Dynamic Chiropractic

SPORTS / EXERCISE / FITNESS

On Stretching

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Stretching exercises are used to improve flexibility which is related to increased range of motion. Increased flexibility should aid in the prevention of muscle strain injury. But, like many methods used in training and rehabilitation, there have been no controlled studies or, for that matter, no clinical studies evaluating stretching and muscle strain.[1] There is definite controversy regarding the benefits of passive stretching.[2,3] Murphy states that a careful search of the literature fails to support the notion that static stretching prevents injury.[2]

There are three basic categories of stretch: static stretching, ballistic stretching, and PNF (proprioceptive neuromuscular facilitation) methods. Static stretching is a method whereby the individual stretches a muscle group to a length just short of causing pain (mild discomfort is acceptable) and holds the stretch for recommended periods of 6-60 seconds or more. It is thought that static stretching in the absence of pain will modify spindle activity (stretch reflex) allowing a slight increase in length.[4,5]

The ballistic stretch allows repetitious bouncing movements at the end-range where the muscles are rapidly lengthened and immediately returned to resting length.[4,5]

This method is supposed to facilitate the myotatic reflex by increasing both static and dynamic spindle activity and muscle stiffness.[5] This method is no longer considered useful as it may cause strain injury.

PNF techniques include contract-relax, hold-relax, contract-relax-antagonist-contract, postfacilitation stretch, and other methods. Alter mentions eight types of PNF techniques.[6] PNF promotes or hastens the neuromuscular mechanism through stimulation of the proprioceptors.[7] When a patient's muscle is stretched and the patient voluntarily isometrically contracts the muscle, it is thought that the Golgi tendon organs' reflexes are stimulated inhibiting or relaxing the muscle (contract-relax and hold-relax method) and the muscle is then passively stretched. If the antagonist to this muscle is next isometrically contracted (contract-relax-antagonist-contract method), then through reflex inhibition, the agonist muscle will be further relaxed. At this point, the muscle can be passively stretched to a new position. The contract-relax-antagonist method may be the most effective of the PNF methods.[5]

Taylor et al.[4] in a very interesting paper attempts to refute the effect of stretching methods based solely on the reflex mechanisms. They feel that the true effect of stretching is related more to the viscoelastic properties of the muscle-tendon unit. The elastic element refers to the spring-like element of tissue where the elongation produced by tensile loading is recovered after the load is removed, thereby creating a temporary or recoverable elongation.[8] The viscous properties allow permanent deformation and are considered time-dependent and rate change-dependent. The rate of deformation is directly proportional to the force applied.4 Stress relaxation and creep are

examples of viscoelastic properties. Stress relaxation occurs if tissue is stretched to a fixed length tolerable to the patient; the tissue will relax and less force will be necessary for the tissue to remain at the same length. If the force is kept constant, the tissue will elongate due to the process known as creep. When viscoelastic tissue is stretched, the above properties allow plastic or permanent deformation.

The muscle-tendon contains an active (contractile) and passive (non-contractile) component. The active part is related to the interaction between the contractile proteins (actin and myosin) within the muscle fibers. The passive components consist of the connective tissue factors within and around the muscle (perimysium, epimysium, endomysium, sarcolemma), the associated tendon and its insertion, and the connections between the sarcolemma and the tendon.[5] Flexibility exercise has its main effect on the passive elements. It is thought that the resistance to stretch is mostly from the extensive connective tissue framework and sheathing within and around the muscle and not from the myofibrillar elements.[8]

In a condition such as adhesive capsulitis of the shoulder, in order to achieve plastic deformation, a prolonged stretch appears to be very beneficial. It has been found that rapid application of force to collagenous tissues results in increased stiffness[2] and affects primarily the elastic tissue. This explains one reason why patients with adhesive capsulitis of the shoulder do not benefit from joint play adjustment and why prolonged stretch is necessary for increased changes in ranges of motion. Often in adhesive capsulitis of the shoulder a joint play adjustment may tear fibers and perpetuate the inflammatory process.

It has been shown that the use of heat along with stretching relaxes the collagen fibers and allows greater elongation. Besides influencing the collagen, the increased temperature increases the sensitivity of the Golgi tendons aiding muscle relaxation. The temperature should be over 104 F. It has been found that the use of ultrasound during stretching is more effective in lengthening. A procedure that works very well in treating adhesive capsulitis is putting the patient in a supine stretched position with the shoulder in lateral rotation for 20 to 60 minutes, with moist heat applied to the shoulder followed by 15 minutes of ice maintaining the stretched position. The patient can hold a weight if it does not increase pain. Cooling the tissue is thought to allow the collagenous microstructure to restabilize more toward its new stretched length.[8]

Taylor et al.[4] experimented with rabbit muscle/tendons and felt that the main response to stretch could be explained by viscoelastic properties alone, exclusive of reflex effects. They found that denervated muscles responded similarly to the innervated muscles in flexibility testing. Interestingly, they found that most of the stress relaxation took place within 12 to 18 seconds of stretch and there was insignificant relaxation afterwards. They also found that in static stretching, 80 percent of the stretch occurred after the first four stretches and stretching afterwards improved elongation very little. Of course we are dealing with rabbit tendons -- are there any human volunteers in the audience?

References

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Editor's Note:

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