

## THE IMPORTANCE OF THE CO-ORDINATION OF MUSCULAR ACTION AROUND THE KNEE-JOINT, IN INJURIES OF THAT STRUCTURE.

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THERE is one point of agreement in all articles written on this subject. That is: an original slight injury to the knee-joint is very often the starting-point of an unstable joint.

There should be no need to stress the importance of the chronic knee, as the soldier who has been in hospital on many occasions with an injury to his knee is an all-too-common sight.

If we are to solve the problem of these recurring injuries to the knee, we must first answer the question—Is there something inherent in a slight injury to a knee-joint which leads to the condition of this joint becoming worse and worse? In my opinion the answer is a definite—No. If this is accepted as correct, then the only explanation is that we are not treating these injuries along the right lines.

I believe that enough attention is not paid to slight injuries to this joint, and that when fluid and pain have left a joint it does not follow that the man is fit to resume full duty.

My reasons for this are as follows :—

The integrity of the knee-joint in the fully extended position depends very largely on the normal condition of its ligaments which prevent abnormal movement and practically form the whole strength of the joint. The extended position is maintained by the tonic contraction of the muscles around the joint. When the knee is in any other position, this is maintained solely by the *co-ordinated action* of the muscles governing the joint, the ligaments, with the exception of the crucial ligaments, being lax.

A voluntary or reflex contraction of one group of muscles around a joint is normally accompanied by a reflex co-ordinated relaxation of the opposing muscle group. *It is therefore easy to see that any lack of co-ordination between opposing muscle groups is bound to throw a strain on ligaments which limit joint action.*

After an injury to a joint, reflex atrophy and loss of reflex and voluntary control over the muscles occur (*vide* diagrams). And, furthermore, this being so there must also be a loss of co-ordination between these groups of muscles.

It does not require much imagination to realize that a joint controlled by such muscles as these is very much more likely to be injured than one controlled by normal muscles.

We must therefore devise a more complete treatment than is adopted at present.

Before we discuss the complete treatment of minor injury to the knee-joint there are several other factors to be taken into consideration.

These are : (1) The synovial fluid secreted as the result of an injury is a pathological fluid and as it is not a normal synovial fluid its absorption

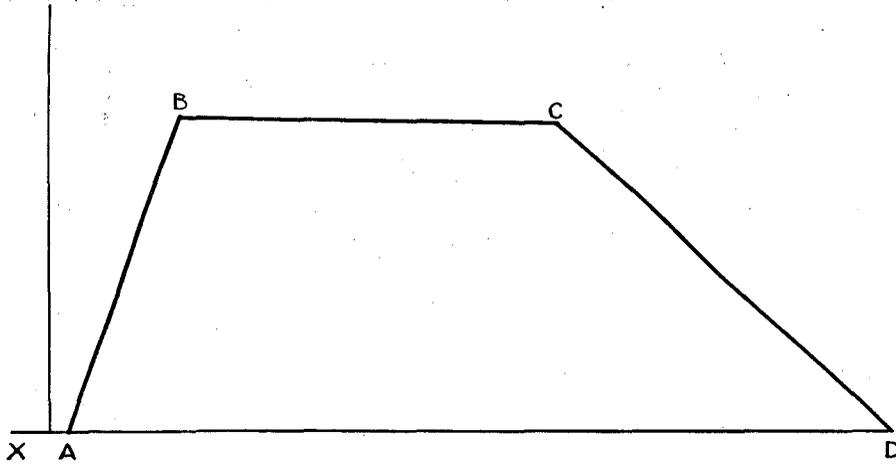


FIG. 1.—This represents a voluntary contraction in a normal vastus internus. The reaction period X—A is short. The contraction rises sharply A—B. It is maintained B—C and it can be relaxed slowly C—D. That is : the muscle is under control.

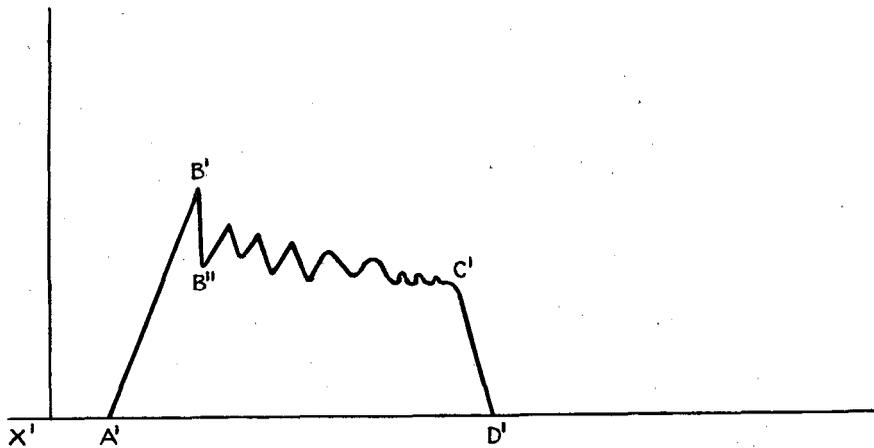


FIG. 2.—This represents a voluntary contraction in the case of a vastus internus atrophied as the result of a strain of the knee-joint in which the accompanying synovitis had subsided. X'—A' the reaction period is longer than normal. The contraction rises slowly and is not as complete as in fig. 1 A—B. There is a sudden drop B'—B'', when the muscle goes out of control. The remainder of the contraction cannot be evenly sustained, B''—C', and finally the contraction ceases abruptly. That is : the muscle is not under control.

does not follow normal physiological principles ; (2) the capsule of the joint is composed of inelastic fibrous tissue ; (3) at the site of any damaged structure there is capillary dilatation and resulting induration ; (4) adhesions, both peri- and intra-articular, are liable to form ; (5) the

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lymphatics draining the joint are numerous; (6) the knee-joint is well supplied by nerves, the principal being the nerve to the vastus internus which it supplies before entering the joint.

As a result of the above factors we get marked wasting, loss of tone, loss of control over, and inco-ordination of the muscles governing, the joint.

The picture we have, therefore, is that of a fibrous sac distended by a pathological fluid plus induration in some part of the sac, and several complications, i.e., reflex wasting and inco-ordination of the muscles and the liability to the formation of adhesions. The longer the joint remains distended, the greater is the wasting of the muscles.

The first aim of treatment should therefore be to get rid of the joint distension. This, as the capsule is a fibrous structure, can only take place at the same rate as the capsule retracts. It is therefore necessary to cause absorption of fluid to take place as quickly as possible, as the longer the distension remains, the greater the difficulty in causing the capsule to retract; also the liability to adhesion formation is increased the longer the fluid remains in the joint.

The method I rely on is to produce the greatest possible increase in the *active blood-supply* around the joint. The effusion being pathological will thereby be absorbed, the fibrous capsule will be toned up, induration will be absorbed and finally the muscles will be made as healthy as possible. I particularly mention an increase in the active as opposed to the passive blood-supply, such as is produced by counter-irritants, which I believe to be bad as the resulting congestion tends to soften the fibrous structures about the joint, which is the reverse of what we want to do.

To increase the active blood-supply, the muscles around the joint must be exercised as the arteries of any structure on which rest is enforced diminish in calibre, in which case the blood-supply will be diminished. At the same time we must not impose any further strain on any injured structure. Muscular action must therefore be obtained without producing joint movement.

The patient is therefore instructed to contract his knee extensors with the leg in the extended position, he also uses the muscles on the posterior aspect of the joint against a resistance.

Contrast douching with hot and cold water is also extensively used as this is a very valuable method of stimulating an increase in the active blood-supply. These baths must be used with the following precautions: At the commencement of treatment three or four applications only must be given twice daily; after two days these may be increased to seven or eight applications; the baths should never be used for longer than two minutes at a time. A large area of the thigh and leg should be included. If these precautions are not observed a chronic capillary dilatation takes place; therefore a passive congestion only is produced which is the opposite to what we desire. Massage is employed a great deal as this also aids absorption by the lymphatics.

The order in which treatment is given is :—

(1) Exercises; (2) contrast baths; (3) massage followed by a tight bandage over ample wool. The bandage is only left on for an hour at a time at the commencement of treatment. As the fluid starts to be absorbed and as tissue reaction commences these bandages are left on for a longer period.

In the early stages of treatment when no reaction has taken place there may be small raw areas, where the synovial membrane has been torn; or where there is capillary dilatation. If these areas are situated where normally the synovial membrane is in close approximation, such as in small recesses, &c., it is quite easy by continuous tight bandaging to cause these areas to adhere and so adhesions are formed. But if these areas are allowed to be separated by a layer of synovial fluid until tissue reaction has taken place, we avoid a probable source of adhesions.

A splint may be necessary, especially at night, but usually a firm bandage over ample wool is sufficient restriction for the joint; the fluid usually commences to absorb rapidly, but after a few days the rate of absorption slows down and proceeds more slowly. The joint should look "clean" in ten days in mild cases. In some cases the fluid refuses to absorb from the start. These effusions should be aspirated at once. In fact, I am rather in favour of aspirating all such joint effusions as I am convinced that the longer there is tension of the capsule, the greater the wasting of muscle; but whatever means is adopted, the joint must be emptied as soon as possible. I have also noticed that those knees which I have aspirated because the fluid was slow to absorb, invariably contained blood.

More active exercises than those described are allowed as soon as the tenderness over damaged structures disappears. Cycling on a fixed bicycle is allowed early. As soon as weight-bearing is permitted, steps should be taken to relieve damaged structures from strain. These exercises should always stop short of producing fatigue in the muscles.

As soon as the muscles have recovered sufficiently to produce an active contraction, re-education and co-ordination exercises must be commenced.

I have for some time been using a very simple exercise designed for this purpose. It only requires a length of catapult elastic or one strand from a patent chest-expander, and a home made anklet. The anklet is fitted on, and the elastic attached to it. The other end of the elastic is attached to a fixed point behind the patient, and at such a distance that the elastic is moderately extended. The patient semiflexes the thigh, and while maintaining the relative position of the thigh and body, he extends the knee against the resistance of the elastic, and slowly and evenly allows it to return to the starting position.

This exercise can be reversed by turning the patient to face the fixed point.

Anyone who tries this exercise will be surprised at the amount of control required to carry out such a simple procedure, as with the thigh

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flexed and the knee flexed against a resistance both flexors and extensors are in a state of contraction, and as the extensors contract further the flexors have to give way slowly in front of them, and vice versa. This exercise therefore re-educates the co-ordination of opposing muscle groups.

Every knee-joint should be put through its full range of movement as early as possible in the treatment. There is no object in waiting until the case has been admitted to hospital a second time to break down adhesions due to the original injury.

This treatment applies equally to a large number of chronic knees. The cause in many cases of chronic knees being merely the wasted condition of the muscles and lack of co-ordination.

### CONCLUSIONS.

A physiological method of treating minor injuries to the knee has been described which gives satisfactory results. Myographs are shown which demonstrate that no man should be allowed to resume full duty until the condition of all the muscles around his knee is found to be satisfactory. This is judged by comparing the two limbs as regards measurements, the rapidity of a contraction and the ease with which a contraction is sustained.

If conscientiously carried out this treatment should lead to a diminution in the number of cases admitted to hospital with recurrent injuries to the knee.

I sincerely hope that this article will be criticized by those who have had more experience than I have. If more articles in the Corps journal were criticized some of us would not be left long in doubt as to the validity of our most cherished beliefs.