ECCENTRIC EXERCISE IN THE THERAPY FOR TENDON INJURIES

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Muscles operate eccentrically to either dissipate energy for decelerating the body or to store elastic recoil energy in preparation for a shortening (concentric) contraction.
The muscle forces produced during this lengthening behavior can be extremely high, despite the requisite low energetic cost.
Traditionally, these high-force eccentric contractions have been associated with a muscle damage response. Damage to the muscle-tendon is not an obligatory response. Rather, the muscle can hypertrophy and a change in the spring characteristics of muscle can enhance power; the tendon also adapts so as to tolerate higher tensions.
Tendon disorders result from intensive repetitive activities. Due to the higher-than-normal eccentric muscle forces transmitted via the tendon, the ability of the tendon to repair itself becomes impaired and the tendon deteriorates. This degenerative process, known commonly as tendinosis, is associated with an abnormal angiofibroblastic healing response.
The tendons, like the muscles, can adapt favorably to physical stress including that of eccentric loads. Tendons become stronger as tenoblast activity increases and an appropriate collagen reaction accelerates. Alfredson et Al. (1998) demonstrate that patients affected by chronic Achilles tendinosis responded favorably to high force eccentric exercises, consisting of calf raises, twice a day, 7 days a week, for 3 sets of 15 repetitions, raising both heels and using the impaired side only to do the eccentric lowering phase. Once the exercise was possible with no discomfort, patients were instructed to add resistance by using additional weight. While the specific mechanism have not been elucidated, high muscle-tendon eccentric forces delivered in a controlled rehabilitation environment are need for optimal tendon adaptation.
The force generated during a concentric-eccentric exercise, or typical strengthening program, is not stimulating these beneficial tendon adaptations. The high forces produced eccentrically, while causing injuries to tissues naïve to such forces, induce a beneficial tissue remodeling response when exposed to such forces chronically and progressively.
A program based on eccentric overload appears to be a suitable resistance exercise to elicit a remodeling response that meets the demands of functional and sport activities.
These high eccentric muscle forces are only produced when an external force exceeds that of the muscle. To induce these high-magnitude forces, an external load capable of exceeding maximal isometric muscle force is required. This is only possible during eccentric, not isometric, nor concentric actions. If an exercise is designated to simply recover, eccentrically, the forces generated concentrically, then that exercise does not take advantage of the unique high force-producing properties of eccentric contractions (2).
In conclusion, eccentric exercise lead to structural changes and adaptations that may help prevent musculoskeletal injury, improve sport performance, and overcome musculotendinous injury.

1. Alfredson H et Al. Heavy-Load Eccentric Calf Muscle Training For the Treatment of Chronic Achilles Tendinosis Am J Sports Med 26: 360–366, 1998.
2. LaStayo PC et Al. Eccentric muscle contractions: their contribution to injury, prevention, rehabilitation, and sport. J Orthop Sports Phys Ther 33(10): 557-71, 2003.