PALPATION EXAMINATION OF THE POSTERIOR CERVICAL SPINE: THE IDEAL, AVERAGE AND ABNORMAL

The two purposes of this paper relate to Man in or beyond his fifth decade. The first purpose is to detail the 'abnormalities' which can be found by palpation examination of the cervical spine posteriorly, and the second is to try to explain what the findings indicate. The 'Ideal' spine, the 'Abnormal' spine and three groups of the 'Average' spine are defined.

The method of examining the cervical spine by palpation techniques is detailed. Discussion centres around what is normal for an ideal spine and the average spine and what it is that changes when the average spine becomes 'abnormal'. The associated 'new' and 'old' tissue changes are discussed in relation to the common findings in the Upper, Middle and Lower Cervical Spine.

GEOFFREY D. MAITLAND

G Geoffrey Maitland, M.B.E., A.A.A., F.C.S.P., F.A.C.P., S.A.S.P., M.M.T.A.A., is well-known for his study, writing and teaching of manipulative therapy in the post-graduate area; he is also a private practitioner in North Adelaide.

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Palpation examination of the posterior elements is the most informative single section of physical examination of the cervical spine (excluding examination for serious disorders of the Central Nervous System, the Peripheral Nervous System and the Vascular System). Frequently, examination of a patient's physiological movements provides inadequate information when related to the complaint. Examination by palpation techniques, on the other hand, is always informative.

This paper is related to Man in his fifth decade and beyond, and has two purposes. The first purpose is to detail the abnormalities which may be found by palpation examination of the cervical spine posteriorly, and the second is to try to explain what the findings might indicate. To achieve these goals, while discussing the routine of the palpation examination of the posterior aspect of the cervical spine, the spine will be descriptively divided into three sections:

- the upper cervical spine (C1-C3), being from the skull to the third cervical vertebra,
- the middle cervical spine (C3-C5), being from the third vertebra to the fifth, and
- the lower cervical spine (C5-C7), being from the fifth to the seventh cervical vertebra (See Figure 1).

Before embarking on the body of the text it is necessary to explain and define what is mean by the 'Ideal' spine, the 'Average' spine and the 'Abnormal' spine.

The Ideal, Average and Abnormal Spine

Ideal

The 'Ideal' spine refers to a series of intervertebral motor segments (ie interbody and zygaphyseal joints with all their supporting ligamentous and motor structures) which are normal in every respect, that is, none is disadvantaged in any way by injury, wear and tear, structural anomaly or disease; each motor segment is perfect.

Average

The 'Average' spine is not 'Ideal'. It does not consist of a series of ideal motor segments.
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One or more of them is 'abnormal' in some way, even if they are not causing any symptoms of major consequence. The joint or joints may be imperfect because of:

- congenital or acquired structural anomalies,
- degenerative changes or
- disease processes or changes resulting from trauma.

Though the 'Average' spine has been defined as having no symptoms of major consequence, this needs qualification. Some people have no symptoms whatsoever while others have minor symptoms of a kind which they accept as being 'normal'.

The three kinds of imperfection in the 'Average' spine are explained as follows:

i) There are people whose spine is disadvantaged by a congenital or acquired structural anomaly. Examples are a bifid spinous process, a spinous process inclining towards the left or the right (see Figure 2), or a congenital fusion between the second and third cervical vertebrae, which is not uncommon. Such anomalies are, of themselves, painless but they do indicate either asymmetry, or that more stress is placed on adjacent intervertebral segments.

ii) Despite the presence of intervertebral degenerative changes due to wear and tear, old trauma, or old disease processes which are not totally inactive, some people do not have any symptoms whatsoever. Within this group some spines, when palpated or stretched, are painless and some have a minor degree of pain or discomfort. Also within this same group of degenerative intervertebral joints there are people who do have the degree of symptoms which are classed by them as being normal. When their spines are palpated or stretched they always have a degree of pain (as compared with the previous group which are either painless or complain only of discomfort).

Of these subdivisions, Group i) (the ones with congenital or acquired structural anomalies), is quite different in kind to Group ii) (those with anomalies associated with degenerative disease or traumatic changes), and should be thought of and seen to be so. They are only 'disadvantaged' because in all other regards the individual segments fit the 'Ideal' group.

iii) The group includes people whose cervical spine shows evidence of joint changes due to disease process or trauma and who do have symptoms, for which they may or may not have had adequate treatment, yet who accept these symptoms as being their normal despite the fact that they interfere with their normal life. On examination their joint movements are painful when stretched and palpation findings are obvious.

Abnormal

The 'Abnormal' spine is a symptomatic spine for which the person seeks treatment. On examination, significant comparable signs will be evident on palpation at the appropriate intervertebral level. The title 'Abnormal' is used to signify an abnormal degree of symptoms rather than abnormal joints, which, as has been stated, may be totally painless.

This labelling into groups highlights important clinical connections between symptoms and examination findings which can be assessed by the palpation examination. The value of the different groupings lies in our ability to recognize the differences between palpation findings which relate to a patient's symptoms, and those which are not necessarily related. Such differentiations can then also be related to treatment expectations. For example, it is possible to recognize, through the interpretations of the palpation findings, that the realistic goal of treatment may be a minimally symptomatic 'Average' state or a painfree 'Average' state rather than an 'Ideal' state.

Unfortunately, very few people over the age of forty have a total complement of 'Ideal' intervertebral joints. Most people, for one reason or another, fit into one of the 'Average' groups. If a group of 40-year-old people, who have no pain or discomfort and consider their necks to be normal, were examined by palpation, abnormalities would be found in nearly all.

The question is, when such a person has a spontaneous onset of neck pain and seeks treatment for it, how does the examiner differentiate between the findings which relate to the present problem and the findings which were present before the spontaneous onset of the neck pain? A similar difficulty arises when attempting to determine the degree of disability which can be attributed to a recent injury and the degree which is attributable to pre-existing yet painless 'average' joint findings.

New or Old Tissue Changes

If an intervertebral joint suddenly becomes painful for no obvious discernible reason, it is still most likely that tissue changes have occurred.
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- If these recent tissue changes have occurred in an 'ideal' joint, the only findings which will be detected by palpation examination will be of the 'new' or 'recent' kind as with, for example, a sprained ankle.
- If these recent tissue changes have occurred in an asymptomatic 'average' cervical joint, then, on examination by palpation, there will be new tissue changes superimposed on the older 'average' tissue changes.

Success in differentiating between the new and old changes makes prognosis, related to both the success of present treatment and to the likelihood of future recurrences, easier to assess. This is an examination skill which can be taught.
- If these recent tissue changes have occurred in a symptomatic 'average' segment, there will be 'recent' tissue changes superimposed on the changes which were already painful when stretched or palpated. Because the patient had symptoms before the exacerbation, the palpable tissue changes would not have been as 'old' as those in the painfree 'average' group.

The ability to differentiate between these tissue changes is difficult to teach to inexperienced practitioners, but a 'method' of thinking and assessing can be taught which will provide a basis for developing the necessary skill.

The abnormalities sought by palpation are of the following kinds:

Soft tissue changes

These changes are to be found in the ligamentous, capsular, muscular and connective tissues as thickening or muscle spasm. Palpation of them will reveal tenderness.

The abnormalities of 'feet' in ligamentous, capsular and connective tissues are that the older they are, the harder they feel, and the more recent they are, the softer they feel. For example, palpating old capsular thickening around the apophyseal joint will be like pressing against leather; there are even variations in the hardness of the leathery feel. Thickening from more recent stresses will be softer or more spongy and this may overlie an older leathery feel. Thickening within the muscular tissue is usually more diffuse and never feels like hard leather. Nevertheless, when thickening is present, it has a stringy feel if it is 'old' and if it is 'new' the thickening feels smoother.

Bony anomalies

Under this heading the features which can be determined by palpation are abnormal deviation of a spinous process from the central line without or with vertebral rotation, absence of one process of the bifid spinous process, abnormal position of one or more cervical vertebrae relative to one another, osteoarthritic osteophyte formation of the margins of the apophyseal joints.

The abnormalities of deviation of spinous process and positions of vertebrae can be confirmed by X-rays. If a positional finding is long standing, the shape of the associated vertebrae will have changed from their symmetrical appearance to accommodate for the changed positions. The articular pillar abnormalities which indicate osteoarthritic (osteo) findings are readily determined by palpation and can also be confirmed by X-rays. If the changes are 'old' and totally inactive, the bony margins of the exostoses will be hard and clean without any sign of soft or leathery covering.

Movement abnormalities

These abnormalities consist of the following: Hyper- or hypo-mobility, abnormal quality of movement through range, stiffness and spasm. Such abnormalities can all be determined by the palpation being applied in a manner which produces intervertebral movement.

Abnormalities of movement should be qualified in terms of not only the available range of movement, but also by any change in the normal free running movement through the range up to the end of the available range. This may be disturbed by such factors as arthritis change, stiffness in supportive capsular and ligamentous structures or by protective muscle spasm.

An 'old' hypomobility has a hard end-feel at the limit of the range, with movement before the limit of the range being a smooth friction-free movement. A 'new' hypomobility on the other hand has stiffness occurring earlier in the range building up in strength of resistance until the end of range is reached, that is, there is 'resistance through range'. When crepitation is present during movement it will be painless if it is unassociated with presenting symptoms, and painful if it is associated.

In 'ideal' joints, when the synovial joint surfaces are strongly compressed and moved, the movement will be painless (Maitland, 1980). There are circumstances when pain is experienced during a large amplitude of the range, and it is sometimes possible to heighten this pain by holding the joint surfaces firmly compressed while moving the joint through the same amplitude of the range.

Pain response

The pain response felt by the patient during the palpation examination of tissues and movement is most important. The pain or discomfort may be felt either through range or at the end of range, it may be felt deeply or may reproduce the patient's symptoms.

Superficial and deep local pain can be detected in both 'new' and 'old' situations. Severe pain felt by the patient when only moderate pressure is applied to a soft tissue, or applied to produce movement, is always 'new'. When a patient has referred pain which can be reproduced by palpation examination, the indication is that it is associated with a 'new' disorder.

The discussion of the palpation findings will be restricted to those patients in their fifth decade whose symptoms have developed spontaneously, rather than to patients whose symptoms result from major trauma, active disease processes or disc prolapse. Although relationships can be drawn between the findings in the two groups, discussion of these relationships is too lengthy to be included in this paper.

It is necessary to describe the routine of the palpation examination and to...
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introduce progressively the general findings which are palpable.

**General Palpation Routine for Whole Cervical Spine**

The routine of palpation examination is performed in the following sequence. It is first necessary to have the patient lying prone with his forehead resting in one palm (hands over-lapped) and his neck so positioned that there is no lateral flexion or rotation, and so that the spine lies in its neutral mid flexion-extension position.

**Temperature change**
- The first step should be to palpate the posterior aspect of the neck (especially laterally) to ascertain the presence of any temperature increase resulting from an inflammatory disorder. This is assessed by using the backs of the fingers (see Figure 3).

**Soft tissue changes**
- To gain the patient's confidence, the second step should be to use the hands and fingers in a general manner over the back of the neck and adjacent supraspinous fossa area as a soothing circular petrissage type massage during which a general impression can be gained as to the state of the superficial soft tissues. This need not take longer than a few seconds and it is invaluable in gaining the confidence of the apprehensive patient or the patient with an extremely tender neck.
- To begin the more positive part of the soft tissue examination, the tips of the middle three fingers should palpate the suboccipital area overlying and superior to the atlas. To do this the pressure of the finger tips should be directed towards the patient's eyes and the tissue should be palpated by both a mediolateral movement and a postero-anterior movement (see Figure 4).
- Palpation continues by now using the full length of the pads of the middle and ring fingers of each hand in the laminar-trough area (that is from the lateral surface of spinous process to the lateral margin of the articular pillar), from C1 to C7. The technique involves moving both hands in rhythm with each other, moving the skin up and down with the pads of the fingers as far as the skin allows, while gently sinking into the muscle bellies and other soft tissue. The purpose is to feel for areas of thickness, swelling and tightness in the soft tissue, and also for abnormalities of the general bony contour. Having performed two or three up and down movements in the upper cervical area, the fingers should be made to slide caudad two or three centimetres and the process repeated.
- This is then continued, moving down the neck in approximately four stages, until the level of C7 is reached. A particular level may be returned to if an abnormality were felt there.
- Once the general and more gross impression has been gained through the full pads of the fingers, the procedure should be repeated but this time using the tip of the pad of only one finger of each hand and emphasising the examination to the areas where discrepancies from the normal have been found.
- A reasonably accurate determination of the site and type of tissue abnormality should be made so that a more detailed determination can be made later.
- The most common findings at this stage of the examination are:
  - general tightness of muscle tissue along almost the full length of one side of the cervical spine,
  - local areas of thickening immediately adjacent to one or more spinous processes,
  - local areas of thickening in the largest part of the muscle bulk in the mid laminar-trough area,
  - soft thickening over the posterior articular pillar at one or more intervertebral levels,
  - hard bony thickening and prominence over the lateral and posterolateral margins of the articular pillar, and
  - tightness of the ligamentum nuchae or localised thickening of a section of it.

**Bony anomalies**
- Bony points and interspinous spaces are palpated next. The tip of the thumb of each hand is used to palpate the bony outline of the spinous processes first. There are two important planes in which to assess the position of the spinous processes. The first is that they should be centrally in the sagittal plane. The second is that from C2 to C6 they should be roughly along an arc of a single sagittal
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Figure 4: General soft tissue palpation — sub-occipital

circle. That is, the spinous processes should change evenly along the normal cervical lordotic curve. However, normal variations with regard to the depth of C3 and the prominence of C6 and C7 should be allowed for when interpreting the positions in this plane.

Common findings are as follows.

• The Axis frequently has either one of its bifid processes absent, or one larger than the other. To determine whether the off-centre feel of such a spinous process is associated with rotation of the vertebra, the relation that each articular pillar bears to the coronal plane should be determined by palpation.

• Prominence of the spinous process of C3, C4 or C5 in relation to the neighbouring spinous processes.

• Loss of interspinous space due to the thickening of the interspinous and supraspinous tissue. This may occur unilaterally.

• Very close proximity of the spinous process of C6 to C7, usually accompanied by surrounding soft tissue thickening.

• Thickening (plus or minus prominence) surrounding the spinous process of C7.

• Next, the articular pillar in its posterior and posterolateral aspects is palpated for bony changes by using the tips of the middle fingers or by using the tips of the thumbs placed back to back and in contact with the articular pillar (see Figure 5).

To ascertain whether the Atlas is in its correct central alignment, a finger tip of each hand should palpate simultaneously for the relationship between the transverse process of the atlas and the adjacent mastoid process.

Figure 5: Palpation of the articular pillar

Asymmetry of the atlas is not uncommon.

Movement abnormalities

• Movement is assessed by using pressure through the tips of the thumbs against the spinous processes first (see Figure 6). Two or three oscillatory postero-anterior movements are performed at each level in turn, moving fairly quickly up and down the spine, until a general impression of comparative movement, in both quality and range, is determined.

The movements created by pressure on the spinous processes can be assessed even more finely by varying the direction of the pressures, inclining them left, right, cephalad and caudad. Combinations of these inclinations can also be used. Not only should the direction of the pressure be varied but the precise point of contact on the spinous process should also be varied. This will also produce a change in the movement occurring at the intervertebral joint (Maitland 1977, pp 36-39).

• The same procedure is carried out over the articular pillar at each level, comparing both the relative movement of adjacent levels, and also comparing that found at one intervertebral level on the left with the movement at the same level on the right (see Figure 5).
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Similar variations of direction and contact are applied to the articular pillar as has been described above for the spinous processes. However one of the most useful test movements in the middle and upper cervical spine is achieved when thumb pressure is applied in a combined postero-anterior and medial direction. This direction of movement produces a maximum sliding of the apophyseal joint immediately under the thumbs. If this direction of movement is performed throughout its total range, that is from maximum foraminal opening (lifting the neck posteriorly and laterally) to maximum foraminal closing, a very valuable assessment of flexibility and quality of movement at the apophyseal joint is readily obtained. The technique for the lifting component of this movement is facilitated by hooking the little finger under the patient’s chin (see Figure 7). Also, by varying the hand and finger positions, these postero-anterior pressures can be performed in such a way as to produce a rotary movement or a lateral flexion movement.

The movement abnormalities which can be found are limited range or hypomobility, resistance to movement through the range due to crepitus, stiffness or muscle spasm, and different qualities of end-feel.

In making determinations, it is important to point out that a hypomobile joint or a hypermobile joint is not necessarily a painful joint. Nevertheless the quality of movement and range of movement must be appreciated before attempting to relate the abnormalities found to the possible cause of the patient’s symptoms.

Pain response

The next stage of the examination is the assessment of pain responses. The first ten stages of examination are carried out without asking for any comments by the patient. In fact it is wise to instruct the patient to make no comment about soreness, tenderness or pain until asked for later in the examination.

Having made the determinations regarding tissue thickenings, bony prominence, quality of movement and range of movement, it becomes necessary to relate the pain responses to these determinations. Not only is it necessary to know which movements either provoke the pain for which treatment is sought or produce local pain only, but it is also necessary to determine whether the sensations are felt to be superficial or deep. It may be necessary to apply firm pressure to obtain an accurate determination.

A stiff joint does not necessarily cause pain, it may be responsible for an associated joint becoming painful. The same applies to thickened tissues.

Having discussed the general examination procedure and the possible findings it is now possible to discuss special palpation techniques and the abnormalities which can be found at each of the three sections of the cervical spine and to indicate what these findings mean to the manipulative physiotherapist.

Upper Cervical Spine

Palpation Routine: Particular

For the upper cervical spine it is important to palpate deeply the soft tissue and the capsular area of each occipito-
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atlantal joint from postero-medially to laterally. It is possible to discern the degree of such thickening when it is present.

Postero-anterior pressures should be applied along the atlas from the midline to the tip of the transverse process. When the patient's head is turned to one side, postero-anterior pressure is applied to the articular process of the axis on the side to which the patient's head is turned. Assessment of the quality and range of atlanto-axial rotation so produced can be assessed in this position and compared with that available on the opposite side when the head is turned to the other side. The quality of this atlanto-axial movement throughout its range is fully assessed by positioning the head in different degrees of rotation before applying the thumb pressures (see Figure 8).

With the patient's head still turned slightly to one side, transverse pressure can be applied to the transverse process of the atlas and a comparison made with the movement available on the opposite side. These pressures can be varied in their directions from posterior through transverse to anterior. While performing these movements not only is it possible to assess the quality of the movement and its range, but it is also possible to assess the quality of the soft tissue immediately surrounding this area which is frequently thickened unilaterally.

There is another particularly important test procedure which is used when it is necessary to determine whether a patient's symptoms are arising from a disorder of the C2/3 apophyseal joint or the C1/2 apophyseal joint. With the patient prone and the head in the neutral position, postero-anterior pressures are applied, for example, to the left articular pillar of C2 so as to move it in a postero-anterior direction. The quality and range of movement, and the accompanying pain response, are compared with the same features when the postero-anterior pressure is applied with the same strength to C2 but with the patient's head rotated approximately forty degrees to the left. If the pain response is greater with the head rotated than it is with the head straight, the disorder is at the C1/2 joint. If the pain response is greater with the head straight then the disorder is at the C2/3 joint.

The common findings are as follows:

Suboccipital Area

Soft tissue changes

Two particularly important findings in the suboccipital area are generalised thickening and tightening of the suboccipital structures overlying the atlas, and, even more particularly, lying between the atlas and occiput. It is more common for this tightness to lie in the medial two thirds of the area, but very occasionally it is felt to be in the lateral half only and only on one side.

The second common finding is marked thickening of the capsule and surrounding tissue of one or both atlanto-occipital joints. The thicker and harder the tissues are, as compared with being more spongy, the older they are.

The relevance of the findings to the patient's symptoms depends upon two things. The first is the agreement between the chronicity of the history and symptoms of the disorder and the oldness of the tissue changes found on palpation examination. The second is the reproduction of the patient's referred pain or the provocation of a degree of deeply felt local pain compatible with the patient's symptoms when the tissues are palpated firmly.

Bony anomalies

The common bony abnormalities of the atlas are that it is often felt to be slightly rotated or slightly displaced to one side in relation to the occiput. Before accepting, from the palpation findings, an interpretation of being displaced to one side, the radiological views should be assessed. This is because it is not uncommon for the transverse process of the atlas to be smaller on one side than the other.

To determine whether a positional abnormality is old or new, the X-rays must be viewed to see if bony adaptions to the changed position have taken place. If the positional abnormality is new, the bone will have slightly changed its shape to accommodate to the adopted position.

A palpable rotary anomaly is only of clinical relevance to the presenting symptoms if derotation by palpation provokes deep local pain or reproduces the patient's symptoms. This principle applies to any palpable anomaly. When very strong palpation pressures produce only a small degree of derotation and only local pain, the positional change is probably longstanding.
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Movement abnormalities

The most common movement finding which can be determined by palpation is a difference in the range of movement produced by postero-anterior pressure over the articular pillar at each level. Stiffness at one level should be compared with the other levels and the same level on the opposite side.

Movement abnormalities have more significance than do the more fixed positional changes. The easier it is to push the opposite side, the more likely it will be to restore the range. However, it is important that the improvement in range must be accompanied by a concurrent improvement in the pain response during the movement.

Bony anomalies

Osteoarthritic (-otic) exostoses are readily palpable at the C2/3 apophyseal joint. Their relevance to a patient's symptoms is, in part, indicated by the sharpness of the margins of the exostoses. If they are not sharp or bony, being covered by other soft tissue thickening, they are more likely to be related to presenting symptoms.

The absence or smallness of one of the processes of the bony spinous process of the axis is common, as it is a deviation of the spinous process from the median sagittal plane. The only importance related to such findings when they exist alone is that

- there must be a reason for the spinous process being shaped thus, and
- it indicates the presence of an asymmetrical functional difference, of some kind, at this cervical level.

Such bony abnormalities do not, of themselves, cause symptoms but they do indicate that the joint may be disadvantaged if subjected to an asymmetrical unguarded movement.

Movement abnormalities

With a patient who suffers from cervical headaches, postero-anterior pressure on the spinous process of C2 inclined cephalad is frequently extremely painful locally and deeply.

It is surprisingly uncommon for the atlanto-axial joint to be limited in range when compared with the frequency of limitation of movement and poor quality of movement at C2/3.

Occurring concurrently with this poor C2/3 movement is the common finding of a prominent spinous process of C3 which is readily palpable.

The common pain response is one of deep pain felt with movement of the C2/3 joint by pressure directed postero-anteriorly over the C3 spinous process and at the articular pillar. If this postero-anterior movement applied over the articular pillar is also directed medially the common finding is a noticeable lack of range associated with marked discomfort and poor quality of movement through range.

Differentiating between pain arising from the C2/3 and the atlanto-axial joints has been described above under 'palpation routine particular'.

Indication of findings

It is important to determine, when palpating over the C2/3 apophyseal joint area, the quality of the tissues. Hard bony prominences, indicating osteoarthritic exostoses are common. When these bony prominences are not covered by soft spongy tissue, the interpretation is that although they indicate osteoarthritic (-otic) changes in the apophyseal joint yet, currently, the arthritic process is inactive and not a source of pain. However, when the tissue overlying the exostoses is thickened, the interpretation is quite different. The thickening varies between two extremes, the first being tough dry leather and the opposite being very soft and spongy. The more leathery it is, the less likely it is to be causing other than mild local symptoms, whereas the softer it is the more likely it is to be of recent origin and associated with recent symptoms.

In terms of treatment, the somewhat harder thickening demands firmer treatment. Also, manipulation may need to be introduced more quickly. The goal of treatment is to totally eliminate any soft spongy tissue changes, to lessen the thickness of the harder soft tissue, or, under ideal circumstances, to eliminate the thickening leaving 'clean' bony exostoses which are painless if pinched.

In relation to prominence of the spinous process of C3 the goal is to improve the quality of the movement in its postero-anterior direction, to decrease its prominence, and to eliminate any deep pain response which may accompany the movement.

Middle Cervical Spine

Palpation Routine: Particular

There are two special aspects of the palpation examination for this section of the spine. Firstly, medially directed unilateral postero-anterior pressure (as described for Figure 7) is particularly relevant. The second is that postero-anterior pressures on the spinous...
processes need, at times, to be performed through their maximum range. This requires that when performing the postero-anterior movements the fingers should lift the patient's neck so that the movement begins from the maximum antero-posterior position.

**Soft tissue changes**

The most common findings in this section of the cervical spine are thickening of soft tissue immediately adjacent to a spinous process or between adjacent spinous processes and posterolaterally over the articular pillar. It is quite common to find prominences and thickening at, for example, C2-3 level on the left and similar changes at C3-4 level on the right. These changes on the right may also extend to the C4/5 level.

**Bony anomalies**

The common bony anomalies which can be found are of two kinds. The first is a prominence of the spinous process of C3 (associated with headache symptoms), a depression of the spinous process of C3 accompanied by a prominence of the spinous process of C4 (usually related to mid cervical pain), and less commonly a prominence of the spinous process of C5 (usually associated with mid or lower cervical symptoms).

The second common finding is the exostoses associated with arthritic change in the apophyseal joints. These may be felt over the articular pillar posteriorly or posterolaterally.

**Movement abnormalities**

As has been mentioned above, the medially directed unilateral postero-anterior pressures are very valuable. Loss of range of movement and poor quality of apophyseal joint movements is readily discernible by this technique.

Large amplitude postero-anterior pressures on the spinous processes when these are prominent, readily shows up their relevance to a patient's symptoms by virtue of the range of movement available and the pain response felt when this movement is pushed to the limit of its range. Pain of two kinds will be provoked.

The first and common one is a sharp pain and the second is a deeply felt sensation.

**Lower Cervical Spine**

**Palpation Routine:**

**Particular**

There are no special aspects to the palpation examination of this section of the spine. However the common findings are important.

**Soft tissue changes**

Soft tissue changes which can be found in the laminar trough and over the articular pillar can readily be determined at the level of C5. If the patient is of the long slender build, then it is equally easy to feel them at the C6 level and sometimes at C7. However, with the majority of people, it becomes more difficult to differentiate the findings the further down the spine the palpation is carried. The soft tissue changes which can be determined are the same as those described above for the middle cervical spine.

Soft tissue thickening around the 'Dowager's Hump' is normal, yet it is of importance if the thickening is excessive and is abnormally painful with such techniques as skin rolling or connective tissue massage.

**Bony anomalies**

Although the prominence of the spinous process of C5 has been described above, it is extremely difficult at times to determine whether it is the source of scapular or supra-scapular symptoms. Most commonly the source is C6, while C7 is more common than C5. The differentiating factors are firstly the extent of the bony anomalies and secondly the pain response to postero-anterior movements. The bony anomaly which occurs most commonly is that the tip of the spinous process of C6 lies very close to that of C7. This leaves a larger gap between the spinous processes of C5 and C6 and gives a feeling of prominence of C5. The pain response will be described below.

**Movement abnormalities**

Associated with the closeness of the spinous process of C6 to C7 described above, the movement abnormality is that there is a distinct restriction of movement with postero-anterior pressure applied to the spinous process of C6. The pain response associated with this movement (and the movement may need to be applied quite firmly) is one of deeply felt pain (sometimes described by the patient as a 'knife hurt'). There may also be a spread of pain into the scapular area or even a bilateral spread. When C7 is the source of the symptoms the pain response is the same as that described for C6, while when C5 is the source of symptoms, pressure on its spinous process, though still provoking a deeply felt pain, less frequently refers pain into the supra-scapular area. Transverse pressures against the spinous process of C6 and C7, with varied inclinations, are also of great value in determining which level is the source of symptoms.

Postero-anterior pressures applied unilaterally over the articular pillar will frequently provoke a significant pain response, though relative movements at C6 and C7 are much harder to determine than is the same movement at C5. Nevertheless, they should form part of the examination procedure for symptoms arising from the lower cervical spine despite the fact that more time is required to discern the findings at this level. It is sometimes necessary to apply these unilateral postero-anterior pressures through the muscle belly while at other times clearer information is gained if the muscles are pushed out of the way so that the articular pillar, particularly that of C7, can be palpated directly.

**Pain Response**

This has been discussed in other parts of this paper but the aspects which are of special significance for the lower cervical spine are:

- the deep local pain referred to above
- the pain reproduction of referred pain, and
- the clear association of the pain response when pressure is applied to the
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soft tissue changes at the spinous processes and articular pillar.

In Conclusion

The importance of the palpation findings on examination of the vertebral column cannot be overestimated. This paper presents a method of carrying out the palpation examination procedure, and although the main possible findings are listed, it must be stated that this list only scratches the surface of the wealth of knowledge which can be gained.

Probably the most important part of the text is the presentation and explanation of the 'Ideal' spine, the mechanically disadvantaged spine, the kinds of 'Average' spine, and the 'Abnormal' spine. The interpretation of 'recent soft tissue changes' and 'old soft tissue changes' becomes more valuable when related to these different states of the spine.

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References