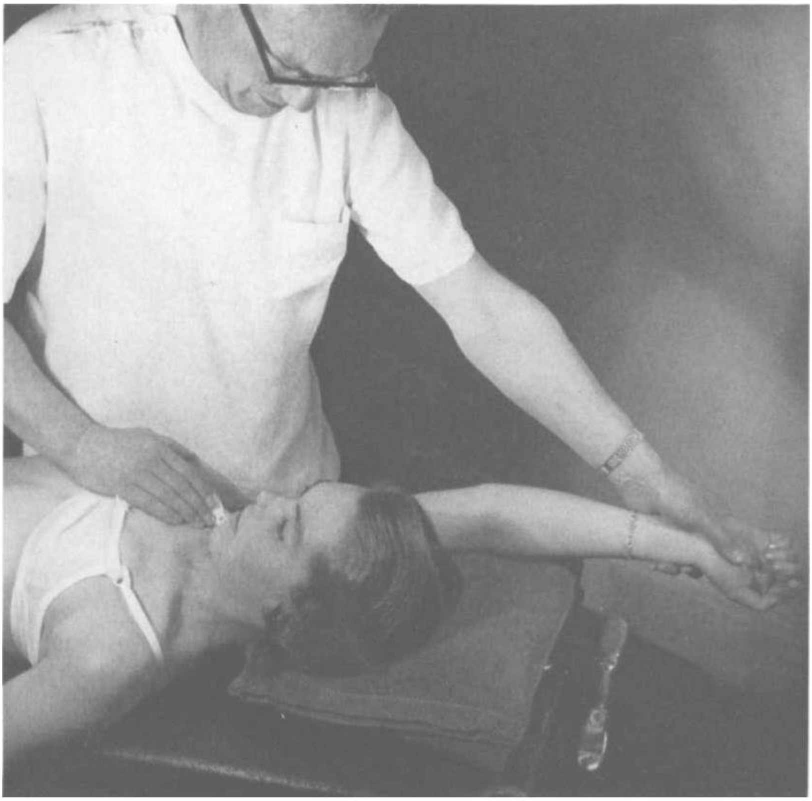


FIG. 55

stretching the pectorals by flexing the shoulder to the full. Some counter-pressure can be applied with the operator's right hand on the belly of the pectoralis major.

ARTICULATORY TECHNIQUES FOR THE CERVICO-THORACIC AREA

All the articulatory techniques for the cervical area can be used to some extent in moving the cervico-thoracic group, but it will be at the limit of the range before any stretching can occur lower down. The techniques described below are also applicable to the cervical group but can be used to better advantage in the upper thoracic joints.

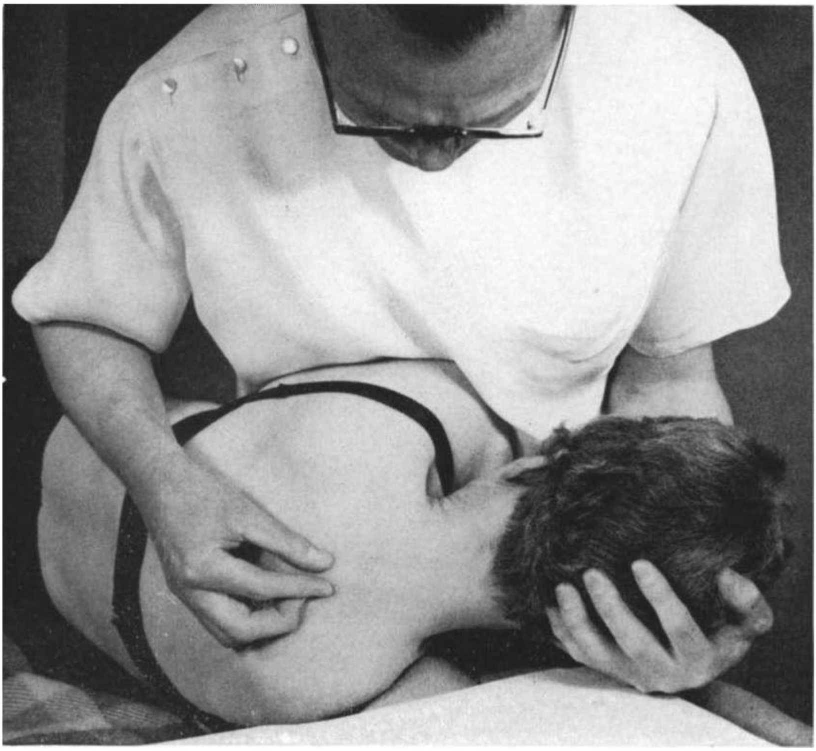


FIG. 56

(I) *Articulation.* FIG. 56

With the patient lying on her right side the operator, facing her, supports her head and neck with his left hand and forearm. The patient's right arm is allowed to rest on the table comfortably with the shoulder and elbow flexed at right angles. Her left shoulder is adducted so that the forearm dangles vertically over the side of the table and it can be held firmly if desired by grasping the forearm between the operator's knees. The operator places his right hand on the upper thoracic area and grasps a spinous process with his finger and thumb. The right hand can then act as a stabilizer to the left hand which is used to either flex, extend, sidebend or rotate the neck to the limit of range in each direction. In this articulatory type of treatment we are not attempting to be specific to any one joint, and therefore we are not concerned with very accurate localizing of forces, nor are we interested in facet-apposition-locking; rather are we using ligamentous tension to achieve our objective of stretching the indi-

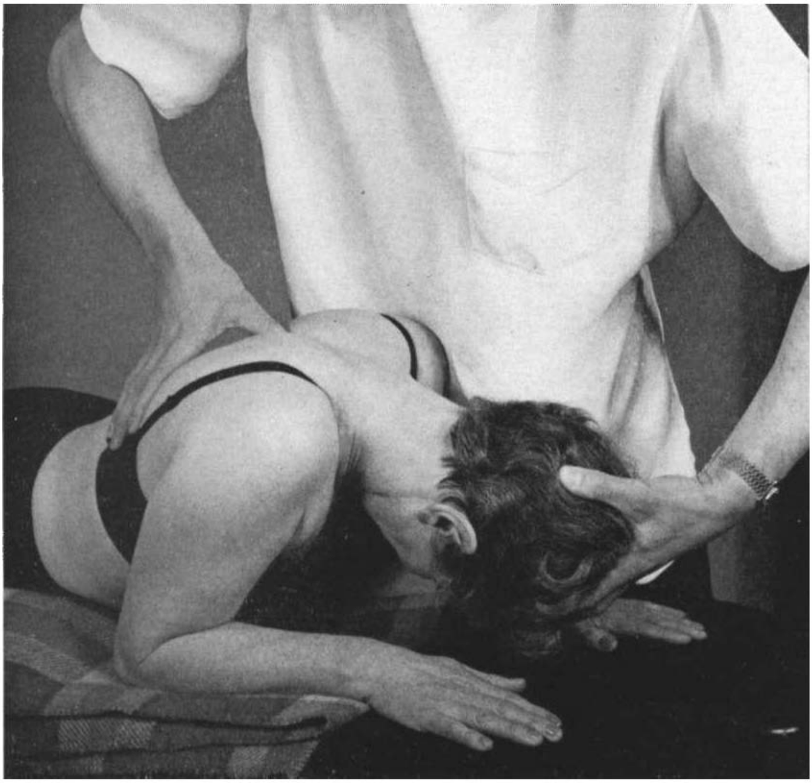


FIG. 57

vidual joints in the cervico-thoracic area. We therefore should confine our articulation to simple sidebending, simple flexion, simple extension and simple rotation and not any combination of these movements.

(2) *Articulation.* FIG. 57

Another position in which articulation of the cervico-thoracic area can be carried out is with the patient prone and resting upon her flexed elbows, her forearms being separated by about 18 in. and lying parallel with each other. In this position the head can be used as a lever for forcing flexion, extension, sidebending or rotation in the cervico-thoracic group of joints. During flexion, the effect is enhanced by applying some degree of vertex pressure on the skull and counter-pressure of the thumb against the spinous processes.

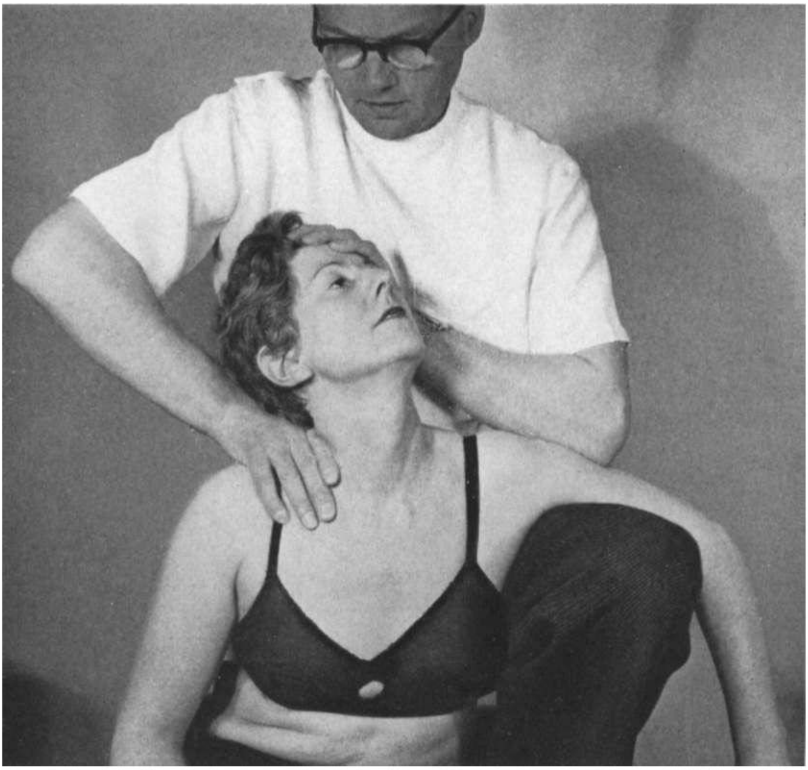


FIG. 58

THE CERVICO-THORACIC SPECIFIC TECHNIQUES

For the purposes of technique, the cervico-thoracic area extends from 6 C. down to 3 T. The type of technique mainly used in this area is by direct specific adjustment using facet apposition locking. By backward bending the neck down to the restricted joint, we cause bilateral facet-locking. In full extension of the cervical spine the inferior facets of the vertebrae above impinge upon the laminae of the vertebrae below. Any further backward bending can only take place at the expense of the anterior longitudinal ligament.

It is possible, in fact desirable, also to use facet apposition locking by sidebending and rotation to opposite sides. As was explained earlier, the normal movement of sidebending in the cervical spine is accompanied by some degree of rotation of the vertebral bodies to the same side, whether the movement starts from a position of flexion or extension or in the neutral position. Therefore, to obtain apposition of facets we must arrange that the sidebending and rotation are in opposite directions. The side to which sidebending occurs is locked by facet apposition and the other side is fixed by ligamentous tension. In other words, if we wish to create a facet-locking of the left row of apophyseal joints in the neck, we must sidebend the neck to the left and rotate to the right.

To obtain localization in the cervico-thoracic area and protection in the neck we use a combination of backward bending, sidebending and reverse rotation and all the following methods have these principles behind them; they merely vary because the starting posture of the patient and operator is different. It will be found that one position is more suitable for one type of patient and another position more suitable for another type. The technique appropriate to a given patient can only be determined by preliminary positional trials to discover the optimum relaxation position.

Sidebending Restriction of 2–3 T. to the Right. FIG. 58

Have the patient sitting on a plinth or a stool with the operator standing behind slightly to her left. The operator places his left foot on the stool beside her with his knee flexed so that the patient's left axilla can rest over his thigh and her left arm can hang loosely down. In this position the operator draws the patient over towards him until she is slightly off balance, resting comfortably on her left buttock and her back supported against the operator's body. The operator now places the thumb of his right hand against the right side of the spinous process of 3 T. The fingers of the left hand are placed on the vertex of the head and forehead. Using his left hand, the operator bends the cervical column backwards to facet-lock the cervical area. He then sidebends the neck to the right and rotates to the left. The reverse rotation helps in further facet apposition of the apophyseal joints. A 'direct specific adjustment' is made by simultaneous transverse force against the right side of 3 T. spinous process with the right thumb and slight exaggeration of sidebending to the right with the left hand.

Prior to the actual adjustment, it is most important that the patient's right shoulder girdle is completely relaxed and her right arm should hang limply down. The patient should not be on too high a stool. A stool 20 to 24 inches is ideal and makes the procedure easier on the operator. The operator's right forearm should be in line with the thumb so that the thrust is downwards as well as transverse and is in fact parallel with the plane of the facet. It will be seen from the photograph that the right elbow is high and well forward of the patient's right shoulder. A preliminary rocking of the patient from side to side using the fulcrum of the left knee is desirable so that the patient is somewhat off balance and the apex of the sidebending is located at 2–3 T.

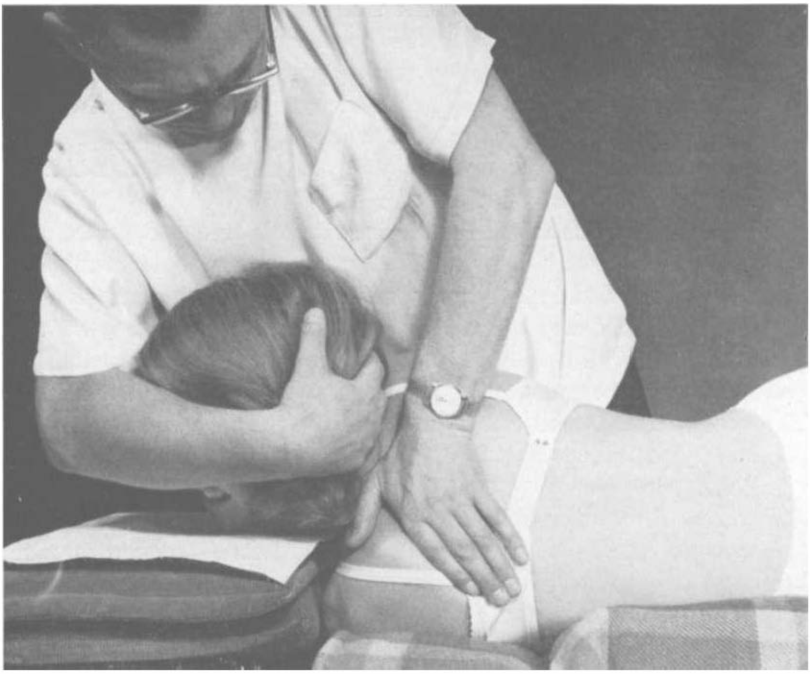


FIG. 59

Sidebending Restriction of 2–3 T. to the Right. FIG. 59

The patient lies on her left side on the plinth with the operator facing her. Her right arm is dropped downwards over the side of the table and held between the operator's knees. This will help to stabilize her right shoulder. Her left shoulder, which is in contact with the table, is sufficiently stabilized by superincumbent weight. The shoulders should be square on the table and her left arm rests on the table out of the way, the shoulder and elbow flexed at right angles. The operator's left thenar eminence is placed firmly against the right side of 3 T. spinous process. He now lifts up the patient's head and neck, placing his right fingers firmly round the lower cervical area with his right forearm supporting the left lateral aspect of her neck and head. The operator now extends the neck down to the lesion and sidebends the head and neck towards himself, i.e. to the right, with rotation towards the left until tension is felt between the 2 and 3 T. spinous processes. Adjustment is made by a sudden transverse, i.e. downwards, force against the spinous process with the left hand and a simultaneous increase of sidebending with the right hand. The same principle of direct specific adjustment is used as in Method One.

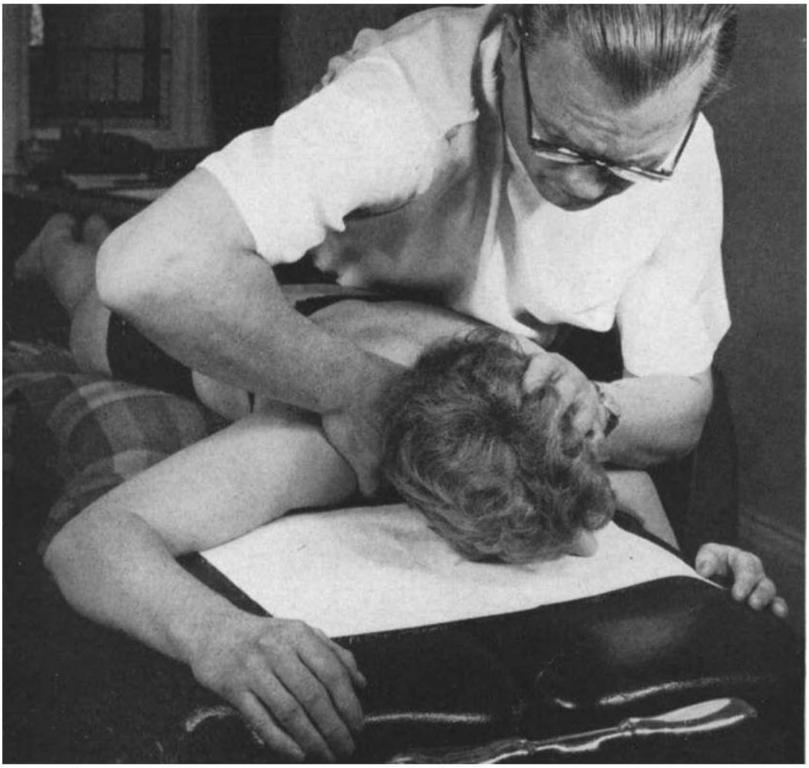


FIG. 60

Sidebending Restriction of 1–2 T. to the Right. FIG. 60

The patient lies prone on the table with her chin resting on a cushion to extend the cervical column. The operator stands on the left side of the patient opposite the shoulder girdles. He leans well over the patient, so far that his torso is almost parallel with the patient's, and places his right thumb firmly against the right side of the spinous process of 2 T. With his left hand he sidebends the cervical column away from himself, i.e. towards the right. To assist in positioning, the patient's upper torso should be near the left side of the plinth. He then rotates the head and neck to the left so that the patient's face is towards him. Adjustment is made by strong direct thrust against the spinous process of 2 T. in a transverse and downward direction while, at the same time, slightly increasing the sidebending with operator's left hand. The left hand is placed against the left side of the patient's face and the patient pivots on her chin to obtain the requisite backward bending, sidebending and rotation.

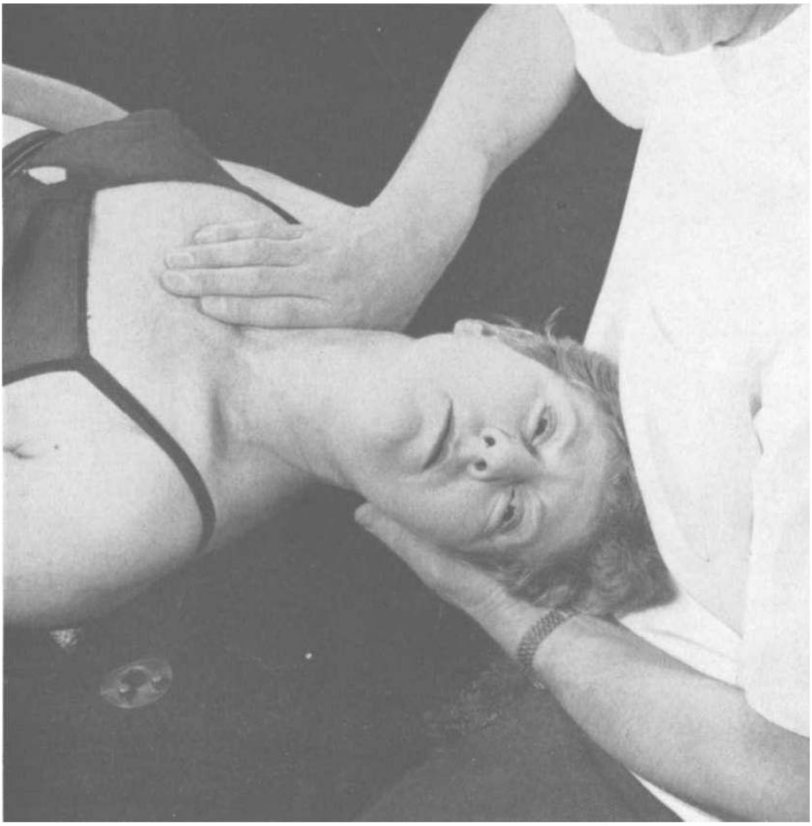


FIG. 61

Sidebending Restriction of 2–3 T. to the Right. FIG. 61

Another position in which the technique can be used is with the patient supine. This time the patient requires to be placed so that her head projects beyond the plinth. The operator sits at the head of the table and uses his left hand to support her head. The patient's thorax needs to be pushed to the left of the table to facilitate sidebending of the neck to the right. The neck is backwards bent down to 2–3 T., then sidebent to the right and rotated to the left. Each of these three components of the movement in turn should bring tension to bear at the 2–3 T. joint. The direct specific adjustment is made by a thrust against the right side of the spinous process of 3 T. using the operator's right thumb, making sure the elbow is approximately over the patient's right shoulder so that the thrust is transverse and slightly downwards.

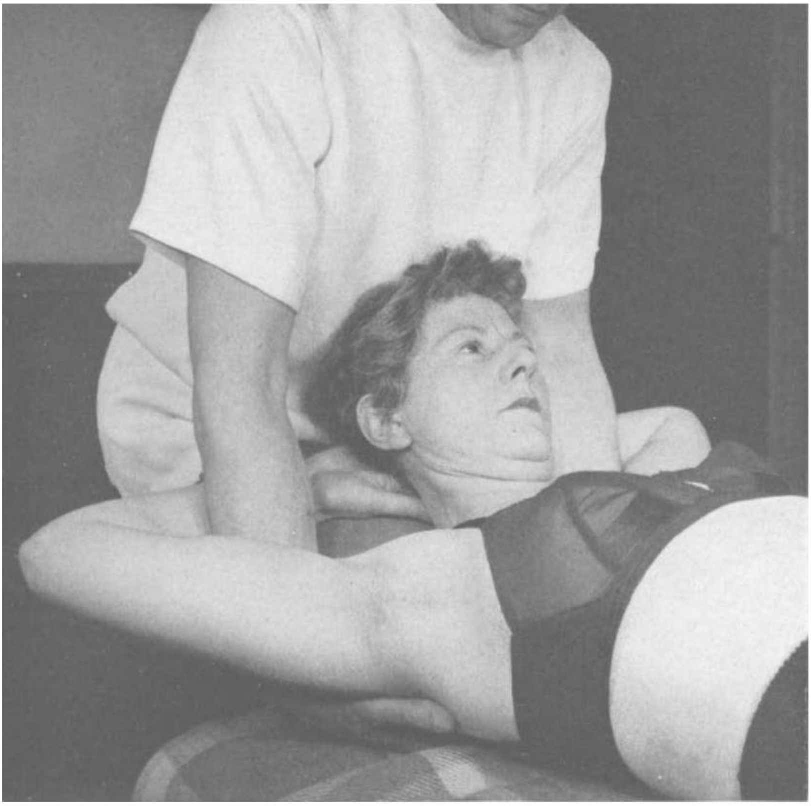


FIG. 62

Backward-bending Restriction of 2–3 T. FIG. 62

The operator stands at the head of table with the patient supine and places his flexed right knee on a cushion at the head of the table. The patient is arranged so that her head and neck are resting over the operator's thigh, with the distal end of the femur just below the site of the backward-bending restricted lesion. The patient now interlocks her fingers behind her head and abducts her arms as far as she can. The operator threads his hands through the spaces thus formed by the patient's arms so that his fingers can reach underneath to the upper thoracic vertebrae. The operator, by lifting up with his fingers against the transverse processes reinforced by an upward lift of the knee and at the same time pressing downwards with his forearms against the patient's arms, can strongly spring the upper thoracic vertebrae into backward bending.

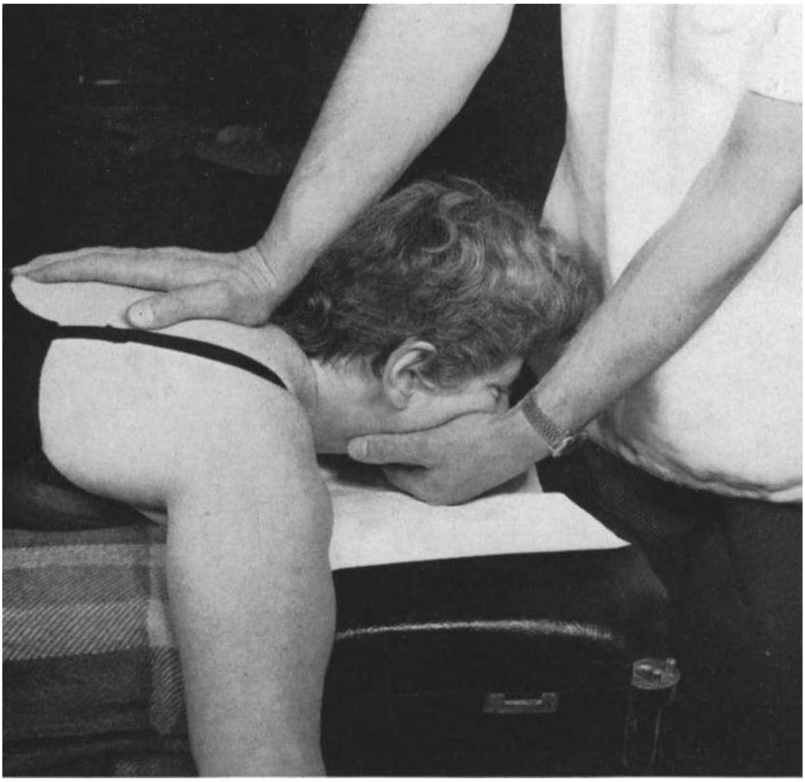


FIG. 63

Backward-bending Restriction of 1–2 T. FIG. 63

This method utilizes the specific thrust principle. With the patient prone, the operator stands at the head of the table. The patient tilts her chin forwards to increase backward bending of the cervical and upper thoracic areas. The operator cups the patient's chin with his left hand and places the heel of his right hand over the spinous process of the vertebra below the restriction. His right forearm rests on the occiput to check too much forced extension of the neck. Correction is made by a strong thrust with the heel of the hand in a downward and forward direction, synchronized with a measure of traction by the left hand on the patient's chin.

Forward-bending Restricted Cervico-thoracic Lesions

In order to obtain sufficient flexional stress on the upper thoracic joints, we require to use the neck as a lever and, in order to avoid undue

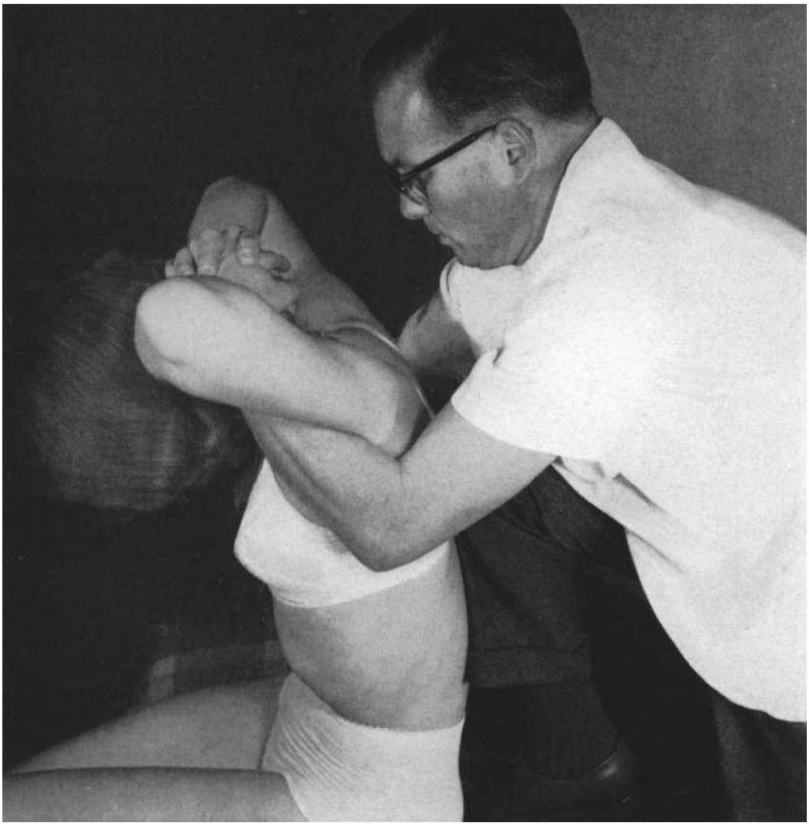


FIG. 64

strain in the upper C. area, we apply our force to the lower C. vertebrae using ligamentous-tension-locking to help in localization. There are two ways of achieving this rather difficult objective.

Forward-bending Restrictions of 2–3 T. FIG. 64

The patient sits on a stool with her back to the operator who rests his right foot on the stool just behind the patient. He threads his forearms under both her axillae and interlaces his fingers together behind her lower cervical area. The patient is then brought back into extension until the operator's knee rests on the spinous process of the vertebrae below the restricted joint. The adjustment is effected by a sharp increase of forward bending of the lower C., combined with an increase of pressure with the knee against the spinous process.

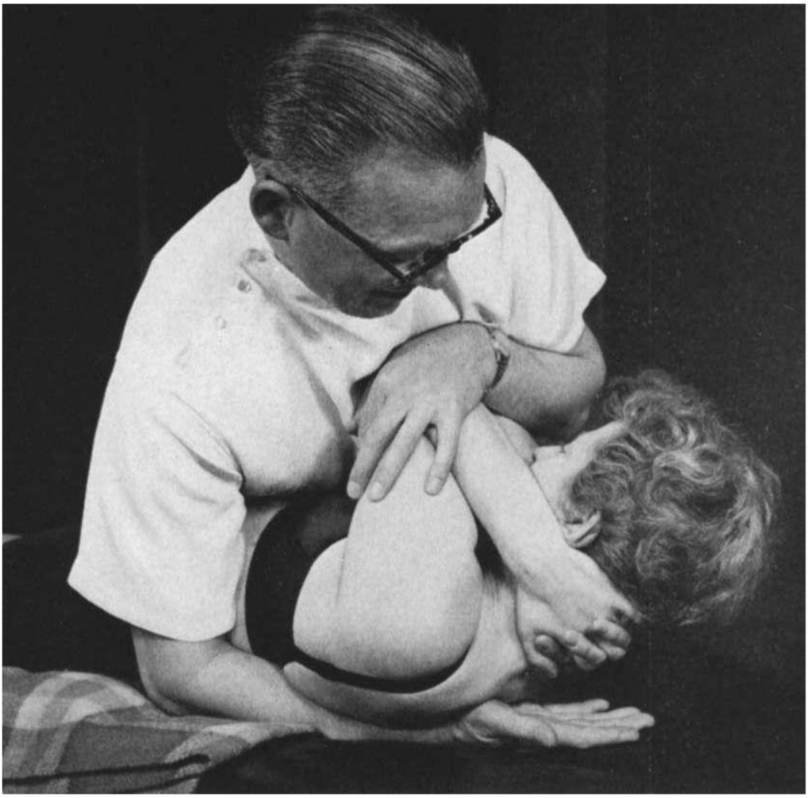


FIG. 65

Forward-bending Restrictions of 2–3 T. FIG. 65

The patient supine, the operator standing to the right of the patient, the patient's hands clasped behind her neck and her elbows close together, the operator rolls the patient towards himself by pulling on her elbows; this enables the operator to insert his right hand to fix against the transverse and spinous processes of the vertebrae below the restricted joint. The operator uses the heel of his hand to fix the spinous and transverse processes, the palm of his hand lying flat against the C.-T. area and the fingers pointing towards the skull. The operator then flexes the patient's neck using the leverage of the elbows and he then makes an 'indirect specific adjustment' by thrusting downwards on the elbows. This in effect causes a flexion gapping force at the joint involved.

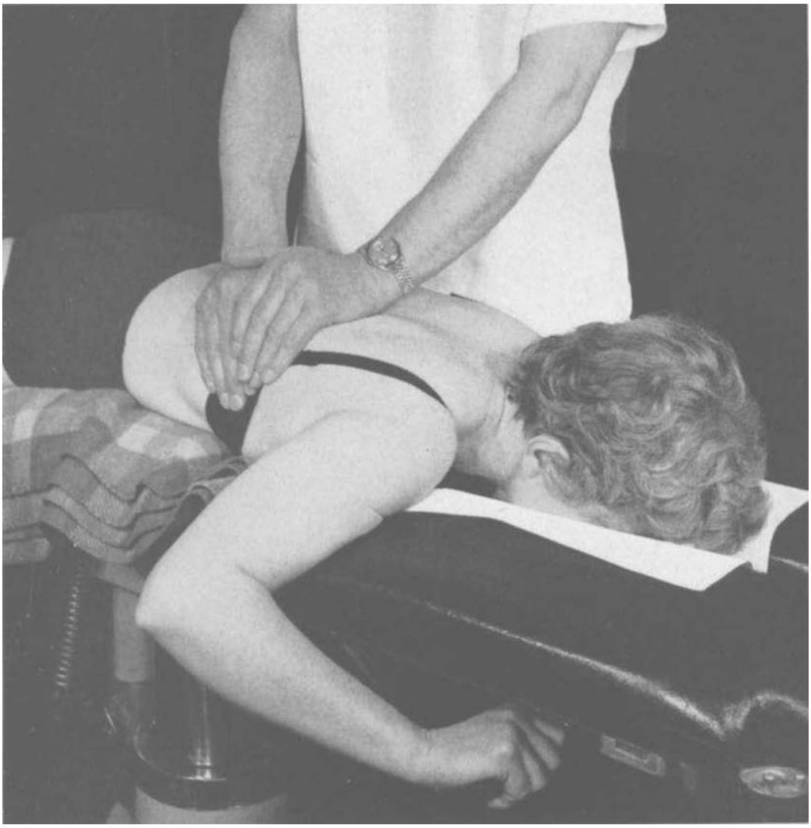


FIG. 66

The Thoracic Spine

SOFT-TISSUE TECHNIQUES

Some of the methods of soft-tissue relaxation have been described earlier when dealing with the C.-T. area. There are several other methods more appropriate for treatment in the rest of the thoracic area and these are now described.

(1) *Kneading the Right Paravertebral Muscles.* FIG. 66

With the patient prone and head turned to the right (or better still use a table with a gap for the nose so that the patient can rest symmetrically

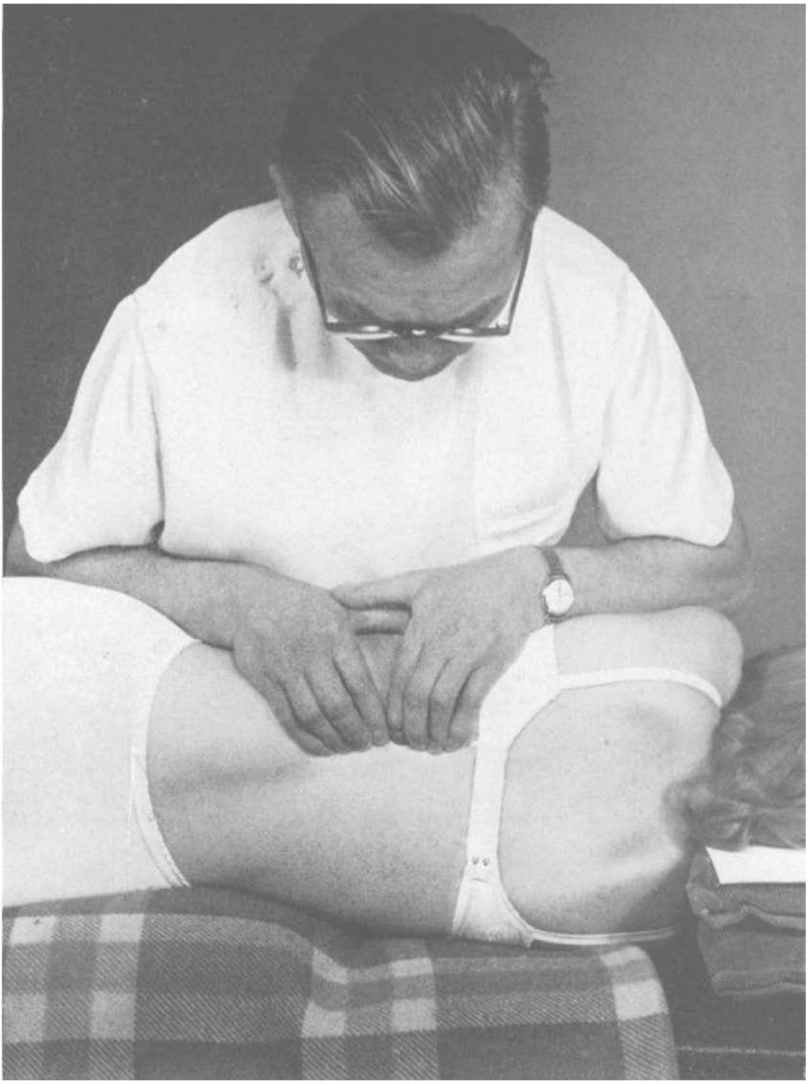


FIG. 67

with the head in the mid line), the operator stands on her left side and places his two hands on the right paravertebral muscles. The heel of the hands should be placed just lateral to the row of spinous processes so that kneading of the longitudinal muscle fibres can be effected transversely. In other words, the hands are pressed laterally from the spinous processes, trying to take in as large an area of muscle as possible. Although there should be no gliding or rubbing of the hands over the skin surface, the method is a slow movement of the hands laterally and round back into the same position. It is not merely a movement of the operator's hands; rather must he keep his arms fairly rigid and his whole body should take part in the action. The kneading should be rhythmical and moderately gentle, aiming at relaxation of the paravertebral muscles. Gradually the operator can move his position upwards or downwards to include the whole thoracic or even lumbar areas of the spine.

Should localized areas of muscle contraction be encountered, then more concentrated effort can be applied there, and instead of using the heel of the hand, the balls of the thumbs can be used to pin-point the faulty site.

A similar circular type of transverse kneading can be achieved in the same position as above but the operator turns sideways looking towards the head of the patient, so that his right thigh rests against the left side of the table. Both thumbs can then be used, one on either side of the spinous processes to stretch the muscles laterally.

(2) *Deep Kneading*

To reach the deeper layers of paravertebral muscles, the thumbs should be placed close to the spinous processes, pressing alternately upwards and downwards, that is, the right thumb pressing cranially and the left thumb pressing caudally, on opposite sides of the spine. This reaches the multifidus and rotatores muscles which are running almost transversely in the thoracic spine.

(3) *Stretching the Left Paravertebral Muscles.* FIG. 67

With the patient on the right side and operator standing facing her the operator places the tips of all his fingers on the paravertebral muscles just to the left of the spinous processes. In this position the fingers can pull upwards on the longitudinal fibres to obtain a stretch in a transverse direction.

At the same time, to obtain an additional stretch of the left paravertebral muscles, the operator can press with his forearms against the crest of the ilium and shoulder, creating a convexity upwards in the thoracic area of the spine.

ARTICULATORY TECHNIQUES IN THE THORACIC SPINE

As defined earlier (p. 88), articulation is the application of passive movements n a smooth and rhythmical fashion, gradually to stretch

FIG. 68

contracted muscles, ligaments and capsules, and in order to achieve this objective we use a variety of levers to assist our fingers in moving each intervertebral joint. It is possible by direct pressure on spinous processes to effect a small range of passive movement between two adjacent vertebrae and the method will be described below, but the use of long leverage is much more effective and less uncomfortable for the patient.

The leverages used in articulating the thoracic spine are the neck, the arms, the ribs, the lumbar spine and the legs, and each lever has its place in the armamentarium of the osteopathic practitioner. Those methods in which the neck is used as a lever have already been described under the heading of articulatory techniques in the C.-T. area of the spine (p. 123). Other methods are now described:

(1) *Rotation.* FIG. 68

With the patient sitting, the operator stands behind the patient and passes his right hand under the patient's right axilla to grasp the front of

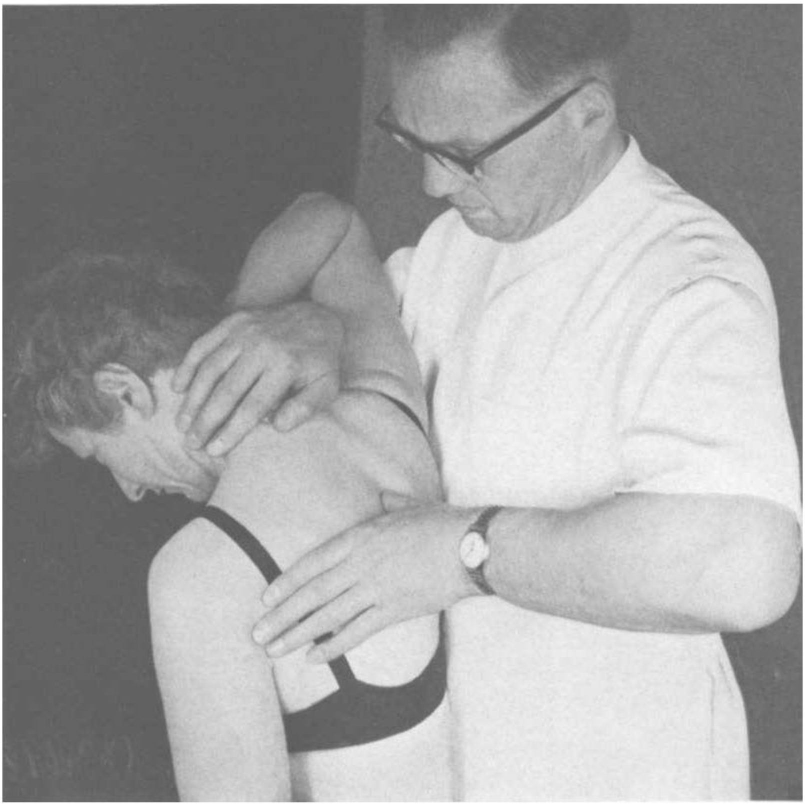


FIG. 69

her right shoulder. He places his left thumb against the spinous processes successively as he rotates the torso to the right. The thumb acts as a counter pressure to check rotation of the joint below, and in this way obtains a movement at each of the thoracic joints.

(2) *Rotation.* FIG. 69

A similar rotatory articulation can be obtained by using the arm as a lever. The patient places her right hand behind her neck and the operator threads his right hand under her right axilla and into the space formed between the arm and neck to grasp the back of her neck, the operator's right hand overlapping the patient's right hand. This has more powerful leverage and enables the operator to incorporate some flexion as well as rotation.

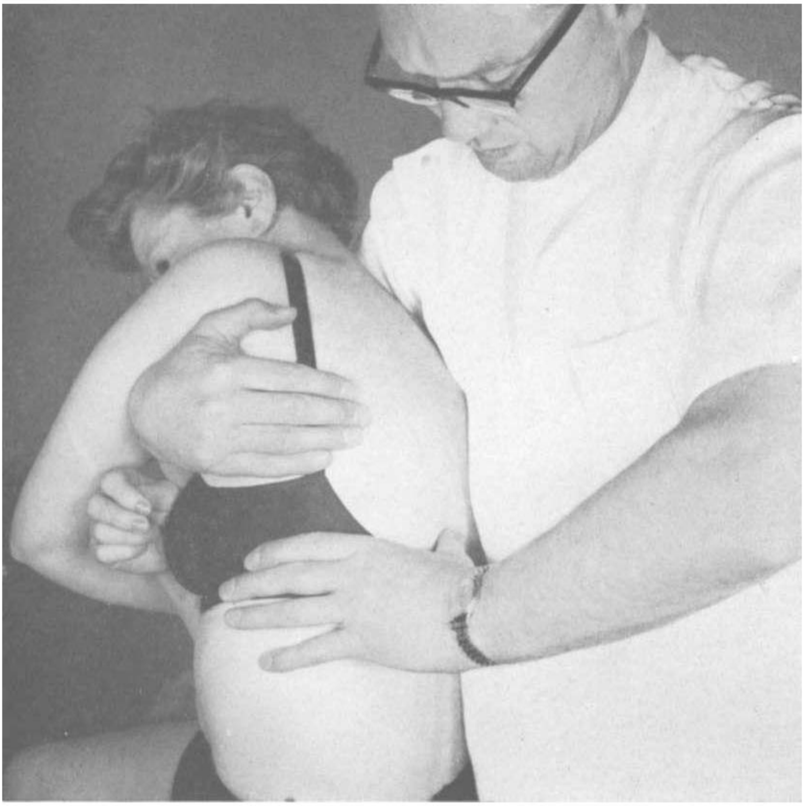


FIG. 70

(3) *Rotation*

With the patient sitting, the operator stands behind the patient who has folded arms; he threads his right hand under her right axilla across her chest to grasp the left shoulder. An even stronger grasp is obtained this way and is mainly used for rotation of the lower thoracic and lumbar areas.

(4) *Sidebending.* FIG. 70

Side bending can be obtained in the sitting position by the operator standing behind the patient with arms folded. The operator turns slightly sideways so that he can pass his right arm over her right shoulder across

FIG. 71

her chest and into her left axilla. The operator can now exert a downward pressure through his right axilla on the patient's right shoulder and an upward lift of the patient's left shoulder with his right hand. In this way a convexity is formed on the left—the spine is sidebent to the right and counter pressure can be applied with the operator's left thumb, successively on each of the thoracic spinous processes.

(5) *Forward Bending.* FIG. 71

Forward bending is best obtained in the sitting position with the patient clasping her hands behind her neck and using the elbows close together as a lever to flex the thoracic spine.

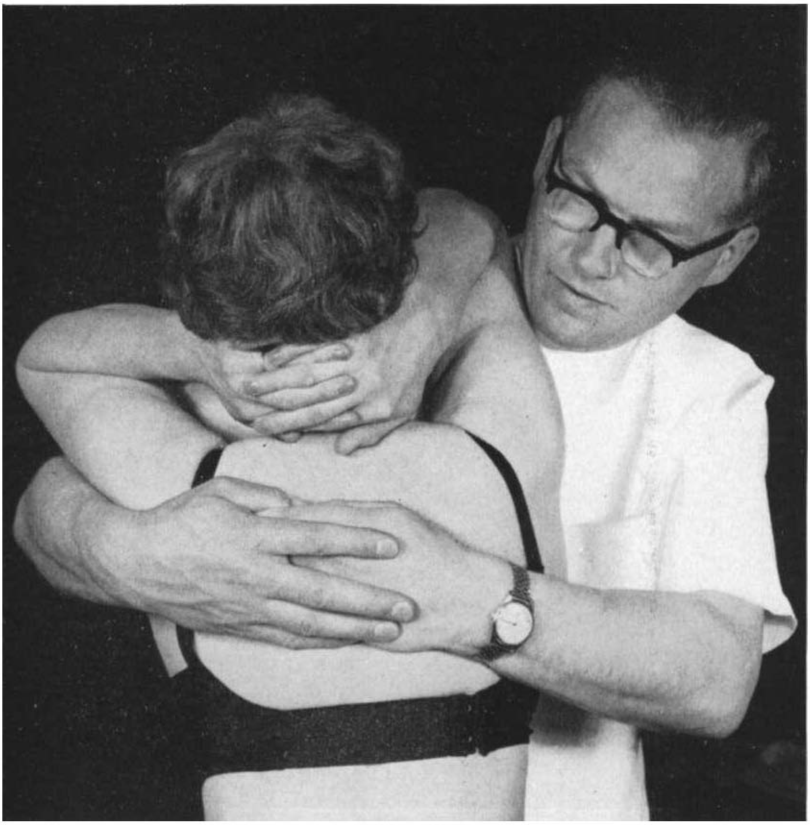


FIG. 72

(6) *Backward Bending*

Backward bending can be achieved in the same way, but the operator reaches under the arms and exerts an upward force on the elbows to extend the thoracic vertebrae.

(7) *Backward Bending.* FIG. 72

Backward bending in the sitting position can also be obtained by standing in front of the seated patient who has her hands clasped behind her neck and her elbows together. The operator stands a little to her right and, placing his right shoulder under her arms, reaches round the patient with both arms to apply a counter pressure against the spinous processes; the hypothenar eminence of one hand can be reinforced by the other hand

FIG. 73

and pressure applied to each spinous process as the elbows are pushed upwards by the operator's shoulder.

(8) *Rotation.* FIG. 73

With the patient lying prone, the operator stands at the head of the table. He grasps the patient's right arm just above her elbow with his left hand and elevates the arm, thereby extending the shoulder. He then uses this leverage to rotate the torso to the right. For comfort, the patient's head needs to be rotated to the right and rested on her pillow. The operator exerts counter pressure with his right thumb successively down the thoracic spinous processes from about 5 T. downwards.

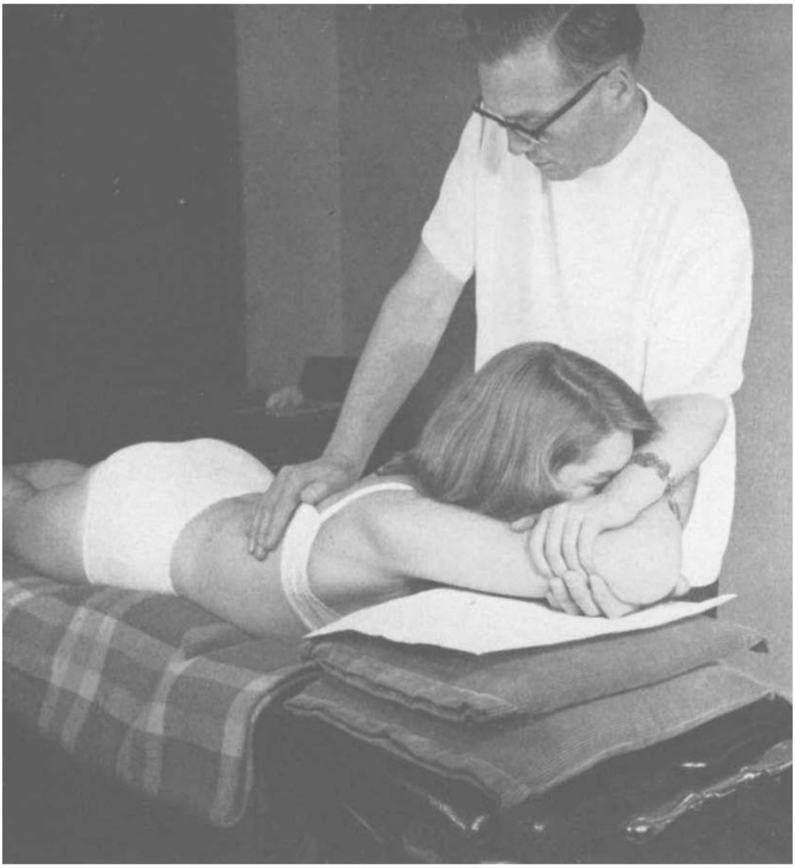


FIG. 74

(9) *Sidebending.* FIG. 74

The patient lies prone and folds her arms above her head, each hand holding opposite elbows. This forms a convenient rest for her forehead. The operator, standing on her left side, passes his left hand under both forearms to clasp the patient's right elbow, and the patient turns her head to the right. This arrangement forms an effective combined neck and arm leverage for sidebending the thoracic spine. The operator applies additional pressure against successive spinous processes with his right thenar eminence to force the spines further into convexity; or he can use his right thumb against the right side of the spine to oppose the formation of the convexity.

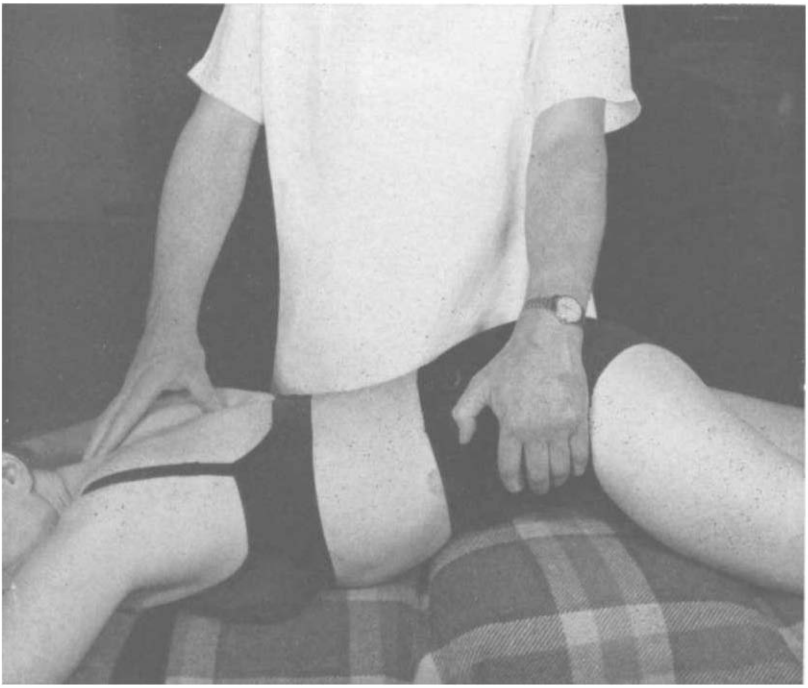


FIG. 75

In either way he is achieving a stretching of the capsules of each individual thoracic joint.

The above leverage can readily be modified to articulate in extension.

(10) *Rotation.* FIG. 75

The patient lies prone, and the operator, standing on her right side, reaches over and with his left hand to grasp her left iliac crest and anterior superior iliac spine region and pulls the left side of the pelvis upwards, thus in effect rotating the torso to the right, though in fact it is a rotation of the pelvis to the left upon a fixed upper torso. The lumbar spine and pelvis are now being used as a lever to rotate the thoracic spine from below upwards. Counter pressure with the operator's right hand (either thumb or thenar eminence) against successive spinous processes achieves an effective rotatory articulation, particularly of the lower thoracic joints.

FIG. 76

(11) *Backward Bending*

With the patient prone, the operator, standing say on the left side of the patient, reaches under the patient's thighs and lifts the lower extremities to force the spine into extension. If the extension is sufficient, the leverage will extend the thoracic joints as well as the lumbar.

(12) *Rotation.* FIG. 76

With the patient on the right side and the operator facing her, he uses the leverage of the patient's left shoulder to rotate the thoracic spine to the left. To stabilize the sidelying position, the patient should flex the knees and hips somewhat and this will stop any wobbling of the lower torso. The operator now reaches over the patient and places his right finger and thumb firmly on a thoracic spinous process. His right forearm rests along the spine below this. He then applies a pushing backward movement with his left hand against the patient's left shoulder and by increasing the amount of movement each thoracic joint can be rotated in turn.

FIG. 77

The same technique can be used in reverse, fixing the shoulder girdle firmly and rocking the pelvis backwards to rotate the thoracic spine from below upwards.

(13) '*Pull and Push.*' FIG. 77

Without using any long leverage, it is possible to articulate the thoracic joints to some extent by applying a 'pull and push' movement with the fingers and thumbs to the spinous processes. For example, the spinous process of 8 T. can be pushed towards the right while the 7 T. spine is pushed towards the left. The same action is carried on through the rest of the thoracic and lumbar areas, though little movement can be achieved in the lumbar joints by this method. In order to facilitate this movement the patient should lie prone with a cushion under her chest. The cushion throws the thoracic area into flexion.

FIG. 78

SPECIFIC TECHNIQUES

Supine Techniques Using Indirect Specific Adjustments

(1) *Forward-bending Restriction of 5–6 T.* FIG. 78

The patient lies supine on the table and the operator stands on her right side. She interlocks her fingers behind her neck and her elbows are brought together over the sternum. The operator now grasps the patient's elbows with his left hand and forearm, rolls her towards himself and makes a firm fixation of the 6 T. vertebra with his clenched right hand. This hand is so arranged that the thenar eminence can be placed against the left

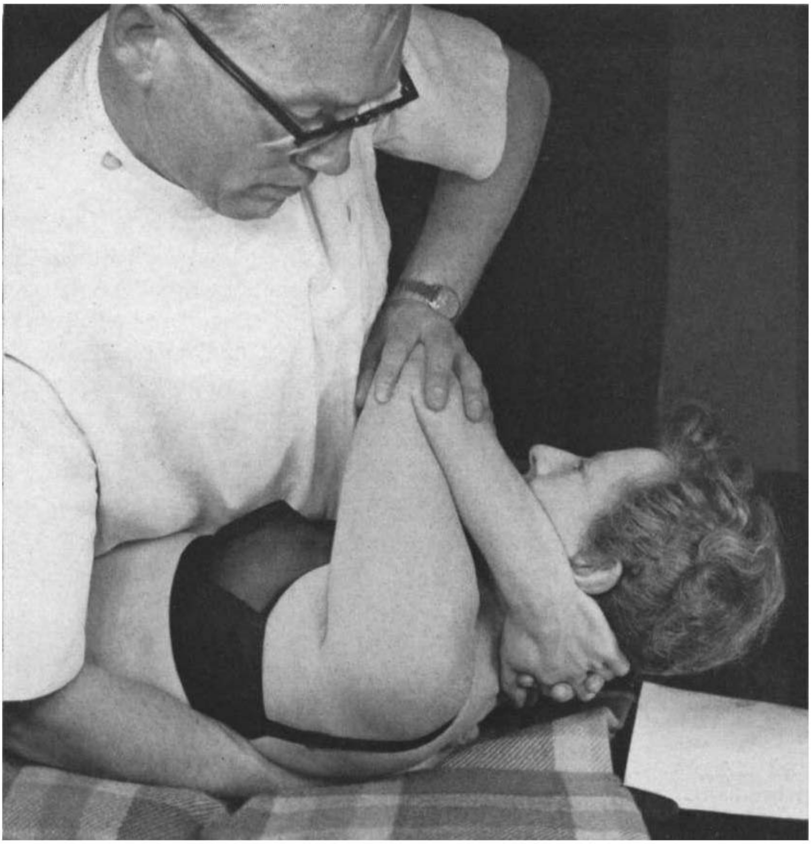


FIG. 79

transverse process of 6 T. while the middle phalanx of the middle finger is placed against the right transverse process of 6 T. and the spinous processes lie in the groove formed by the knuckles and thenar eminence. The operator's index finger lies out straight and takes no part in the fixation. The patient is now rolled back on to the table over the operator's right hand using this firm fixation of 6 T. as a fulcrum. The operator leans over the patient and makes a sudden sharp thrust against the patient's elbows with his left hand in a downward direction. This forcibly flexes all the thoracic vertebrae above, using ligamentous tension locking and, if the tensions are accurately applied, the 5–6 T. joint is gapped.

All the thoracic joints can be manipulated in this way by altering the position of the fulcrum and by altering the position of the patient's hands behind the neck. We require less flexion in the upper thoracic area compared with the lower thoracic area, and to achieve this the patient's hands should be low in the neck for the upper thoracic joints and high in the neck for the lower thoracic joints.

(2) *Backward-bending Restriction of 5–6 T.* FIG. 79

The method here described is similar in position to the above but, instead of placing the thoracic spine in flexion, it is placed in extension.

The patient lies supine with her hands clasped low down behind her neck. The elbows are brought together over the sternum. The operator grasps the patient's elbows with his left forearm and hand, rolls the patient over towards him and firmly places his flexed right hand over 6 T. as in the previous technique. The patient is then allowed to roll back flat on to the table over the operator's flexed right hand. The patient does not require any pillow as the head does not flex at all. The thoracic spine is in full extension using this firm fixation of 6 T. as a fulcrum. The operator leans over his patient, makes a sudden sharp thrust against her elbows with his left hand in a downward direction so that the resultant force will pass through the articulation at 5–6 T.

(3) *Backward-bending Restriction.* FIG. 80

The above technique may be varied by crossing the patient's arms over her chest instead of clasping the hands behind the neck. The advantages of this method are that it places less strain on the shoulders and avoids neck leverage—this may be desirable in some cases.

The patient crosses the arms fully rather than folds the arms so that she clasps her left shoulder with her right hand and her right shoulder with her left hand. The same type of fulcrum against the transverse and spinous processes is used.

(4) *Rotation-restricted Lesions in the Thoracic Spine*

Frequently if there is a restriction of rotation, say to the right, there is a positional fault and the vertebra is fixed in rotation to the left, so making the left transverse process prominent. We therefore use this transverse process as a point of fixation. The other point of fixation is the opposite transverse process of the vertebra below—in this way a strong, very local rotation force can be effected.

In this lesion, the operator stands on the right side of the supine patient who has clasped her fingers behind her neck (as in Fig. 78). The operator grasps the two elbows close together using his left hand and forearm and, in this way, pulls the patient towards him, thus exposing the thoracic spine, which can be carefully palpated. The operator places his right thenar eminence on the prominent transverse process on the left and his flexed

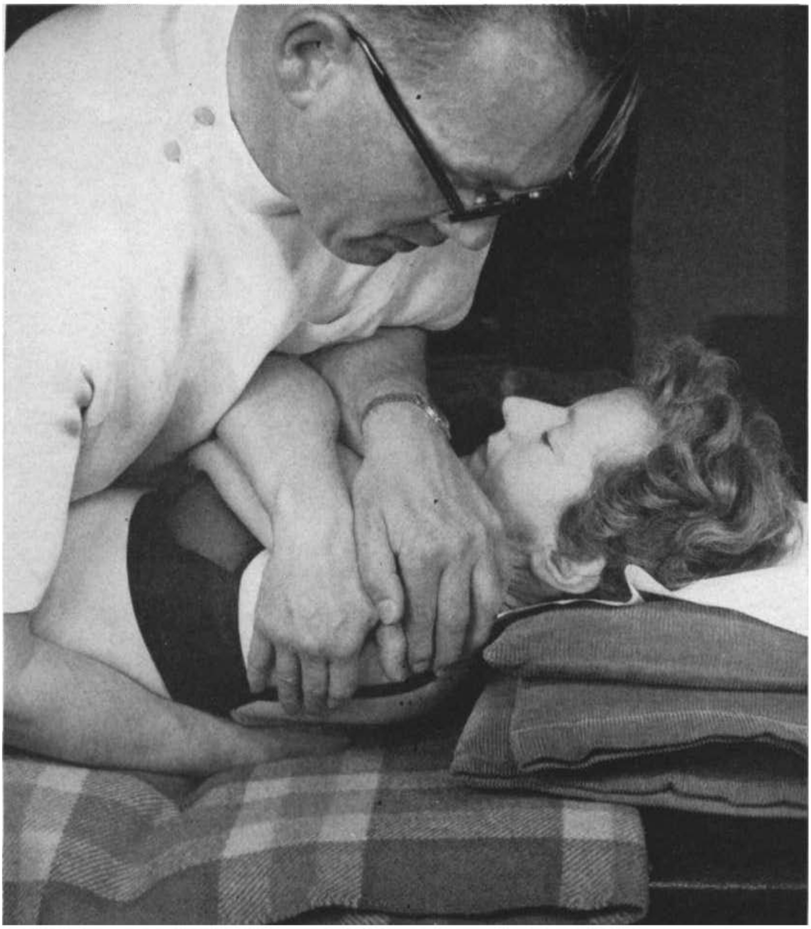


FIG. 80

knuckle of the right middle finger on the patient's right transverse process of the vertebra below. Then rolling the patient back on to the operator's hand, he gives a downward thrust—so arranged as to build up the tension at the restricted joint mainly on the left of the joint. We therefore need to bring the elbows a little to the left of the sternum rather than midway over the sternum as in the previous techniques. It should be noted that firm fixation of the hand against the spine while returning to the supine position is imperative, otherwise it is very easy to alter your position and so lose the effectiveness of the manipulation.

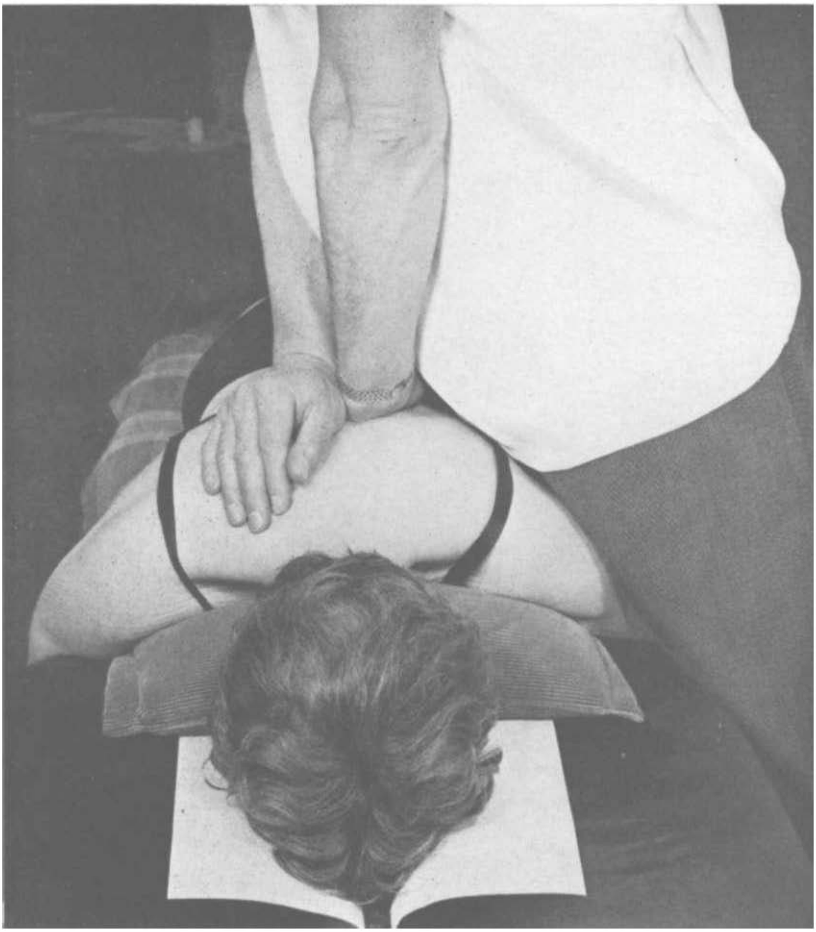


FIG. 81

Prone Techniques in the Thoracic Area

In carrying out this type of technique, it is important to ensure that the patient is lying on a well-padded or sprung surface. If the surface is hard, injury to the ribs or the sternum may result.

(1) *Backward-bending Restriction.* FIG. 81

The patient lies prone with her neck and upper chest supported on cushions to force the thoracic spine into extension and the head stays in the mid line. The operator with wrists fully extended applies his pisiform bones to the transverse processes of the vertebrae below the fixation. The fingers of one hand must point towards the patient's head and the fingers of the other hand must point to the feet. The operator leans well over the plinth, bringing his weight to bear on his wrists, at first firmly to take up slack and then a very rapid forced thrust of short amplitude vertically downwards with both hands. It is important not to relax the initial pressure before delivering the thrust. The purpose of the thrust is to break apophyseal joint fixation and the maximum effect is achieved by a force directed at right angles to the facet planes. In many patients, especially those who are heavily built or rigid, the thrust may be delivered as the patient exhales in order to enhance relaxation. In comparatively frail patients the thrust should be delivered as the patient breathes in, in order to increase stability.

(2) *Forward-bending Restriction*

This may be corrected in a similar manner except that the patient is supported under the centre of the chest with several pillows to throw the thoracic spine into full flexion. The head also falls forward but remains in the mid line.

With reference to the above two techniques, a study of the angles of the facets will show that the upper facets face backwards but also slightly upwards, so that the direction of the downward thrust in the above technique should not be absolutely vertical, but with a few degrees of caudal direction. The caudal component of the vertical thrust increases as you ascend the spinal column.

(3) *Rotation Restriction*

Take, for example, restriction of rotation to the left of the 6–7 T. joint. With the patient prone, the operator stands on her left side and places his left pisiform over the left transverse process of 7 T., the fingers pointing to the patient's feet. The right pisiform is placed over the right transverse process of 6 T. and the fingers of this hand point towards the patient's head. Pressure is directed down towards the table with the left hand and upwards towards the head with the right hand. At first the pressure is firm and is followed by a forcible rapid thrust of short amplitude.

Other Techniques

Backward-bending Restriction. FIG. 82

The patient is seated, the operator facing her. She raises her arms and rests them on the operator's right shoulder. The operator reaches round the patient's torso and laces his fingers together, so that the ulnar border of the right hand (reinforced by the left hand) can be applied to the spinous

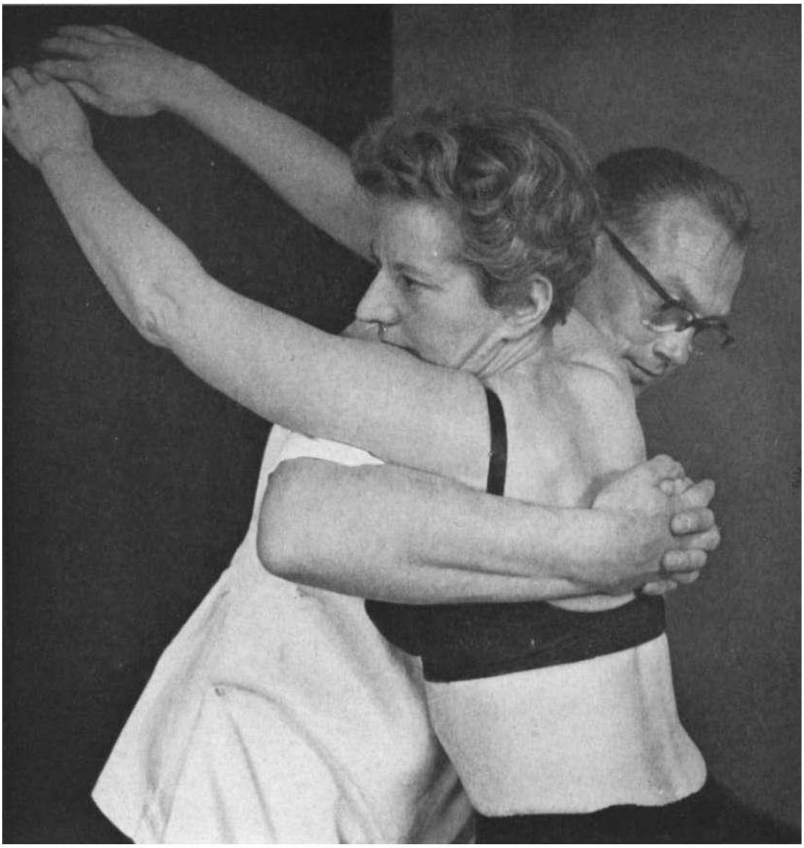


FIG. 82

process of the vertebra below the fixed joint. At the same time the operator brings the patient into extension but, to check the patient from being forced forwards off the plinth, the operator must fix the patient's right knee within his two thighs. Note that the operator must get well down to avoid pressing on to the patient's throat with his shoulder.

Backward-bending Restriction

With the patient prone, the operator grasps both thighs with his right arm to elevate both lower extremities (this is only suitable for a light patient) and extend the lumbar spine up to the joint fixation. The left hand at the same time applies a downward thrust upon the lower of the two vertebrae in fixation.

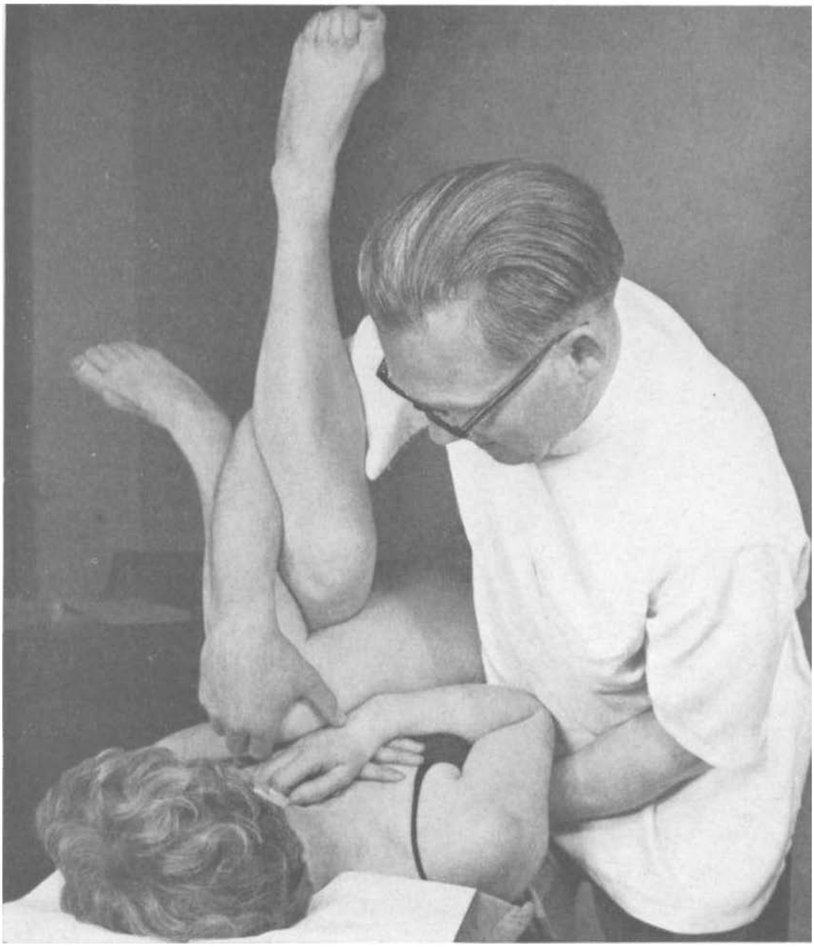


FIG. 83

Forward-bending Restriction. FIG. 83

With the patient supine, the operator stands on the patient's right side and the patient crosses her flexed knees so that the right knee lies over the left knee. The operator then threads his right hand and forearm *between* the patient's calves so that the operator's right hand can rest on the patient's right patella. This is a useful grip to enable the operator to flex the whole pelvis. The operator then fixes the upper vertebra and flexes the lumbar spine to the lesion. A strong flexion force can be exerted in this way at the site of the lesion but one should take care not to use this technique in disc lesions.

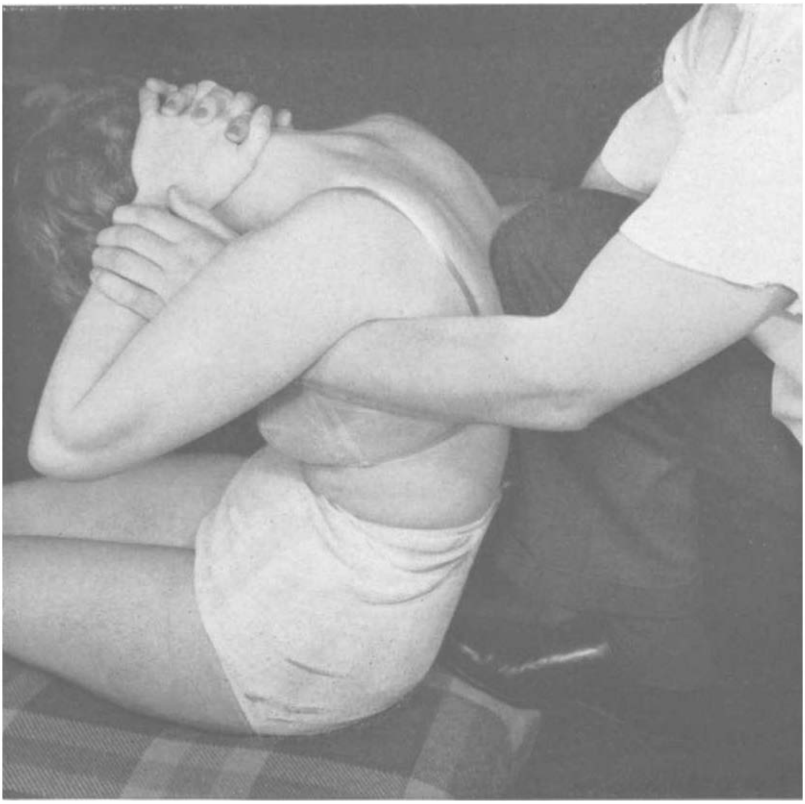


Fig. 84

Knee-thrusts. Forward-bending Restriction. Fig. 84

With the patient sitting, the operator stands behind her, places his right knee, suitably padded, at the site of the restricted joint and rests his foot on the table or a stool of a suitable height. The patient now laces her fingers behind her neck and the operator threads his hands under her axillae and anteriorly through the space formed between the patient's arms and forearms to grasp her wrists. In this position all the ranges of restriction of movement can be corrected by merely altering the place of the thrust. In restricted forward bending fix the spinous process of the vertebra below by applying pressure with your tibial tuberosity and flex the upper spine by pressing forwards on the patient's wrists—gauging the degree of flexion by palpating the spine—if necessary momentarily release your left hand and feel the movement with your thumb. Having determined the degree of tension, the correction is an increase of flexion against the fixation of the knee.

Knee-thrusts. Backward-bending Restriction

Restriction of backward bending is corrected by a much more positive forward thrust of the knee and an upward pull on the patient's forearms. The operator applies his knee to the spinous process of the lower vertebrae and he brings the patient backward into extension. The whole upper thoracic area is kept in flexion as a unit and the lower thoracic brought into extension. The thrust is downwards and forwards with the knee while applying some traction under the axilla.

Rotation restrictions can be similarly corrected by applying the thrust of the knee to the transverse process of the vertebra below the restricted rotation.

Many operators will find this technique difficult partly because the operator is a long way away from his patient and therefore long leverages are involved, but also the knee is not very sensitive and can easily wobble about over the site of pressure. On the other hand, the technique is effective sometimes when other techniques fail.

The Lower Thoracic Area

When dealing with lower thoracic lesions, it is possible to use the leverage of the elbows as in mid-thoracic forward-bending restriction lesions with the patient supine, but it becomes increasingly more difficult the further we go down in the thoracic spine. The reason is partly because the leverage becomes too long and the patient has greater difficulty in relaxation, but also because it is sometimes difficult to force the patient sufficiently forward to create tension in the lower joints. However, the main movement in the lower thoracic area is rotation, and restriction of rotation is much more common here. By releasing rotation, frequently the forward-bending restriction is also released. We therefore tend to use combined movements when dealing with the lower thoracic group rather than simple forward and backward bending.

Before going on to deal with the combined adjustive techniques, let us review the normal movements of this area and consider the effect of forward and backward bending upon facet apposition locking.

It will be remembered that in the cervical area rotation is associated with sidebending to the same sides whether the neck is in forward or backward bending. This is not so in the thoracico-lumbar area of the spine. Only from forward bending does the T.-L. area behave like the C. area. From backward bending and in the neutral position, sidebending and rotation occur to opposite sides.

To make this clear by example, if we first bend forward the T.-L. area and then sidebend to the right, the bodies of the vertebrae rotate to the right; but if we first backward bend the T.-L. area and then sidebend to the right, the bodies of the vertebrae rotate to the left. This occurs to enable the articular facets to glide upon each other. If we deliberately try and move the spine in directions the reverse of the above, we drive the facets into each other and create what we call facet apposition locking. This method of locking is useful to us in manipulation because it helps us to localize our forces and helps to check undue movement in adjacent joints.

There are two ways therefore of producing facet apposition locking in the T.-L. area. From a position of forward bending we must sidebend and rotate to opposite sides whereas from a position of backward bending we must sidebend and rotate to the same side. These points are brought out in the description of specific adjustments in the T.-L. area below.

Although these remarks hold good for the lower thoracic and the lumbar joints, the lumbar joints are much more confined in their range because the facets are almost sagittal whereas in the thoracic they are almost coronal in plane, therefore it is much easier to achieve facet locking in the lumbar spine than it is in the lower thoracic area. Thus we need to use far more *digital fixation* and thrust in the thoracic adjustments than we do in the lumbar. In other words, localization of forces is not so easy in the lower thoracic area and this fact is reflected in the techniques.

Furthermore, such is the flexibility of the lower thoracic joints, it is even difficult to achieve facet apposition locking at all and we are often driven to using ligamentous tension locking. When we consider the above points about combined movements in this lower thoracic area (that from forward bending, sidebending and rotation occur to the same side whereas from backward bending, or from the neutral position, sidebending and rotation occur to opposite sides) *there must be a position of very slight forward bending, when sidebending is an almost pure movement, neither rotating to one side or the other. Similarly in slight flexion, rotation is almost a pure movement.* It is in this position of slight forward bending that the most satisfactory adjustments can be made in this area. In slight forward bending, therefore, we cannot achieve any localization of forces by using sidebending; we use pure rotation as our adjustive force, arranging the rotation so that the maximum torsion occurs at the restricted joint we are dealing with. This type of technique will be described, but first here are several methods using facet-locking:

(1) *Rotation Restriction to the Left.* FIG. 85

Lie the patient on the right side for a left rotation restricted lesion and, while facing her, flex the patient's left hip and knee high on to the chest,

FIG. 85

in fact to the point where you feel tissue tension mounting to the restricted joint. Then pull on the patient's right arm to bring the right shoulder forward. Push her left shoulder backwards to rotate her torso down to the fixed joint. In forward bending we require to sidebend and rotate to opposite sides to achieve facet-locking. Therefore, we need to introduce some sidebending to the right. We do this by placing cushions under the patient's right loin so that maximum sidebending occurs at the joint in fixation. The final correction is an increase of backward rotation of the shoulder and a forward rotation of the pelvis. As facet-locking is not easy to achieve in this area we need to apply considerable finger pressure over the spinous processes further to help in the localization of forces.

FIG. 86

(2) *Rotation Restriction of 11–12 T. to the Left.* FIG. 86

The above technique can be modified using backward instead of forward bending in our preparatory positioning but sidebending and rotation have to be to the same side to obtain a sufficient facet apposition locking. The technique then is as follows for a rotation-restricted lesion of say 11–12 T. to the left.

Lie the patient on the right side and face her. Flex her left hip and knee just sufficient for comfort (but not to flex the spine) and allow the left knee to rest on the edge of the table. Then arrange pillows under her right shoulder so that sidebending is at a maximum at 11–12 T. If you have a McManis table, the upper half of the table can be used to create this sidebending. It can be more accurately and easily achieved this way. Next, rotation to the left is accomplished by pulling her right shoulder forward and pushing her left shoulder backward (as above) and pushing the pelvis

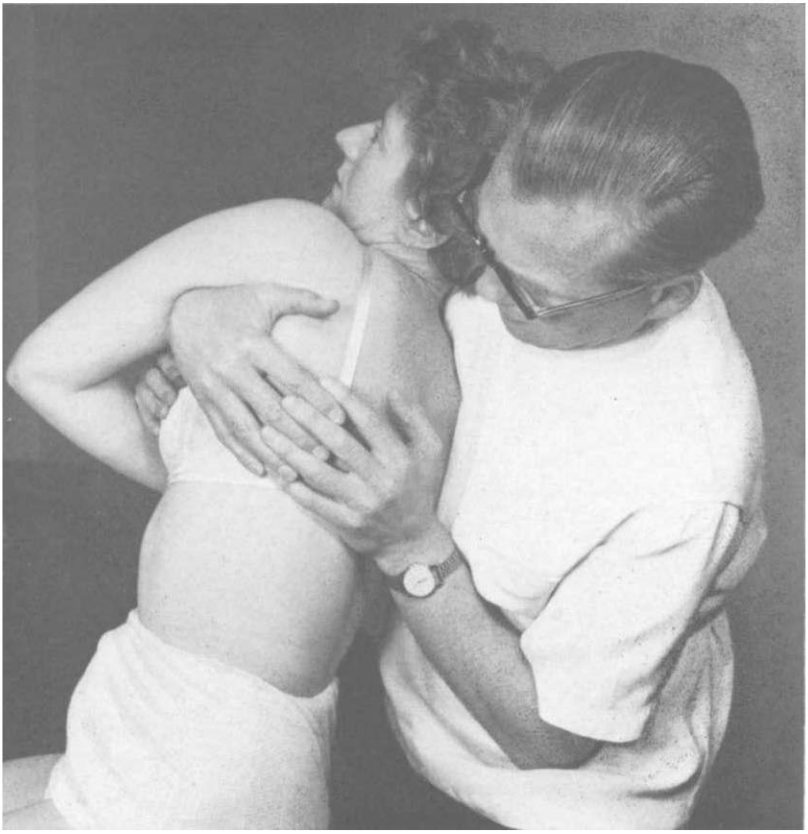


FIG. 87

forward. Both of the operator's forearms take part in this motion, his left forearm resting on the patient's left pectoral area and his right forearm resting on her left iliac crest area. In this position the operator's two hands are free to apply strong finger pressure on the spinous processes on the 11th and 12th thoracic vertebrae. The correction is achieved by an increase of rotation plus additional finger pressure over these spinous processes, attempting to rotate the spine of 11 T. to the left and the spine of 12 T. to the right.

(3) *Rotation Restriction of 8–9 T. to the Right.* FIG. 87

The patient is seated on a table with folded arms, the operator stands behind her and fixes the left transverse process of 8 T. with the pisiform bone of his left hand. He passes his right arm over the patient's right

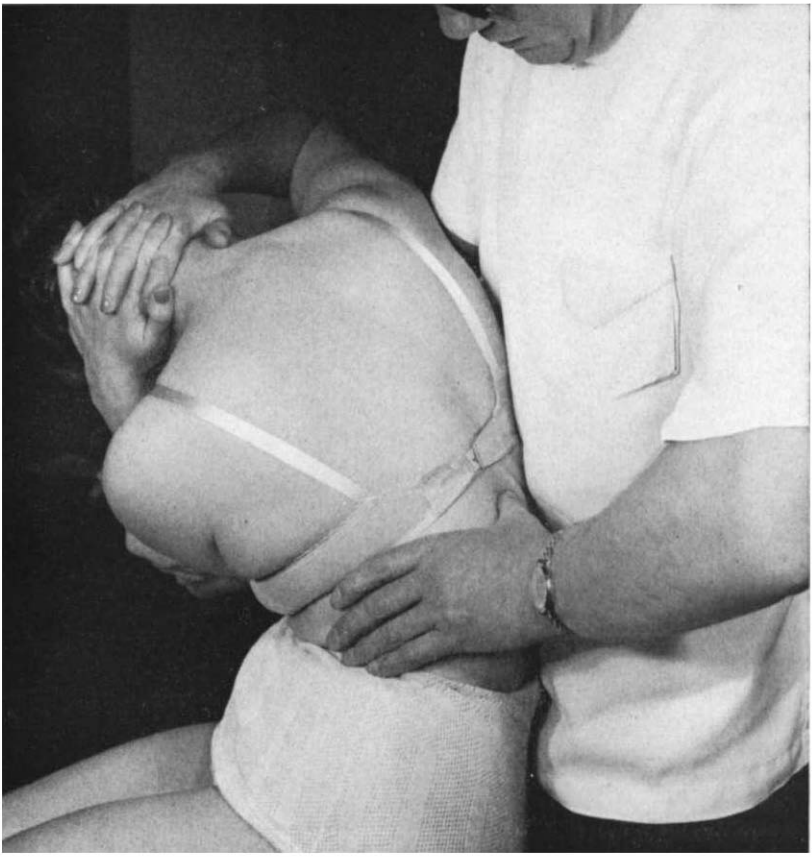


FIG. 88

shoulder, resting his axilla over the point of her shoulder. The operator passes his right arm across the patient's chest and under her left axilla. The fingers of the operator's two hands are now pointing towards each other and if possible they should be interlaced. The operator must stand close to the patient and maintain the fixation of the left transverse process of 8 T. strongly. The operator now sidebends the patient to the right by pressing down on her right shoulder with his right axilla, buckling the patient, as it were, so that maximum sidebending occurs at 8–9 T. Then he pivots round on his hips to the right to bring the patient into backward bending and rotation to the right. When in this position of backward bending, sidebending to the right and rotation to the right, the patient is asked to relax and flop her head backwards to rest on the operator's right shoulder. Correction is then made by a sudden sharp thrust by the left hand against the left transverse process of 8 T. in an upward direction combined with an increase of rotation. It is important that the backward bending of the torso is not excessive otherwise the facets will be jammed and the joint strained. Added stability and force can be obtained by the operator resting his left elbow on his own left iliac crest.

(4) *Rotation Restriction of 8–9 T. to the Right.* FIG. 88

The alternative sitting technique combines rotation and sidebending to opposite sides with forward bending. As above, stand behind the seated patient who has her arms clasped behind her neck. The operator places his left thumb on the spinous process of 9 T., allowing his fingers to spread round her left lower ribs. He then threads his right arm through under her right axilla and grasps her left arm. He is now in a position to flex the torso down to the 8–9 T. lesion. Then sidebending the patient to the left to obtain maximum sidebending at 8–9 T. and rotating the body to the right feeling tension mounting at the 8–9 T. with his left thumb, the correction is made by increasing rotation against the fixation pressure of the operator's left thumb on 9 T.

(5) *Rotation Restriction of 10–11 T. to the Left.* FIG. 89

This technique uses a position of *slight flexion* with pure rotation as an adjustive force because, as explained in the preamble about this area, there is a point between the neutral and full flexion where there is no secondary sidebending following primary rotation.

The patient is placed on the right-hand side for a left rotation-restricted lesion, say at 10–11 T. The operator faces the patient and pulls her right shoulder slightly forward and then he rotates down to 10 T. by pushing the left shoulder backwards, using his left forearm against her pectoral region. He then pushes forwards on her right ilium with his right forearm. The patient's upper knee and hip have been previously flexed slightly to obtain slight gapping of the lumbar and lower thoracic up to 11 T. With the two forearms engaged, his hands are then free to apply additional finger and thumb pressure on the spinous processes, helping the spine of 10 T. to the right and the spine of 11 T. to the left.

(6) *Rotation Restriction of 10–11 T. to the Left.* FIG. 90

The same principle is used as in method (5). The patient should be sitting and the operator standing behind. She places her left hand behind her neck. The operator threads his left hand through the triangular space so formed from before backwards and rests his left hand over her left hand on the back of her neck. This enables the operator to use powerful leverage in

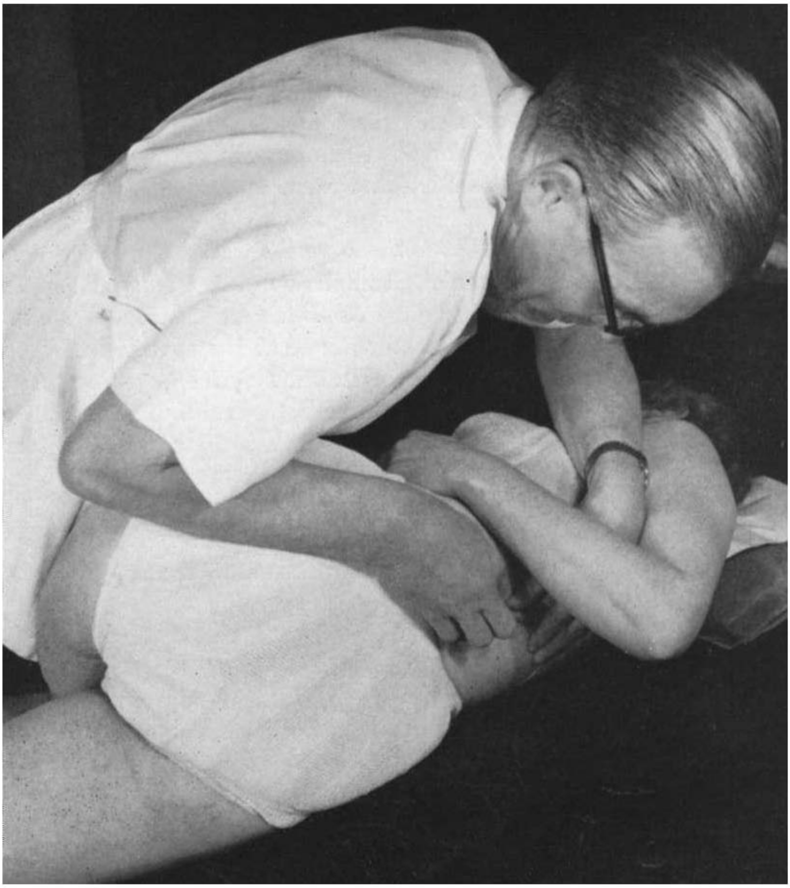


FIG. 89

rotation to the left. He then places his right thumb on the spinous process of 11 T. and uses this as a fixed pivot. The operator then rotates down to the 10 T. and maintains a shade of flexion on the torso.

In this technique it is not easy to keep the patient's seat in one position, and to prevent her slipping forward it is desirable to have an assistant to hold the knees or to have the patient sit astride the table.

(7) *Sidebending Restriction*

Pure sidebending restriction is unusual in the lower thoracic group and sidebending in the mid-thoracic area is virtually non-existent because of the ribs, so that the techniques for releasing rotation in the lower thoracic area

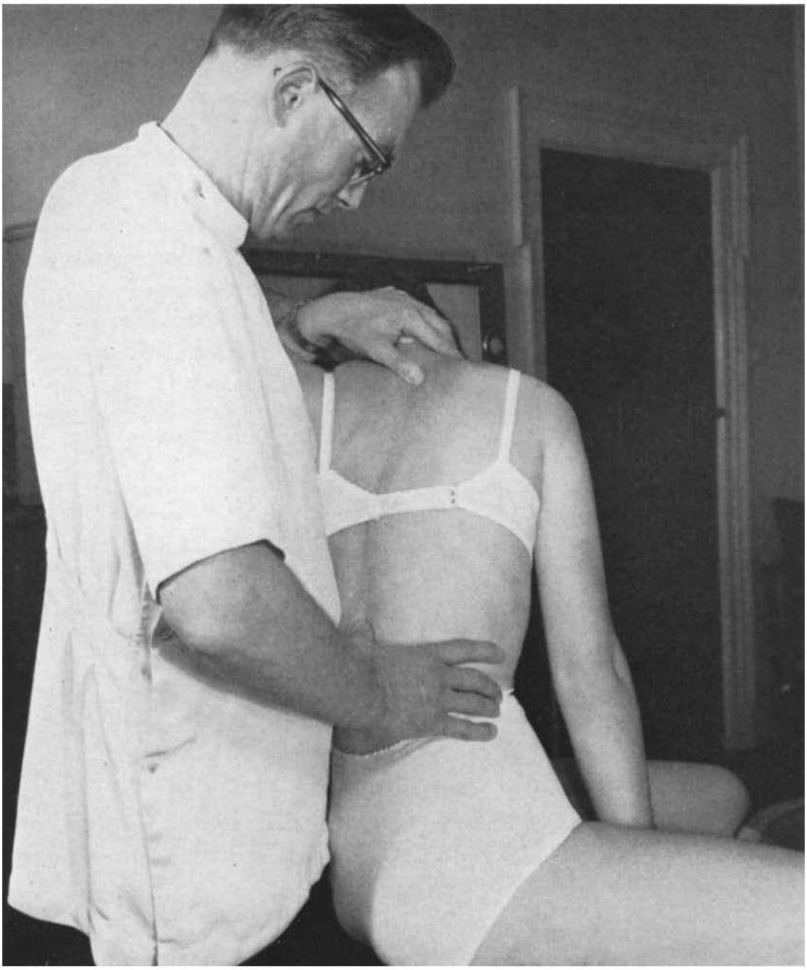


FIG. 90

are used for sidebending restrictions. We also rely on using articulation to free the sidebending movements of this area (*see* Figs. 70 and 74).

McManis technique. The patient lies prone with her feet strapped in to prevent wobbling, the lower leaf of the table is withdrawn so that the pivot of sidebending is under the level of the lower thoracic area, the leaf of the table is swung to and fro using strong counter-pressure against the spinous processes with the two thumbs so that the leg leverage and thumb pressure cause maximum sidebending at the joint in restriction.

SOFT-TISSUE TECHNIQUES FOR THE THORAX

(1) *Stretching the Scaleni Muscles*

This is an important preliminary procedure to correction of 1st and 2nd rib restrictions but the method should be avoided if there is a brachial plexus disturbance in which traction on the plexus causes pain. The patient lies supine, the operator at the head of the table holds and supports the patient's head under the occiput—say with his left hand—and then he fixes her right shoulder with his right hand. The operator stretches the scaleni by sidebending the head to the left while anchoring the shoulder on the right (*see* Fig. 37, p. 99).

(2) *Kneading the Scaleni*

As the brachial plexus emerges between the anterior and medial scalene muscles, it is clearly undesirable to knead over these muscles when the patient has brachial plexus or nerve-root irritation. In any case the area is liable to be tender, therefore relax the scaleni by sidebending the neck to the side on which you are working and be fairly gentle.

(3) *Inhibition*

Inhibition or deep pressure over the scaleni is often the only method open to the operator. The patient's head should be sidebent to the side of the rib lesion and deep, sustained pressure exerted with the thumb (*see* p. 89 for details of inhibitory technique).

(4) *Stretching the Left Interscapular Muscles.* FIG. 91

The patient lies on her right side facing the operator who leans over her left shoulder and holds it with his left hand, the palm over the deltoid area and the fingers spreading over the scapula. The operator's right crooked arm supports the patient's left crooked arm under her elbow, leaving his right hand free to reach the interscapular muscles. In this position the whole left shoulder girdle can be rotated or stretched upwards and downwards. The operator's fingers grasp the vertebral border of the scapula to control the movement and apply stretching, especially to the rhomboids, levator scapulae and trapezius muscles.

(5) *Pectoral Muscles*

In order to reach the pectoral group of muscles the patient should lie

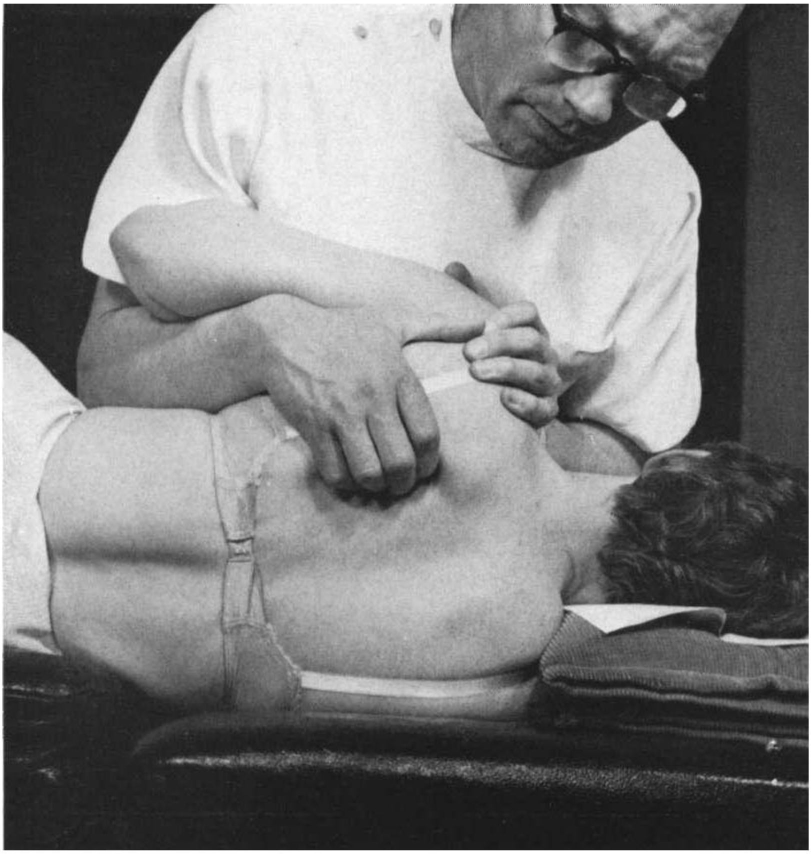


FIG. 91

supine and the operator, grasping the patient's wrist, extends the arm fully to place the pectorals on a stretch.

(6) *Intercostal Muscles*

Individual intercostal muscles can be reached only by localized finger-work between the ribs. Where intercostal spasm has occurred it will be necessary to work the whole way round from the sternum to the angles of the ribs. The intersections of serratus magnus and abdominal muscles often require detailed attention. Breasts and scapulae prevent local attention in the upper ribs.

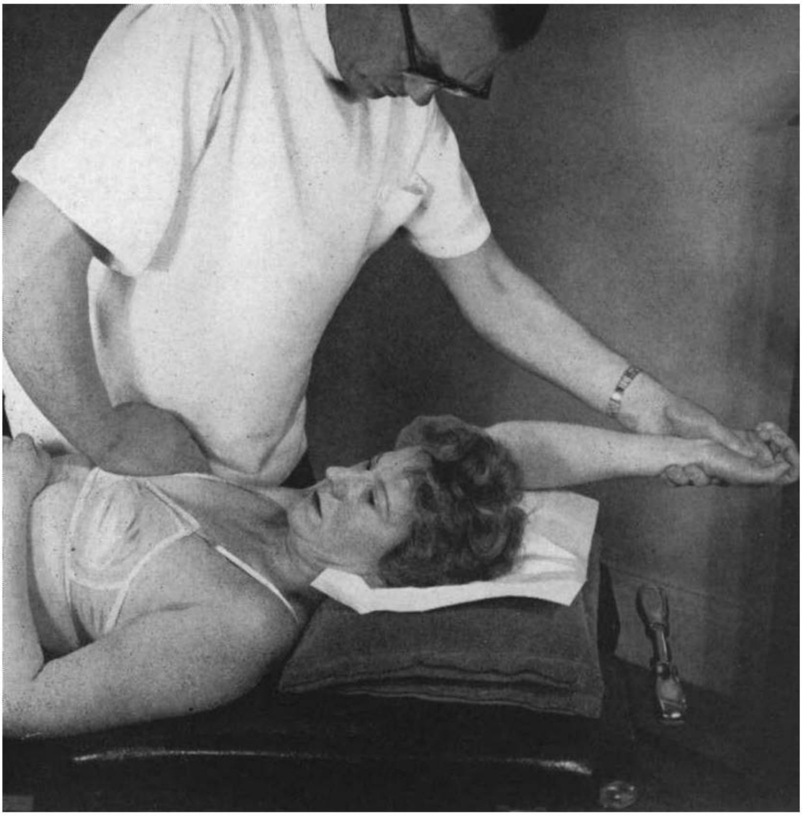


FIG. 92

ARTICULATORY TECHNIQUES FOR THE RIBS

(1) *Anterior Articulation.* FIG. 92

With the patient supine, the operator stands on her right side, grasps her right wrist with his left hand and stretches her arm upwards, while fixing the anterior ends of her right ribs with his right hand. The operator may use the ulnar border and little finger of his right hand or the thumb and thenar eminence or may group the tips of his fingers into a row to fix the lower of the two ribs. To reinforce the stretch and separation of the ribs, the patient should be asked to inspire deeply and the operator synchronizes his stretch with full inspiration.

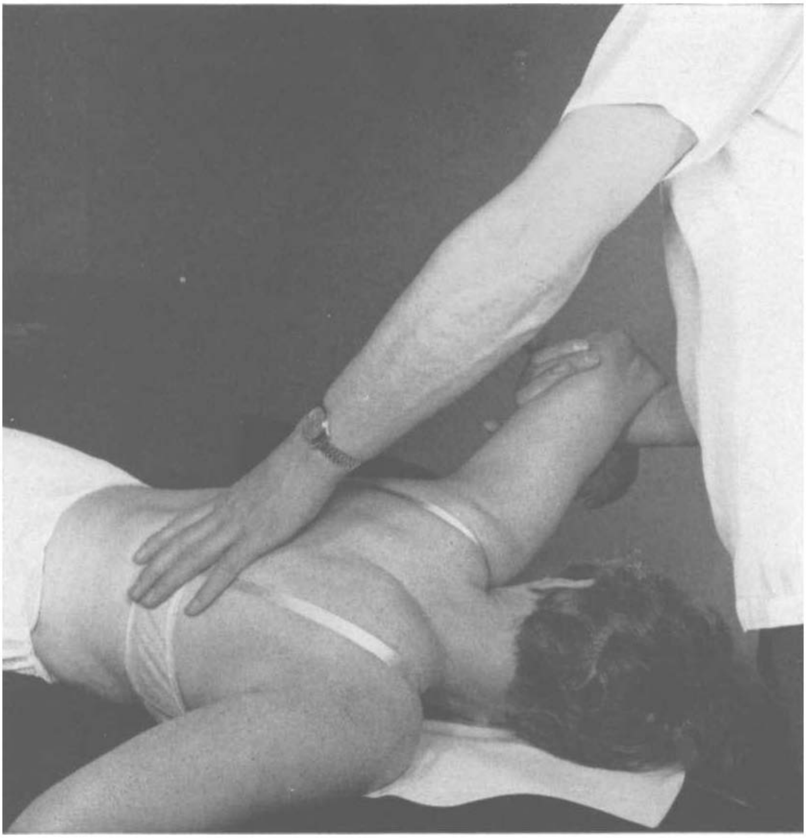


FIG. 93

(2) *Posterior Articulation.* FIG. 93

With the patient prone, her head facing towards her left, the operator stands at the head of the table, takes hold of the patient's left arm just proximal to her elbow and stretches the arm into full abduction, taking a somewhat backward swing with her elbow. The operator fixes each rib in turn with his thumb and thenar eminence at the angle of the lower rib. Quite a powerful stretch of each intercostal space can now be achieved using the leverage of the latissimus dorsi, particularly on the lower ribs.

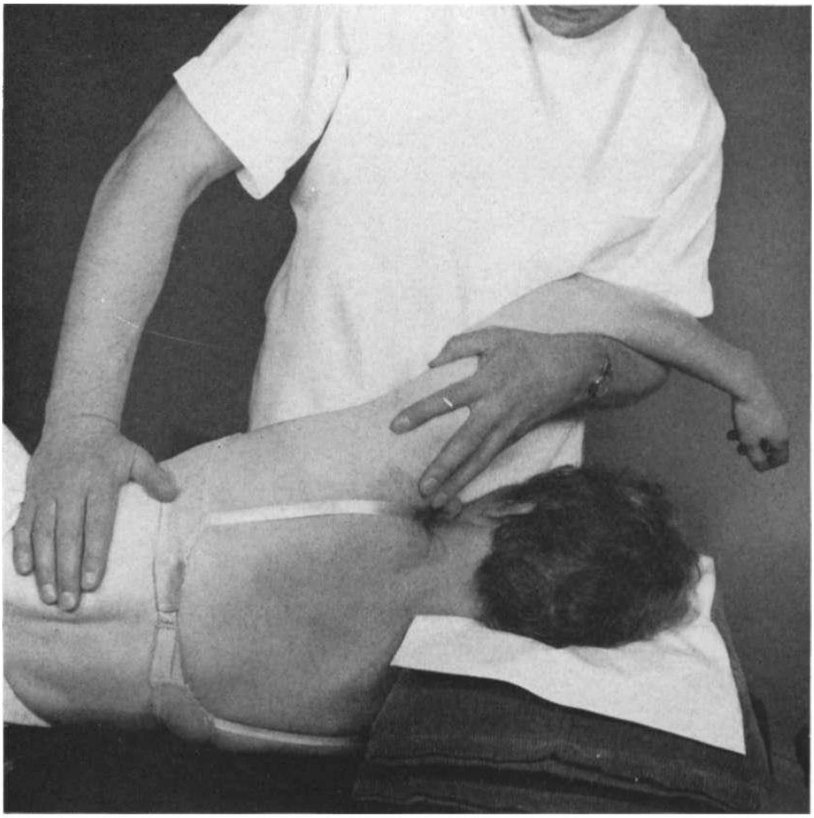


FIG. 94

(3) *Lateral Articulation.* FIG. 94

The patient lies on her right side, the operator faces her and grasps her left flexed elbow with his left arm stretching the shoulder into full abduction and fixing each rib in the mid-axillary line with his right thumb and thenar eminence.

(4) *Elevation.* FIG. 95

The patient lies supine and the operator, on the left side of the table, lifts the patient's arm (left) into full abduction so that her wrist is held firmly by his right axilla. In this way the operator has two hands to pass under the patient's left scapula. The tips of the operator's fingers are now pressed upwards against the angles of the patient's left ribs, co-ordinating

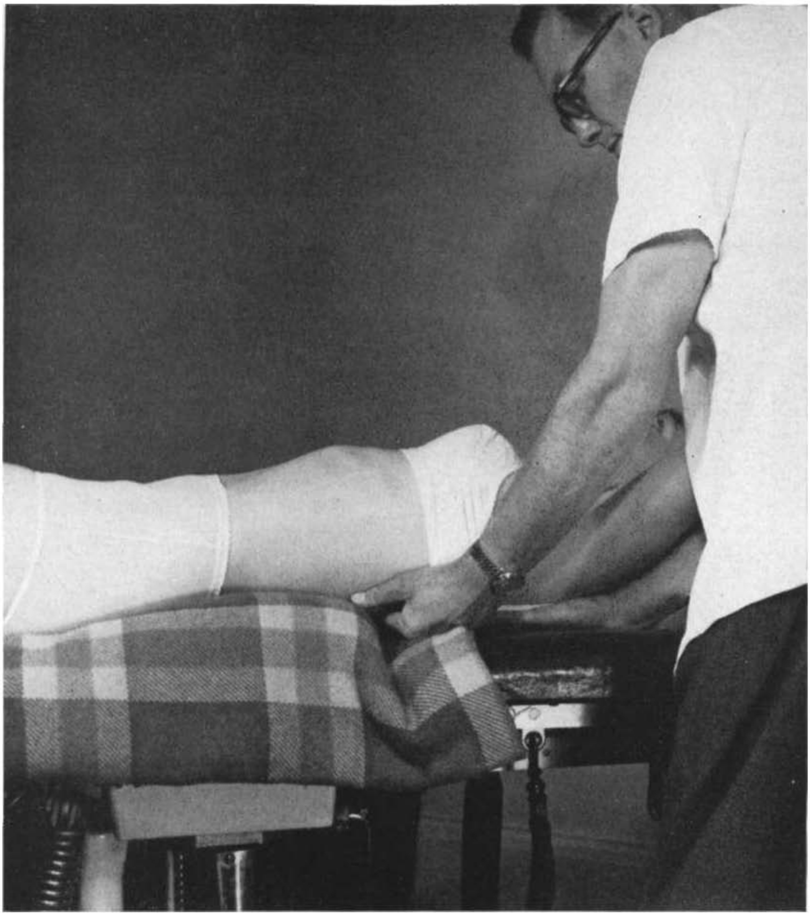


FIG. 95

this with a stretch of the arm upwards and outwards. It is usually necessary for the operator to bend slightly at the knees to do this technique comfortably and effectively. It is a non-specific method of elevating the middle section of the ribs.

(5) *Springing*. FIG. 96

The patient lies prone and the operator at the head of the table, looking towards her feet, climbs on to the table, placing a knee at each side of the patient's head. He then leans forwards so that the heel of each hand rests

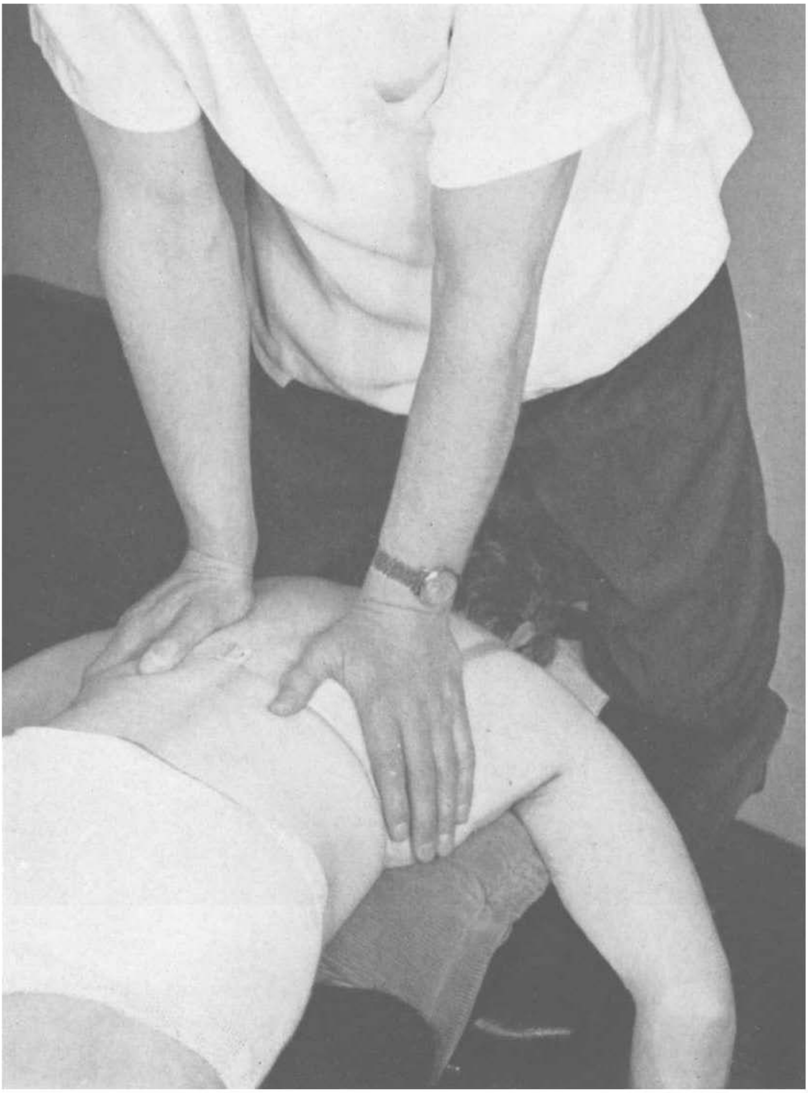


FIG. 96

on the angles of the ribs and his fingers spread laterally across the scapulae and chest wall. The operator must keep his elbows fully extended. The patient now breathes deeply and during expiration the operator leans more weight and gently springs the ribs, the object being to create a separational stress at the costo-vertebral joints.

FIG. 97

(6) *Articulation.* FIG. 97

The patient is seated with her hands clasped behind her neck. The operator stands facing her slightly to her right and fixes her right knee with both his thighs to prevent her from sliding about. He reaches round below the patient's arms to apply pressure to the angles of the ribs with a hand on each side, the tips of the fingers being arranged along the course of the rib above the restriction. Then, using his arms against the patient, he can create sidebending and extension of the torso, thereby causing movement of the ribs.

SPECIFIC RIB TECHNIQUES

For the purposes of technique, the ribs can conveniently be divided into three groups: 1st and 2nd ribs, 3rd to 9th ribs, and 10th, 11th and 12th ribs. These divisions are convenient because different mechanical factors are operative and therefore different types of leverage are required in the three areas. The 1st and 2nd ribs are separated off because of the attachments of the scaleni muscles, while the 10th, 11th and 12th ribs are merely attached to one vertebra instead of two as is the case of the middle group of ribs.

As discussed in Chapter 2, a rib may be restricted in its range of movement because of intercostal muscle spasm or because the intervertebral joint associated with the rib is also in lesion. The majority of individual rib lesions are in approximation—the lower rib is approximated to the one above and the rib appears to be everted so that the lower margin is more prominent. This implies a position of relative inspiration and therefore *restricted expiration*. We should make use of this point when applying specific separational techniques. When an expiration-restricted lesion is found, we should make our thrust at the point of maximum expiration with the object of increasing that expiratory range. Similarly, with an *inspiration-restricted* lesion, we find the rib tends to be approximated to the rib below and fixed in a relative position of expiration. Such lesions should be corrected at the point of full inspiration. In practice, this differentiation is a refinement of technique, and separational thrust are applied both at the point of full inspiration—thrusting upwards on the upper rib, and at the point of full expiration—thrusting downwards on the lower rib. The main objective is freedom of movement at the costo-vertebral and costo-transverse joints and unless the intercostal muscles have not become fibrosed and shortened then the relative positions of the two ribs will be restored.

Specific Techniques for the 1st and 2nd Ribs

(1) *Elevated 1st Left Rib.* FIG. 98

With the patient prone and the operator standing at the top of the table, he places his left pisiform bone on the angle of the patient's 1st left rib. The patient rests her chin in the mid line while the operator places the palm of his right hand on the patient's left cheek with his fingers spread

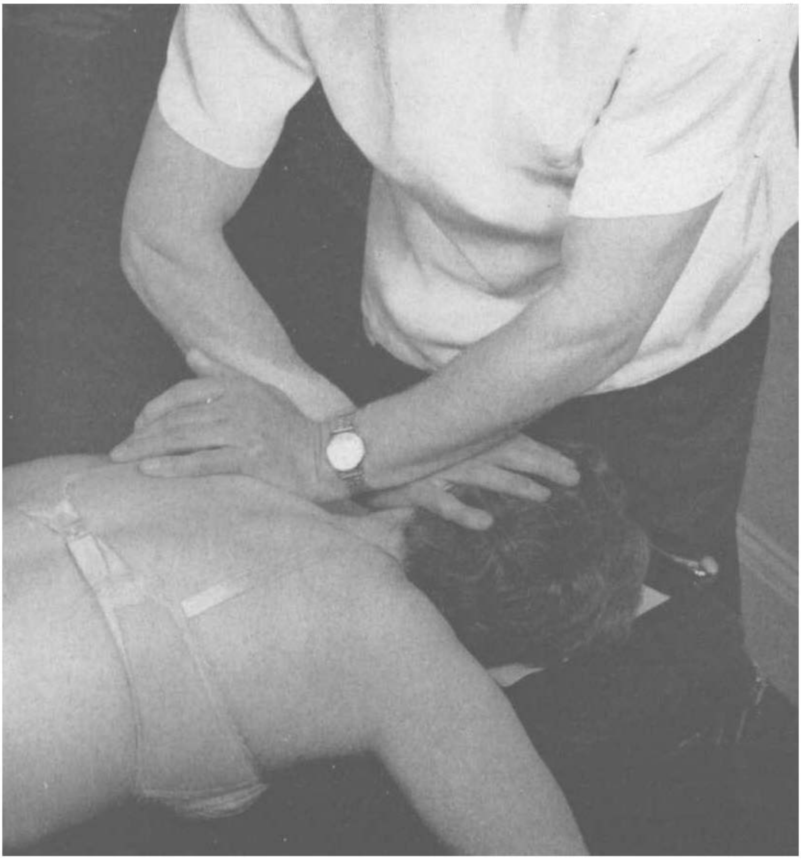


FIG. 98

across her ear and scalp. The patient's head is now sidebent to the right and rotated to the left to lock the cervical column. Correction is by an increase of thrust of the operator's left hand downwards and forwards against the stabilizing effect of the right hand.

(2) *Elevated 1st Right Rib.* FIG. 99

The patient is sitting; the operator, facing her back, then places the radial border of his right index finger against the angle of her 1st right rib. The operator places his left hand over the patient's vertex and rotates her head to the left and sidebends her neck to the right using sufficient rotation, sidebending and backward bending to lock the cervical area and to bring the localization of forces to the 1st right rib. The operator's right elbow

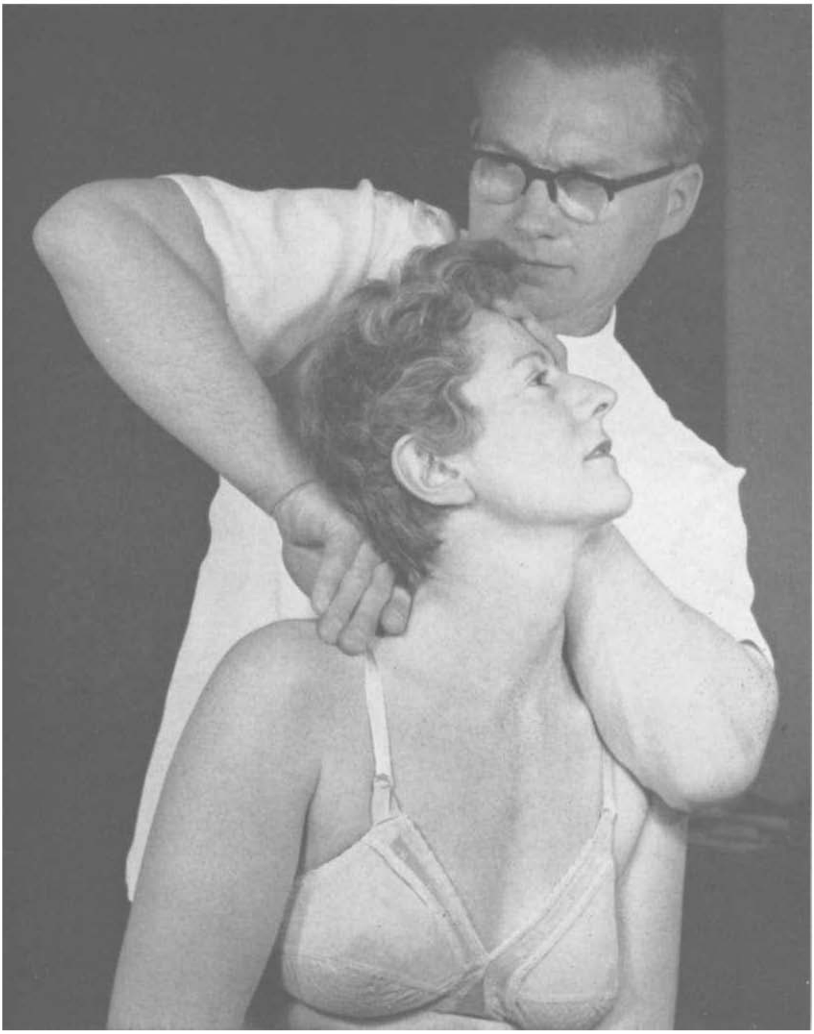


FIG. 99

must be high so that he can thrust downwards and forwards through his index finger to the costo-vertebral joint.

(3) *Elevated 1st Right Rib.* FIG. 100

With the patient prone and resting her chin to keep the neck in extension, the operator, on the left side of the patient, places his left hypo-thenar eminence firmly against the patient's right 1st rib, his right hand passes

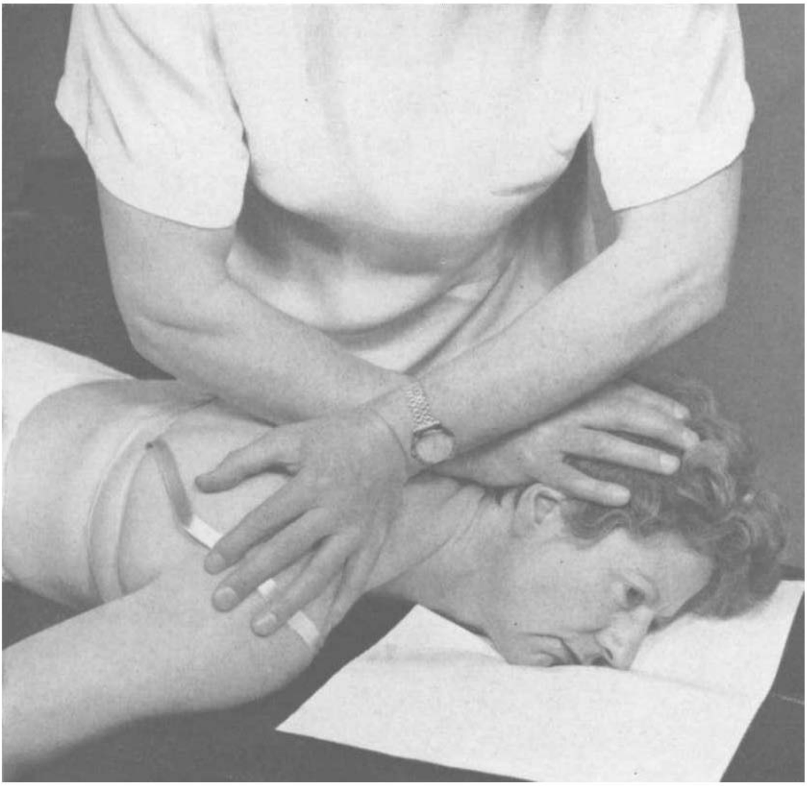


FIG. 100

under his own left forearm so that the palm of his right hand and fingers lie against the right side of the patient's head and neck. In this way the patient's head is rotated to her right and sidebent to her left. The correction consists in a sudden increase of the extension and sidebending by the operator's right hand and a sharp thrust with his left hand. There is apposition of the operator's two wrists and they reinforce and strengthen each other. N.B. Tests should be done with the chin in different positions in order to make sure of the tension and correct amount of sidebending.

Specific Techniques for the Middle Group of Rib Lesions

In this group of ribs from the 3rd to the 9th, we can use respiration as an aid in correction. Ribs tend to be restricted in inspiration or expiration. If in inspiration, we should obtain the help of the patient and encourage

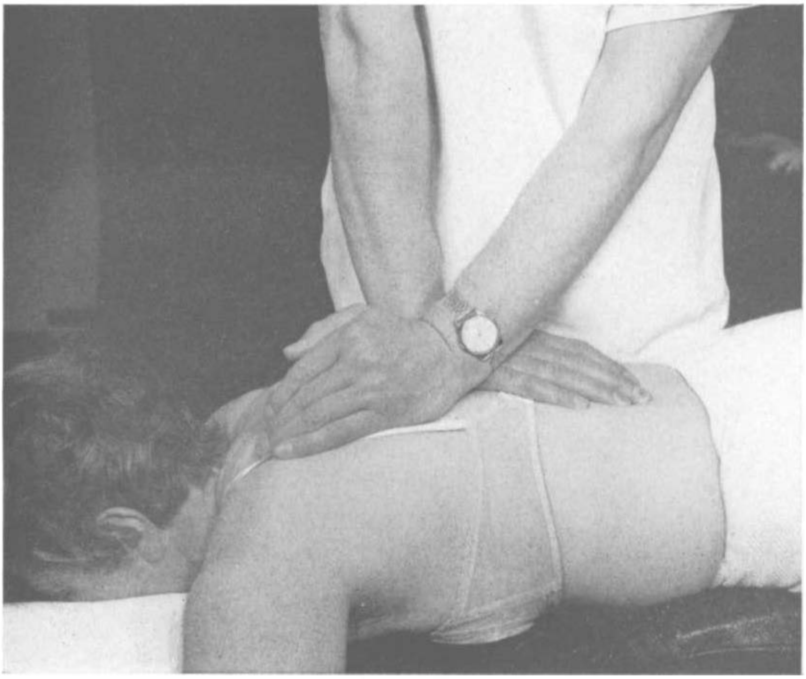


FIG. 101

release of inspiration by making our adjustment at the position of maximum inspiration. Alternately, with restriction of expiration, we need to make our adjustment at the maximum point of expiration.

(1) *Inspiration-restricted 6th Left Rib.* FIG. 101

With the patient prone, the operator stands on her right side and places the pisiform part of the left wrist against the lower border of the 6th rib at its angle. The pisiform part of the right wrist rests on the right transverse process of the 6th thoracic vertebra, the fingers pointing towards the patient's feet. Firm pressure is directed upwards towards the patient's head with the left hand and vertically downwards with the right hand followed by a short rapid thrust in these directions simultaneously with the two hands.

To correct an *expiration-restricted lesion*, the hands should be reversed so that the right hand rests on the upper border of the 6th rib and the left hand on the transverse process of the 6th thoracic vertebra, directing a downward force towards the feet upon the rib and a vertically downward force on the transverse process.

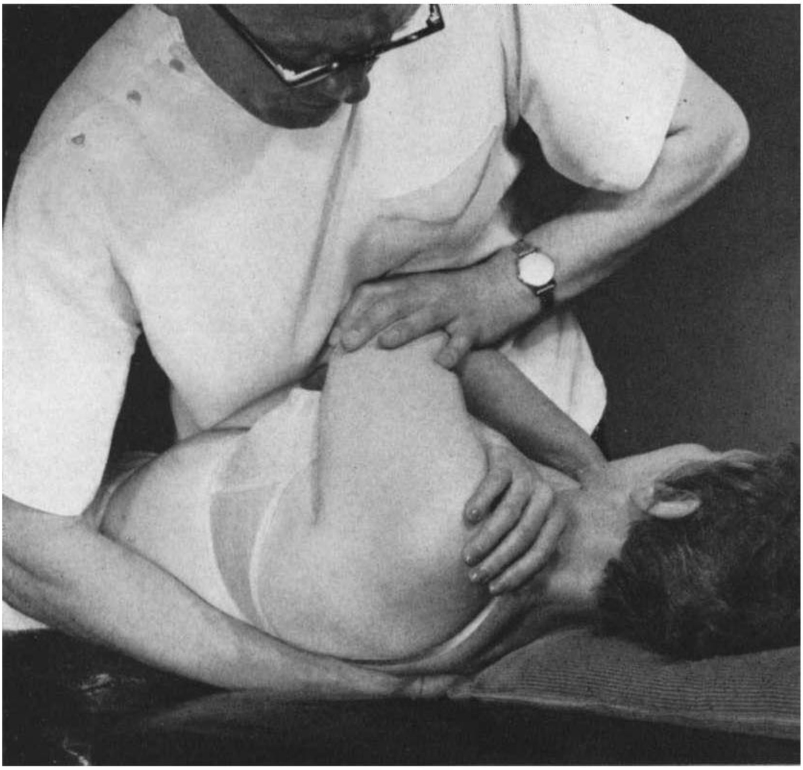


FIG. 102

(2) *Technique for 6th Left Rib.* FIG. 102

An alternative method is with the patient supine. The patient's arms are crossed over her chest so that her fingers clasp opposite shoulders and her elbows approximate one above the other. The operator, standing on the right side of the patient, rolls her a little towards himself with the left hand, clenches his right fist firmly, reaches over the patient and places the clenched fist on the plinth in such a way that the angle of the 6th rib is resting on the thenar eminence, the knuckles of the fist resting on the plinth. The operator leans over the patient, grasps her elbows in his left hand and rolls the patient away from him until the weight of her thorax is felt to be balanced on his clenched fist. A slight increase of pressure vertically downwards with his chest and hand will then cause separation of the 6th costo-transverse joint. (At the moment of separation the fist may be rocked slightly on the knuckles in order to direct the lesioned rib upwards or downwards as required.)

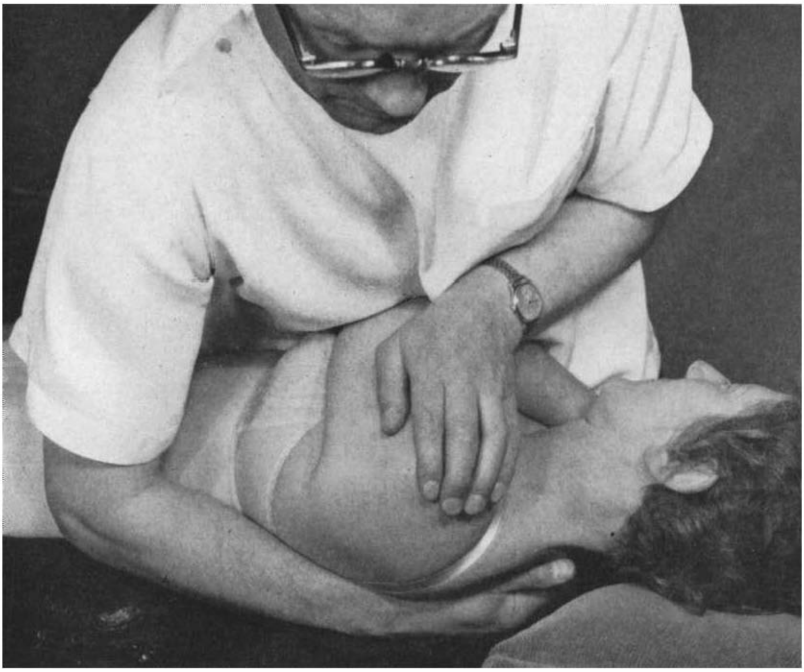


FIG. 103

(3) *Expiration-restricted 5th Left Rib.* FIG. 103

The patient should lie supine and place her left hand behind her neck, or on her right shoulder, keeping the elbow approximately over the angle of the 5th rib. The operator stands at the patient's right side and using the leverage of her left elbow rolls her towards him so that the angles of the ribs become evident on the left side. The operator places his right thenar eminence on the angle of the 5th rib and uses this as a fixed point to effect a separational stress between the 4th and 5th left ribs. The operator rolls the patient back into the supine position without losing his fixation on the 5th rib. The operator's left arm and chest are now used to apply a downward thrust on the patient's left arm. This thrust is given at the point of maximum expiration in order to force the final range of expiration which was previously restricted.

A similar technique is used for inspiration restriction but the downward thrust is given at the point of maximum inspiration. The patient may well expire on receiving this thrust, but so long as the expiring is only respiratory, all will be well!

The position of the patient's left elbow is found as a preliminary to the

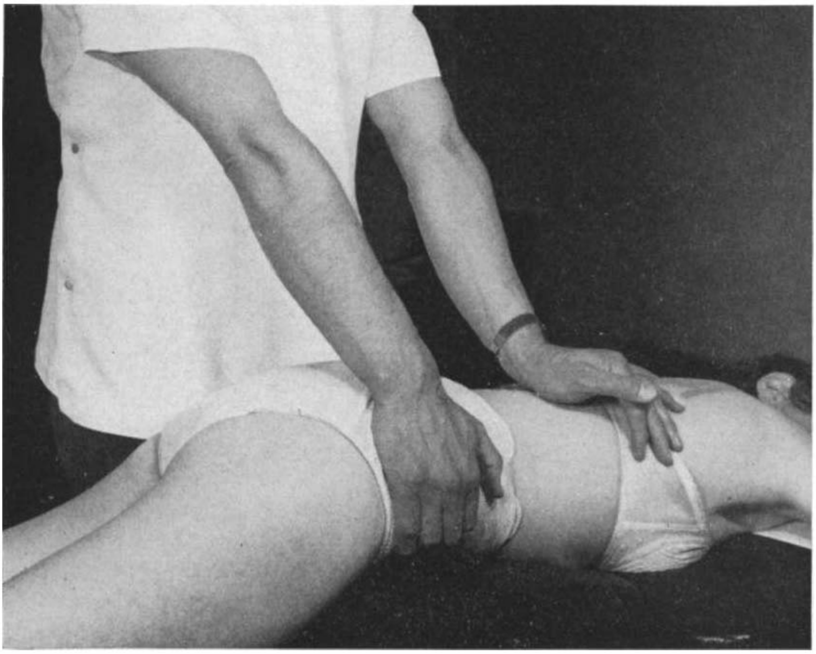


FIG. 104

above technique by altering position slightly, palpating the while for the development of tension at the angle of the rib.

Lower Group of Rib Lesions

In this group of ribs, the 10th, 11th and 12th, we are dealing with very freely movable bones. In addition to the pump-handle and bucket-handle type of movement, a purely lateral movement occurs and the heads of the ribs articulate with their own vertebral body and transverse process only. They do not articulate with two vertebral bodies as do the ribs above. Furthermore, there is such a wide range of movement in the thoracico-lumbar group of vertebrae that the ribs have to move equally freely, secondary to torso movement. The *last rib* is held down by the attachment of the quadratus lumborum muscle and it is unusual to get anything other than inspiration restriction at this rib.

(1) *Technique for 12th Rib.* FIG. 104

With the patient prone, the operator, on her left side, reaches across with his right hand to grasp the patient's right hip region—a convenient

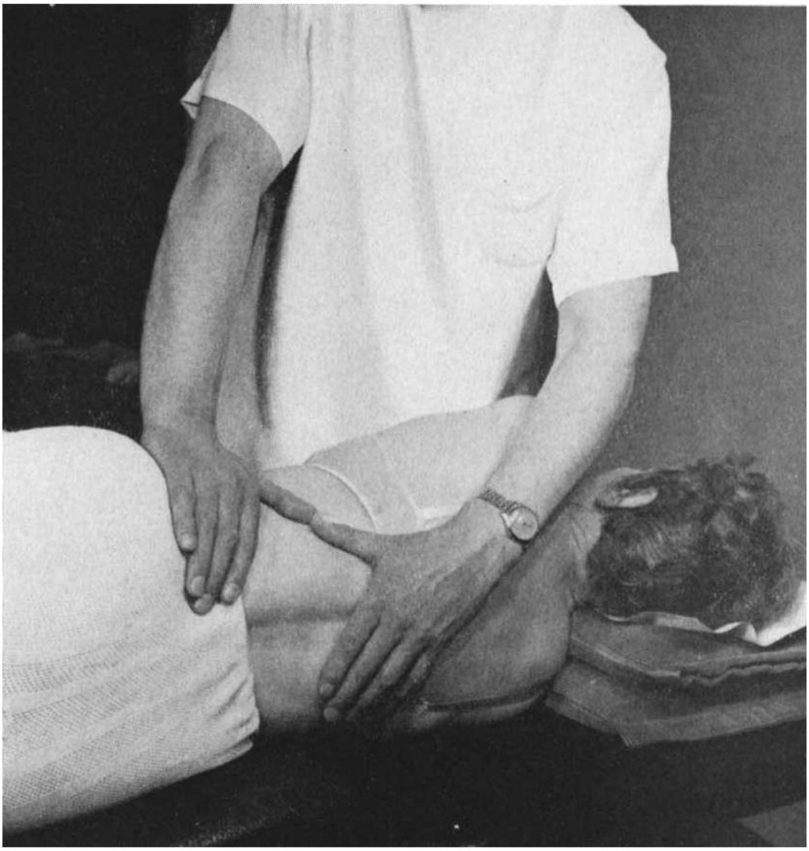


FIG. 105

grip is with the fingers curved round the anterior superior iliac spine. The operator places the heel of his left hand on the angle of the lesioned rib, using it as a fixed point while rotating the lower trunk to the right by elevating the right side of the patient's pelvis. The operator's left hand thrusts upwards and outwards on the lesioned rib. It virtually causes a gapping of the costo-transverse joint. With this technique it is not usually necessary to combine respiration with the thrust but, if difficulty occurs, then the thrust can be given at the point of full expiration.

(2) *Expiration Restriction.* FIG. 105

The patient lies on her right side, her left arm reaching upwards and

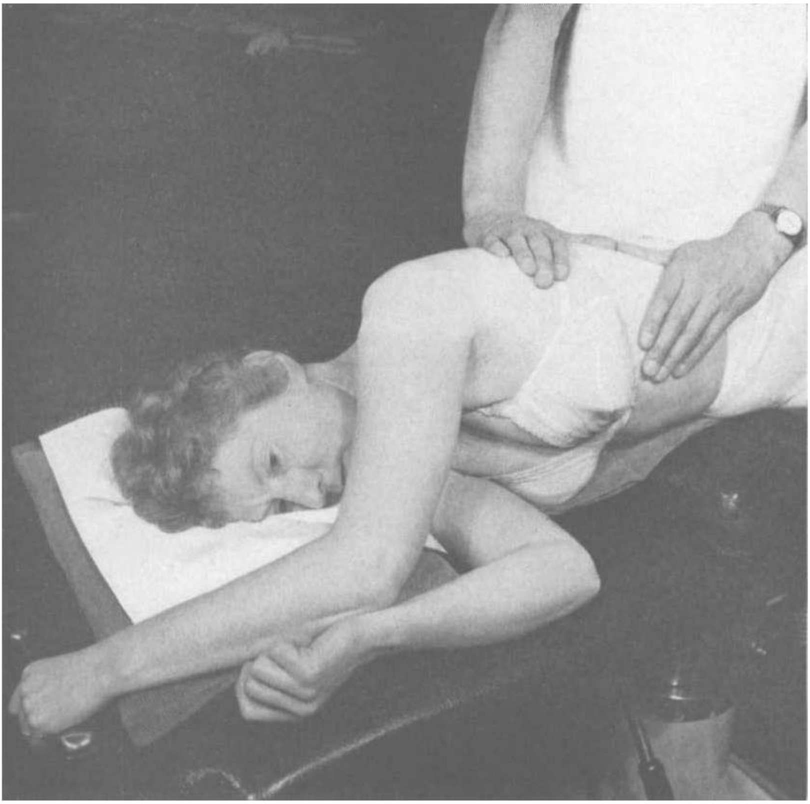


FIG. 106

grasping the top of the plinth while her left leg rests behind her right leg. This places a considerable separational stretch on the lower left ribs. The operator faces the patient and uses both hands to fix and thrust on the affected rib, the tips of the thumbs are placed on the rib in the mid-axillary line and are allowed to rest together with the thenar eminences along the whole course of the rib. The patient expires to the full and at this maximum possible stretch a thrust is directed caudally to break fixation.

(3) *Inspiration Restriction.* FIG. 106

The patient is placed as in the above technique (2). The operator stands behind the patient and spreads his thumbs along the inferior border of the lesioned rib. At the point of maximum inspiration the thrust is directed cranially to break fixation.

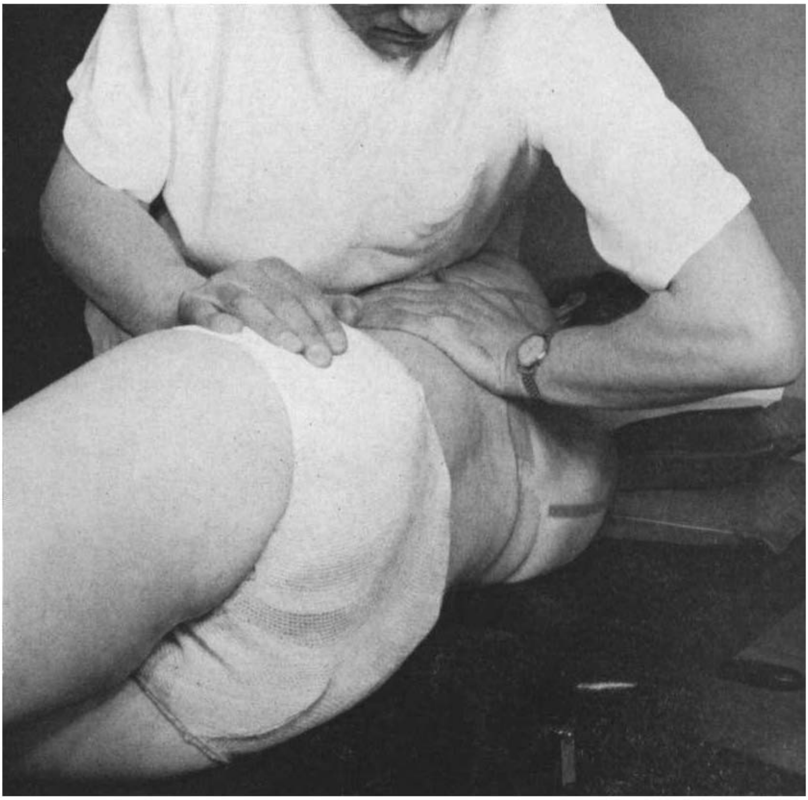


FIG. 107

(4) *Costo-vertebral Restriction.* FIG. 107

The patient lies on her right side, her left hand reaching upwards and her left leg lying behind the right. The operator, facing her, places his right hand on her left iliac crest. He leans well over the patient so that his left hypothenar eminence can be applied to the lesioned rib; the operator's left elbow is pointing away from him so that a forward and upward thrust can be exerted on the rib. The pelvis is steadied by the right hand. This can be used in inspiration- or expiration-restricted lesions.

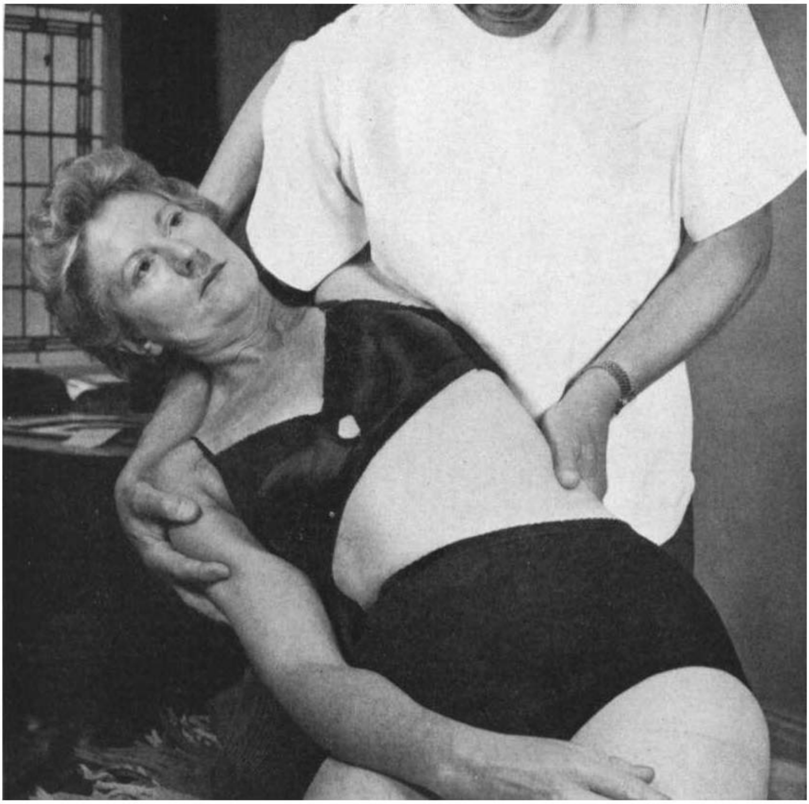


FIG. 108

(5) *Expiration Restriction.* FIG. 108

With the patient sitting, the operator stands behind her and asks her to place her left hand behind her neck while he places his flexed right knee on the table close to her right side to support the right side of her body. The operator then leans forwards under the patient's left axilla and threads his right hand through the patient's crooked left elbow from anterior to posterior, then across her lower neck to grasp her right shoulder with his right hand. He is now in a good position to sidebend the patient to the right over his own right thigh and this puts a good stretch on the left lower ribs. The operator's left outstretched thumb and index finger are then applied to the patient's affected rib and thrust given downwards to release a restricted-expiration lesion.

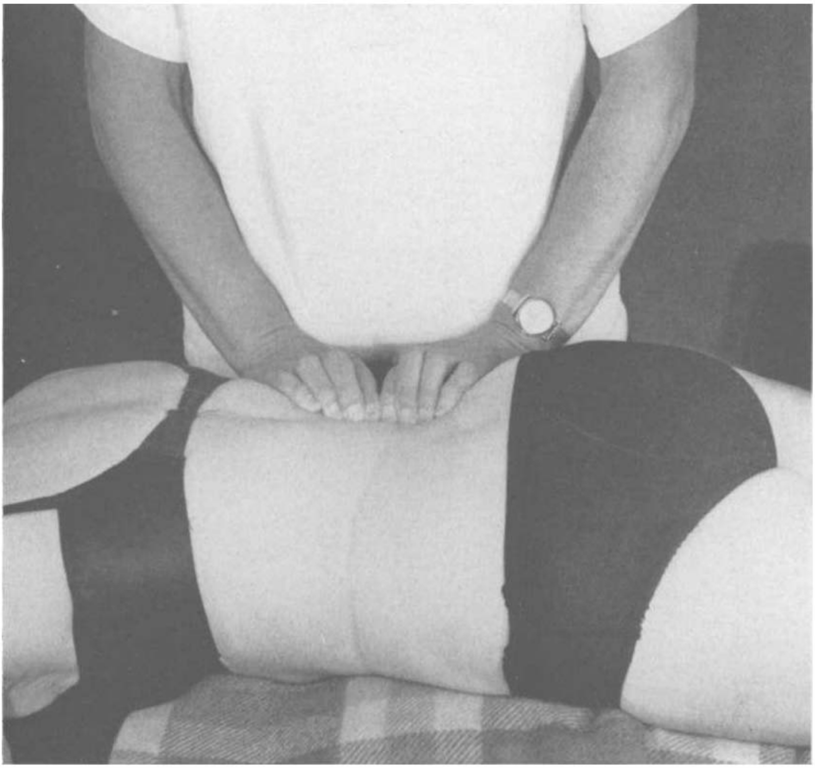


FIG. 109

The Lumbar Region

SOFT-TISSUE TECHNIQUES

(1) *Kneading the Paravertebral Muscles.* FIG. 109

With the patient prone and the operator on her left side, he places the heels of both hands on the erector spinae mass of muscle on the right of her spinous processes. He then kneads the muscles in a lateral direction to stretch them at right angles to the muscle belly. One hand may be used over the other to reinforce the action when a deeper pressure is required. The operator may then pass round to the other side of the table to work on the patient's left erector spinae muscle mass or, still working from the right-hand side of the patient, he may use his finger-tips in a row just lateral to the left side of the spinous processes and using a pulling motion to achieve the same type of stretching of the muscle at right angles to its fibres.

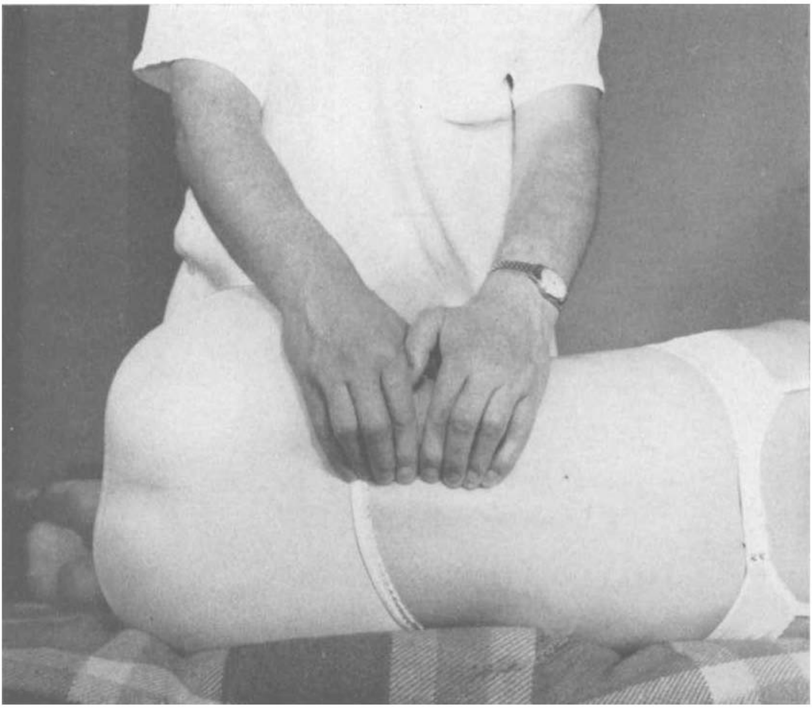


FIG. 110

(2) The patient lies prone and the operator places his two thumbs adjacent to the spinous processes on opposing sides and using a circular motion upwards, outwards, downwards and inwards, emphasizing the outward motion to stretch the muscles transversely.

Where local muscle tension can be palpated, the operator may concentrate his attention on this site, using his thumbs in a transverse direction to the contracted fibres.

(3) *Stretching the Left Erector Spinae Muscles.* FIG. 110

With the patient on her right side and the operator facing her, he flexes her knees and applies pressure with his thighs against the knees to force the lumbar spine into flexion. This puts some stretch on the erector spinae muscles, the operator leans over and grasps the patient's left erector spinae mass with his fingers ranged in a row just above the spinous processes. Again a kneading action in a transverse direction is achieved while the erector spinae muscle is under a stretch. The degree of tension on the muscles may be varied by altering the pressure on her knees. In fact a

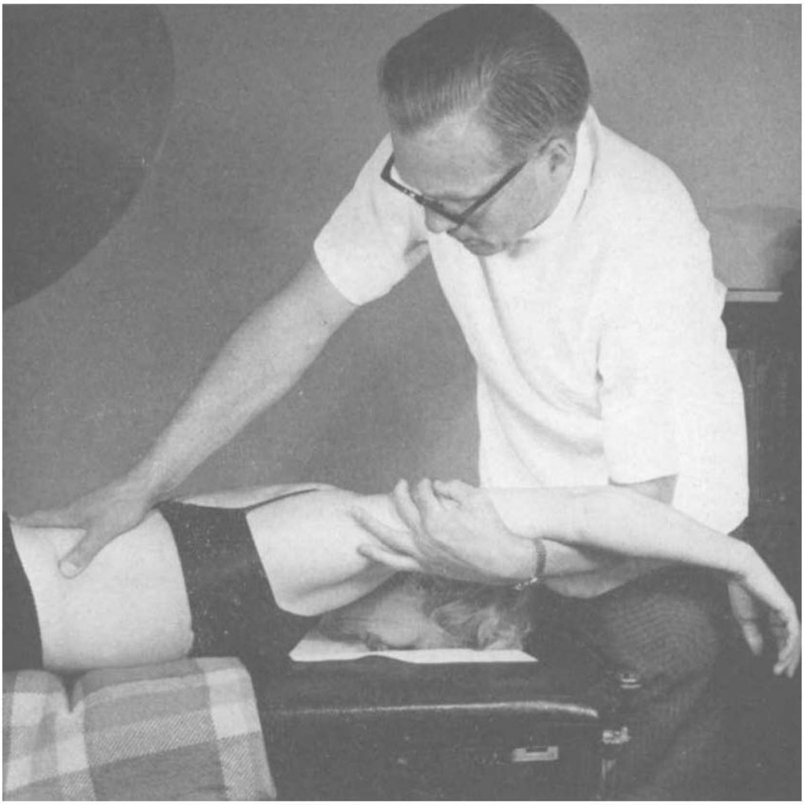


FIG. 111

rhythmic motion against the knees, counter-balanced by the pulling action on the erector spinae muscles, is an effective way of releasing tight muscles here. This technique also stretches the quadratus lumborum but this muscle is still more effectively stretched with technique number (5).

Inhibition can be effectively done in this position using sustained pressure of the finger-tips. Inhibition can also be done with the patient prone using the normal method (p. 89), but still more pressure can be used by applying the heel of the hand over an area of muscle.

(4) *Stretching the Latissimus Dorsi.* FIG. 111

It is sometimes desirable to relax and stretch the latissimus dorsi muscle. For this technique the patient lies prone, and the operator stands at the head of the plinth and grasps the patient's right crooked elbow in his left crooked elbow, using his left forearm to support her right arm. The

FIG. 112

operator then leans well over and applies some counter pressure along the course of the latissimus dorsi with his right hand while stretching her left arm by strongly abducting her shoulder.

(5) *Stretching the Quadratus Lumborum.* FIG. 112

With the patient on her right side and the operator facing her, he applies both hands to the left erector spinae muscle above the spinous processes, the tips of his fingers being arranged in rows. Then his right forearm and elbow rest on the patient's left iliac crest and his left forearm and elbow on her left lower ribs. By applying outward pressure with the two forearms the lumbar spine is made to arch upwards, creating a stretch on the patient's left erector spinae and quadratus lumborum muscles. This stretch is further increased by pulling upwards with the fingers on these muscles. A rocking motion helps in relaxation of these groups of muscles.

FIG. 113

ARTICULATORY TECHNIQUES IN THE LUMBAR REGION

(1) *Sidebending.* FIG. 113

The patient lies prone on the table with the operator standing on her left side, facing and on a level with the pelvis. The operator flexes the patient's left knee and, reaching round her leg, grasps her left thigh with his right hand and holding her limb against his body he abducts the thigh at the hip to create leverage on the pelvis and so sidebends the lumbar area to the left. He then applies pressure against the spinous processes, with his left thumb against the left side of the spinous processes. The idea is to create as much sidebending as possible in the joint immediately below the one fixed by the operator's thumb.

(2) *Sidebending.* FIG. 114

The same position as above is used but in this case the operator

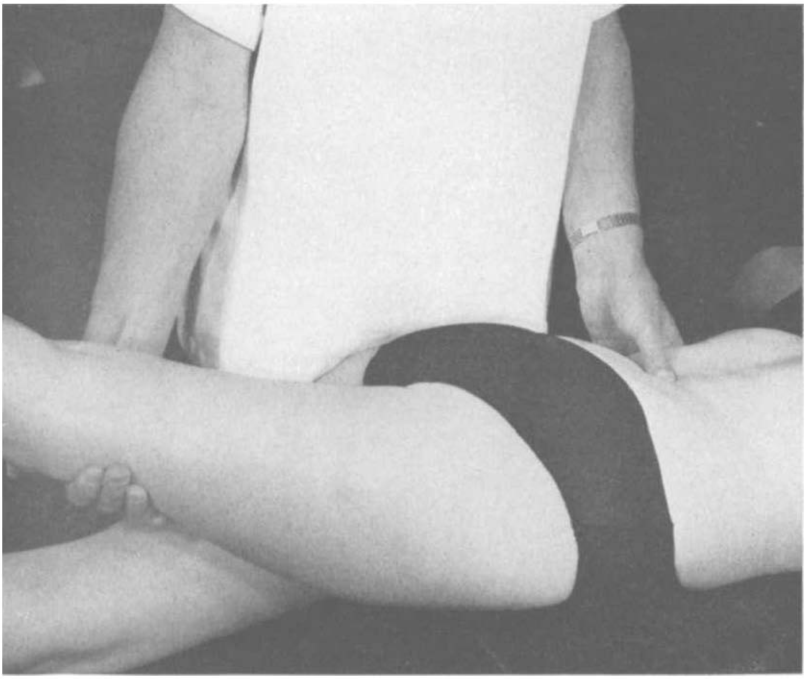


FIG. 114

reaches across to the patient's right thigh, grasping the thigh with his right hand just above the patella. (Be careful not to hold the limb by the patella, for this is unpleasant for the patient.) The patient's knee remains extended. The operator then adducts the patient's right thigh across and above her left thigh. He applies counter pressure to each of the spinous processes with his left thumb on the left side of each spinous process, thus forcing a left sidebending-rotation movement in the lumbar area. This position can be utilized to create backward bending in the lumbar area. In this case the adduction is replaced by pure extension at the hip.

(3) *Sidebending*

Both legs used in unison can be an even more effective lever to producing sidebending or rotation or backward bending in this prone position, but it requires a good deal more physical effort on the part of the operator. Standing on the left side of the prone patient, the operator reaches under both thighs with his right forearm and lifts them into any position he likes, again using counter pressure with his left thumb successively on each spinous process.

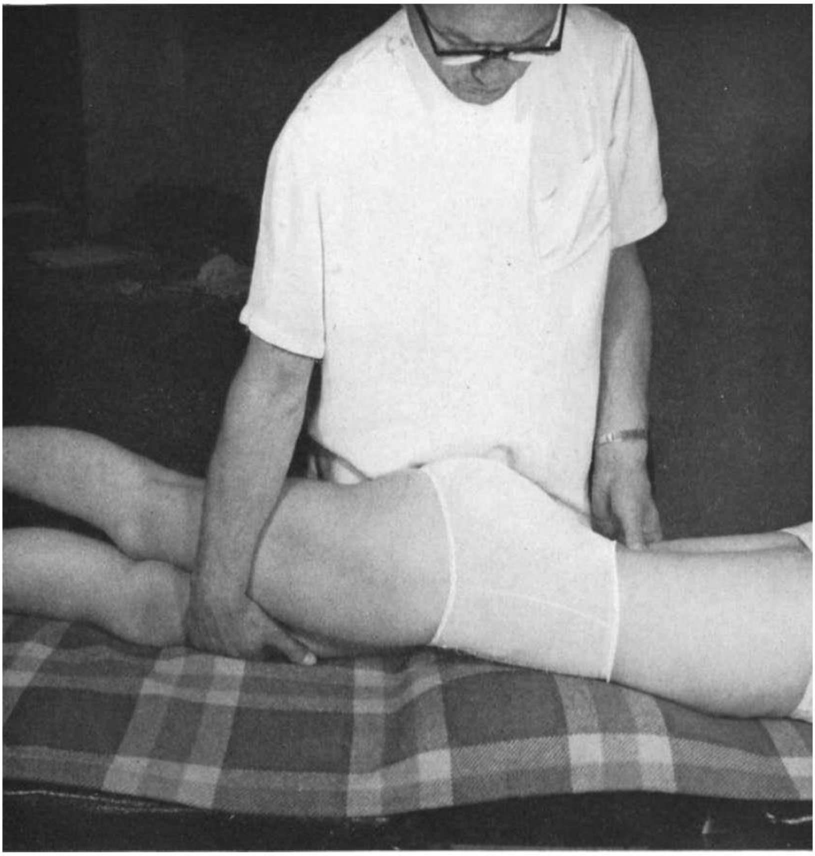


FIG. 115

(4) *Rotation.* FIG. 115

To create rotation in this position, place the patient's right thigh above and across her left thigh, then reach over the thighs with your right hand grasping the patient's left thigh anteriorly so allowing your right forearm to rest upon her right thigh. The two crossed thighs are then brought near to the edge of the plinth but are checked from going right over the edge by your right thigh. You are now in a position to rotate the pelvis to the right by pressing against her right thigh with your right forearm—rolling the patient as it were and pivoting on your right knuckles. This technique does not call for as much muscular effort on the part of the operator as is required in the previous technique.

FIG. 116

(5) *Flexion.*

With the patient supine, the operator, standing on her right side, flexes both her knees and hips by placing his right forearm under both her knees. His left hand lies flat under her lumbar spine, the fingers palpating the flexion and assisting fixation of the spinous processes while the flexion is going on. Sidebending can be incorporated into this movement while in flexion.

(6) *Flexion.* FIG. 116

More forcible flexion can be achieved by flexing both hips and knees and the operator resting his right pectoral area on her knees, reaching round with his right hand to her left loin. A powerful flexion movement can be exerted at each level of the lumbar spine in this way.

FIG. 117

(7) *Rotation.* FIG. 117

With the patient sitting astride at the end of the table, the operator stands facing the patient and to her right side. The operator asks the patient to fold her arm across her chest and lean forward. The operator places his right arm under the patient's folded arms, reaches across her chest, and firmly holds her left shoulder. The patient is now turned slightly to her right and leans further forwards so that her entire trunk is supported on the operator's right arm. With his left thumb the operator fixes each lumbar vertebra in turn while, at the same time, he swings his trunk around to the right. This procedure, which can be repeated on both sides, stretches each lumbar articulation to its full extent in rotation and extension. There is some tendency for the patient to slip forwards, so the operator needs to fix her right knee by pressure against it with his right thigh.

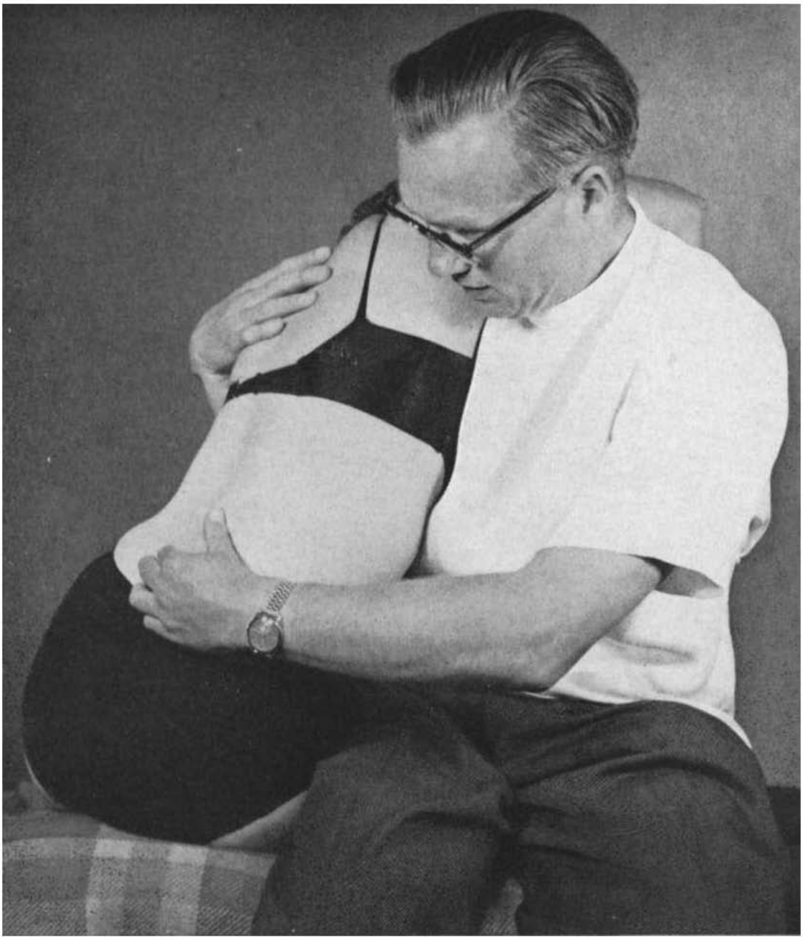


FIG. 118

(8) *Rotation with Traction.* FIG. 118

To obtain some traction and articulation at the same time, have the patient seated on the plinth and sit yourself beside her but facing opposite ways so that your right side is against her right side. Ask the patient to hold her own right wrist with her left hand to stop the arms flopping about. Reach under her right axilla with your right shoulder. Then put your right arm round her trunk and hold her left scapular region. Apply pressure against her lumbar spine with your left hand. In this position it is easy to lift the patient almost off the table and, at the same time, to rotate the trunk to the right or to sidebend her to the left or a combination of both ranges of movement.

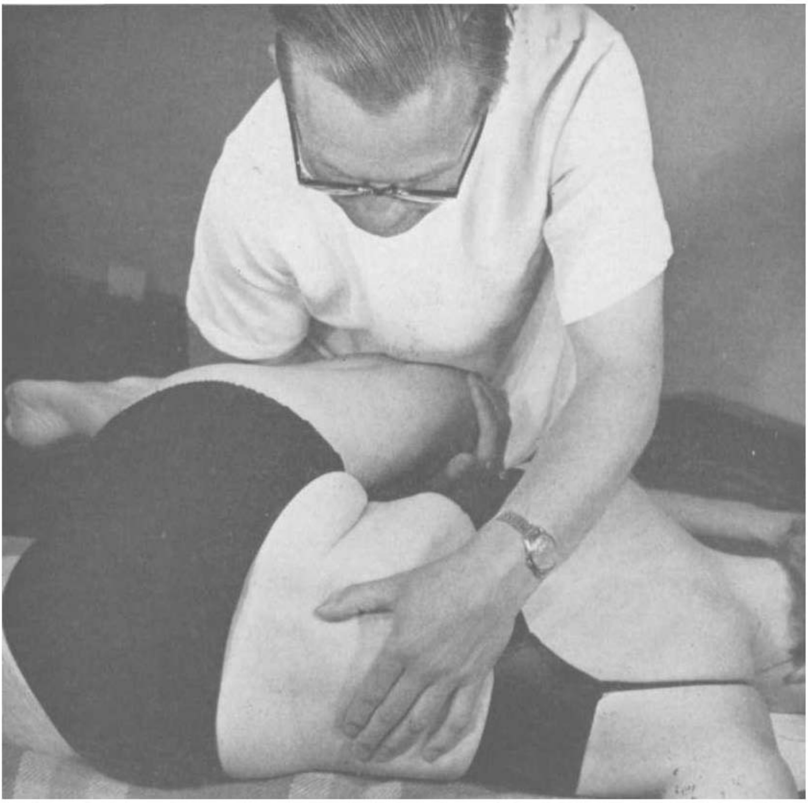


FIG. 119

(9) *Extension.* FIG. 119

With the patient prone, the operator stands on her left side, grasping her left flexed knee with his right hand. He brings the knee over the side of the table to facilitate flexion of the hip to about a right angle. The patient's left knee can be additionally supported by the operator's right groin. The operator bends well over and thrusts upwards along the thigh to force the pelvis backwards and so force the lumbar spine into extension and rotation to the left.

Counter pressure can then be applied by the operator's left thumb against the spinous processes in progression from 5 L. to 1 L.

FIG. 120

SPECIFIC TECHNIQUES FOR THE LUMBAR SPINE

Many of the introductory comments which precede the description of specific thoracico-lumbar manipulations are also applicable to the specific techniques for the lumbar spine (*see* p. 157). The ranges of movements normally possible in the lumbar area are to be found listed in the Appendix. Maximum movements of combined forward and backward bending occur at 3-4 L. When analysed into component parts forward bending increases from above downwards but the lumbo-sacral movement is least. Backward bending increases from above downwards right down to the L-S joint. Sidebending is freest at 3-4 L. and rotation is very restricted. The apophyseal facets are almost vertically placed in a sagittal plane and within a few degrees the approximation of facets checks further

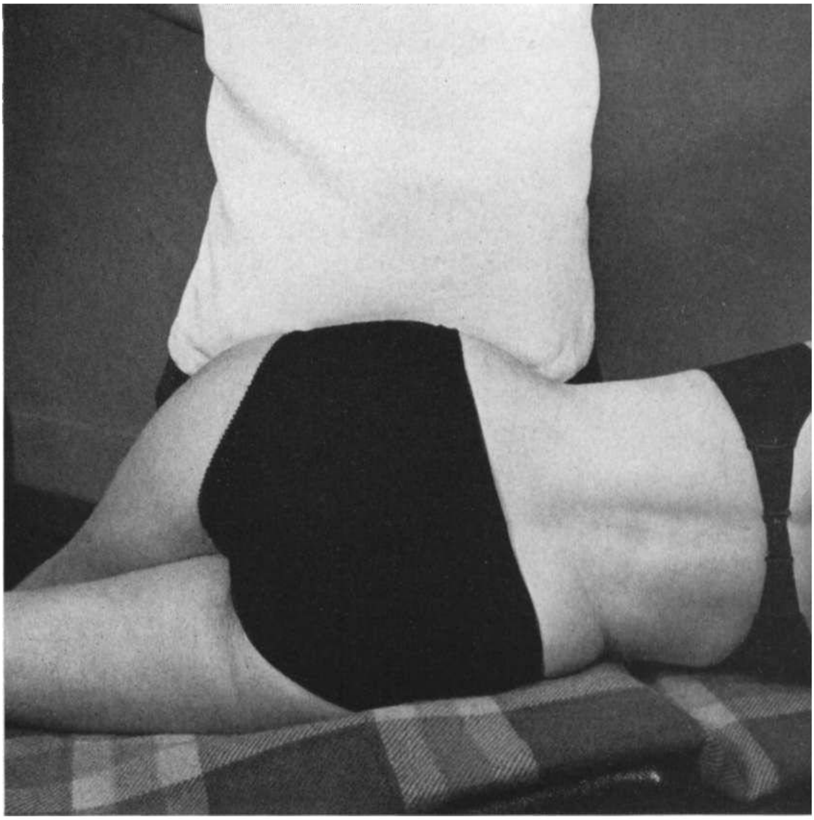


FIG. 121

rotation. When combined with sidebending the range of movement is fairly free. This combined movement is limited by the annulus fibrosus of the intervertebral disc. From a neutral, or from a backward bending position, sidebending and rotation occur to the opposite sides, whereas from a position of forward bending, sidebending and rotation occur to the same sides. Because of this, we must arrange our combined forces in the appropriate manner to achieve facet apposition locking. As indicated on p. 158 there is a position of slight forward bending when sidebending or rotation occurs as pure movements so that slight forward bending is the starting position for most lumbar corrections. Much less digital pressure is required on the spinous processes of the lumbar area because facet apposition locking is so much more effective than in the thoracico-lumbar area. A position of full backward bending causes bilateral facet apposition locking. Such locking is used mainly in the manipulation of the sacro-iliac joints.

Sidebending to the Left. FIG. 120

When a patient is lying on her side there are two useful ways of obtaining additional sidebending using leg leverage. For example, if we have the patient on her right side and we wish to create a sidebending to her left, we can flex her left knee fully, partly flex her left hip and then force her left thigh into internal rotation by placing her flexed knee between the operator's thighs. This position tilts the pelvis caudally on the right and cranially on the left, forcing the lumbar spine into sidebending to the left and creating a concavity uppermost.

Sidebending to the Right. FIG. 121

If, on the other hand, we wish to create a sidebending to the right, i.e. with a convexity uppermost, while the patient is lying on her right side, then we allow the patient's left leg to fall over the side of the plinth, keeping her knee straight and the hip slightly flexed. In this position the weight of the left leg pulls the left side of the pelvis caudally and so tilts the pelvis to the left and the lumbar spine develops a convexity uppermost.

Neutral Position. FIG. 122

If we require as in most instances to make an adjustment from a position of slight forward bending using no sidebending at all, this can best be achieved by placing the patient's uppermost limb slightly flexed at the knee and hip so that her uppermost foot hooks behind her other knee. Such a position lends stability to the manœuvre and enables the operator to concentrate his attention on the degree of rotation required to localize tension on the joint in question. Sometimes a little more flexion is required than can be obtained with the patient's uppermost foot hooked behind the patient's other knee so that you will need to release the foot and bring the patient's uppermost knee into further flexion, until you feel some tension gathering at the joint in question. Flexion is particularly necessary where the patient has an increased lumbar lordosis, otherwise insufficient gapping is obtained to break fixation.

A further aid to the localization of forces in the lumbar area can be obtained by using the leverage of movement either from above or below. This means in practice that for upper lumbar lesions we rotate the torso on a relatively fixed pelvis whereas in lower lumbar lesions we rotate the

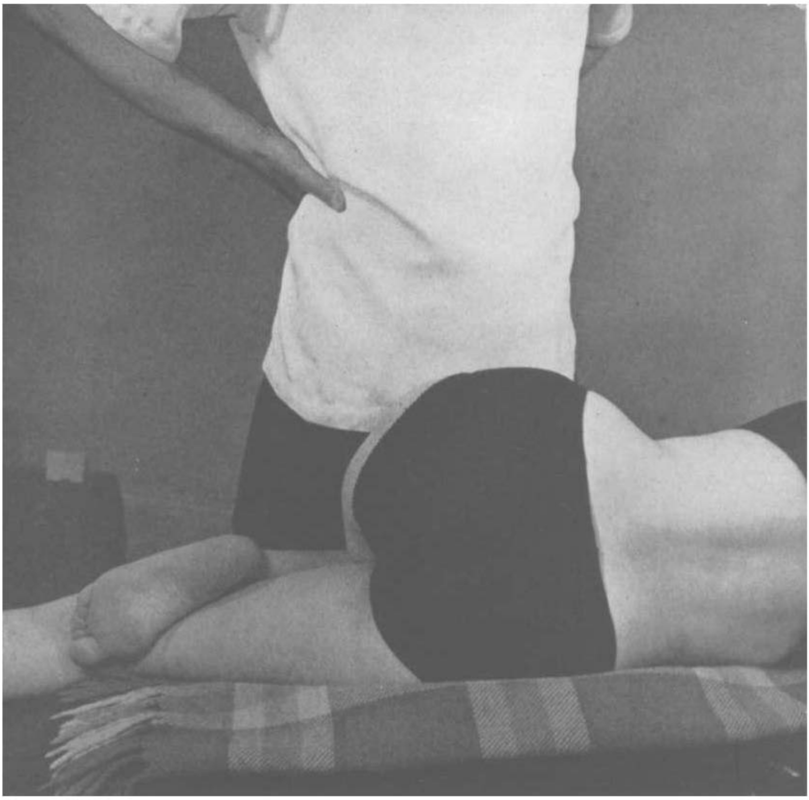


FIG. 122

pelvis on a relatively fixed torso, and for mid-lumbar lesions we co-ordinate the opposite rotations almost equally.

To explain this more fully, supposing we have a restricted rotation lesion to the right at 1–2 L., we place the patient on her left side, flex the lumbar spine from below upwards to reach 1–2 L. by using leg leverage, then we rotate the torso from above downwards until tension develops at 1–2 L. The lower lumbar area is held relatively fixed and forced rotation of the trunk to the right produces a *direct specific adjustment* of the right apophyseal joint of 1–2 L. The slight flexion and rotation causes a facet apposition locking of the left row of apophyseal joints and enables a gapping of the right row.

Then supposing we wish to make a direct specific adjustment at 4–5 L.

where there is restricted rotation to the left, we place the patient on her right side, hook her left foot behind her right knee to give a slight flexion at 4–5 L., then rotate the torso strongly to the left as far as 4–5 L., so causing facet apposition locking on the right row of joints. Hold this position firmly while you apply a forcible additional rotation of the pelvis forward on the left.

At 2–3–4 L. we can use combined torsional forces in opposing directions so that the peak of the torsion occurs at the restricted joint.

Regarding the lumbo-sacral joint, this is almost a law unto itself, partly because the range of movement is slight anyway, but also because there are so many anomalies there. As indicated in the Appendix there is a wide range of facet angles here from completely coronal to completely sagittal, and not infrequently the two facets are by no means symmetrical with each other. Further, the ilio-lumbar ligaments are normally quite strong and for all intents and purposes make the lumbo-sacral joint almost a syndesmosis with the sacrum, at least in sidebending and rotation if not in forward and backward bending.

If we wish to utilize the starting position of full forward bending to make indirect specific adjustments using ligamentous tension locking, we require to arrange the sidebending and rotation to opposite sides and, as this is not particularly easy in the side-lying position, this technique is mainly used in the sitting position and will be described (p. 207). Full backward bending on the other hand so locks the facets bilaterally that this starting position can only be profitably used for sacro-iliac corrections.

Specific Adjustments in the Lumbar Spine

The principles of adjustive technique in the lumbar area for rotation-restricted and sidebending-restricted lesions have been discussed above. Frequently the restrictions occur in combination but if the restriction is predominantly in sidebending there would need to be some emphasis on the sidebending component of the adjustment, and equally if rotation were predominantly restricted then there would need to be an increase of rotation in the adjustment. The most commonly used technique is now described for rotation-restricted lesions.

Rotation Restriction at 2–3 L. to the Left. FIG. 123

Place the patient on the right-hand side and face the patient. Flex her left knee until you feel a slight gapping of the 2–3 L. joint. Then rest her left flexed knee on the table and, if convenient, tuck her left toes above and behind her right knee. This position with the lower back at right angles with the plinth is held firmly while you pull the patient's right shoulder forwards in order to rotate the trunk to the left. Feel for the tension to develop down

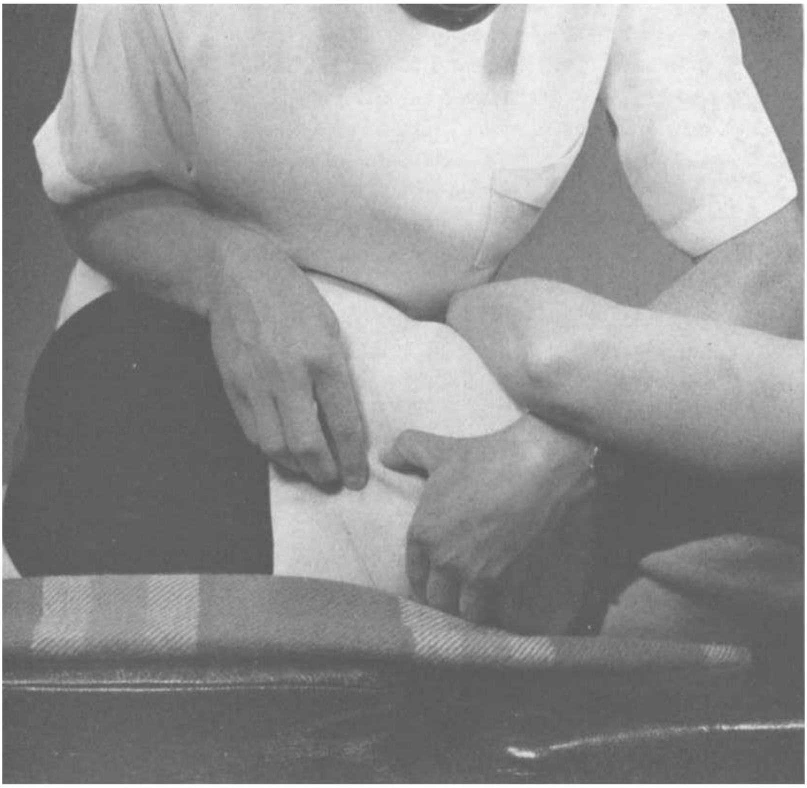


FIG. 123

to 2–3 L., then you have the starting position correctly. You then arrange for the patient's left forearm to rest on her left lower ribs so that her elbow is pointing backwards. Thread your own left forearm through the triangle thus created between her body and left arm so that the upper part of your left forearm can rest against the patient's left pectoral region. You use this place for applying a backward rotation force on her left shoulder to increase the torsion to the left. Your right forearm now rests across the patient's left buttock and you apply a strong fixation pressure with your right thumb and fingers on the spinous process of 3 L. Now by applying a backward thrust with your left forearm and a forward thrust with your right forearm, together with reinforcing pressure on 3 L., causes a gapping of the left apophyseal joint of 2–3 L.

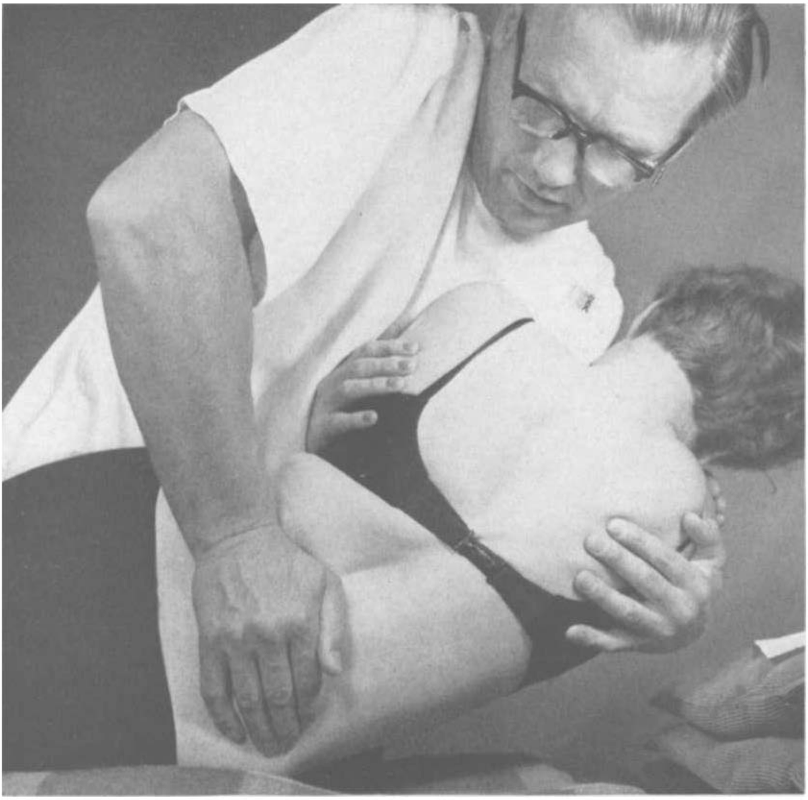


FIG. 124

Sidebending Restriction at 2–3 L. to the Left. FIG. 124

Have the patient, as in fig. 123, lying on her right side. Flex her left knee to cause slight gapping at 2–3 L. Then ask the patient to fold her arms so that she holds opposite shoulders with her hands. Reach under her right shoulder with your left hand and forearm so that you can elevate her trunk—that is, sidebend her to the left down to the 2–3 L. level. The right thenar eminence is now placed forcibly against the spinous process of 3 L. so that a vertically downward thrust can be applied at the same time as an increase of sidebending is effected by your left arm.

FIG. 125

Rotation Restriction at 3–4 L. to the Left. FIG. 125

With the patient sitting and arms folded, stand behind her and thread your left hand beneath her left axilla, reaching across her chest to grasp her right shoulder. Flex her trunk down to the point where you feel a slight gapping at 3–4 L. then apply your right thumb to the spinous process of 4 L. on the right. The adjustment is by pure rotation of the upper trunk to the left against the fixation of 4 L. by your thumb. It is as well to rotate gently at first until you feel the tension at 3-4 L. and then apply an extra rotation of the trunk and a thrust on 4 L. simultaneously. There is a tendency for the patient to slip and this can be countered by having an assistant to hold the patient's knees or having the patient sitting astride at the end of the table.

FIG. 126

Sidebending Restriction at 1–2 L. to the Left. FIG. 126

With the patient sitting and arms folded, stand behind her and reach across her left shoulder, resting your left axilla on the shoulder, then place your left hand under the patient's right axilla. You are now in a position to sidebend the patient to the left—as it were to buckle the spine with maximum sidebending at 1–2 L. Flex the spine to obtain slight gapping at 1–2 L. and then, pushing downwards with your left axilla on to her left shoulder and elevating her right shoulder with your left hand, you can exert a maximum sidebending strain at 1–2 L. reinforced by a thrust with your right thumb against the left side of the spinous process of 2 L. thrusting laterally to the right.

FIG. 127

Rotation Restriction at 2–3 L. to the Left. FIG. 127

With the patient sitting astride at the end of the plinth, stand on her left side facing her so that your left thigh is resting against her left knee. This acts as a stabilizer when rotating the trunk to the left. The patient's arms are loosely folded across her chest. The operator reaches with his left hand under her folded arms to grasp her right scapular region. The operator bends forward and instructs the patient to let her weight fall loosely on his left shoulder. It is important that the operator bends well forward so that he can take the whole weight of the patient's trunk across his shoulder (the operator requires good sound discs of his own for this procedure!). The operator flexes the lumbar spine down to 2–3 L. and then rotates the trunk to the left while holding firmly against the spinous process of 3 L. with the right hand. The adjustment is achieved by an exaggeration of these motions.

FIG. 128

Locking Technique in Flexion. FIG. 128

To utilize the starting position of full forward bending and a combination of sidebending and rotation to opposite sides, have the patient sitting with her hands clasped behind her neck, then stand behind and reach under her right axilla to clasp the patient's left arm. Now fix the vertebra below the restricted joint with your left thumb and strongly flex the lumbar spine, asking the patient to sag into the slumped position, then strongly sidebend the trunk to the left and rotate to the right, arranging your forces to be at their maximum at the lesion in question.

Forward-bending Restriction at 2–3 L. (*see* FIG. 83)

With the patient lying supine, stand on her right side and cross her right flexed knee over her left flexed knee. Then thread your right hand

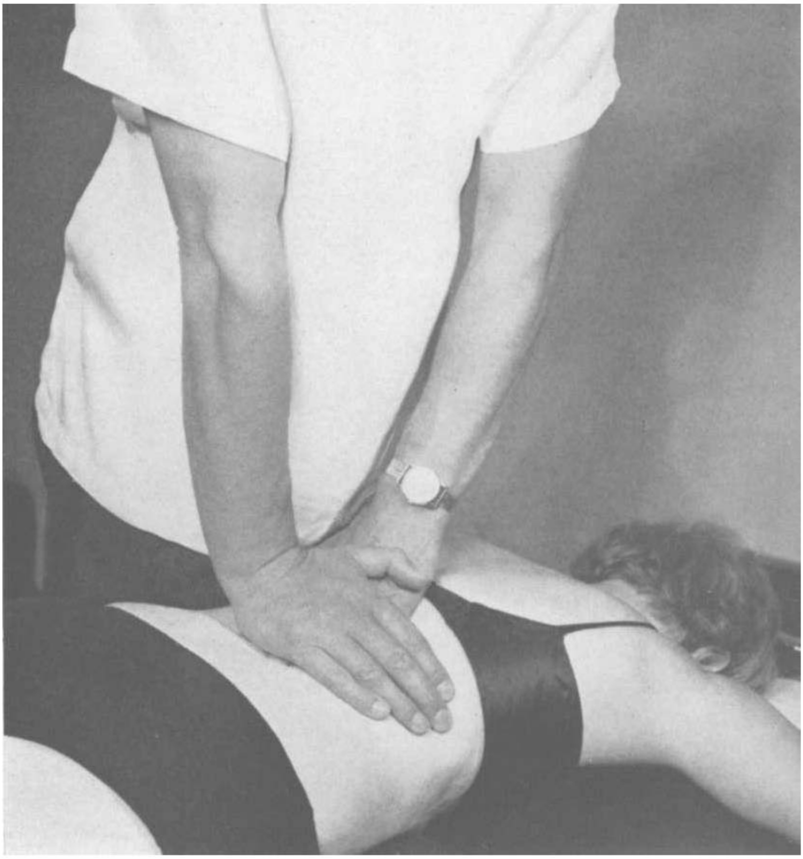


FIG. 129

between her legs from behind forwards so that your right hand can hold her right knee over the patella. With this commanding leverage roll the pelvis away from you so that you can insert your left hand under her lumbar spine to fix the spinous process of 2 L. Then roll her back over your flat hand—the hypothenar eminence resting on 2 L.—and then flex the hips, pelvis and lower lumbar vertebrae to gap the 2–3 L. joint. This technique uses ligamentous-tension-locking and must, of course, be avoided if a disc lesion is suspected.

Thrust Technique. FIG. 129

A direct vertical thrust can be applied to the lower of the two lumbar vertebrae in lesion when the patient is lying prone. The thrust may be

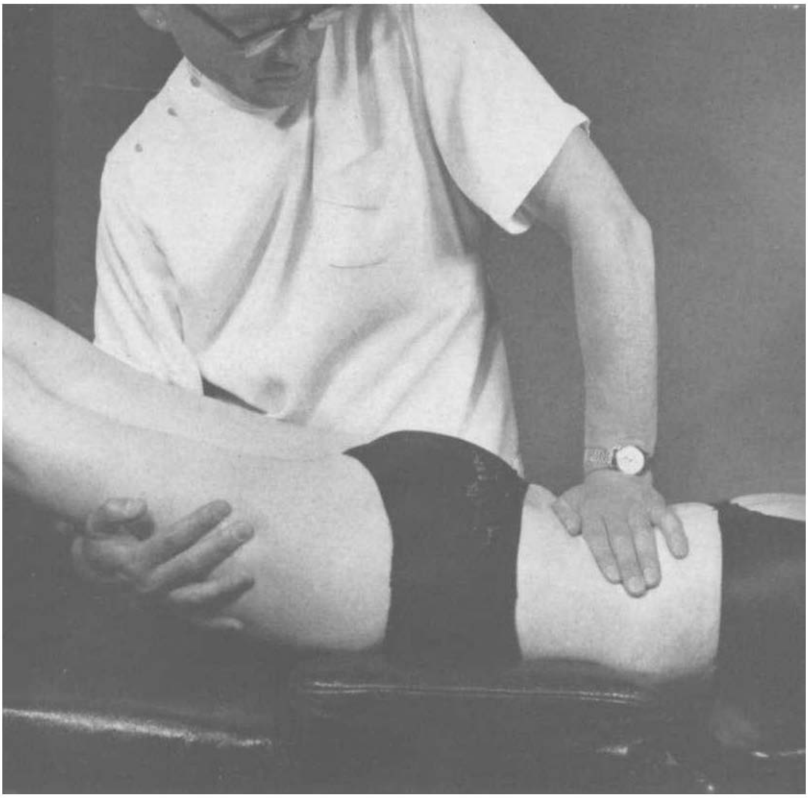


FIG. 130

directed against the spinous process or against the transverse processes on both sides. Using the transverse processes, apply the tips of the left index and middle fingers and place them on the transverse processes and then the right hypothenar eminence is used to press over these finger-tips. The operator's right arm must be held with a straight elbow and his whole trunk used to exert the strong, sharp vertical thrust necessary in this technique.

Backward-bending Restriction. FIG. 130

With the patient prone, stand on her left side and, using your right arm under her thighs, elevate the limbs to extend the hips, pelvis and lumbar spine as far as the lesion and then apply a vertical thrust on the spinous process of the vertebra above the lesion.

O

Locking Technique in Extension

Lie the patient on the right side and tilt the pelvis to the left by flexing the patient's left knee and hip, inserting her knee between your thighs and so forcing her lower extremity into internal rotation (*see* Fig. 120). The patient's left shoulder is then pressed backwards to rotate the trunk down to the lesion. Then lean well over the patient so that you can apply a thrust on the spinous process of the lower vertebra in lesion. The direction of the thrust is ventrally to force the joint into extension so it is necessary to place your right elbow well out to enable the forearm to be in line with the direction of the thrust. The patient should be turned on to the other side and the process repeated to force both apophyseal joints in extension.

The Lumbo-Sacral Joint

The lumbo-sacral facets have such a wide range of angles that it is well worth while consulting X-ray films prior to attempting your adjustment. If the facets approximate to the sagittal type then the techniques above are applicable, but if the facets approximate to the coronal type then a special technique now described is more effective. The idea of this technique is to rotate the pelvis to the left against a fixed lumbar spine.

Rotation. FIG. 131

To release the left lumbo-sacral apophyseal joint place the patient on her right side and arrange her trunk to be straight with the plinth. The flat of the back should be vertical so that the spine is neutral without rotation, sidebending, flexion or extension. The patient will need to be near the edge of the plinth so that when she flexes her left knee it can hang over the side of the table. The operator faces the patient and places his right thigh firmly against the table distal to the patient's left knee so as to check the patient from rolling off the plinth and prevent her extending her knee during the manœuvre. The operator now rests the palm of his right hand on the patient's left calf, sliding up so that his thumb and index fingers lie on either side of the knee, and the web of his hand between the index finger and thumb is resting in the popliteal space. The operator's right forearm is then placed along the patient's left thigh and he leans well over the patient in order to make a thrust through the popliteal space to force the pelvis into rotation to the left.

The opposing force is the fixation of the patient's 5 L. spinous process by the operator's left index finger and thumb plus the body's inertia. Flex the patient's left thigh so that with a few tentative gentle thrusts with your right hand you can feel the rotation of the pelvis causing a movement at

FIG. 131

the lumbo-sacral joint. When you are satisfied about the position, the joint is gapped by a sudden sharp thrust with your right hand in the popliteal space. The idea is to catch the joint and the patient unawares—a 'shock' technique which by its very rapidity does not require any locking device for localization apart from the help obtained in holding the 5 L. spinous process with your left hand.

The Pelvis

From the mechanico-structural point of view, the pelvis, as the foundation stone of the spinal column, is of the utmost importance and when examining the patient for the first time the level of the pelvis is a primary consideration. To attempt to make mechanical adjustments in the spine without paying due regard to the level of the pelvis is a short-sighted policy because the results of such treatment are likely to be of temporary value only.

If on examination the crests of the ilia are level and the spine straight, we can assume clinically that the sacrum is level also, but if the iliac crests are not level or if there is the slightest scoliosis then we cannot assume a level sacrum. The only really reliable way of determining this is to take an erect X-ray film of the pelvis, observing all precautions to avoid errors in arranging the film, cassette, patient, etc. With this proviso, such an X-ray film is a reliable guide to the level of the sacrum. If the sacrum is not level then inevitably abnormal stresses and strains will develop in the lumbar spine and above it. Steps must be taken to correct the sacral level either by manipulation or by the use of heel lifts before attempting to restore mobility in the rest of the spine.

Now the theme of this book until now has been that positional faults in the vertebral column are of much less importance than mobility faults, but where the pelvis is concerned the role of position and mobility can almost be reversed. The sacral level is the vital one, not only laterally but antero-posteriorly as well. An increased lumbo-sacral angle with its attendant lumbar lordosis and thoracic kyphosis can be almost as serious a mechanical disorder as a lateral sacral tilt. The commonest cause of a sacral tilt is some discrepancy of leg lengths so that femoral levels must be taken into consideration at the same time. Here again clinical measurements, while useful, are quite inadequate for accurate mechanical work and we need X-rays of the pelvis taken in the erect position. Such films will demonstrate femoral discrepancies and sacral tilts and the practitioner will be in a better position to assess the relative importance of these two measurements. They will give the examiner useful help in diagnosing torsional strains as between the innominates themselves or as between the sacrum and the innominates.

Because of these points, I would regard a structural examination of the pelvis as incomplete without erect X-ray films, and to lend weight to the argument I would point out that in a series of 100 consecutive cases presenting with low backache which I examined in 1951, I found that 60 per cent of the cases had ¼-inch or more of femoral discrepancy and 17 per cent of them had ½-inch or more femoral discrepancy. It was interesting to find that in a control series of fifty random cases without backache there were 28 per cent with ¼-inch or more of femoral discrepancy and 8 per cent had ½-inch or more femoral discrepancy. In other words, more than twice the number of patients presenting with backache had a short leg compared with the controls, and who is to say that even these controls would not have developed backache or some other related symptom at a later date? It was found that a short leg did not necessarily produce a scoliosis, nor even a pelvis tilt. Adaptation to shortening has, of course, to take place somewhere, and frequently ¼-inch is 'taken up' by the sacro-iliac joints, so that the superior surface of the sacrum or the uppermost limit of the alae of the sacrum (the point most convenient for measurement) is more level than the heads of the femora. Such 'taking up' by the sacro-iliac joints implies a state of strain at these joints, and may well have been a factor in the backache production.

The sacral levels of the whole series were measured and the results for the measurements of sacral discrepancy were as follows:

Number of cases with ¼-inch or more sacral discrepancy	35 (35%)
Number of cases with ½-inch or more sacral discrepancy	1
In the control series:	
Number of cases with ¼-inch or more sacral discrepancy	7 (14%)
Number of cases with ½-inch or more sacral discrepancy	none

When the sacrum itself is tilted, compensation to it must take place above, most commonly at 5 L.–1 S. or 4–5 L. joints. A lateral wedging of the discs in these joints is seen in a majority of cases.

The most understandable type of compensation to the sacral tilt is a gradual scoliosis following the direction of the tilt, so that the convexity in the lumbar area in these cases is on the side of the short leg. However, in a small proportion of the cases the tilt is so marked at the lumbo-sacral or 4–5 lumbar joint that the convexity is to the side of the long leg. Such marked wedging of the intervertebral discs can only take place as a result of (or at least concurrently with) profound internal changes in the nucleus pulposus of the affected disc. This in turn creates marked ligamentous strain at the affected joint, and leads to further backache.

Thus we see a short leg gives rise primarily to sacro-iliac strain and secondly to lumbo-sacral or lower lumbar strain. The compensatory mechanism, such as increased muscle tone where it is needed and the thickening of ligaments, are often adequate to cope with the femoral or sacral discrepancy, but such cases are predisposed to backache. Further, the ligamentous and muscle strain does interfere with local circulation and leads to degenerative changes there earlier than they would normally arise. Such patients require a relatively minor additional strain to break down the compensation and precipitate an attack of backache. Additional strains such as change of habit, fatigue, general loss of muscular control through illness or inactivity and/or some minor injury, stretches the ligaments beyond their normal length and they give way. A close parallel obtains in the feet—the aching of *pes planus.* While muscle tone is good the feet do not ache, but unaccustomed or prolonged standing precipitates either the gradual development of falling arches with a continuous dull ache or the rapid inflammatory reaction of an acute flat-foot strain.

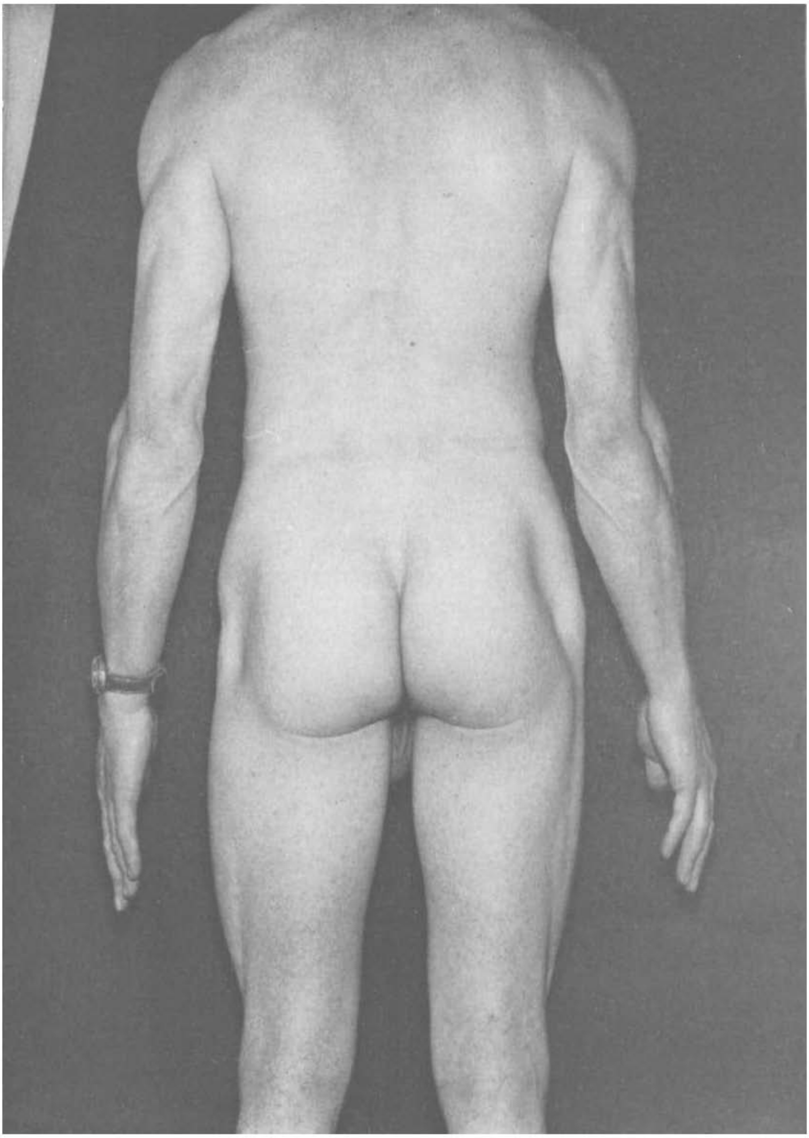


FIG. 132*a*. *Short left leg*

The *clinical recognition of a short leg* is not difficult, especially where there is more than ¼-inch difference, yet it is frequently missed or, if observed, considered insignificant by experienced practitioners A short leg (left, for example) presents the following features:

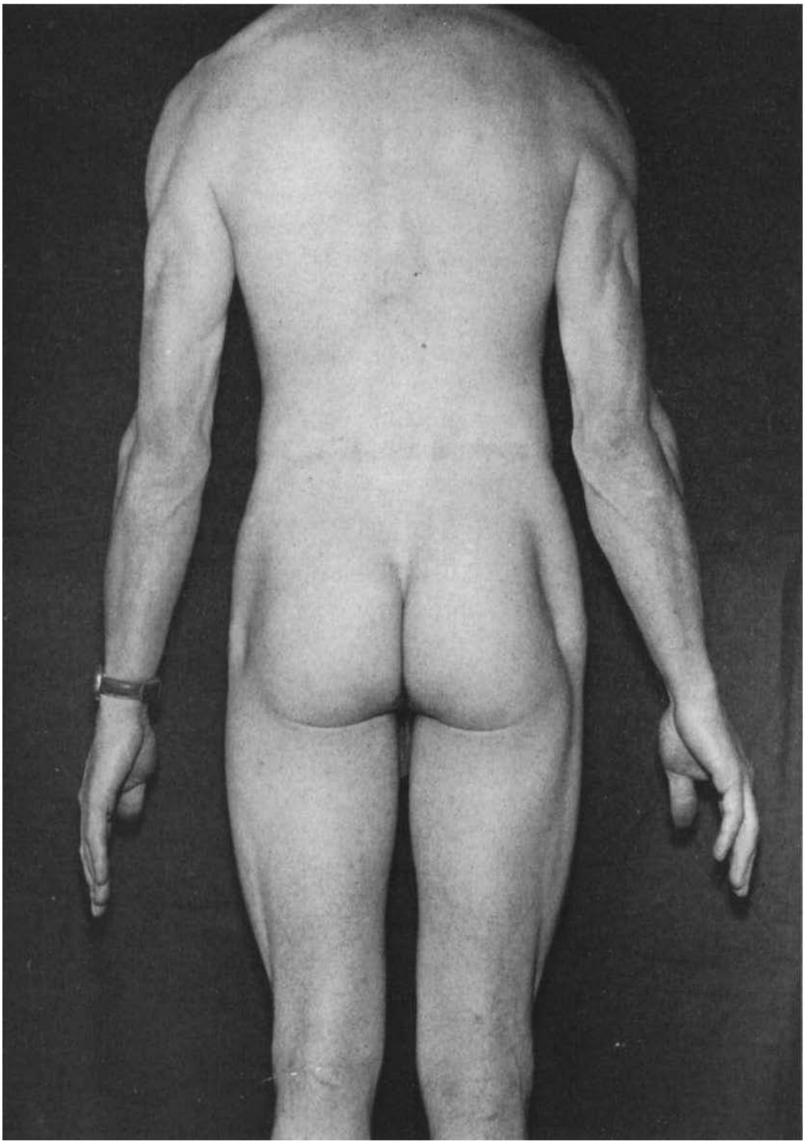


FIG. 132*b*. *Short left leg, corrected with a heel lift*

(1) The left gluteal fold is lower.

(2) The left dimple over the posterior superior iliac spine is lower. If these dimples are not obvious, then palpation of the posterior superior iliac spine will reveal a discrepancy. It is very easy to 'wobble' on these

spines, but when palpating, if the thumbs are brought upwards to rest on the lowest prominence, then a more accurate positioning can be obtained.

(3) The crest of the left ilium is lower. The index finger should rest on the crest of the ilium at its highest point, and the finger and hand held horizontally to give the eye a rough measurement.

(4) The normal concavity in the waist outline is straightened on the left and that on the right is accentuated. When the patient is obese, there are horizontal creases instead of curves and the left crease is at a lower level than the right.

(5) A scoliosis is frequently present with convexity to the left in the lumbar area and to the right in the thoracic area. Where the discrepancy is slight, the line of the spinous processes may be vertical and compensation appears only in the form of rotation of the vertebral bodies (with the high side on the left in the lumbar and on the right in the thoracic areas). Sometimes the convexity is to the opposite side. In these cases a pronounced tilt is observed at the 4th or 5th lumbar vertebrae on the X-ray plate.

(6) In full flexion of the spine with the patient standing, the left buttock area is seen to be at a lower level. This is best observed by looking along the spine tangentially, from the head of the patient. This is probably the *most reliable of the clinical signs of a short leg.*

(7) When the patient walks, the head rises and falls unevenly, sinking lower when weight is carried on the left leg.

Even though these clinical signs of a short leg are fairly easily recognized, clinical observation alone is inadequate because several surprising results were found during this investigation. For example, one patient had a ¼-inch shortening of the right femur, yet the sacrum was tilted in the opposite direction, i.e. down on the left, with a difference of ⅛-inch at the sacral alae. Five cases were level at the femoral heads and had ⅛-inch discrepancy at the sacral alae. Two others were level at the femoral heads and even had as much as ¼-inch discrepancy at the sacral alae.

The above investigation had a purely limited objective—to show the relationship of a pelvic tilt to backache. Important as this is it does not by any means indicate the full effect of pelvic tilts on the spine. The whole body is affected. I have had three patients with obscure anterior thoracic pain caused by a short leg. Their pain yielded to the prescription of an appropriate heel lift without any other form of treatment. Numerous cases of 'fibrositis', neuritis, headaches and referred pains can be traced to this cause alone and to ignore it would be as foolish as to ignore the diet when treating for constipation.

Notwithstanding the above remarks, it is possible for the pelvis to be tilted to the side or shifted laterally by influences from the lumbar spine and, before treatment is commenced on the pelvis as such, we must examine the lumbar area carefully to exclude this possibility. Unilateral muscle spasm either of the erector spinae muscles or the psoas can easily upset the balance of the pelvis and, while such spasm exists, X-rays of the pelvis in the erect position are misleading.

Antero-lateral pelvic balance is usually secondary to muscle tone and posture and can be corrected by attention to these points. Here again the spine above can influence the sacral position. For example, a lower thoracic kyphosis from osteochondritis can cause a secondary lumbar lordosis and an exaggeration of the lumbo-sacral angle.

These aspects of pelvic mechanics can merely be touched upon in a manual of technique but they must all be considered in the assessment of a patient's structure.

The Sacro–Iliac Joints

The range of movement in these joints is very small indeed (*see* Appendix) and, as in other joints of the spinal column, there may be hypermobility as well as hypomobility. Where stability is all-important, as in the pelvis, hypomobility is to be preferred to hypermobility but both faults can cause symptoms.

After examining the pelvis from the point of view of the sacral level, our next concern is to examine the sacro-iliac joints to test their mobility (p. 75) and then to observe the clinical signs of lesions at these joints (p. 81). If the patient presents signs of *hypermobility* the treatment must consist of adequate support, strengthening exercises, and if necessary injections of a sclerosing agent to tighten the ligaments artificially. Forcible manipulation of the joint or joints is absolutely contra-indicated yet it is often done—in fact, repeated manipulation of the joint is a definite cause of hypermobility there. The mistake is in the initial examination, merely testing for positional faults and not paying enough regard to the mobility tests.

To support the sacro-iliac joints adequately, a lumbo-sacral type of corset with sufficient depth is desirable, plus a strong wide belt passing round the whole of the pelvis and fitted with a strong buckle so that the joints can be held tightly together.

Hypermobility in any joint is the result of over-stretching the elastic tissue in the ligaments and capsule of the joint. Normal tone in ligaments is dependent upon the natural stimulus of intermittent stretching—they give way under violent stretching or prolonged sustained stretching. Where the elastic tissue has given way and lost its tone, it is possible for

FIG. 133

such ligaments to regain their tone only if the ligaments are not overstretched for several months. Controlled and gentle stretching short of causing pain is a useful and natural stimulus to the elastic tissue so that it is useful to apply articulatory techniques in moderation to the sacro-iliac joints where they are hypermobile.

Articulatory techniques are also valuable in hypomobility, but here we should aim to give strong movements to obtain as much stretching as possible.

ARTICULATORY TECHNIQUES FOR THE SACRO-ILIAC JOINTS

(1) *Springing.* FIG. 133

Place the patient prone, resting the pelvis on a soft cushion. Lean well over the patient, keep your elbows straight and apply a springing pressure

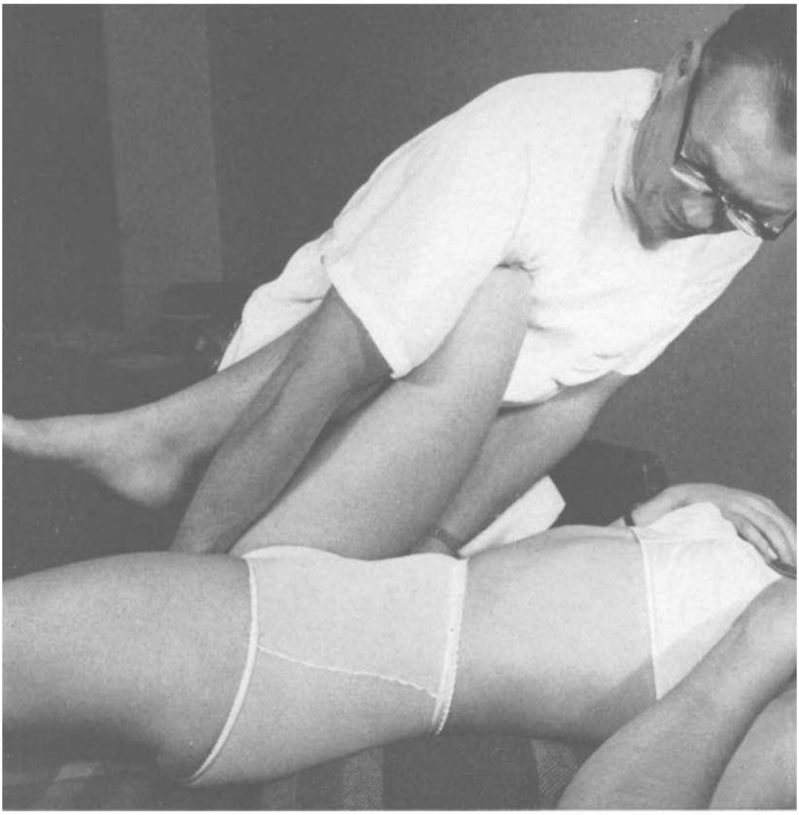


FIG. 134

with one hand over the apex of the sacrum and the other over the posterior part of the crest of the ilium. This creates a torsional stretch of the sacro-iliac joint. Torsion in the opposite direction may be obtained by applying one hand to the base of the sacrum and the other to the ischial tuberosity.

During this technique a soft click sometimes occurs in the joint, which means you have achieved both an articulatory and a gapping effect.

(2) *Articulation.* FIG. 134

With the patient supine, stand on her right side and flex her right knee and hip fully by grasping her knee between your right arm and pectoral area. This leaves your right hand free to tuck it under the right buttock and to grasp the ischial tuberosity. Then hold the patient's right iliac crest with your left hand and exert a rotational effect on the right innominate, trying to pivot the ilium or the sacrum round about the 2 S. level.

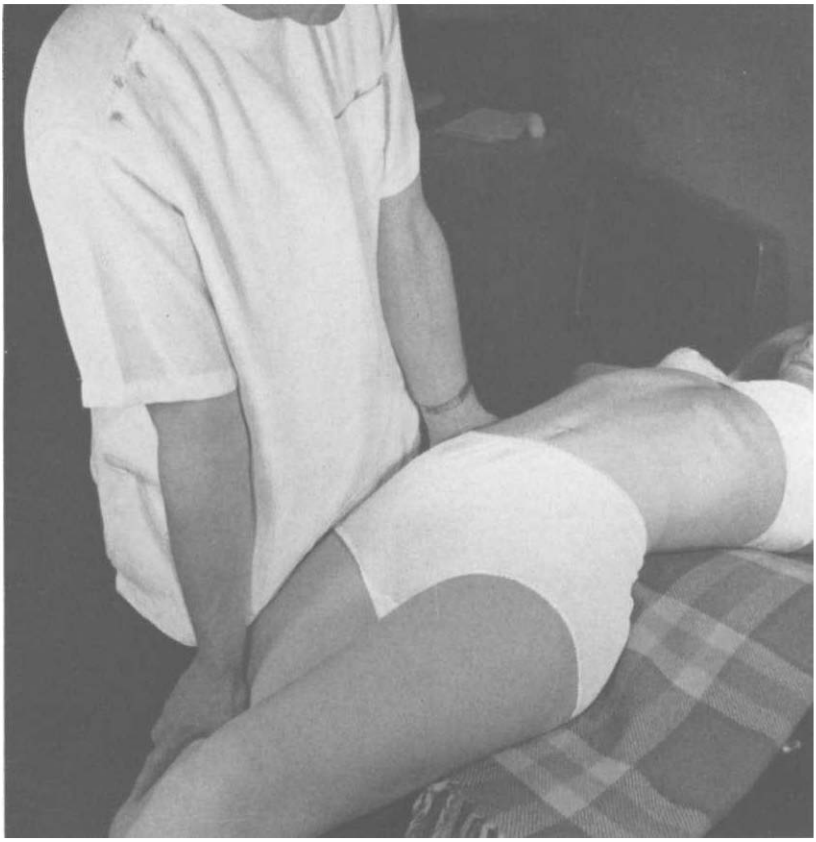


FIG. 135

(3) *Articulation.* FIG. 135

With the patient supine, stand on her right side and allow her right leg to hang over the side of the table to cause an extension of the hip and a torsional effect in a reverse direction to the previous technique. The operator's right hand can be placed on her thigh to push the hip into further extension and the operator's left hand can be applied to the patient's right posterior superior iliac spine, pushing upwards to increase the forward twist of the right innominate on the sacrum.

(4) *Articulation.* FIG. 136

By grasping the patient's right flexed knee with your right arm and moving the hip joint fully, you can apply a gapping effect either inverting

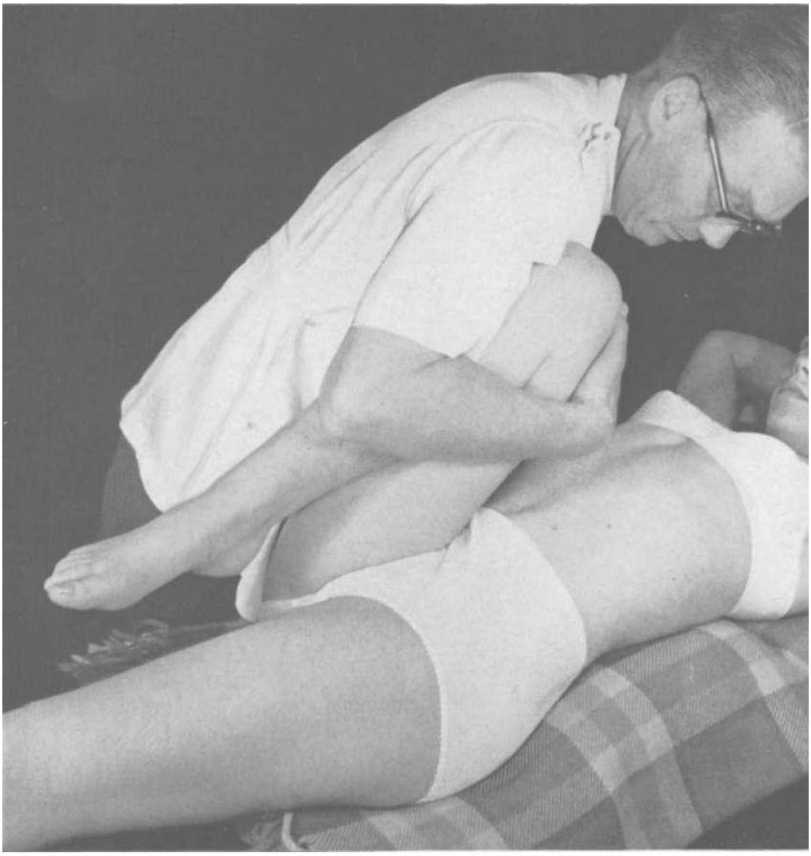


FIG. 136

or everting the innominate by strong adduction or abduction of the flexed right hip. The operator's left hand can rest on the table palpating the relative movements during the manœuvre.

(5) *Articulation* (*see* FIG. 27)

With the patient prone, and the operator standing on her right side, he should flex her right knee and hip down by the side of the table after the manner described in tests for sacro-iliac mobility. The patient's right knee can be kept flexed by the operator's right thigh and reinforcing pressures can be applied by the operator's right hand applied to the crest of her right ilium in a posterior direction and the operator's left hand applied to the ischial tuberosity in an anterior direction.

FIG. 137

SPECIFIC TECHNIQUES FOR THE SACRO-ILIAC JOINTS

The hypomobile sacro-iliac joint only causes symptoms if there is also a positional fault and, therefore, in considering techniques for the restoration of mobility in these joints, we require to pay due attention to the positional component of the lesion.

(1) *Backward-rotation Lesion on the Right.* FIG. 137

With the patient prone, stand on her left side and reach across with your right hand to lift the extended right leg at the thigh just above the patella. Extend and adduct the right hip with your right hand and apply pressure over the right posterior superior iliac spine with the heel of your left hand. Maintain tension on the joint by maximum extension and adduction of the hip and then apply a short, sharp thrust with the left hand. A successful manipulation produces a soft click under your left hand.

The springing techniques described under the heading of articulation quite often cause a click and 'unhitch' the sacro-iliac joint.

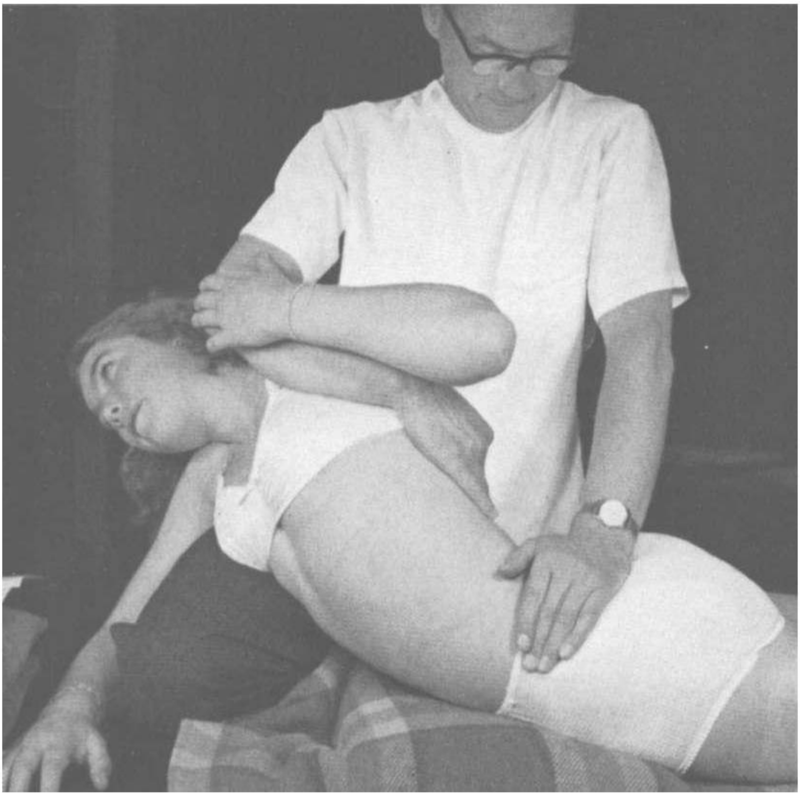


FIG. 138

(2) *Backward-rotation Lesion on the Left.* FIG. 138

With the patient prone and the operator standing on her right side, ask the patient to raise up on her hands for a moment while you place your flexed right knee under her right axilla so that she can rest her right pectoral area on your right thigh. Then reach across with your right arm to support the patient's left shoulder. Thread your hand over her left shoulder and down through her left axilla to grasp her left scapula area. You are now in a position to increase the backward bending of the patient's lumbar spine right down to and including the lumbo-sacral facets. With this amount of backward bending all the lumbar joints are facet-locked and we can then apply our thrust over the posterior superior iliac spine on the left, thrusting in an almost vertical direction in the plane of the sacro-iliac auricular surfaces.

If a greater degree of facet-locking is desired in the left row of lumbar

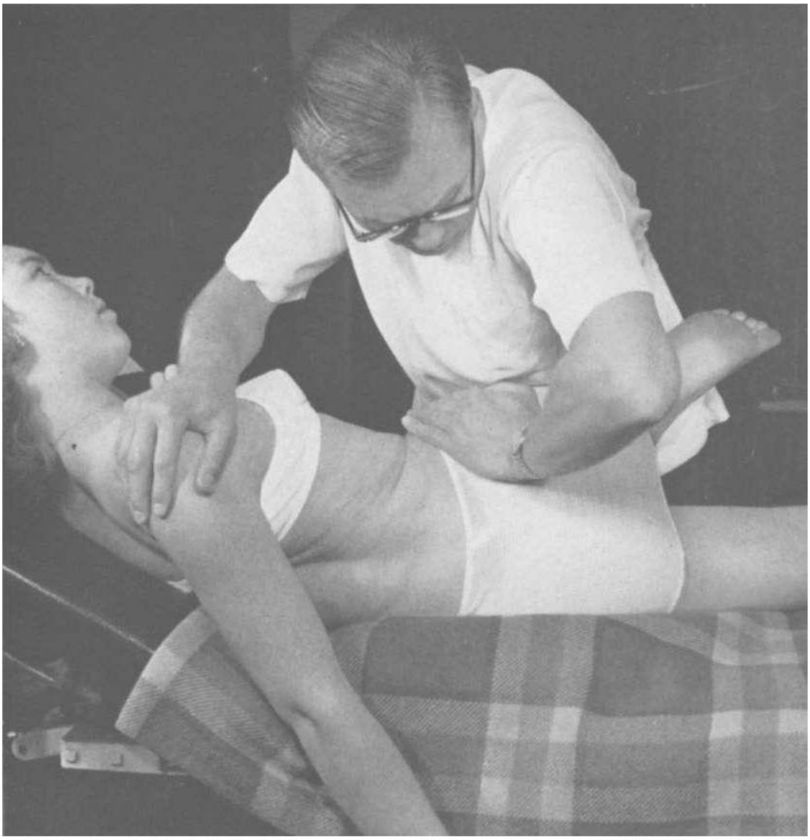


FIG. 139

facets, we can modify the above technique by additional sidebending and rotation to the left. To obtain the sidebending you must bring the patient's pelvis well over towards your side of the table and put her feet towards the other side of the table. To obtain the rotation you exert an increased pull against her left shoulder with your right arm.

(3) *Backward-rotation Lesion on the Right.* FIG. 139

With the patient on her left side, supported with pillows under her left shoulder to create a sidebending to the right, the operator faces the patient and flexes her right knee and thigh, putting the knee between his own thighs and so forcing the patient's right thigh into adduction and internal rotation with the object of tilting the whole pelvis up on the right and down on the left. This increases the sidebending of the lumbar spine to the right.

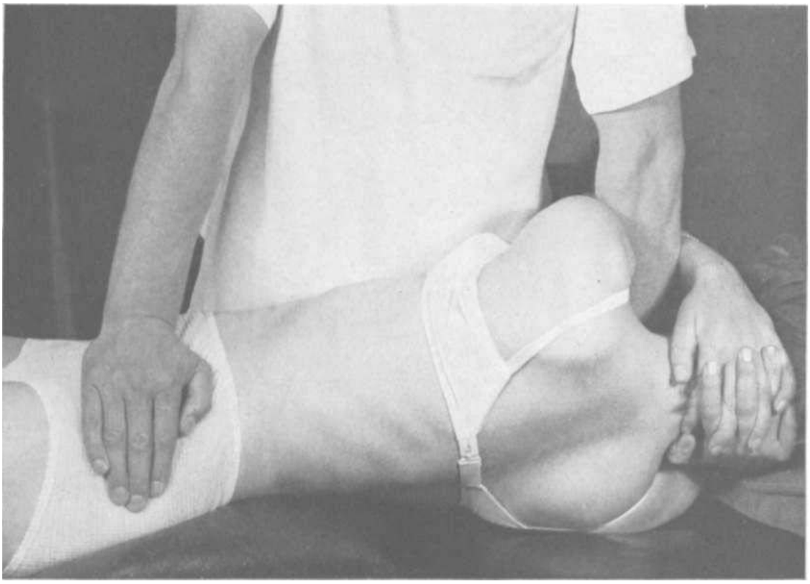


FIG. 140

Now rotate the torso to the right by pushing her right shoulder backwards with your right hand. Keep the lumbar spine in extension to increase facet apposition locking in the apophyseal joints down to and including the lumbo-sacral facets. The lumbar spine and sacrum are now working as a unit and provide a solid basis for an adjustment of the right sacro-iliac joint. The operator should now lean well over the patient so that he can apply a thrust to the posterior superior iliac spine in a forward direction. The operator's elbow points away from the pelvis so that his forearm can be directed in the plane of the joint.

(4) *Forward-rotation Lesion on the Left.* FIG. 140

In order to create a backward torsional adjustment of the left sacro-iliac joint, have the patient lying on her back and stand on her right side, and in order to create sidebending to the left place the patient's pelvis well to your side of the plinth, place her left shoulder well to the other side of the plinth and do the same with her feet, thus forming a concavity to the left in the lumbar spine. Then ask the patient to clasp her hands behind her head, bringing her elbows together. Thread your left hand through her left arm from left to right so that you can push your forearm across her chest and you can rest your left hand on the plinth just near her right axilla. This leverage enables you to rotate the trunk to the right and to

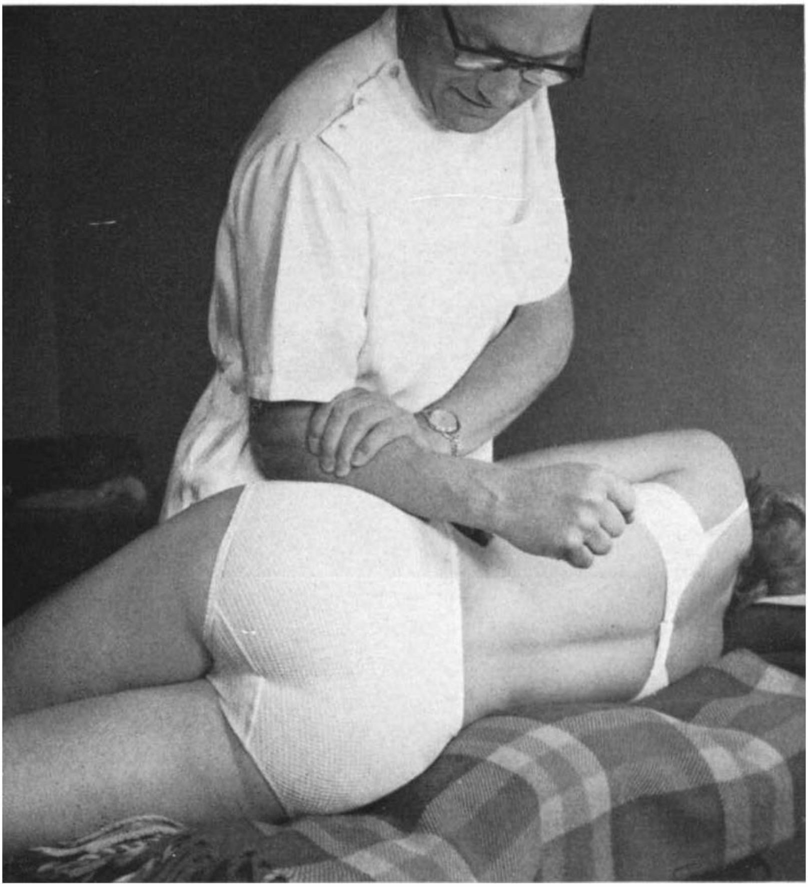


FIG. 141

bring the lumbar spine into flexion. This has a facet-locking effect on the left row of lumbar joints. By arranging your forces accurately the lumbar spine and sacrum become a unit and now a thrust on the patient's left innominate through the anterior superior iliac spine (covered with a thin cushion for comfort) will force the sacro-iliac to move.

All the above techniques are designed to free sacro-iliac joints which are locked in rotation, but sometimes they require gapping in the horizontal plane.

(5) *Technique for Gapping.* FIG. 141

A very simple method for doing this is to have the patient on the side comfortably arranged with the upper knee slightly flexed and the back at

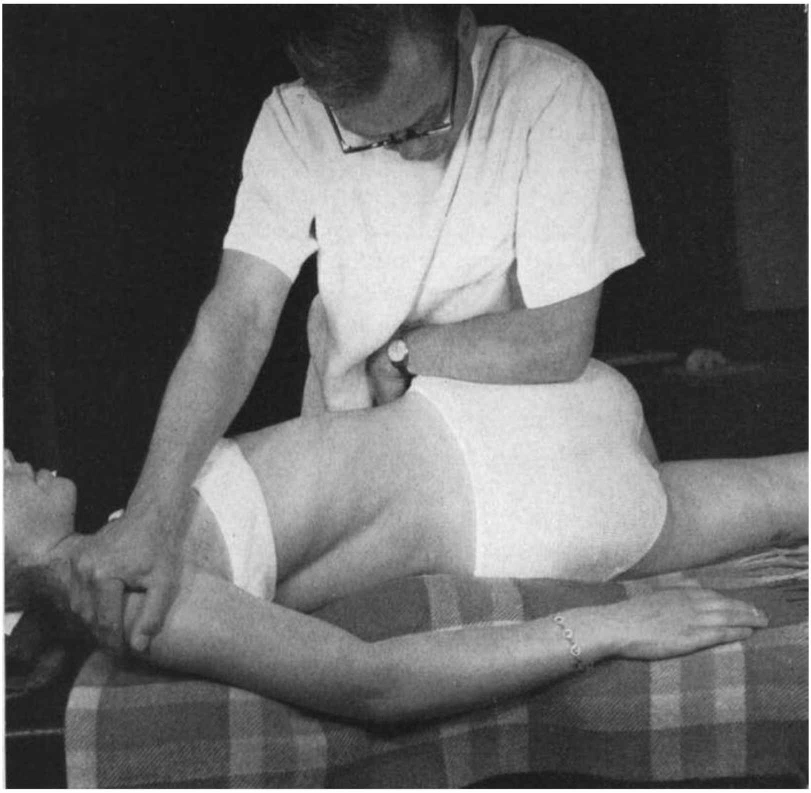


FIG. 142

right angles with the plinth. Then place your forearm on her pelvis just below the iliac crest, reinforce your forearm with the other hand and then apply a vertical thrust through the pelvis. This will have a gapping effect on both sacro-iliac joints but especially on the upper of the two.

(6) *Reverse Gapping*

Gapping in the reverse direction can be achieved with the patient supine and applying a thrust to each anterior superior iliac spine. To obtain the maximum effect, cross your arms and thrust on opposite iliac spines, and as these places are sensitive it is just as well to use small cushions for the purpose.

(7) *Gapping on the Right.* FIG. 142

To gap the right sacro-iliac joint place the patient on the left-hand side, stand facing her and allow her right leg to hang over the side of the table, knee extended. Feel for tension developing over the right sacro-iliac joint by altering the degree of flexion and adduction of the hip. At the correct angle you can feel a tightening of the soft tissues over the right sacro-iliac joint. Then maintain this position of the patient's right thigh by placing your left thigh against the table, leaving her leg to hang freely. It is the weight of the leg which is going to help in the gapping technique. Now pull on the patient's left arm to rotate the torso down to the lumbo-sacral joint to effect a degree of facet apposition locking. Then place your left forearm against the patient's right gluteus medius area and thrust through the forearm against the innominate to gap the joint still more.

This technique is not easy, though to obtain a click this way is easy enough. The click tends to occur in the lower lumbar joints because the locking is not complete. The secret is to make your thrust short and sharp, once having satisfied yourself that the tension is correctly localized to the sacro-iliac joint. The technique should only be used in recent sacro-iliac lesions because it would be quite ineffective in a long-standing lesion with strong adhesions. It would also be unwise if there were co-existing disc pathology because if the force were incorrectly arranged, the lack of facet-locking would not protect the lumbar joints adequately.

The Sacro-Coccygeal Joint

Articulation of the sacro-coccygeal joint can be achieved by using the leverage of the gluteus maximus (*see* Fig. 143). The patient lies prone and the operator stands on her left side. He then grasps the left flexed knee under the thigh just above the patella with his right hand, holding the leg firmly between his chest and right arm. The operator then flexes his own knees to bring the hip into about 90 deg. of flexion and adduction. This places a stretch on the fibres of the gluteus maximus which are attached to the posterior surface of the coccyx. The operator can apply his left thumb to the left side of the patient's coccyx to enhance the stretch on the joints and the soft tissues between the coccyx and the sacro-tuberous ligament.

Specific manipulation of the coccyx can only be done per rectum. I prefer to have the patient prone for this purpose. After passing the index finger gently through the anal canal, you can then curl the finger upwards to feel the anterior aspect of the joint and the coccyx. Then with your thumb reinforced if necessary with the other thumb as well, you can apply forced flexion, forced extension or forced rotation. Any of these movements will free the joints but I find that forced flexion is best done initially and the other movements secondarily.

Sometimes the coccyx is displaced laterally and then we require to apply a corrective force in the opposite direction, having freed flexion, extension and rotation first.

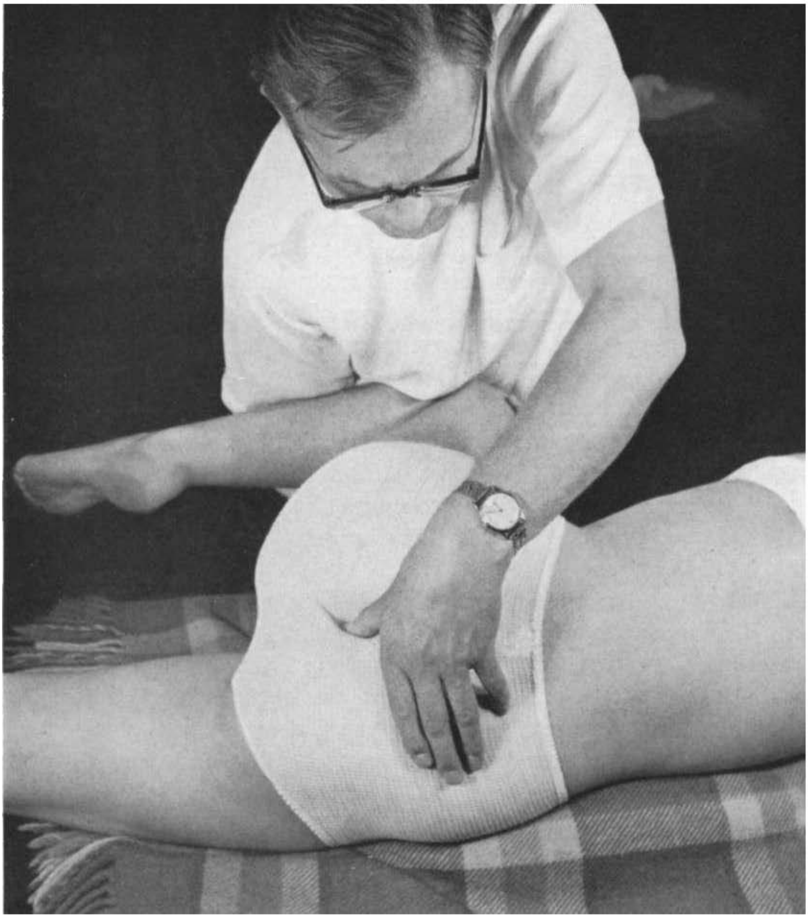


FIG. 143

It is well to remember what was said earlier in the book that many coccydynias are due to lesions higher up and it is just as well to treat the lumbar spine in all cases where the localizing signs round the coccyx are indefinite.

Releasing the adhesions round the coccyx once is not necessarily sufficient because adhesions reform easily in a joint which has such a little natural movement anyway. The exercise of contracting the levator ani is well worth prescribing after manipulation of the coccyx with this point in mind.

4

THE INTERVERTEBRAL DISCS

WHEN a patient presents with a history of an acute attack of low back pain after bending down to do up a shoe, followed a day or so later with sciatica and signs of nerve-root pressure, we can from this history alone almost certainly make a diagnosis of a prolapsed lower lumbar disc; but this is not the beginning of the story, rather is it the end—the final episode in a long chain of changes in the intervertebral disc. The simple movement of flexing forwards without any lifting or pulling strain is surely insufficient to cause damage to normal discs. There must have been advanced degenerative changes already present. What has led up to this final episode? What has predisposed this disc to give way under such relatively minor strain?

There must be numerous predisposing factors, such as injury, congenital anomalies, constitutionally weak cartilage, hormone and chemical disturbances, weak musculature, ligamentous strain, but I would say the most important cause is a compression injury of the spine. If patients are questioned about injuries they will frequently deny any history of trauma, but upon further questioning on the second visit the patient will often recall a fall downstairs or a slip on the ice or some other such injury years ago. When there is *definitely* no history of injury, such patients frequently have a short leg or a pelvic tilt. The initial injury or the continuous strain of the pelvic tilt leads to degenerative changes over the years.

It is indeed rare for a patient to present himself or herself with signs and symptoms of a disc prolapse without previous symptoms—perhaps an occasional attack of lumbago or mild backache from time to time after unusual exertion. The very length of the history suggests that whatever process is going on must be a very slow one indeed. It may even be a normal process which is merely accelerated by injury or intermittent strain.

Schmorl[1] in his investigations of four thousand spines found degenerative changes in the discs early in life and his view was that such degeneration was the first demonstrable post-mortem evidence of the usual ageing process—earlier than atheromatous changes in the aorta, for example. He particularly found cracks in the cartilaginous plates between the nucleus pulposus and the vertebral bodies. He also noted the blockage

[1] BEADLE, O. A., 'The Intervertebral Discs', Medical Research Council, *Special Report Series*. No. 161 (London, H.M. Stationery Office, 1931).

of the small perforations in the cartilaginous plates. These perforations convey tissue fluid between the cancellous bone of the vertebral body and the nucleus pulposus. This partial interruption of nutrition to the disc could easily account for the slow degenerative change in the discs.

Degenerative change in any tissue is caused by increasing age and by a reduction in blood supply to the tissue. It is an established fact that injuries—either one severe injury or repeated minor ones—lead to earlier degenerative changes in such joints compared with others in the same body. It seems reasonable to assume that the injuries result in an interference with the blood supply to the damaged structure. If there were no such interference with the blood supply it would be difficult to explain the degeneration on any other basis.

The late pathological changes in intervertebral discs have been studied and observed well, but so far the earlier changes have not, and we can only guess at what occurs within the disc structure before symptoms arise. Discs might well be compared with the liver, in which four-fifths of its substance can be destroyed before symptoms arise. The fact that the disc has no nerve supply probably accounts for the delay in subjective symptoms, but there are objective signs of change within the disc—clinically observable signs plus X-ray changes in the early stages—elicited by careful examination long before anything so obvious as a prolapse occurs. In this connection mobility X-ray films are of more value than the usual straight X-rays (*see* p. 47).

The physical signs of change within the intervertebral joint in its earliest stages are in my opinion the very signs which osteopaths have been observing for years and have been calling the osteopathic spinal lesion. A description of the physical signs of this lesion will be found in Chapter 2. I do not suggest that the osteopathic lesion necessarily leads on to a prolapse of the intervertebral disc; after all, degenerative changes are seen radiologically in many spines where minimal symptoms only have occurred, but by the very nature of the osteopathic spinal lesion, the hypomobility, the muscle tension, the complex reflex disturbances which arise from it, all are likely to interfere with the blood supply to the joint—in fact to the area of the segment involved. Such slowing of circulation will inevitably lead to early degenerative changes and in due course to the late degenerative changes known now as spondylosis, viz. narrowed disc spaces, splayed vertebral bodies, osteophytes, osteoarthrosis of apophyseal joints, herniations and prolapsed discs, expansions and ballooning of the discs, reinforcing lines of calcification in the vertebral bodies, Schmorl's nodes, narrowed intervertebral foraminae, overlapping of apophyseal facets—all these are late changes in the degenerative process in the vertebral joint. Quite apart from all the bone and joint structures involved, the impaired circulation leads to changes in the nerves and spinal cord—the myelopathies and root-sleeve fibrosis, the nerve-root pressures and disturbances of the autonomic nervous system through irritation of the grey and white rami communicantes.[1]

The *circulation* within the spinal column has certain peculiarites for, while the cord has a good arterial supply with an artery entering each intervertebral foramen, dividing and anastomosing freely forming five longitudinal trunks, it has a venous drainage which leaves much to be desired. There is an external venous plexus and an internal venous plexus, the latter joining to form two anterior and two posterior longitudinal channels. The internal plexus communicate with each other to form a series of venous rings one opposite each vertebra between the disc and the bone. The internal plexus is linked with the external plexus by basi-vertebral veins which run through the bodies of the vertebrae and posteriorly through the ligamentum flavum. Now this arrangement does allow free anastomosis, but the normal mechanism of venous drainage—muscle action and valves—are not operative within the spinal canal. There are in fact no valves in the veins of the cord and brain and no muscles within the canal, so that congestion of blood within the veins must very easily occur. On this vascular hypothesis Aladar Farkas[2] has built up a whole theory of the low backache syndrome and, while I cannot agree that venous congestion accounts for almost all low back troubles as he implies, I do consider that it is an important factor, not only in the degenerative changes which we are discussing, but also in the mechanism of production and accentuation of the symptoms. Look how sensitive the back is to coughing and straining during the acute phase of a disc herniation. Compression of the jugular veins and abdominal veins in these circumstances causes a marked increase in pain by increasing the mechanical pressure on the nerves, the dura and the ligaments.

To ensure adequate venous drainage in the vertebral column, *all* the intervertebral joints should be freely movable. Any restriction of movement (the most important quality of the osteopathic spinal lesion) in the spinal column is going to slow down the venous drainage in that area. Apart from mere hypomobility, which can only interfere with drainage in a passive sort of way, consider the effect
joint. It may be insufficient to block the arterial supply but it will certainly be enough to check the venous drainage. To side-track a moment, this surely is the mechanism of many congestive headaches—tension in the small suboccipital muscles would be sufficient to interfere with drainage of the vertebral veins and increase the venous pressure within the cranium.

There has been much work done recently on the question of cervical

[1] Brain, Sir Russell, 'Spondylosis. The Known and the Unknown', *The Lance* (3.4.54), p. 687.

[2] Farkas, Aladar, m.d., *Rheumatism*, Vol. 6, No. 4 (October, 1950 .

spondylosis affecting the spinal cord and its nerve-roots. Much of it is invaluable but the study is rather directed to the final stages than the early ones. Greenfield[1] is of the opinion the mechanical compression from cervical spondylosis acts indirectly on the cord by interfering with the blood supply through the anterior spinal artery. Sir Russell Brain[2] postulates a similar mechanism. If the effect is an indirect one it is likely to occur as a result of reflex disturbances of vaso-motion in the area—an idea postulated years ago by the osteopaths. The idea is of a mechanical lesion causing reflex disturbances of vaso-motion and viscero-motion. 'It is the strong view of the writers that the effects of the osteopathic lesion are produced *reflexly* by a stimulus arising in sensory end organs in the joints, muscles, ligaments and surrounding tissues involved in the condition of joint strain which exists in an osteopathic lesion.'[3] This was written by Macdonald and Hargrave-Wilson in 1935. They contended that there is a *somatico-visceral* reflex. 'In this case the impulse arises in a somatic structure and manifests itself in a viscus by vascular, trophic or muscular phenomena.' They used a whole chapter in their book presenting the evidence for the existence of this type of reflex.

It is a common-enough finding clinically in sciaticas due to disc prolapses that there is a disturbance of vaso-motion in the lower extremity. One can only assume that there is some mechanical or reflex disturbance of the grey rami communicantes which pass through the intervertebral foraminae.

If vaso-motion is disturbed by mechanical spinal faults, why not viscero-motion through either grey or white rami communicantes? Samson Wright[4] in the 1952 edition of his *Applied Physiology* goes so far as to say: 'The sharp distinction which is customarily drawn between the autonomic and somatic nervous system, though useful for purposes of description, is to a considerable extent misleading. *Afferent somatic structures may reflexly influence viscera*' (italics mine).

This is side-tracking somewhat from my theme in this chapter, but as it is now current medical thought that somatic disturbances can cause vascular changes in the spinal cord, secondary to spondylosis, surely such changes can occur earlier from the mechanical lesions that antecede spondylosis?

If, as I suggest, preceding joint sprains and compression injuries lead to degenerative processes and finally to intervertebral disc herniations, the treatment of such herniations ought really to have started long ago.

[1] GREENFIELD, J. G., *Rev. med. Suisse* rom. 78, 227 (1953).
[2] BRAIN, SIR RUSSELL, 'Spondylosis. The Known and the Unknown', *The Lancet* (3.4.54), p. 687.
[3] MACDONALD, GEORGE, HARGRAVE-WILSON, W., *The Osteopathic Lesion* (Heinemann, 1935), p. 44.
[4] WRIGHT, S., *Applied Physiology*, London (Oxford University Press, 1952).

We should manipulate and mobilize osteopathic spinal lesions long before they lead to these degenerative changes and not leave them to take their course. If on examination of a spine we find areas of restricted mobility or even single lesions our duty is to release the restricted joints and ensure normality as far as is within our power. Even the admonitions of Cyriax,[1] who holds that minor disc herniations should be manipulated early to prevent still further disc changes, are almost already too late. Once a herniation has occurred we can merely patch it up as best we can and hope that the patient will be sensible in avoiding undue strain there again.

I am of the firm opinion that a herniated disc can sometimes be replaced by manipulation, but when a true prolapse of the disc occurs I am convinced that it is impossible to replace the nuclear material by manipulation. At that stage all that can be achieved by manipulation is the empirical attempt to shift the position of nerve-root and prolapsed nuclear material so that less pressure occurs on the nerve root.

By a herniation of the disc I envisage a bulging of the annulus sufficient to press on and irritate the posterior longitudinal ligament and dura mater without a complete rupture of the annulus and the posterior longitudinal ligament. If there is sufficient outer annular fibres and posterior ligament to hold the herniation from protruding right through, then I think it ought to be possible to re-position the nuclear material—not that such a state of affairs

clinically at least such cases are rewarding in that they obtain a dramatic relief of symptoms, even though at a later date they may well have a relapse. After all, a track has been formed in the circular fibres of the annulus and such a track does not repair well, if at all, because cartilage once torn is not repaired with cartilage but merely with fibrous tissue. At best we can hope for fibrous tissue repair and provide additional support either by improving the muscles surrounding the joint or by using artificial external supports.

When nuclear material has escaped into the spinal canal and become wedged between the nerve-root and intervertebral foramen, manipulation can sometimes alter the site of pressure or shift the prolapsed material to another site where there is less irritation of the nerve-roots. If the techniques are designed to achieve this and they are sufficiently gentle to avoid further damage, they are well worth attempting because in roughly half the cases the attempt succeeds. If successful, the patient has still to observe caution and the hope is that the prolapsed material will in time shrink and cause less trouble. In the meantime a laminectomy has been avoided. If the attempt is unsuccessful and the technique is designed to avoid further

[1] CYRIAX, J., *Textbook of Orthopaedic Medicine*, Vol. 1 (Cassell & Co. Ltd., London 1956).

damage, the patient is no worse off and if necessary can still take advantage of surgical procedures.

Criticism of manipulation in the treatment of intervertebral disc lesions is justified on some grounds; it is justified if the operator thinks he is replacing a disc prolapse; it is justified if the procedure leads to further damage; it is justified if the procedure converts a herniated disc into a prolapsed disc. *But* to condemn manipulation outright because one case in a thousand has been made temporarily worse is hardly fair.

The techniques which follow have been found to be safe, at least in my own hands. Some techniques which I will mention later I have found to be unsafe and are, therefore, to be avoided in all cases where disc degeneration is demonstrated or even suspected.

The differential

is based on the clinical observation of nerve-root pressure or otherwise. If there are no abnormal neurological signs, like loss of reflexes, loss of power and loss of sensation, I form the opinion that the disc is herniated rather than prolapsed—the pain may be local and referred but it is a segmental reference of pain rather than a single nerve-root distribution of pain. We have here just an indication of the difference between prolapsed and herniated discs but there are numerous signs and symptoms to be taken into consideration. A manual of technique, however, is not the place to discuss all the detailed differential

which give rise to clinical pictures similar to those caused by disc lesions. The reader can readily refer to orthopaedic textbooks for such details. (James Cyriax, *Textbook of Orthopaedic Medicine*, Volume I (Cassell, London), is probably the best for this purpose.)

TECHNIQUES FOR THE REDUCTION OF HERNIATED INTERVERTEBRAL DISCS

Rhythmic Adjustive Manual Traction. FIG. 144

Place the patient supine on the table and strap the ankles down (it is quite inadequate to have assistants holding the feet). The operator sits at the head of the table and grasps the patient's head with his right hand under the occiput, the thumb pointing to the patient's right mastoid process and the index finger to the left mastoid process. The main traction is applied through the occiput and the left hand merely steadies the head by holding under the patient's chin.

The operator's body position is important in that he should have his feet firmly planted against the base of the table. He can then safely lean right back so that his two arms are extended and he can apply his traction using his own body weight rather than his biceps only. The 'slack' is taken

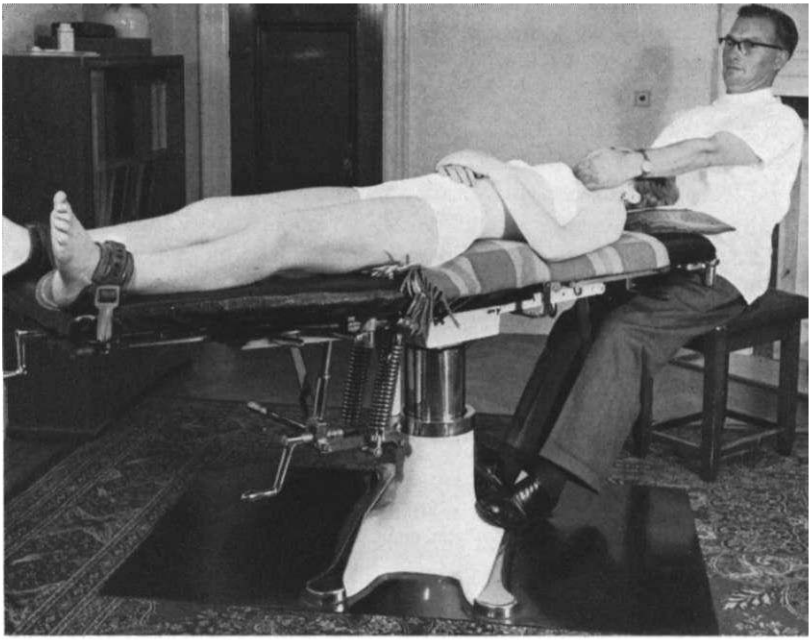


FIG. 144

up by a preliminary pull, making sure that the patient's body cannot move by further traction.

In this position, the operator then rhythmically pulls on the patient's head—a number of such pulls are performed partly to obtain the feel of the traction and elasticity of the spine but also to make sure the patient is relaxed. (This technique is quite hopeless if the patient is resisting, for her spinal muscles are much stronger than your arm muscles and in any case we wish to exert the *minimum* force consistent with achieving our result and a tug of war is more likely to do harm than good.)

The rhythm is partly determined by the inertia and weight of the patient. Your own body weight is involved also because your own body and the patient's body move in unison. On this account it is futile to have your elbows flexed. The heavier the patient the slower is the rhythm and the lighter the patient the quicker is the rhythm. After practice the operator learns that each patient has her own rhythm and only practice will teach this feel of a patient. It is the sixth sense of the osteopath—tissue-tension sense—without which the operator can never be an effective manipulator. The difference between the manipulator with a keen sense of tissue tension and one without such tension sense is as wide as that of the painter of portraits and the painter of houses. It is as wide as the skill of the surgeon and the butcher, the watchmaker and the blacksmith, the sculptor and the joiner. Herein lies the difference years of close application to his art and the operator who thinks he can learn manipulation in a few easy lessons.

After a preliminary rhythmic pull to obtain the feel of the patient and establish the right rhythm to promote relaxation, the operator should pause a moment before repeating the process and then at the right moment, say after six or eight pulls, the operator exerts a much stronger pull. If the manipulation is successful, a click is felt by the operator and by the patient. It is sometimes an audible click, but if so it is probably of less clinical significance than the soft, almost imperceptible, click which one hopes for.

The position of the patient's head in this technique is important—the pull must be as straight as possible. We do not want to disperse our forces with the neck in flexion or extension. One very thin pillow is desirable and the technique is only really satisfactory if friction between the patient and the table is reduced to a minimum. The table top therefore needs to be of smooth leather and the patient lies on a sheet or blanket so that her skin does not stick to the leather. This point about the surface of the table is more important when using the techniques for the thoracic and lumbar areas of the spine. It is possible to use this technique in the cervical area with a cloth-covered table but even so the smooth table is preferable.

When applying the technique for disc lesions in the lower sections of the spine, we must first be satisfied that such traction will not have any adverse effect traction technique described later (p. 239).

Rhythmic adjustive manual traction is ineffective fact it tends to stretch and irritate the already irritable nerve-root which is being compressed. However, it has its application in the ordinary osteopathic spinal lesion where there is restricted mobility. In fact sometimes this is the only effective some lesions because it is the longitudinal adhesions which give way with this technique.

We must be on our guard when dealing with hypermobile joints. Obviously, if any one of the spinal joints is hypermobile, that joint will stretch first and may exacerbate symptoms, but if we are first sure that there are no hypermobile joints we can safely apply adjustive manual traction and obtain most satisfying results.

The technique may be used on several subsequent occasions, and the usual sequence is that after the second or third treatment no more palpable clicks occur and the procedure becomes painless. Then we can be satisfied that at least all the longitudinal adhesions have been released. In chronic osteopathic spinal lesions, where a certain amount of fibrosis has

FIG. 145

occurred, it is sometimes desirable to apply the technique at intervals of four to eight weeks and the same joints are released each time, only to tighten up again in the interval.

Another point with this technique is that on the first occasion you may release a cervical joint, on the second occasion a thoracic joint and only finally on a subsequent occasion may the lumbar joints yield. The principle of using the minimum of force consistent with achieving the objective is never more needed than in this technique. One should be content to release one joint at a time and so reduce the reaction of treatment to the minimum. When you have obtained the full confidence of the patient and she has the ability to relax completely it is surprising how little traction is needed. It is possible with this method when using excessive force to actually produce subluxations—no doubt that is what medieval prison officers had in mind when they used the rack on their victims, but this is not our objective with patients!

Vertical Adjustive Traction. FIG. 145

The patient and the operator stand back to back. The patient grasps her own opposite shoulders and allows the arms to rest against each other so that her elbows are poking forwards. The operator then reaches round backwards to grasp the patient's two elbows; then bends forward and holds the elbows rigidly, thus lifting the patient from the ground (it is no use a short operator attempting to do this on a tall patient!). The patient is asked to flex her head—to take up any slack in the ligaments. Then the operator, after a preliminary lift, shakes the patient, as it were—he uses the weight of the patient's legs to create the traction, and he obtains the effect by using his knees. The shake is effected by sudden extension of his knees to lift the patient still higher off the ground. If the patient is too tall for this technique the operator could use a low platform for the purpose, but the method is not so satisfactory because the patient, feeling somewhat insecure, tends to resist too much. The method effectively places a separational strain on the lower thoracic and lumbar vertebrae.

The technique may be modified and sometimes this is more effective by asking the patient to clasp her hands together in front; the operator then threads his arms backwards through the patient's elbows and round again to reach down to hold the patient's garments lateral to the hip joints. This forms an effective hold for lifting the patient. The same type of 'shake' of the patient creates adjustive traction to the lumbar area.

Vertical Adjustive Traction in the Sitting Position. FIG. 146

Sometimes a patient with a herniated lumbar disc finds she cannot take her weight on her legs without a good deal of pain but yet can sit fairly comfortably.

The patient sits with her hands clasped behind her neck. The operator can then stand looking at the patient's back and thread his two hands beneath the patient's axillae from back to front, then reach up to grasp the

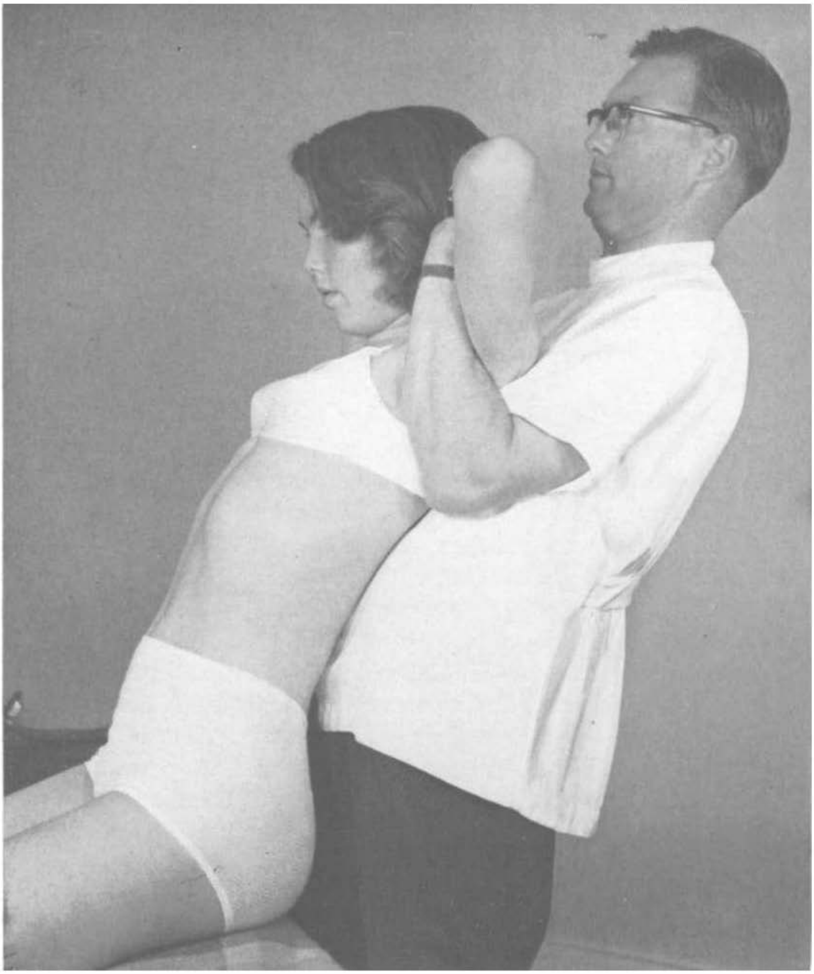


Fig. 146

patient's wrists. The operator has an effective grip and by leaning backwards he can lift the patient off the table. The patient will now have a tendency to try and straighten her knees but she must be asked not to do this and relax as fully as possible. The operator then attempts to shake the patient after the manner of the previous techniques by using his knees.

All the above techniques work most effectively treated early. Ideally the traction should be applied in the first few hours of the onset. The tissues have not had time to swell and the muscles are less irritable. The pain is less intense and there is some prospect of relaxation, sufficient perhaps for the manipulation to be effective.

If swelling and guarding and pain have had a chance to establish themselves then there is little prospect of success by manipulation for several days until again the pain and muscle-guarding have settled sufficiently to use the above techniques. In the meantime, rest, heat and analgesics are indicated. Sustained traction or any form of movement only serves to aggravate the muscle-guarding and therefore the pain.

At this stage relief may be obtained by epidural infiltration with local anaesthesia through the sacral hiatus. Local anaesthesia into the erector spinae muscles is also a useful measure in this acute phase but it needs to be very widely applied to be effective.
are also useful adjuncts in this acutely painful stage.

Where we have a herniated disc it is relatively easy to turn it into a prolapsed disc by manipulation! It has this tendency anyway spontaneously, and any injudicious manipulation can easily convert a lumbago into a sciatica. I have found for example from experience that it is unwise to apply torsional techniques. Particularly it is important to avoid torsion in the sitting position. The probable reason for this is that the torsion just tears the few remaining fibres of the annulus fibrosus which are left to hold the nuclear material from bursting through. Similarly any forced flexion technique is likely to convert a herniated disc into a prolapsed disc.

If a herniated disc cannot be reduced by traction techniques which are safe, the patient is in a highly vulnerable state—it is almost preferable to have a full prolapse because the patient at least becomes fairly stabilized even though there is nerve-root pain instead of the segmental referred pain arising from the posterior longitudinal ligament and dura.

However, it is not our purpose to accelerate the change from a herniation to a prolapse and patients hardly thank us for such a procedure. If the herniation is irreducible a plaster of Paris jacket is the best safeguard against further prolapse.

Another method of value in reducing a herniated disc is to apply a vertical thrust while the patient is under gentle longitudinal traction.

The patient lies prone on the McManis table, the ankles fixed at the lower end of the table and the thorax fixed by a strap. The lower leaf of table is then unscrewed to exert a traction effect.
gradually and not as much as the patient can bear. If the traction gives relief then a little more can be given. Another guide as to how much traction to apply is the state of guarding in the erector spinae muscles. If during the traction the guarding diminishes then something has been achieved and further traction can be applied. If relaxation and reduced pain ensue from the traction it is then safe to apply a vertical thrust.

The index finger and middle finger are applied one on each side of the

FIG. 147

spine over the transverse processes and the heel of the other hand then applies a thrust over these fingers. In this way we have two palpating fingers through which the thrust can be applied. A successful manipulation is accompanied by a very soft click which can be felt by the fingers.

The ideal thing now, if it is possible, is to apply a plastic corset (after the manner of McKee[1]) or a plaster of Paris jacket or at least some adhesive strapping (*see* Fig. 147) to prevent the patient from flexing her spine at all. Simple forward bending at this stage without any strain is sufficient to herniate the disc again. Flexion must be avoided for four to six weeks to enable fibrous union to take place.

If weight-bearing even with the spine erect brings on the pain again, then the manipulation has failed and we can only hope that time and nature will effect [illegible] this is a long and tedious business both for patient and practitioner alike.

MANIPULATION IN LUMBAR PROLAPSED INTERVERTEBRAL DISCS

As indicated earlier, manipulation cannot hope to reduce a prolapsed intervertebral disc because the track through which the nuclear material has escaped is smaller than the extruded material and the pressure within the disc is much greater than that in the vertebral canal. All we can hope for by manipulation is to alter the relative position of nerve-root and prolapsed nuclear material. Frequently this can be achieved, and provided we avoid damage to the nerve-root the method, albeit empirical, is well worth while—it may help the patient to avoid surgery. Nothing has been lost by the patient even if it fails and recourse has to be made to surgery later.

My own criteria for advising surgery are:

(1) Where the patient is in such severe pain that he or she cannot tolerate it any longer and manipulation and all other conservative measures have failed.
(2) Where the patient has suffered recurrent crippling attacks of pain which are seriously affecting his or her livelihood, and
(3) Where there are cauda equina pressure symptoms and signs.

In all other cases I would at least attempt the following manipulative technique. The chances of success depend partly on the size of the prolapsed material and partly on the site of the lesion. My own guide in prognosis is the straight leg raising test. If the test is positive at 30 deg. or less, the prospects of success are distinctly limited. The smaller the angle the less likely is manipulation to be successful and the lower the level of disc lesion the less chance of success, and the probable reason for this observation is that the lowest intervertebral foramen has the smallest-sized hole

[1] McKee, G. K., 'The Treatment of Disc Lesions of the Lumbar Spine', *The Lancet* (21.4.56).

and largest nerve-root. There is therefore less opportunity for manœuvre and alteration of position.

Given a patient with a disc prolapse at say 4–5 L., and a straight leg raising test positive of 45 deg., the chances of success by manipulation are over 50 per cent, and by success I do not mean complete relief of pain but a substantial reduction of pain and reduction of physical signs. After all, complete relief of pain can hardly be expected for the extruded nuclear material is still there, but in a position to cause less pressure. Such a patient would still be required to avoid flexion strains and wear a lumbosacral support for several months to enable shrinkage of the nuclear material to take its slow course.

Technique for Stretching the Sciatic Nerve. FIG. 148

The technique described here is best *given under anaesthesia* in order to obtain adequate relaxation, but it is not always necessary.

The patient is placed on her side with the painful side against the table and the torsional mobilizing technique for releasing the appropriate joint performed as described on p. 202 (Fig. 123). The idea here is to make sure that the apophyseal joints are at least mobile and that adhesions are released on the non-painful side. The patient is then turned over on to the other side so that the painful side becomes uppermost. Next, instead of using the usual technique as above, the patient's painful leg is now allowed to come over the side of the table (*see* Fig. 148). If the patient has, for example, left-sided sciatica from a prolapsed 4–5 L. lesion, then she will be lying on her right side and the operator places her left leg between his two legs, so that his right leg contacts the patient's left calf and his left leg contacts her left thigh. This position of the operator enables him to control the degree of flexion at the hip while maintaining the patient's knee in extension; that is, we can apply a stretch to the sciatic nerve while attending to the other details of technique. If the patient is anaesthetized, the operator should know at what angle the straight leg raising test is positive. If the patient is conscious she will soon indicate the angle to him. Having positioned the patient and her painful leg, the operator should just 'let up' a few degrees to relieve tension for a moment or two while arranging the upper part of the body. The torso should be rotated down to the correct level (4–5 L. in this case) as in the standard torsional technique. The operator is now in a position to make a direct specific adjustment of the 4–5 L. joint in combination with a stretch of the sciatic nerve. To be effective the release of the joint and the stretch of the nerve should be accurately synchronized—by no means easy because the operator is awkwardly balanced, particularly when the straight leg raising is of a low order.

Years ago, before disc pathology was understood, the stretching of the sciatic nerve under anaesthesia was empirically performed with the idea of

FIG. 148

breaking adhesions in the perineurium and a small percentage of cases were successful. Now we know more, it is likely that that procedure in fact altered the position of the nerve-root and the prolapsed disc. This technique is, I maintain, an advance on the older method of applying a strong stretch to the nerve with the patient lying supine on the table.

As a rule such a procedure causes a temporary exacerbation of pain, no doubt because of the stretching of an irritable nerve. It is desirable that the patient should have bed rest for a fortnight after the manipulation. It takes a week or more for inflammatory exudates to subside in the most successful of manipulations and this is best achieved by bed rest. When the treatment has been successful in reducing mechanical pressure on the nerve we find the straight leg raising test a guide to prognosis. Within two or three days the angle is increased and the pain diminishes fairly quickly after that.

Another guide to prognosis is the degree of muscle-guarding in the lower erector spinae group. Such guarding in successful cases subsides in a week. It is not possible to forecast with complete certainty that the manœuvre has been effective in less than a fortnight, but the straight leg raising and muscle-guarding are a great help in assessing progress.

I do not find that traction is of much help in the early days after such a procedure. My view is that the patient should be left alone and given fairly heavy sedation. Then, if the straight leg raising is rapidly increasing there is no need for traction. If, on the other hand, the straight leg raising test shows little change, I then use the 'Camp Varco' type of traction apparatus with a pull of about 20 lb. and use it to apply sustained traction with the foot of the bed raised 9 in.

When the manipulation has been ineffective

usually help in relief of pain, but the progress is much slower and bed rest needs to be continued very much longer.

In the successful case, I prefer to apply a plaster of Paris jacket or at least a strong lumbo-sacral corset before the patient gets up from bed. We minimize the risk of a relapse if this is done.

MANIPULATION IN CERVICAL PROLAPSED INTERVERTEBRAL DISCS

In my view the manipulation of the fully prolapsed intervertebral disc cannot replace the prolapsed material, and this applies equally well in the cervical area as in the lumbar area. We can, however, frequently alter the position of the prolapsed material and the nerve-root and thereby achieve a measure of relief for the patient. Such manipulation is more likely to be effective

there is relatively more space and the size of the prolapse is much smaller.

The technique used is much the same as that described on p. 113 (Fig. 46) for the direct specific adjustment of a rotation-restricted lesion but with the added use of traction during the technique.

While it is possible to apply this technique with the patient conscious and sometimes make an effective

effective under Pentothal anaesthesia, the reason being that the degree of pain such patients have precludes them from giving you adequate relaxation voluntarily. To attempt the manipulation without anaesthesia sometimes merely irritates the nerve because the release of pressure is ineffective.

we are dealing with a disc prolapse at 5–6 C., causing 6th cervical nerve-root irritation or compression on the right, the procedure is to release the left side and gap the right at the same moment.

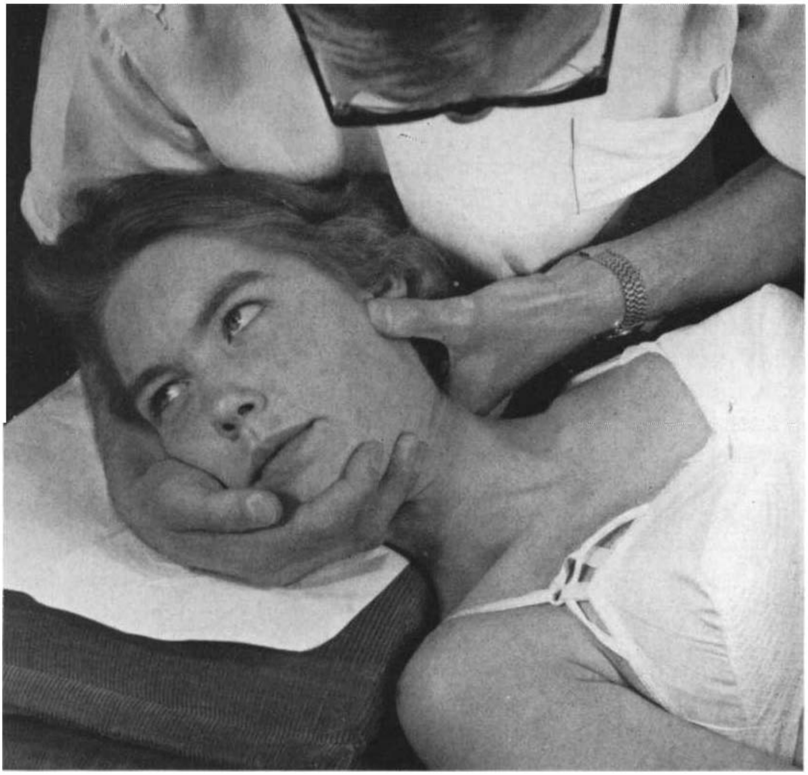


FIG. 149

Technique Using Traction for a Cervical Prolapsed Disc. FIG. 149

The patient lies supine and the operator stands at the head of the table. He applies his left index finger to the articular process of 5 C. on the left and holds the patient's chin with the right hand, his right forearm and arm supporting her right cheek and vertex of her head in such a way as to be able to exert traction as well as sidebending and rotation. The sidebending is controlled by the left hand pushing laterally to the right (to cause side-bending of the neck to the left) and the rotation is controlled by the right hand. The sequence of positioning then is first to flex down to 5–6 C., then sidebend to the left at 5–6 C. and rotate to the right, all the while maintaining a moderate degree of traction. The final adjustive force is an accentuation of the *rotation.*

The patient should be allowed to come round from the anaesthetic and be kept lying supine with a low pillow for two or three days. It is desirable to use a comfortable type of cervical collar to restrict movement for about two weeks. I have tried a wide range of designs of cervical collars and have come to the conclusion that the home-made one of padded cardboard is the most effective. It can be easily fitted. It allows some movement and yet restricts sufficiently. It can be made in a few minutes and can be replaced as and when necessary without expense.

With this technique I have never found the condition accentuated, and I consider it always worth while and safe even in the presence of marked nerve-root compression. A singularly effective and dramatic result occurred using this technique in a farmer aged sixty-three who had bent down to get under a railing at a race meeting; he misjudged the movement and rose too soon, catching the back of his neck against the lower bar of the railing. Within ten minutes pins and needles had developed down the right arm, then pain of increasing intensity and in twenty-four hours commencing weakness of the extensors of the wrist, fingers and thumb. When I saw the patient three days later he had had no sleep, and was in great distress and in no condition to manipulate without anaesthesia. The next morning, after the manipulation under Pentothal followed by $\frac{1}{8}$-gm. of morphia to give him a night's sleep, all the intense pain had gone and there was some return of power, especially in the extensors of the wrist. There was a permanent residual paresis in the extensor digitorum communis and the two extensors of the thumb but full recovery in the extensors of the wrist when I saw him a year later.

Where manipulation of the cervical spine fails to reduce a herniated disc or fails to alter the position of a prolapsed disc, we must then use traction either sustained or intermittent sustained. When to use sustained traction and when to use intermittent sustained is largely a question of the severity of the symptoms. When very severe, *sustained traction* is desirable. The patient lies supine in bed, a comfortable halter applied round her chin and occiput, and the traction is maintained by weights over a pulley at the top end of the bed.

The average weight required is 35 lb.—it should be sufficient to relieve the pain at least partially while the traction is maintained, and the neck requires to be kept at about 30 deg. of flexion. The reason for this is that during flexion the intervertebral foramina are opened, whereas in the neutral and extended positions they are narrowed. Years ago I tried applying the traction vertically with indifferent
abandoned it for horizontal traction. When using vertical traction it is virtually impossible to avoid backward bending of the neck and therefore it defeats our objective of releasing pressure on the nerve-root in the intervertebral foramen. Furthermore the patient is almost always apprehensive in this position and finds it practically impossible to relax, again defeating the object of the treatment.

Intermittent Sustained Cervical Traction has a more frequent applica-

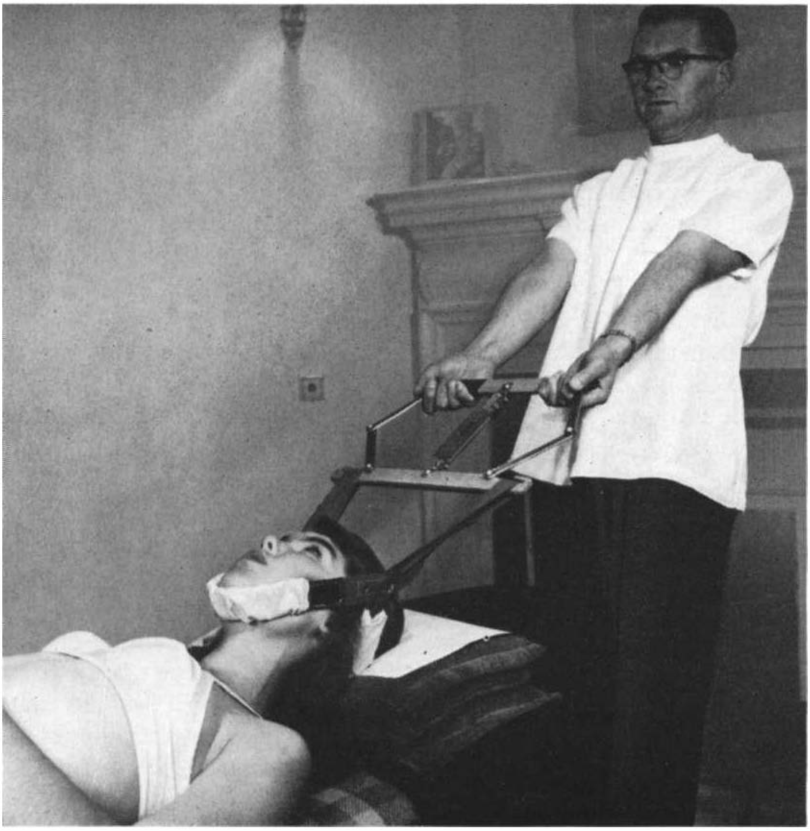


FIG. 150

tion than sustained for two reasons. The first is that with sustained traction the patient requires to be in bed, which usually means hospital, and the second disadvantage is that maintaining the neck quite still tends to reduce the flow of blood in the area. If much of the pain is due to congestion and swelling in the intervertebral foramen and nerve-root, as I believe happens in these cases, we are using a less effective measure
a certain amount of movement to take place. Movement, however slight, encourages the flow of blood and improves drainage. Therefore, unless the symptoms are extremely severe I find intermittent sustained traction more effective.

The method is to use a comfortable halter and the best design is the one illustrated in Fig. 150. The halter is attached to a spreader and bar between which is placed a spring balance to enable the operator to see how much traction he is applying. The average effective pull is 35 lb. Under 30 lb. is ineffectual and over 40 lb. tends to irritate the nerve-root. In the appropriate case this can be demonstrated beautifully. At 35 lb. there is relief from pain whereas at 30 lb. there is no change and at 40 lb. the pain is accentuated. I am aware that much greater force is used by some practitioners but I do not find this necessary or desirable.

There are certain details of technique which need to be observed if the method is to be successful. First of all the patient needs to be comfortable in order to relax. She must have confidence in the operator and must be firmly held to prevent slipping. The halter has to be the right design and size so that the major part of the pull is at the occiput and not at the chin. The pull on the chin must not hurt the teeth and the patient must be able to close the mouth without pain. The feet ought to be enclosed securely by ankle straps though body weight is usually sufficient if the patient is in bed or on a table with a cloth top. On the first occasion it is preferable to apply the traction direct using two hands, with the idea of giving the patient confidence and to enable the operator to make sure his patient is relaxing. When using the halter and bar it is difficult to feel the relaxation properly. One soon learns to pull at roughly 35 lb. by hand but it is a tiring procedure and cannot be maintained as long as when using the halter.

If the halter and bar are used it is quite easy for the operator just to lean backwards with his arms extended and merely letting his own body weight do the work. One could go on all day with this apparatus if the need arose!

It is *imperative* to commence and end the traction gradually. If the traction is jerkily started or finished the nerve-root is merely irritated and nothing is achieved; so commence the traction slowly and start with a pull of say 20 or 25 lb. just to give the patient an idea of what to expect and then tell her the next pull will be 30 lb. and then 35 lb. All these little points help in obtaining relaxation, without which you might as well not bother.

Having gradually pulled out to 35 lb., sustain the pull about half a minute and then *equally slowly* reduce the traction; wait a few seconds and then reapply the traction. Six to eight pulls are usually sufficient at one session and this should be done daily while acute, and alternate days when it is subsiding. The majority of cases begin to show signs of progress after three or four treatments and it is unusual for no progress to be made after six treatments. Between the traction the patient should be lying supine with pillows to maintain about 30 deg. of flexion.

If manipulation and traction fail, and this is rare, recourse to a cervical collar is necessary and occasionally in a very unstable disc lesion I have found it necessary to use a collar for three months. To use a collar for much longer than this leads to complications from adhesions and rigidity, both very undesirable, and are the result of the treatment rather than of the condition.

THORACIC DISC LESIONS

The thoracic intervertebral discs undoubtedly become herniated and even prolapsed but as their range of movement is small and there is plenty of room in the intervertebral foramina the incidence of thoracic disc lesions is small and their effects recognized. When very acute and when the pain is referred anteriorly, the pain may be sufficiently severe as to cause difficulties in differential diagnosis with such conditions as angina pectoris, pleurisy, perforated ulcers, intestinal and gall-bladder colic. If in such cases the spine is not examined, needless alarm is created or even laparotomies performed.

Adjustive manual traction should be attempted in these cases, and where it fails further manipulation should be avoided completely. With bed rest the pain usually subsides in two to three weeks. A shoulder brace to help splint the thoracic spine is a useful adjunct to the bed rest.

THE LATER STAGES OF DISC PATHOLOGY

Thus far we have dealt with manipulative procedures applicable to the acute and subacute phases of disc pathology. Now let us turn to those manipulative procedures which are of value in the later stages of disc pathology—to the cases in which the acute signs and symptoms of nerve-root pressure have diminished but yet persist in grumbling away many months after the original attack; also those not sufficiently severe to warrant surgery, nor making any progress with plaster of Paris jackets, corsets, and various physiotherapy modalities; patients with residual stiffness and backache; patients who have lost confidence in their spines; patients with chronic degenerative changes in their discs and adjacent apophyseal joints.

These patients do remarkably well on non-specific osteopathic articulatory techniques. Many of these techniques were described earlier in Chapter 3, but there are some additional techniques described below for those practitioners who have a McManis or a Grafton osteopathic treatment table.

These tables are invaluable because the centre pillar allows an up-and-down movement to raise or lower the level of the table; the lower leaf of the table can be moved up and down or from side to side or rotated. The centre portion is an air cushion for springing techniques and the upper portion will gap at the centre to provide a breathing space for the prone-lying patient; furthermore, it hinges so that the top end can be lifted up to form a back-rest. Ankle straps can be applied at the lower end of the table and this section can be wound out and used for sustained traction.

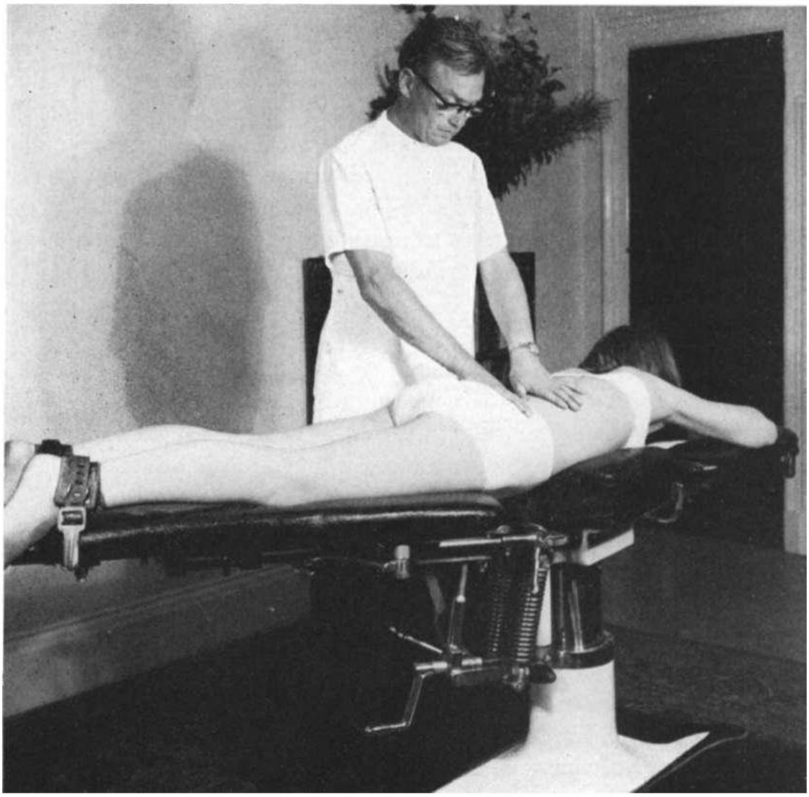


FIG. 151

McManis Sidebending Technique. FIG. 151

The patient lies prone and the operator stands on either side so that he can use the metal hoop round his thigh to control the side-to-side movement of the lower leaf of the table. This lower leaf is drawn out so that the pivot of movement is under the lumbar spine and the patient's ankles secured loosely in the ankle straps. A side-to-side movement is obtained and controlled with the operator's thigh. This leaves both hands free to apply pressure over each spinous process in turn. Pressure may be applied on the side of the concavity to force the joints into still more sidebending or pressure may be applied on the convexity side to oppose the sidebending in the joint above, while encouraging full sidebending in the joint below the fixation. This rhythmical sidebending articulatory technique alternately stretches and squeezes the soft tissues and blood vessels and can be kept up for several minutes. The sidebending may be combined

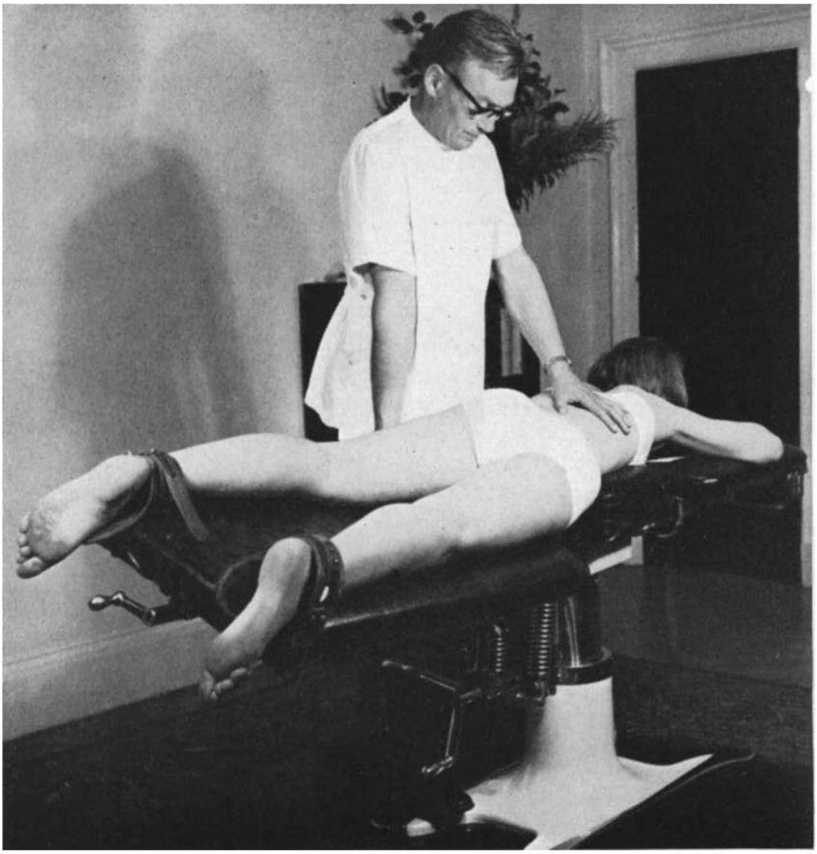


FIG. 152

with rotation by pulling on the opposite side of the pelvis and co-ordinating the lifting of the pelvis with the sidebending.

This technique can be used in complete safety in all mechanical and disc lesions in the lumbar spine and is a movement I use almost as a routine measure in the majority of cases with lumbar lesions.

Rotation Technique on the McManis Table. FIG. 152

The patient lies prone with her ankles loosely strapped on the table. When the operator stands on the patient's left side, he applies pressure and control of the lower leaf of the table with his right hand. The operator's left hand is then free to oppose or enhance the rotatory movement with pressure on the spinous processes.

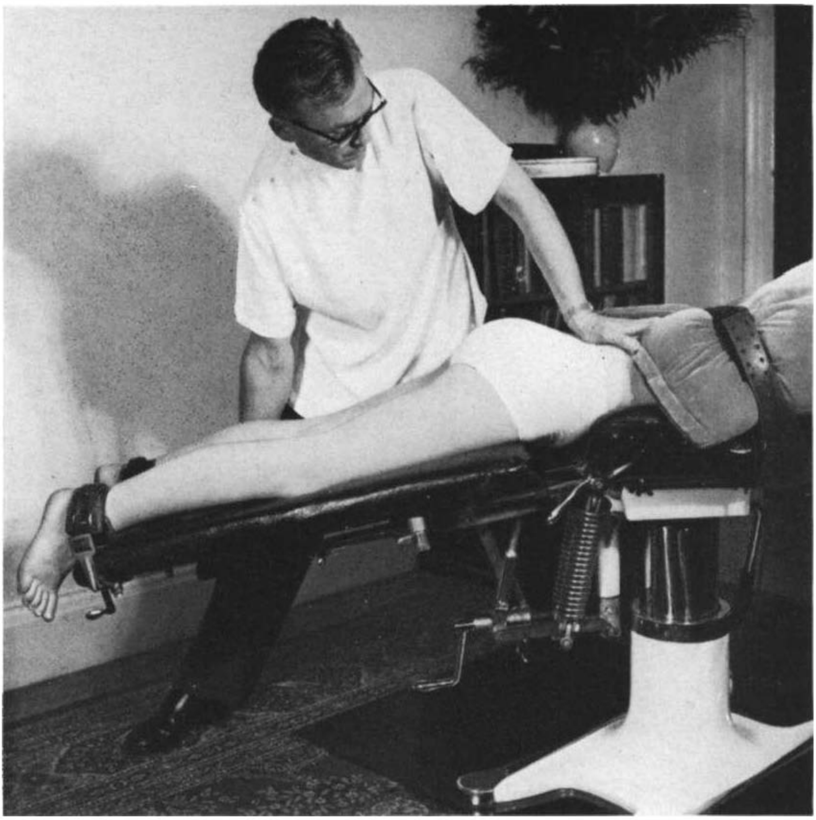


FIG. 153

Flexion and Extension Techniques on the McManis Table. FIG. 153

The patient again lies prone on the table strapped in at the ankles and she holds the handle-bars at the top of the table, or if this hold is not possible for any reason a strap may be applied round the patient's lower ribs. Then the lower leaf of the table is screwed out to put a stretch on the lumbar spine. The operator then moves the lower leaf of the table up and down in a slow, rhythmical fashion with one hand and applies counter pressure with the other hand on each successive spinous process.

This technique needs to be used with circumspection where there is disc degeneration because the leverage and force available is considerable. The lower leaf ought not to be pressed far down into too much flexion in case gapping of the joint causes a herniation of the disc. In a number of cases where the apophyseal joints are hitched (as in forward-bending restricted lesions) the method may be the only one which will unhitch the joint. It gives way with a soft click and the patient obtains relief immediately.

During the flexion the spinous processes can be felt to separate, and in cases where there is no separation or inadequate separation a downward thrust can be applied with the other hand over the spinous process above that of the lesioned joint.

The technique is applicable to the thoracic spine as well as the lumbar area, but here we must rely on the patient's co-operation and her ability to grip firmly at the top of the table and yet relax her spine. Such controlled relaxation is not by any means easy but should be possible by the average intelligent patient.

A combination of movements can be obtained by using the lower leaf of the McManis table open to two of its ranges but such combined movements are complex, not easy to control, and are rarely indicated anyway. The point to remember is to try and arrange the pivot of movement to be just below the level of the lesion, and while articulating at all levels of the lower thoracic and lumbar joints to pay special attention to those joints where there is a restricted range of movement.

Any of the movements can be used to exert an articulatory effect the lower thoracic as well as the lumbar joints, but we need to have the lower leaf extended out to its fullest extent.

Motorized Rhythmical Traction

Rhythmical traction, obtained by using a motor to pull at the rate of twelve per minute, is designed to achieve an improvement in the fluid interchange of the intervertebral discs and it is of inestimable value in the treatment of chronic degenerative changes in discs.

The theoretical basis for the assumption that intervertebral disc fluid exchange can be improved is as follows: As there is no blood supply to the discs, its nutrition must be obtained by tissue-fluid diffusion between cancellous bone of the vertebral bodies and the nucleus pulposus of the disc. There are numerous small perforations in the cartilaginous plates which separate the bone and nucleus. These plates act as semi-permeable membranes to allow for fluid interchange without blood interchange. There must be a balance between hydrostatic pressure and osmotic pressure, and when we find that in a dissected intervertebral joint with all its ligaments severed there is about a millimetre of increase in width which requires approximately 30 lb. compression to restore it to its previous width, it indicates how high the osmotic pressure must be within the nucleus pulposus and how strong the annulus fibrosus must be to maintain the approximation of the vertebrae.

There is a considerable diurnal variation in the fluid content of the intervertebral discs because on average the total height of the individual is ½-in. to 1-in. taller after a night's rest in bed compared with after a day of activity. Presumably during the day, superimposed body weight compresses the intervertebral discs and reduces their water content and during the night they tend to expand again. The spongy nature and water-imbibing properties of the disc are those of the mucopolysaccharides (chondroitin sulphate) within the cartilage and it is not unreasonable to suppose that many of the disc phenomena are due to the variation of fluid content. J. Charnley, in the *British Medical Journal* of 5.2.55, discusses this theory and logically explains the acute episodes of lumbago on an increased fluid tension basis. A. Naylor and D. L. Swane, in the *British Medical Journal* of 31.10.53, postulate that the possible sequence of changes leading to the development of the disc syndrome consists of (1) Depolymerization of the polysaccharides of the collagen polysaccharide complex in the nucleus pulposus, leading to (2) increased power of water absorption causing (3) absorption of fluid by the nucleus, the fluid entering via the end-plate, (4) increase of pressure within the disc. The forces developed by leverage and muscular action would augment this.

Cloward and Buzarid (*American J. Roentgenol*, 68, 552, 1952) demonstrated that considerable fluid interchange can occur, as shown by rapid absorption of 35 per cent diodrast when used in disc nucleography.

Bearing in mind that the intervertebral discs have these hydrophilic qualities and that there is a diurnal variation of height, it is not unreasonable to assume that the increase of height occasioned by rhythmic traction is due to fluid expansion of the intervertebral discs. I have demonstrated to my own satisfaction an increase of height of ¼-in. to ¾-in. in large numbers of patients subjected to rhythmic traction. Such increase of height takes about two hours to return to normal. If the increase of height were due to elastic stretching or straightening out of the curves of the spine, it would be reasonable to expect such increase to return to normal immediately upon the assumption of the erect position.

If it takes eight hours of bed rest to produce a ½-in. increase of height and only fifteen minutes of rhythmic traction in the horizontal position to produce ½-in. increase of height, it is a reasonable assumption that the treatment is a powerful stimulus to the imbibing of fluid into the discs.

Now if we can increase the fluid interchange artificially in this way we must also improve the nutrition of the discs in the process, and in chronic degenerative discs the method is of undoubted clinical value. I have not been able to demonstrate any permanent increase in thickness of discs but the clinical improvement in patients' symptoms is unquestionable and the above theory appears to fit the picture well. Under such treatment the increased fluid tension within the disc may be sufficient to cause a bulging of the disc and thereby signs and symptoms of herniation. On one or two occasions this in fact has happened so that I now avoid using motorized

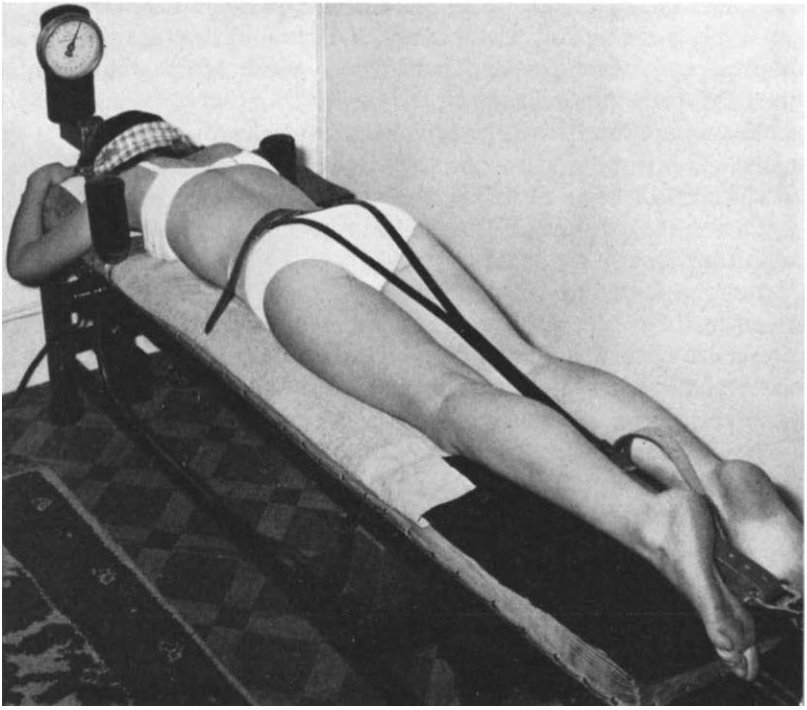


FIG. 154

rhythmic traction upon patients where I consider there is instability and risk of herniation. Rather do I confine this method of traction to the chronic low backache syndrome associated with X-ray evidence of narrowed disc spaces.

There are several motorized rhythmic traction tables in use. The one shown in Fig. 154 has been in continuous use since 1934. Ideally the apparatus should have a spring balance at the top of the table to measure the traction being exerted at the head and another attached to the lower strap to measure the traction being exerted at the pelvis.

SPINAL TRACTION

Indications and Contra-indications

It will be seen from the above discussion on the treatment of intervertebral disc lesions that spinal traction holds an important place and plays a definite role in the armamentarium of treatment. It is desirable, however, to place it in its proper perspective with other forms of treatment and while pointing out its value and indications, also to emphasize its disadvantages. Excessive and indiscriminate use of traction will only bring the method into disrepute.

The *types of traction* have been mentioned already—they are (1) sustained, (2) intermittent sustained, (3) rhythmical, and (4) adjustive, each of which may be applied manually or with some mechanical aid.

During the application of sustained traction it is possible to effect an overall increase in height of about one inch in the average young adult. Part of this is due to a straightening out of the curves, but most of the stretch can be demonstrated on X-rays to be due to separation of the vertebral bodies. The films show a widening of the disc spaces and intervertebral foramina, and some separation of the apophyseal joints. All these effects can

The *purposes of traction* are:

(1) The adjustment of position.
(2) The freeing of longitudinal adhesions.
(3) The relief of nerve-root pressure.
(4) The separation of apophyseal joints.
(5) The obtaining of a circulatory effect.
 (*a*) Decongestion round the intervertebral foramina, and
 (*b*) Reduction of hydrostatic pressure inside the disc.

By the adjustment of position is meant either the repositioning of a herniated disc or the realignment of adjacent vertebral bodies. Oftentimes both these objectives are realized at the same time, but no claim is made that a fully prolapsed disc can be adjusted during traction. The types of traction used for these purposes is rhythmic adjustive manual traction (p. 235) for the cervical and thoracic areas, and vertical adjustive traction (p. 239) in the lower thoracic and lumbar areas.

The freeing of longitudinal adhesions may well be obtained by the adjustive tractions just mentioned, and frequently these techniques are the only ones which satisfactorily achieve such release.

The relief of nerve-root pressure or irritation may be obtained with sustained or intermittent sustained traction, and the pros and cons of each type are discussed on p. 248.

The separation of apophyseal joints is particularly valuable in osteoarthritis of these joints, just as traction is valuable in osteoarthritis in most other joints.

The probable explanation of the benefit of traction in osteoarthritis is that the traction breaks into the vicious cycle of pain, muscle spasm and pain. Presumably contact of the roughened opposing articular surfaces

sends abnormal afferent impulses to the spinal cord which causes reflex muscular-guarding round the joint. Such muscle contraction causes more apposition of joint surfaces, therefore more pain and more abnormal affe [illegible]
feels relief of pain—provided the patient relaxes well and the traction is sufficient to separate the surfaces and yet not too much to pull on sensitive structures—then there must be a reduction of the abnormal affer [illegible] bardment of the spinal cord, fewer abnormal efferent impressions to the muscles, and therefore relaxation. The breaking into this vicious cycle, even if only for a few minutes, has a lasting effect, just as infiltration of a local anaesthetic can have a lasting effect by breaking into the cycle of pain, spasm, pain.

Where there is considerable nerve-root pressure there must surely be a good deal of local congestion and swelling. While traction is applied, e.g. intermittent sustained traction of the neck, the patient often feels relief quickly and the benefit is felt long after the traction has stopped, so that it is reasonable to assume that there has been some reduction in the venous congestion and swelling round the nerve-roots.

The other circulatory effect of traction is in the reduction of hydrostatic pressure within the nucleus of the disc, thereby a relative increase of osmotic pressure and the imbibing of more fluid with resultant swelling of the disc. This turgidity may be a disadvantage in herniated discs, but it can be of great value in the treatment of degenerated discs (*see* p. 255) by motorized rhythmic traction.

The Contra-indications to traction are to some extent self-evident from what has been said, but there are several others, and these are listed below:

(1) Traction must not be applied in the presence of inflammation or disease.
(2) Traction should not be applied where there is any risk of converting a herniated disc into a prolapsed disc.
(3) Rhythmic traction is contra-indicated in foraminal compression lesions.
(4) Traction is inadvisable in the presence of hypermobility.
(5) Traction is unsuitable in the patient who has a structural scoliosis or a marked kypho-lordosis.

Traction need never be more than 50 lb. and greater force than this is contra-indicated, in my view.

APPENDIX

THE APOPHYSEAL FACETS

A key to the understanding of the normal spinal movements is to be found in the study of the apophyseal joints, and for the purposes of manipulative techniques it is essential to have a working knowledge of the *angles of the facets.*

The superior and inferior facets oppose each other and in the main the two sides are symmetrical, so that it is only necessary to visualize and describe the superior facets. Broadly speaking, the superior facets of the cervical region face upwards and backwards, those of the thoracic area outwards and backwards, while those of the lumbar area face inwards and backwards.

The angles given here are an average of a number of studies of the skeleton and X-rays. All the measurements are of the superior facets, and the angles are based upon the normal erect anatomical position. The figures are measured to the nearest 5 deg. because this is near enough for practical purposes, and in any case it is not easy to measure the angles more accurately. Ideally, when learning techniques one should have an articulated spine to look at, at the same time as one positions the patient. Then the visualizing of the facets will not be merely a question of memory.

The Atlas

The superior facets of the atlas are kidney-shaped, concave in both directions, and their long axes point forwards, meeting at an angle of 50 deg. They face upwards making an angle of 60 deg. with the vertical coronal plane, and inwards making an angle of 75 deg. with the vertical sagittal plane. These angles vary, of course, with the curvature of the concavity. The above angles are those of the interior part of the facet.

The Axis

The superior facets of the axis are almost circular with a flattened part of the arc postero-medially. They are convex antero-posteriorly, and face upwards (85 deg. with the vertical coronal plane), and outwards (110 deg. with the vertical sagittal plane).

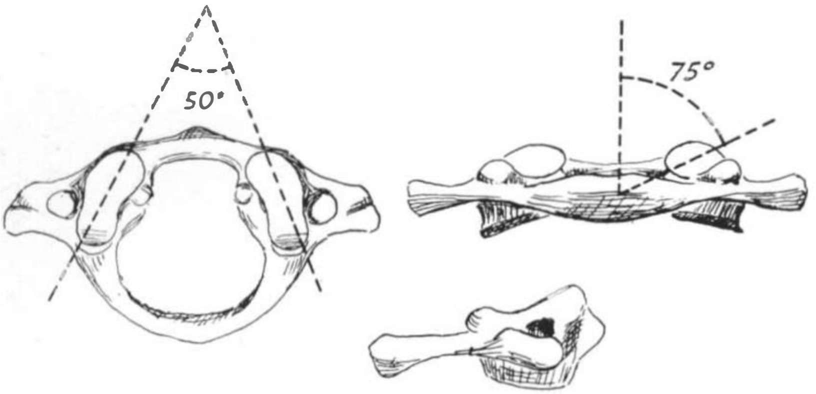


FIG. 155. *The atlas.* Left: *superior aspect.* Right: *posterior aspect.* Foot: *lateral aspect*

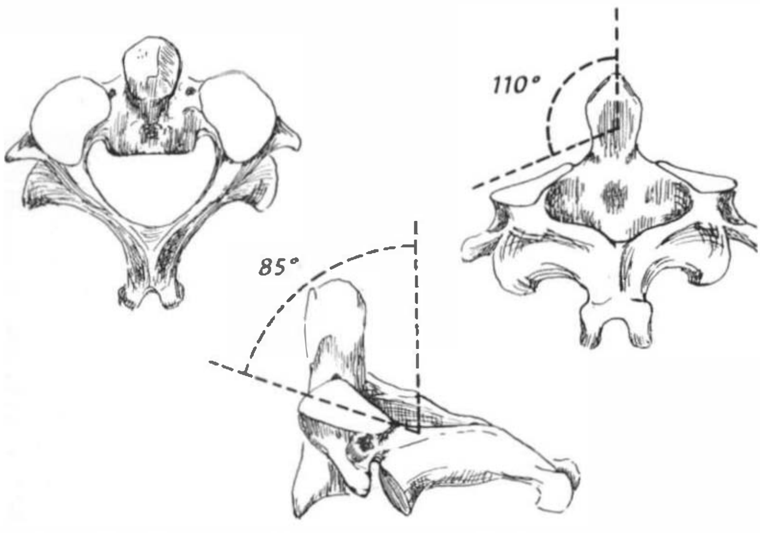


FIG. 156. *The axis.* Left: *superior aspect.* Right: *posterior aspect.* Foot: *lateral aspect*

3 C.–7 C.

The superior facets face backwards and upwards. A line joining the planes of these facets is practically coronal in direction and they are almost flat.

The angles formed with the vertical coronal plane are:

3C., 30 deg.; 4 C., 50 deg.; 5 C., 60 deg.; 6 C., 55 deg.; and 7 C., 40 deg.

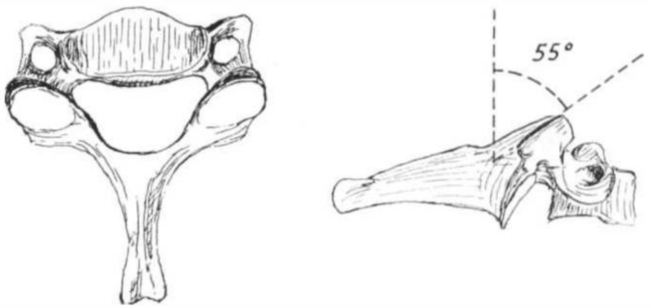


FIG. 157. *A cervical vertebra.* Left: *superior aspect.* Right: *lateral aspect*

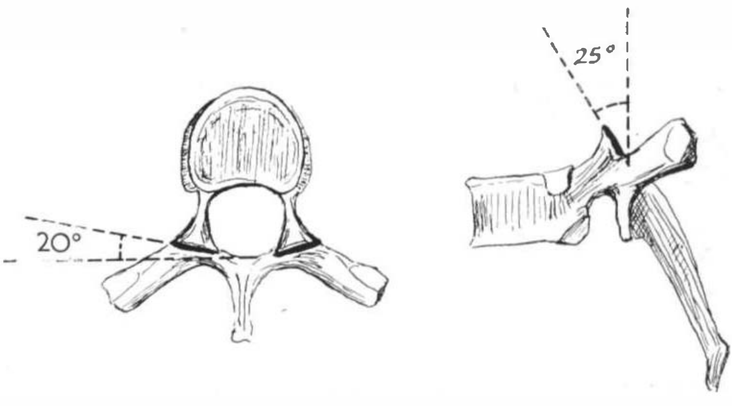


FIG. 158. *A thoracic vertebra.* Left: *superior aspect.* Right: *lateral aspect*

1 T.–12 T.

The superior facets face backwards and slightly outwards, and the upper ones upwards. If the planes of the facets are joined together they form an arc of a circle whose centre is well forward of the body of the vertebra.

The upward and backward angles formed with the vertical coronal plane are:

1 T., 60 deg.; 2 T., 45 deg.; 3 T., 35 deg.; 4 T., 30 deg.; 5 T., 25 deg.; 6 T., 25 deg.; 7 T., 20 deg.; 8 T., 5 deg.; 9 T., 0 deg.; 10 T., 0 deg.; 11 T., 5 deg.; 12 T., 10 deg.

The outward angles formed with the vertical coronal plane are:

1 T., 5 deg.; 2 T., 10 deg.; 3 T., 20 deg.; 4 T., 30 deg.; 5 T., 30 deg.; 6 T., 20 deg.; 7 T., 20 deg.; 8 T., 20 deg.; 9 T., 15 deg.; 10 T., 10 deg.; 11 T., 0 deg.; and 12 T. faces inwards at an angle of 50 deg.

1 L.–5 L.

The superior facets of the lumbar vertebrae face backwards and inwards and are almost vertical. They are curved, concave backwards, and if their surfaces are projected towards each other they form the arc of a small circle whose centre is approximately at the middle of the spinous process.

The 1–3 superior facets are vertical, but 4 and 5 L. face a little upwards, 4 L. forming an angle of 10 deg., and 5 L. 20 deg. with the vertical coronal plane.

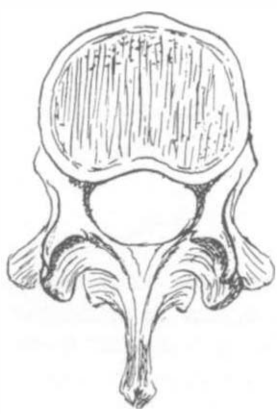


FIG. 159. *A lumbar vertebra: superior aspect*

The Lumbo-Sacral Joint

The angles of the lumbo-sacral facets are notoriously variable and their plane may be almost sagittal or actually coronal. Dunning[1] made an excellent study of these angles in 330 specimens of sacra, and found these angles may be as small as 27 deg. (almost sagittal), to as large as 93 deg. (just beyond the coronal plane). The angles 45 deg.--60 deg. were considered average. These are the angles formed by the superior surface of the 1 S. facets with the vertical sagittal plane. These facets tend to be less concave than those of the lumbar facets.

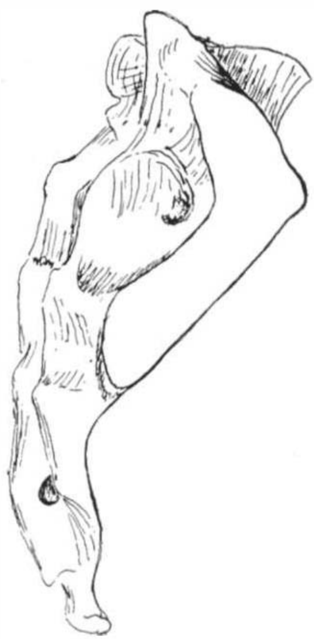


FIG. 160. *The sacrum: lateral aspect*

Sacral Facets

The auricular articular facets which form the sacro-iliac joints are extremely variable in shape, and the surfaces are most irregular, but the irregularity of the sacral facets fit in with the opposing irregularities of the iliac facets. The outline of the auricular surface is roughtly L-shaped, with

[1] DUNNING, MURIEL, D.O., M.R.O., 'An Analysis of the Lumbo-Sacral Articular Facets' in the *Proceedings of the Osteopathic Association of Great Britain* (1956).

a longer almost horizontal section joined to a shorter almost vertical section.

Recently I examined 50 sacra, 30 of which were female and 20 male. 64 per cent of them were concavo-convex, and 20 per cent were mainly concave and 16 per cent mainly convex antero-posteriorly. 92 per cent were wedge-shaped with the wider part superiorly, and 8 per cent had one side wider inferiorly. Two of the sacra had 'wasp waists'. It has been taught that most sacra have a promontory at 2 S. level, but I found only 4 per cent with this feature. On the other hand, many showed a deep irregular depression posterior to the auricular surface at the level of 1–2 S. for the attachment of the interosseus sacro-iliac ligament. This depression was more marked in the female sacra, and slightly higher in level—at 1–2 S. or even 1 S., rather than at 2 S. where the male sacral depression was usually situated. 80 per cent of the sacra have very irregular surfaces and 20 per cent were comparatively smooth, one surface being practically flat. The implications of these points with regard to movement are discussed in the next section.

NORMAL MOVEMENTS OF THE SPINE

Various references to normal movements are made in the main text of this manual, in particular to the works of Halladay and Fryette, and this section is partly based upon their findings, together with ranges of movements taken from measurements of a large number of mobility X-rays. Average figures only are given because individual variations are considerable. The range of movement of an acrobatic dancer is hardly comparable with the restricted range of the adult who takes little or no exercise. Ranges of movement decrease with increasing age, so that the ranges here described are those of normal young adults. Even when comparing the same age group, there is a constitutional factor to be considered. Some people have relatively long ligaments, while others have short ones, so that what might be considered hypomobility in one patient would not necessarily be so in another. It is worth while just examining the metacarpophalangeal joints and elbows on each patient to obtain an idea of their particular degree of ligamentous elasticity. If the ligaments of these joints are lax, then those in the spine are also likely to be lax.

When examining a joint we wish to know its active range first, and secondly its passive range. In order to check our clinical findings mobility X-ray films are used. Weight-bearing mobility films give the range of active movements, whereas mobility views taken lying down give the passive range of movements in an area. For the purposes of techniques the passive range is of more importance, so that in practice this type of mobility film is used rather than the weight-bearing ones.

It is easy enough to obtain X-ray pictures of the spine in forward and backward bending, and even in sidebending, but it is difficult to obtain films showing rotation of the spine, and in any case such films are useless for measurement purposes. The assessment of rotation then remains a clinical matter which cannot satisfactorily be checked radiologically.

Measurements of Angles of Movement

These angles given are averages only. Errors of measurement taken from X-ray pictures inevitably creep in, because of the difficulty in positioning the patient accurately. Errors of parallax creep in also, and sometimes the drawing of lines on the films cannot be done precisely because of overlapping of adjacent bones. However, with care these errors can be minimized and they are a guide, though of course it is the clinical palpation which has to be relied on. Just as in X-raying the gastro-intestinal tract, the films are a help and often confirmatory, but the whole clinical picture must be the basis of diagnosis. However perfect the laboratory instruments become, clinical judgment will inevitably be the most important factor in diagnosis, and this applies particularly so when making a mechanical diagnosis.

Ranges of Movement

The Occipito-atlantal Joint

The only range which can be measured from radiographs is forward and backward bending. The average is 10 deg. Sidebending and rotation can be palpated but there is only a small range which occurs at the very limit of the movement, i.e. when all the other cervical joints have reached the limit of their range.

The Atlanto-axial Joint

The main movement here is rotation, and it is very easy to palpate, but cannot be measured. The forward and backward range is 15 deg. It is curious that this is a greater range of flexion-extension than occurs at the occipito-atlantal joint.

2–3 C. Joint

Forward-bending–backward-bending range: 10 deg.
Sidebending range could not be measured.

3–4 C.

Forward-bending–backward-bending range: 15 deg.
Sidebending: 9 deg.

4-5 C.

Forward-bending–backward-bending range: 17 deg.
Sidebending: 8 deg.

5-6 C.

Forward-bending–backward-bending range: 12 deg.
Sidebending: 5 deg.

6-7 C.

Forward-bending–backward-bending range: 12 deg.
Sidebending: 8 deg.

7 C.-1 T.

Forward-bending–backward-bending range: 4 deg.
Sidebending: 8 deg.

THORACIC MOVEMENTS

Forward bending and backward bending		*Sidebending*
3 deg.	1–2 T.	3 deg.
3 deg.	2–3 T.	3 deg.
3 deg.	3-4 T.	2 deg.
2½ deg.	4–5 T.	2 deg.
2½ deg.	5–6 T.	1 deg.
2 deg.	6–7 T.	2 deg.
2 deg.	7–8 T.	4 deg.
1 deg.	8–9 T.	5 deg.
1 deg.	9–10 T.	5 deg.
4 deg.	10–11 T.	5 deg.
7 deg.	11–12 T.	6 deg.
9 deg.	12 T–1 L.	6 deg.

LUMBAR MOVEMENTS

Forward bending and backward bending		*Sidebending*
9 deg.	1–2 L.	6 deg.
11 deg.	2–3 L.	8 deg.
12 deg.	3–4 L.	10 deg.
12 deg.	4–5 L.	8 deg.
10 deg.	L.–S.	2 deg.

Combination of Spinal Movements

Although forward and backward bending occur as simple movements in the spine, it is almost impossible to obtain pure sidebending or pure rotation in any area of the spine. This is because after a few degrees of pure sidebending the facets come into apposition and these then force the vertebral bodies into rotation. Conversely commencing with rotation the facets enforce a measure of sidebending after the first few degress of rotation. One exception to this rule is in the thoracico-lumbar area, where sidebending or rotation can occur as pure movements provided the spine is slightly flexed to start with. The clinical implications of these facts are described in the technique section of this manual.

The direction of the rotation occurring secondary to sidebending depends on the area of the spine and whether the sidebending commences from an original position of erect normal, or from a position of forward bending, or from a position of backward bending.

The rule is that in the cervical area the rotation of the vertebral bodies occurs to the same side as the sidebending. This applies from whatever degree of forward or backward bending you start.

In the thoracic and lumbar areas, on the other hand, rotation and side-bending occur to the same side only from an original position of forward bending. If the original position is an erect or backward-bending position, then the rotation of the vertebral bodies occurs to the opposite side to which the torso is sidebent.

Sacro-iliac Movements

The maximum rangeof sacro-iliac movements occurs during pregnancy, when the ligaments are more elastic than at any other time. Studies by James Young[1] on movements of the pelvis during pregnancies showed that there were two components of movement, a hinge-like one and a rotatory one. He showed that during the first six or seven months of pregnancy there was an average increase of width of the symphysis pubis from 5 mm. to 9 mm. Such an increase of width at the symphysis means a horizontal ginglymus movement at the sacro-iliac joint, with an approximation of the posterior superior iliac spines. Young also showed that by taking X-rays of the symphysis pubis in the erect position, with the patient taking the weight alternately on one leg and then on the other, that there was an upward and downward movement of the symphysis of 2 mm. in each direction. This movement implies a rotatory or trochoid movement at the sacro-iliac joint. The pivoting is likely to occur round the concentrated posterior sacro-iliac ligaments at the1–2 S. level mentioned earlier (p. 265) rather than at the promontory occasionally seen in sacra at 2 S. level.

[1] Young, James, 'Relaxation of the Pelvic Joints in Pregnancy', *Journal of Obstetrics and Gynaecology of the British Empire*, Vol. 47, No. 5 (1940), p. 493.

The distance from the symphysis pubis to the sacro-iliac joint is about four times that of the distance from the posterior superior iliac spines to the sacro-iliac joints; and if the maximum excursion of both ginglymus and trochoid movements at the symphysis is 4 mm., then it follows that the maximum excursion at the posterior superior iliac spines is 0·5 mm. in either plane. This is a small-enough range and difficult to detect clinically but it is certainly palpable with sensitive fingers.

SURFACE ANATOMY OF THE SPINE

For detailed mechanical diagnoses it is necessary to locate the level of the vertebral joint accurately, so that a record can be made of findings. Spinous processes are the most obvious to palpation and the levels of some of these processes are more easily determined than others. Then it is a matter of counting upwards or downwards to the level of the joint in question.

The vertebrae best used for this purpose are 2 C., 7 C., 11 T. and 5 L.

The *atlas* posterior tubercle is difficult to feel but the transverse processes quite easy, between the rami of the mandible and the mastoid processes.

The *axis* spinous process is usually very large and is the first bone to be palpated below the occiput. The transverse process of 2 C. is difficult to feel, but can usually be found vertically below the transverse process of the atlas deep to the sternomastoid.

The 7 C. spinous process is known as the *vertebra prominens* because its spine is so much larger than those above. It is the first to be felt easily below 2 C. when running the finger from above downwards along the ligamentum nuchae. If while palpating the 7 C. spinous process the neck is bent backwards the spine of 6 C. tends to become even less conspicuous. This test will confirm that you are indeed at 6–7 C.

When counting the remaining cervical vertebrae it is easiest to flex the neck with one hand (preferably with the patient supine and fully relaxed) and palpate the spinous processes with the other thumb, starting either from above at 2 C. or from below at 7 C. Then, by moving the palpating thumb or finger round the neck forwards, you will be able to palpate the articular processes corresponding with the spinous processes in question. The tips of the spinous processes are on a level with the inferior margins of the articular processes of the same vertebrae, i.e. they are on a level with the apophyseal joints. By palpating longitudinally one is often able to feel the margins of these apophyseal joints and, of course, if there is a positional fault, the margins are felt more readily. The transverse processes are deeply situated in the cervical region, their tubercules are covered by the scaleni attachments and the spinal nerves, making their exits there, cause difficulty with palpation. Some degree of tenderness here must not be considered abnormal.

The spinous process of 1 T. is on the same horizontal level as its transverse processes and the angles of the 1st ribs.

As we move down the spine we have no distinct surface-marking. We merely have a rough guide from the scapulae. With the arms comfortably hanging down in the sitting or standing positions the spine of the scapula is on a level with the spinous process of 3 T. and its apex on a level with the spinous process of 7 T. But to be accurate, it is necessary to count downwards from 7 C. or 1 T. Occasionally, owing to approximation of spines, the interval between is difficult to determine and they are often misshapen. Another consideration is that the spinous processes of the thoracic area incline downwards at an increasing angle as far as 7 or 8 T. Thus at 1 T. the transverse and spinous processes are on the same horizontal level; at 4 T. the spinous process is on a level with the transverse processes of 5 T., and at 8 T. the spinous process is on a level half-way between 9 and 10 T. transverse processes.

The spinous processes below 8 T. rapidly shrink in length and decrease in obliquity so that from 10 T. down to 5 L. the middle of the spinous process corresponds horizontally with half-way between the transverse process of the same vertebra and the transverse process of the vertebra below.

A fairly accurate way of finding the spinous process of 11 T. is to follow the lines of the last ribs. They are usually easy to feel and if the palpating fingers move along both 12th ribs towards the centre they lead directly to the spine of 11 T.

The angles of the ribs are important for testing rib mobility and position. They are found on the same horizontal level as the transverse processes.

With regard to the lumbar spinous processes, we have the crest of the ilium as a guide. The standard anatomy textbooks say that the crest is on a level with the spinous process of 4 L., but this is *not* so in the majority of cases. By studying the levels of the iliac crests on erect X-ray pictures we find that 60 per cent of the crests are on a level midway between 4 and 5 L. spinous processes and only 22 per cent on a level with 4 L. spinous process. The remainder are on a level with 5 L. spinous process.

There is of course the problem of anomalies in this area, and anomalies are more frequent here than elsewhere in the spine, so that without an X-ray we must rely on palpating for movement at the lumbo-sacral joint. There are very few lumbar spines without some palpable mobility at this level. When we find the lowest movable joint the vertebra above is the last lumbar vertebra whether it be 4 L., 5 L. or 6 L.

The posterior superior iliac spines of the innominates are not of much use in counting lumbar spinous processes, though they are invariably at the level of the body of 2 S. The difficulty here is that the spinous processes of 1 and 2 S. are very poorly defined. When comparing levels of the posterior superior iliac spines with each other, it is best not to wobble about at the peak of these promontories but rather to feel below and palpate upwards to the lower margins of the posterior superior iliac spines. This gives a more reliable estimate of levels when testing for sacro-iliac and pelvic lesions. Other surface-markings and levels, and the direction of ligaments and muscle fibres, are described in standard textbooks of anatomy. The student will be well repaid by a study of these surface-markings.

He cannot hope to become adept at mechanical diagnosis and manipulation without having a mental picture of what underlies his palpating fingers.

INDEX