

## Section of Physical Medicine

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### Effects of Faulty Posture

#### PRESIDENT'S ADDRESS

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LITTLE attention has been directed in recent years to the relation between disturbances of posture and disorders of the locomotor system. This is largely to be accounted for by the recognition of the prolapsed intervertebral disc and its clinical implications. Another contributory factor is that the standard of postural treatment is often inadequate, in consequence of which results of treatment are poor. It can readily be appreciated that belief in the importance of postural treatment is likely to diminish if patients, for whom such treatment is prescribed, repeatedly fail to make symptomatic or structural improvement.

In what may be called the orthopædic era of low back and sciatic pain, when lumbosacral and sacro-iliac strains were considered the most important causes of these disorders, attention was naturally directed to the mechanics of the back. Between 1929 and 1939 numerous papers on posture appeared in the medical literature; the White House Committee on "Body Mechanics" reported in 1934, and the first two editions of the celebrated book by Goldthwait, Brown, Swaim and Kuhns appeared in 1934 and 1937. Now that the prolapsed intervertebral disc is held—almost certainly correctly—to be the most important cause of sciatic pain, and is also considered by some—almost certainly incorrectly—to be the most important cause of low back pain, interest in the mechanics of the back has diminished and contributions in the English and American literature are few and far between.

In this lecture three arguments will be developed; first, that notwithstanding the prolapsed intervertebral disc, there is a significant relationship between faulty posture and low back pain; second, that pain in the limbs and in other parts of the back are often to be attributed to postural defects and, third, that corrective postural treatment carefully worked out and purposefully carried out, greatly benefits a large group of patients attending Departments of Orthopædics and Physical Medicine.

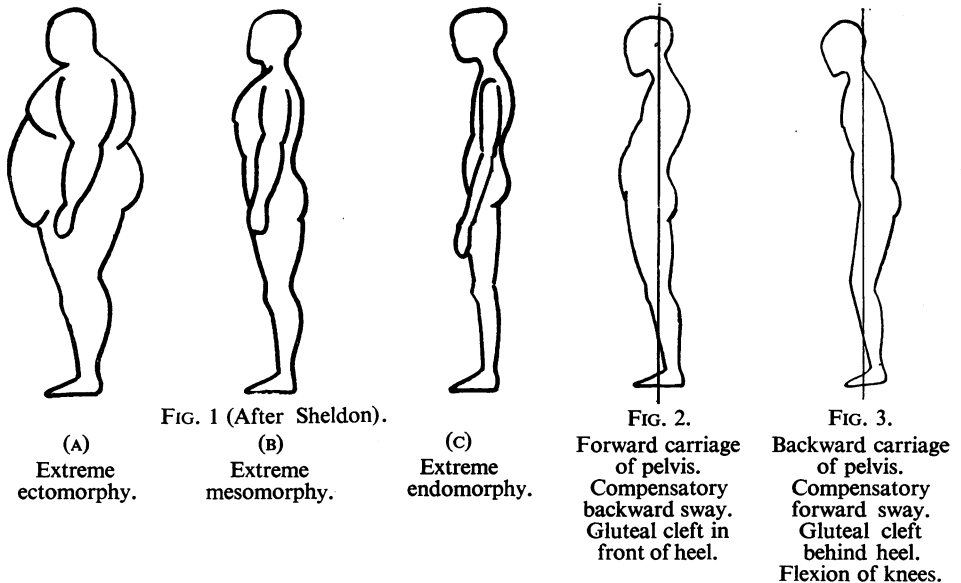
#### NORMAL POSTURE

Posture can be regarded from the different viewpoints of the physical educationalist, who is chiefly interested in form; the anatomist, who is chiefly interested in structure, and the clinician whose main interest lies in the relation of posture to disease. Opinion of what constitutes good posture has undergone many changes in the course of time, and in the past has often been influenced by æsthetic and utilitarian considerations. The Greek idea of good

posture can be judged by studying their statues; it embodies the characteristics of the supreme athlete who in those times was an all-rounder. It might be thought nowadays when athletics are increasingly popular that we should return to the Greek ideal of posture. We find, however, that there are no special postural features characteristic of the athlete. Rather is there marked lack of uniformity, some athletes in the highest class showing postural defects of the back and even of the feet.

In the past, physical educationalists exerted an important influence. We find, for example, that it was they who encouraged the lumbar lordosis and prominent chest which was particularly common in Germany, and also in the Sergeant Majors of most countries. This posture was encouraged as it gave the impression of domination and strength. Not many years ago a reaction set in against the lordotic stance and people were encouraged to develop the flat back, which, as Wiles (1937) and others have shown, is not infrequently associated with low back pain. The extent to which physical educationalists have been prepared to go is shown in the following statement from a book of gymnastics quoted by Appleton (1946). "In women the shoulders should not be drawn back as this would appear unbecoming and defiant." The æsthetic and utilitarian aspects will evidently not carry us very far.

From the point of view of anatomy, no rigid rules can be laid down owing to the large variation in the physique of members of a community. Those who are familiar with Sheldon's classification (1940), and study his illustrations (Fig. 1, A, B, C) of extreme ectomorphy, mesomorphy and endomorphy will appreciate the need for a wide definition.



Certain rough tests are of considerable help to the clinician. The first of these is to suspend a plumb line from the tip of the mastoid process. The plumb line should pass through the greater tuberosity of the humerus, the great trochanter of the femur, and through a point about  $1\frac{1}{2}$  inches in front of the lateral malleolus. The last point is at the level of the tuberosity of the tarsal scaphoid. The plumb line will not pass through all these points if, the chin is poked forward, the shoulders are rounded, or if there is forward or backward carriage of pelvis.

The next rough test is to observe the pelvic carriage, the significance of which has repeatedly been emphasized by Appleton (1944, 1946, 1949). Normally the upper end of the cleft of the buttocks is approximately in the same vertical level as the back of the heel. With a forward pelvic carriage (Fig. 2) the ankle is dorsiflexed and the pelvis is over the front instead of the back of the foot. To restore balance of the body which is thereby disturbed adjustments in the back have to be made, the commonest of which is a backward sway in the dorsilumbar spine. Less frequently except in pregnant women (Appleton, 1944) there is backward carriage of the pelvis, the essential feature of which is flexion at the knee. To compensate disturbance of balance the trunk comes forward (Fig. 3) and a posture described by Wiles (1937) as "Round Back Type I" is produced.

The pelvic carriage is measured by observing the position of the intergluteal cleft relative to the back of the heel, the permissive range lying between 2 inches in front and  $\frac{1}{2}$  inch behind (Appleton).

Neither of the two tests described above provides any indication of the curves of the spine. The lumbar region is most conveniently studied by the measurement of the pelvic angle for which purpose Wiles devised a special inclinometer. The two points advised by Wiles are the upper part of the symphysis pubis in front and the posterior superior iliac spine behind. Appleton prefers the anterior superior iliac spine to the symphysis but also uses the posterior superior spine. The normal angle with Wiles's points is about 30 degrees, with Appleton's 5-10 degrees, an increased angle denoting a lumbar lordosis, a decrease denoting a flat back.

The cervical and dorsal curves are judged by noting respectively the relation of the back of the head and the most prominent part of the dorsal spine to the gluteal cleft. A cervical kyphosis is present if the occiput is more than 2 inches in front of the cleft, a lordosis if the back of the head is over half an inch behind. The dorsal curve may be considered abnormal if its more prominent part is over half an inch behind the gluteal cleft.

#### TYPES OF FAULTY POSTURE

(1) *Lumbar lordosis*.—Though lumbar lordosis is an important variety of faulty posture, the impression often given that it is the most important and most common postural fault is untrue. The features are as follows, there is an increase of the pelvic angle, overaction and later shortening of the erector spinæ and hip flexors, and weakness and stretching of the glutei. Often the abdominal muscles are also stretched and weak, but this, contrary to the general opinion, is not invariable. Moreover, as Wiles has pointed out, contraction of the abdominal muscles unaccompanied by contraction of the glutei has no effect in tilting the pelvis, and therefore no effect in correcting lordosis. That is not to say that poor abdominal musculature may be ignored, for clearly with a protuberant abdomen and consequent displacement of the abdominal organs the centre of gravity of the body is altered and needs correction.



FIG. 4.  
Shop-girl's hip. L. buttock protruding.  
Weak and stretched L. gluteus medius.  
R. knee bent.



Sway back. Type I.  
(Wiles's round back  
Type II).



Sway back. Type II.  
(Wiles's sway back)

*Common features:* Tight pectoral muscles; weak rhomboids; forward carriage of pelvis; weak abdominal muscles.

*Differences:* Decreased or normal pelvic tilt (Type I); Increased pelvic tilt (Type II).

FIG. 5.

(2) *Shop-girl's hip*.—The term "shop-girl's hip" was used by Wesson (1938) to describe a relatively common postural fault in which the subject habitually stands with one knee bent, and the opposite buttock pushed out. This results in stretching and weakness of the gluteus medius and sometimes the Trendelenburg test is positive. Clinically patients with "shop-girl's hip" may present in one of three ways, with postural backache, with "swelling of the hip", with pain referred to the abdomen which, if on the right side, is often diagnosed as appendicitis. There have been innumerable instances of removal of a normal appendix when what was required was a course of postural exercises, and at least one patient had an unnecessary exploration for a tumour of the buttock.

(3) *Flat back*.—The term “flat back” is self-explanatory. The condition as a rule occurs in young women and gives rise to backache which is often resistant to treatment.

(4) *Sway back*.—The most common type of faulty posture encountered at the present time is the “sway back”. There are two variations of the fault, and this often gives rise to confusion in terminology. It should be realized that the essential feature of both varieties is the same, namely a forward carriage of the pelvis. The difference between the two lies in the pelvic inclination. In Type I, which in my experience is the more common, there is no increase in the pelvic angle (there may even be a slight decrease), and the sway starts in the mid or upper lumbar region. In the less common Type II there is an increase of pelvic inclination and the sway begins at the lumbo-sacral junction. In both types of sway back other features are usually present, namely weakness of the abdominal muscles, tightness of the pectorals and poking forward of the chin.

In his classification of posture Wiles restricts the term sway back to the second type; for the first he uses the term “Round Back Type II”.

(5) *Dorsal kyphosis*.—According to Wiles dorsal kyphosis usually follows dorsal epiphysitis (Scheuermann’s disease), and Windle (1945) also found that a large proportion of young soldiers with dorsal kyphosis attending the Army Physical Development Centres showed evidence of epiphysitis. Dorsal kyphosis is also a common finding in middle-aged chronic bronchitics. The postural fault is invariably accompanied by rounding of the shoulders, tight pectorals and poor rhomboids.

(6) *Poking chin*.—The last type of deformity to be discussed is “Poking Chin” (Fig. 6). The features are as follows: there is an obliteration of the cervical lordosis and a compensatory tilting back of the head at the atlanto-occipital joint. In the posterior cervical muscles there is stretching and weakness of semispinalis cervicis and overaction with ultimate shortening of semispinalis capitis. The corresponding flexor muscles in front, namely, longus cervicis and longus capitis shorten and lengthen respectively. In middle-aged women in whom this postural fault is relatively common, a pad of fat over the seventh cervical and first dorsal spines may develop, to which the name of “the dowager’s hump” is sometimes given.



FIG. 6.—Poking chin.

Head tilted back at atlanto-occipital joint.

Chin forward.

Decreased cervical lordosis.

Stretching and weakness of semispinalis cervicis and longus capitis.

Shortening of semispinalis capitis and longus cervicis.

#### FINDINGS ASSOCIATED WITH FAULTY POSTURE

There are certain findings associated with faulty posture which occur so frequently, and which often appear to play such an important part in the production of symptoms that it seems reasonable to ask if it is the postural fault with which we should primarily be concerned, or a collection of findings of which the anatomical defect is one. Are we, in fact, really dealing with a syndrome of faulty posture? Associated findings are three in number and consist of inability to relax muscles, diminished agility, and limitation of movement of the spine.

Incomplete muscular relaxation, often over a wide area, is present in the majority of patients with long-standing pain in the back. It is often described as muscular spasm and is regarded as a protective mechanism. That protective muscle spasm does occur cannot be denied, but it is usually in response to acute pain. The “spasm” under consideration occurs when pain is not acute; it may affect single or multiple groups of muscles. An example of incomplete relaxation in a single muscle group is seen in patients with chronic lumbar pain. When such patients lie comfortably on a couch in the prone position, even under a heat lamp, the erector spinae remain tense even though no pain is experienced at the time. Prolonged treatment may be necessary before such patients are able to relax their muscles, but when the habit of relaxation has been re-acquired symptoms almost immediately start to improve. Until then, however, progress is slow. An example where many groups of muscles are involved is seen in long-standing acroparæsthesia, where the head, neck and shoulders are held tensely and the muscles of the arm and forearm are tight. The latter may be the predisposing cause of pain in the elbow which not infrequently complicates acroparæsthesia.

Inability to relax muscles produces or increases fatigue muscle pain; it also ultimately leads to muscular wasting, for a muscle which never fully relaxes never fully contracts, and a prolonged period of incomplete muscular contraction is followed by wasting.

Lack of agility and movement may be considered together. There are two chief causes, first, incomplete muscular relaxation described above, and second, the result of adhesions either between the muscle fibres or between muscle groups. These adhesions which were described by Gratz (1937) interfere with normal contraction of muscle and also with the gliding of one muscle over another.

When abnormal posture has been maintained for a long time shortening occurs in muscles, ligaments and joint capsules, and in severe cases there may be alteration in the shape of the vertebræ. In these instances full correction by non-surgical methods is out of the question.

#### CLINICAL SEQUELS OF FAULTY POSTURE

The clinical conditions associated with faulty posture may conveniently be considered under three headings. Fatigue muscular pains in any part of the back constitute a primary group, acroparæsthesia, back strain and chronic recurrent cervical fibrositis constitute a secondary group, and osteo-arthritis of the hip and lumbar spine a late secondary group.

#### PRIMARY EFFECTS

In a Department of Physical Medicine patients are frequently seen with a history of pain in one or other region of the back which develops during the day, is made worse by long periods of standing and is relieved by rest. The pain is of a dull aching character; it is never acute or stabbing, and after a night's rest the back feels entirely normal. As time goes on the aching pain develops earlier in the day, but for months, and often for years, the response to rest is unchanged.

Muscle fatigue is the probable explanation for these symptoms. Its cause is that either the muscles are too weak for prolonged use, or that they are playing too great a part in the maintenance of the upright posture. The backache associated with a flat back is an example of pain arising from a muscle which is too weak. The pain occurring with a lumbar lordosis is an example of a muscle having too much to do, for with lumbar lordosis the upright posture instead of being maintained by equal action of the erector spinæ and glutei is maintained by the erector spinæ alone.

#### SECONDARY EFFECTS

*A. Acroparæsthesia.*—A great increase in the incidence of acroparæsthesia has been noted by many. The symptoms consist of pain down the arm, numbness and tingling in the hands of both sides, nearly always worse at night and first thing in the morning. Throughout the night the victim is awakened by "pins and needles" in the fingers and in the morning the arms ache and the fingers are clumsy, so that it is difficult to pick up a cup of tea and not infrequently the cup is dropped. Such activities as carrying baskets and ironing clothes invariably aggravate the condition which affects members of the female sex almost exclusively, the victim as a rule being a middle-aged woman. On clinical examination abnormal physical signs are absent with the exception of horizontal clavicles and some drooping of the shoulders.

For many years the condition was diagnosed as brachial neuritis. The opinion has recently been put forward by Walshe, Harvey Jackson and Wyburn Mason (1944), that acroparæsthesia is due to an altered relation of the shoulder girdle and thoracic outlet secondary to poor tone of the shoulder girdle muscles. Traction and compression of the lower cord of the brachial plexus and possibly also the subclavian artery are the essential mechanical factors underlying most, if not all, cases of acroparæsthesia in women.

Walshe's (1945) clinical description of acroparæsthesia cannot be improved upon. His remarks on treatment, however, require some qualification: "Treatment" he writes, "is generally allowed to be unsatisfactory and includes radiant heat, massage, ionization and diathermy and when the desperate patient has sought relief from practitioners not on the Medical Register, manipulation of the spine is still further added to her torments." If acroparæsthesia is in fact caused by sagging of the shoulder girdles, radiant heat, massage, ionization, diathermy and manipulation cannot be expected to have any effect. The only logical method of treatment is to correct the sagging of the shoulders by improving the tone and strength of the shoulder elevator muscles. This is borne out by results when treatment along these lines is carried out.

*B. Back strain.*—A common cause of acute back pain is a tear of a muscle, joint capsule or ligament. Such a tear or "strain" is likely to occur at the junction between elastic and less elastic tissues, or between elastic and non-elastic tissues (Cohen, 1948), a common site being the attachment of muscle or ligament to bone. For example, it occurs in the back where the muscles are attached to the transverse processes of the vertebrae, and also where the inter-spinous ligaments are attached to the spines. The reason why strains are particularly common in subjects of faulty posture is because of their lack of agility and limitation of movement. The normal, mobile back can adapt itself to sudden and unexpected movements. The back moves quickly and there is a large range over which the spine can move without over-stretching muscles or ligaments. The spine which is not agile cannot react quickly to the unexpected, and a clumsy, abnormal movement is made. Moreover, if there is also shortening of muscles and ligaments, a sudden or relatively large movement is likely to cause a tear. There was a great increase in the incidence of back strain in the earlier part of the war when middle-aged and elderly gentlemen, who were quite unused to exercise, took to gardening. In the majority of instances the spine was found to move slowly, movement was often limited and posture abnormal.

*C. Chronic recurrent cervical fibrositis.*—Though not, strictly speaking, a direct consequence of faulty posture, chronic recurrent cervical fibrositis may be considered here owing to the frequency with which it is found in association with "poking chin". Many patients give a history of having received repeated courses of heat, massage and other forms of physiotherapy. Often relief has been obtained, but, as a rule, it has been partial and temporary. A great difference can often be made to these unfortunate people if, in addition to physiotherapy given to relieve pain, the postural defect is also attended to.

It is not suggested here that all cervical fibrositis is due to bad posture. It is, however, pointed out that fibrositis and bad posture are commonly associated, that faulty posture is undoubtedly an aggravating feature and that it may also be an important predisposing cause.

#### LATE SECONDARY EFFECTS

*A. Osteo-arthritis of the hip.*—Osteo-arthritis is likely to occur in joints whose mechanics have been seriously disturbed, whether by disease, deformity or trauma. The association of faulty body mechanics and osteo-arthritis of the hip has been emphasized by Kuhns on more than one occasion (1934, 1942). Normally at the hip-joint the weight of the body is borne by the central portion of the femoral head in contact with the strong upper portion of the acetabulum. Whenever this is not the position of use, as is the case when an increased forward inclination of the pelvis accompanies faulty body mechanics, disalignment results and osteo-arthritis is likely to occur.

Kuhns (1942) treated a series of 183 patients with osteo-arthritis of the hip by conservative rather than surgical treatment. The aim of treatment was to restore normal weight bearing as much as possible, and this was achieved with exercises concentrated on correcting the lumbar lordosis and improving the tone of the glutei. Where necessary patients were fitted with a low back support. The end-results of treatment were striking. Of the 158 patients who were followed up 47, including 28 with bilateral osteo-arthritis, returned to work free from symptoms, and another 58 had slight symptoms only. Important points raised by Kuhns are, therefore, first, that there appears to be a significant relation between faulty posture and osteo-arthritis of the hip, and second, that attention to body mechanics is likely to have beneficial results on osteo-arthritic patients.

With regard to ankylosing spondylitis Swaim (1949) states first, that in spondylitic patients whose posture is good, hip involvement is rare; second, that if attention is paid to posture in the early stages of the disease, hip involvement can usually be avoided; finally, he quotes instances of spondylitics with hip involvement where great improvement of hip function resulted from correction of faulty posture.

#### TREATMENT

There is perhaps no form of physiotherapy which requires more accurate performance than the correction of faulty posture. Minor errors of judgment are likely to have serious effects on the result of treatment and may nullify it altogether.

In the treatment of faulty posture five factors have to be considered: improvement of agility, improvement of mobility, re-acquisition of the ability to relax muscles, improvement in the strength of weak or relatively weak muscles and finally re-education of the postural reflex, that is to say, the patient must be taught automatically to adopt the correct posture

and to maintain it in all circumstances. In planning treatment it is necessary to assess these five factors for each individual and list them in order of priority, for it must be realized that their relative importance varies from patient to patient. For example the most important factor with a flat back is that the muscles are weak, and in such a case the emphasis must be laid on improving their strength. In the sway back re-education of the postural reflex is the most important factor. With a dorsal kyphosis it is usually lack of mobility which must be dealt with before symptomatic improvement will be obtained, while in many instances of lumbar pain associated with a lordosis an essential condition of improvement is the ability to relax the erector spinæ muscles.

Improvement of agility is best achieved with exercises in a class. The methods of obtaining improvement of mobility vary according to whether limitation is due to intermuscular adhesions, tightness of ligaments or shortening of muscles. Mobilizing exercises, in some instances supplemented with massage or faradism, may be expected to improve the first group. When there is tightness of ligaments, traction, continuous in severe cases, repeated in the less severe, is the method of choice, a halter being of value with lesions in the cervical and upper and mid-dorsal regions (Wiles). When there is muscular shortening care has to be exercised for it is generally agreed that forcible stretching of muscles is undesirable and may be dangerous. Wiles and others recommend that exercises against resistance for the antagonists produce complete relaxation of the shortened agonist muscles and ultimately lead to increase in their length.

Individual treatment is necessary in the early stages to teach muscular relaxation and also to re-establish a normal postural reflex. To start with individual treatment is also necessary for the teaching of specific muscle strengthening exercises. When these have been mastered the patient should join the class.

Failure of the exercises to achieve their object is almost invariably due to incorrect performance, and it is surprising what difficulty certain exercises present to certain patients. As a rule it is obvious when an exercise is being performed incorrectly. On other occasions it may be difficult to appreciate error unless one is alive to certain trick movements which are readily picked up and which often mimic closely the correct method. One exercise commonly ill-performed consists of a slow drawing backward of the neck starting with the chin on the sternum and ending with the neck vertical. The spine is moved segment by segment with the head kept flexed throughout at the atlanto-occipital joint. The object is to strengthen the semispinalis cervicis, to relax the semispinalis capitis and thereby improve the condition of "poking chin" and the symptoms that arise from it. Its correct performance depends on maintenance of flexion at the atlanto-occipital joint; failure occurs when flexion takes place at a lower cervical level.

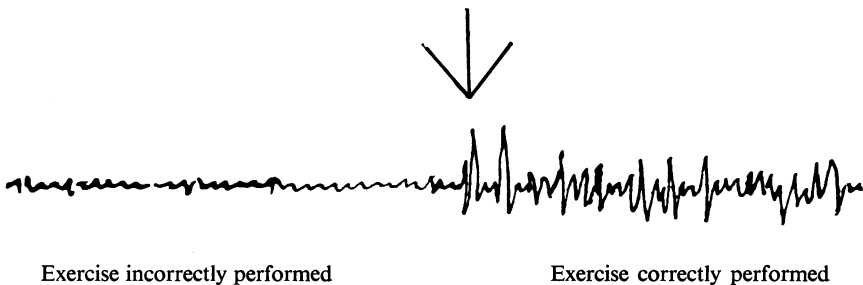


FIG. 7.—Electromyographic tracing with needle in semispinalis cervicis during performance of exercise for "poking chin".

An electromyographic tracing with the needle in the substance of semispinalis cervicis is shown (Fig. 7). In the first part of the tracing the exercise is incorrectly performed with flexion of the neck in the mid-cervical region. In the second part performance is correct, flexion being maintained at the atlanto-occipital joint. The tracing illustrates very well the great difference in motor unit activity when exercises are correctly and incorrectly performed. They also suggest that electromyography may provide a useful means of determining whether a newly devised exercise achieves what it sets out to do.

## SUMMARY

(1) A wide definition of normal posture is necessary owing to the variations in physique in members of the community.

(2) Useful clinical information can be obtained from three tests: the plumb line, the pelvic carriage and the pelvic angle.

(3) The common varieties of faulty posture are: (1) Lumbar lordosis; (2) shop-girl's hip; (3) flat back; (4) sway back; (5) dorsal kyphosis; (6) poking chin.

(4) Features constantly found in association with faulty posture are: (1) Inability to relax muscles; (2) loss of agility; and (3) loss of mobility of the spine.

(5) The clinical sequels and accompaniments of faulty posture may be considered under three groups: primary (fatigue muscle pain), secondary (acroparæsthesia, back strain and chronic recurrent cervical fibrositis), and late secondary (osteo-arthritis of the hip and lumbar spine).

(6) Five factors have to be considered in treatment. Improvement of agility, improvement of mobility, re-education of muscular relaxation, strengthening of weak muscles, re-education of the postural reflex. These five factors vary from patient to patient.

(7) Unless treatment is carefully worked out and accurately carried out improvement is not obtained.

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