Dynamic Chiropractic

SPORTS / EXERCISE / FITNESS

Stretching the Tendon

Warren Hammer, MS, DC, DABCO

Did you ever think that stretching the tendon could be more valuable than stretching the muscle?

Most studies on stretching have concentrated on the muscle, rather than the tendon,[1] but stretching the tendon may be more beneficial for certain sports or activities. How can you stretch a tendon without stretching the muscle, too? Well, you can't, but some types of stretching put more emphasis on the tendon and may be a reason why these types of stretches are more preventative than other types of stretches, depending on the sport or activity.

Tendons have two functions, which do not necessarily occur equally when used. They create a tensile force transmission, and they store and release elastic energy during motion. These two functions can be individually emphasized for a particular sport. For example, the tendon function that emphasizes the tensile force transmission in cycling, skating, wrestling and boxing requires a rapid development of force in an isometric or concentric muscular contraction and benefits from an increase in musculotendinous stiffness. When the muscle tendon is stiffer, a faster force is transferred to the bones and the resulting movement of the joint is quicker.[2]

With the effect of this stiffness factor in particular sports, there would be no need for a highly elastic muscle-tendon that acts like a spring, releasing elastic energy. Could overstretching in these types of sports be counterproductive by reducing the necessary stiffness factor? In sports that require more stiffness, the muscle-tendon metabolic energy is converted into mechanical work in a concentric contraction. This is not the type of function recommended in sports or exercises that require a stretch-shortening cycle (SSC), such as the baseball pitch, tennis serve or golf swing, or jumping and bouncing - as occurs routinely in soccer, football and gymnastics.

In the SSC, an eccentric muscle action is immediately followed by a concentric action. When an activated muscle is stretched before shortening, the following concentric phase is enhanced. During the eccentric part of the SSC, it is mostly the tendinous tissue that stores the mechanical work as elastic energy and releases the elastic energy during the shortening phase. This storage and release is known as an "energy-saving" system. The tendon structures are the major sources of the elastic component where the energy is stored. The tendinous elastic tissues that store the energy are the epimysium, perimysium, endomysium, sarcolemma and endosarcomeric structures.[1] So, if the sport or activity emphasizes an SSC type of motion, the tendon where most of the elastic energy is stored requires a particular type of stretch, since a more compliant tendon is necessary, rather than a stiff one. A more compliant tendon will be able to absorb more energy and will be less likely to reach the maximal energy-absorbing capacity, thereby resulting in less chance of injury. The ability of the tendon to absorb more energy also will lessen the stress on the muscle, helping to prevent muscle injury.

Exercises that emphasize eccentric contraction, such as ballistic and plyometric exercises, are useful for SSC activity, while static contractile exercises are more useful for movements that require minimal energy-absorbing capacity. Therefore, if there is no need for a compliant tendon to absorb energy, increased stretching may be of no value, and may even be responsible for overly fatigued muscles and result in injury. These concepts may explain some of the controversy

regarding the use of stretching.

In a study comparing static and ballistic stretching on the stiffness of the Achilles tendon,[3] static stretching decreased the passive-resistive torque, but did not change Achilles tendon stiffness. Ballistic stretching resulted in a significant decrease in Achilles tendon stiffness. So, for tendon stretching to allow a greater absorption of energy, an eccentric type of stretching should be used. Eccentric exercises use the principle of ballistic exercise with much less possibility of injury. In both exercises, the muscle is contracting while the tendon is elongating and performing in a repetitive manner. Ballistic stretching bounces into or out of a stretched position using the stretched muscles as a spring, and is not usually recommended. An example is bouncing down repeatedly to touch your toes. However, an ideal exercise to improve tendon energy absorption would be the use of plyometrics, which is a quick, powerful movement involving prestretching of a muscle. This movement activates the stretch-shortening cycle, which stimulates the body's proprioceptors to facilitate an increase in muscle recruitment over a minimal amount of time.[4] In plyometrics, whether throwing a medicine ball or using tubing for shoulder external and internal rotation, there is the eccentric phase or preloading period, the phase or time between eccentric and creative phase and the concentric phase, which is the facilitated contraction.

High quality research presently supports the clinical effectiveness of eccentric exercise over other treatments in the management of tendinopathies of the Achilles, patella and common wrist extensor tendons of the lateral elbow.[5] It becomes apparent that some stretching techniques are found to be superior to and more sport specific than others. While static and eccentric stretching have different effects on passive-resistive torque and tendon stiffness, both types of stretching should be considered as complementary for the training and rehabilitation programs of tendon injuries.[1]

References

1. Witvrouw E, Mahieu N, Roosen P, McNair P. The role of stretching in tendon injuries. *Br J Sports Med,* 2007;41:224-6.
2. Witvrouw E, Mahieu N, Danneels L, McNair P. Stretching and injury prevention: an obscure relationship. *Sports Med,* 2004;34(7):443-9.
3. Mahieu N, McNair P, De Muynck M, et al. Effect of static and ballistic stretching on the muscle-tendon tissue properties. *Med Sci Sports Exerc,* 2007.
4. Wilk KE, Voight ML. Plyometrics for the Shoulder Complex. In: Wilk KE, Andrews JR. *The Athlete's Shoulder.* New York: Churchill Livingston, 1994:543-65.
5. Woodley BL, Newsham-West RL, Baxter DG. Chronic tendinopathy: Effectiveness of eccentric exercise. *Br J Sports Med,* 2007;41:188-98.

AUGUST 2007