It is known that tendons transmit to the bones the force that is produced by the muscle belly during contraction, contributing to the human movement. Each muscle has two tendons, the distal and the proximal. The myotendinous junction is the point where the tendon connects to the muscle. The osteotendinous junction is the point where it connects to the bone. The place where a muscle’s proximal tendon attaches to the bone is referred to as the muscle origin, and the distal tendon attachment is referred to as the insertion (19, 20, 36).

The epitenon is a sheath that covers the tendons and contains nerves, blood vessels, and lymphatics. Superficially, it is surrounded by the paratenon while it deeper extends into the tendon commonly known as the endotenon (24, 49). Each tendon consists of cells, collagen fibers and ground substance (36,49). It is innervated by few nerves that follow the vascular channels that run along the axis of the tendon (17). Tendons withstand stretching and tensile forces, but are less tolerant to compressive and shearing transmitted by the muscles (15).

The metabolism of tendon cells is generated by the anaerobic glycolysis, pentose phosphate shunt and krebs cycle, with the latter being the only metabolic pathway throughout the life span. Since tendons have lower oxygen consumption than skeletal muscle, they can sustain loads and remain tensioned without risk of injury (11, 17). Negative aspects of the low metabolic rate in tendons are the slow recovery after activity, and healing process after an in-
jury. Physical activity seems to improve the tensile mechanical properties of tendons, while immobilization or disuse have negative effects (25).

Tendinopathy is a term that describes the different types of non-rupture tendon disorders, which manifest symptoms as pain, swelling, and impaired function (6).

The etiology of tendinopathy is multifactorial and depends on particular tendon pathology. The involving risk factors are extrinsic and intrinsic. In the case of acute tendon injuries, the extrinsic risk factors are predominating, while chronic tendinopathy is accumulatively caused from both extrinsic and intrinsic (19, 36).

The intrinsic risk factors include age, anatomical elements, systemic diseases, genetics, decreased flexibility of the joints, high bodyweight, and muscle weakness/imbalance of the muscles (12). The extrinsic risk factors include training errors, improper footwear, running on hard, slippery or uneven surfaces and poor technique. Also, overuse or overload (including compression) and underuse is believed to be the major factors that cause tendinopathy (12, 17, 19, 20).

Recently, low-level laser treatment (LLLT) has been used in the traumatology department for treating sport injuries demonstrating positive results (2, 31-48). Laser seems to have a biostimulatory effect via photoreceptors; as these receptors absorb the laser light, a metabolic cascade reaction is initiated in the cells. The photoreceptor that initiates the reaction is the enzyme c oxidase. The latter is activated through the presence of nitric oxide, adenosine triphosphate and reactive oxygen spaces, which result in changes in the electron transport chain (21). Frigo et al, (13), Chen et al, (10), who investigated the gene expression profiles of human fibroblasts, showed that most genes suppress apoptosis, or enhance cell proliferation indirectly or directly from LLLT. Also laser light seems to regulate oxidative stress (Moriyama et al, (26) and reduces expression of pro-inflammatory mediators (29).

A number of clinical studies demonstrated that LLLT decreases pain, which is the main symptom of knee osteoarthritis (Hegedus et al, (14), neck pain (Konstantinovic et al, (23), tendinopathies (Stergioulas, (38); Stergioulas (33), Stergioulas et al (32), lower back pain (Jovicic et al, (18) and myalgia (8, 9).

However, the exact mechanism(s) of decreased pain intensity relief is/are not fully understood. A possible explanation would be a nerve-blocking effect caused by LLLT, which was demonstrated by Chow et al (7) in a laboratory study. Also, suggestions of pro-inflammatory cytokines as a trigger for pain (3, 22) make the anti-inflammatory effects a possible explanation for pain relief.

Plyometrics is a Greek term that describes an increase in the length of a muscle/tendon unit. Plyometric exercises are incorporated in training programs for sports such as volleyball or in a track and field event such as high jump. Plyometrics is considered to increase the elastic energy of the
muscle/tendon unit during stretching of its full length (plyometric contraction) and to free it during decrease of its length (concentric contraction) (36, 49). However, in the current literature the term commonly used instead of "plyometrics" is "eccentric". In the case of tendon disorders that maneuver can improve local inflammation, and realign the collagen fibers near the insertions in the periosteum (1, 4, 5).


Recently, Alfredson et al, (1) developed a pain-free eccentric training program for patients with mid-portion Achilles tendinopathy that demonstrated excellent results. This protocol has been used by other researchers, who have confirmed its results (5, 30).

Some researchers used a combination of LLLT and eccentric training in patients with tendinopathies. Stergioulas et al (33), showed that a combination of LLLT with plyometric exercises was more effective than placebo laser and exercise in the treatment of patients with lateral epicondylitis. In another investigation, Stergioulas et al, (31) found that low-level laser therapy, with plyometric exercises, accelerated clinical recovery from chronic Achilles tendinopathy. On the contrary, Tumilty et al (50) did not find any effects of LLLT and eccentric exercises in the Achilles tendinopathy.

This author believes that a combination of LLLT with plyometric exercises, as a lot of studies recommended, allows collagen to heal, reduces the pain intensity, improves local inflammation, realigns the collagen fibers and finally improves the athletes' performance. Therefore, professionals who want to construct a rehabilitation program for tendinopathy, should take into account the views presented in this article as well as the particular topic "tendon and sport", in order to gain positive results and to improve the athletes' status.

REFERENCES


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