REPETITIVE-STRAIN injuries occur every day in competitive athletics, recreational activities, the workforce, and the military. Many treatment options are available, but there is little consensus and few outcomes-based studies to indicate which treatment is better than another. Eccentric exercise has been advocated since the early 1980s as a viable treatment option for tendinopathies. Studies in the clinical setting by Stanish et al.¹ and Fyfe and Stanish² have produced positive results, and there have been good results evident in outcomes-based treatment studies³-⁵ in patients with chronic Achilles- and patellar-tendon injuries. This article is intended to help athletic trainers and therapists apply the principles of eccentric exercise to Achilles and patellar tendinopathies.

Eccentric Exercise

In order to advocate the use of eccentric exercise, one must look at the cause of the injury itself. It has been hypothesized that repetitive eccentric loading during activity causes microtrauma to tendons.³,⁶ This is thought to occur when a maximum load is placed on a tendon during eccentric force.²,⁷ If the tendon cannot handle the forces because of muscle weakness or the inability to decelerate the applied forces, the stress goes to the degenerated and already weakened tendon, resulting in injury. Therefore, training the tendon to withstand the forces that lead to injury might prevent an overuse injury from occurring.

The focus is to train individuals to activate muscles at the appropriate time²-⁵ so that the body segments decelerate safely, resulting in a decrease of average force transmitted through the tendon during movement.⁹ Functional eccentric-contraction exercises might decrease the force experienced during repetitive activity and, ultimately, the risk of injury recurrence.²-⁵

Eccentric training can be started when there is no disabling pain evident during treatment and continue for a period of 3–6 months.²-⁵,⁷,⁸

Eccentric-Exercise Programs

There have been variations of the original program started by Curwin and Stanish² in the early 1980s, which consisted of following certain movement speeds on particular days for specific Achilles- and patellar-tendon exercises. According to the specifics of the program, an individual progressed from slow speeds on Days 1 and 2 to moderate speeds on Days 3–5 and then to fast speeds on Days 6 and 7 when performing the exercises. Stretching was incorporated before the start of the program, followed by application of ice to the area when the session ended. A short rest period followed by stretching between repetitions was emphasized. Resistance was not added until the second week, starting at 10% of body weight and increasing 10–30 lb progressively during Weeks 3–6. The progression in the program was based on pain. It was normal to experience pain during the last set of 10 repetitions. If pain were felt in all three sets of repetitions, however, little positive effect would be evident, and the program would not be successful. Athletes were usually asymptomatic after 6–8 weeks.

Alfredson et al.³ modified the original program presented by Curwin and Stanish² for treating Achilles tendinopathy. Because eccentric exercise does not appear to be velocity specific,³ a slow speed was used throughout the entire program. Weight was added when minor pain or discomfort was not experienced. An individual was allowed to experience pain as long as it was not disabling. In fact, experiencing muscle soreness would be normal during the first 1–2 weeks of the program. The eccentric protocol consisted of two types of eccentric toe raise/heel drops isolating both
the gastrocnemius (Figure 1) and the soleus, starting with three sets of 15 repetitions. In this outcomes-based study and in another by Mafi et al. comparing eccentric exercise following the same protocol with concentric exercise, pain levels decreased with participation in sports within 12 weeks.

Cannell et al. modified the patellar-tendon protocol originally established by Curwin and Stanish by performing the activity with a rapid eccentric force instead of progressing from slow to fast. A fast speed in which the individual drops rapidly into knee flexion was used because of the strong forces transferred to the patellar tendon from the quadriceps contraction during normal activity. After 2 weeks of rest, the protocol was begun. The drop squat is started while standing with both knees in extension (Figure 2). The knees are unlocked rapidly and stopped when both thighs are almost parallel to the ground (Figure 2, inset). Hand weights are progressively increased when the current level becomes easy. The starting weight is determined by body weight, using 20% at the first level and then increasing by 2.5 kg for the next three levels. At the end of 12 weeks in the Cannell et al. study, decreased pain was experienced in both the drop-squat group and the leg-extension/curl group, but the authors noted that because of the complexity of patellar tendinopathy the drop-squat program might go longer than 12 weeks.

A successful program used on the clinical level has the drop squat performed 7 days a week for 6 weeks, adding more repetitions and weight as the weeks progress. At this particular clinic, one third of the patients did not require any further treatment at the end of 6 weeks.

Summary

An eccentric-exercise program should be established as another form of treating Achilles and patellar tendinopathy. From outcomes-based studies, the programs developed by Alfredson et al. and Cannell et al. should be used but individualized, using pain for progression.

A slow velocity should be used for Achilles tendinopathy, whereas a faster velocity should be incorporated for patellar tendinopathy because the energy being transferred from the quadriceps muscle to the patellar tendon is very high. Further outcomes-based clinical studies on eccentric exercises for tendinopathies are necessary because there is very little information in the literature on the treatment of Achilles and patellar tendinopathies.

The reader is encouraged to refer to the sources in the references for specific protocol information.

References


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