Tendinopathy: Why the Difference Between Tendinitis and Tendinosis Matters

Evelyn Bass, LMT

Massage Department, Southeast Medical Clinic, Juneau, Alaska, USA

Think tendinitis and you think pain and burning in the affected area, decreased strength and flexibility, and pain caused by everyday activities. As it turns out, tendinosis is far more often responsible for these symptoms than tendinitis[1,2,3]. It is important for health care practitioners to distinguish between these disorders in order to apply the most appropriate treatment.

Tendinitis is the inflammation of the tendon and results from micro-tears that happen when the musculotendinous unit is acutely overloaded with a tensile force that is too heavy and/or too sudden. Tendinitis is still a very common diagnosis, though research increasingly documents that what is thought to be tendinitis is usually tendinosis[1,2,3,4,5].

Tendinosis is a degeneration of the tendon's collagen in response to chronic overuse; when overuse is continued without giving the tendon time to heal and rest, such as with repetitive strain injury, tendinosis results. Even tiny movements, such as clicking a mouse, can cause tendinosis, when done repeatedly.

The confusion about the difference between tendinitis and tendinosis is widespread. Many injuries commonly presumed to be tendinitis are actually tendinosis. For example, tennis elbow is usually described as tendinitis of extensor carpi radialis brevis; however, "signs of either acute or chronic inflammation have not been found in any surgical pathologic specimens in patients with clinically diagnosed lateral tennis elbow syndrome," proving that tennis elbow is not tendinitis[4]. The histology of tennis elbow shows that it is actually tendinosis[5].

A microscopic view of tendinosis reveals an increase of immature type III collagen fibers (mature type I fibers dominate in healthy tendon tissue); loss of collagen continuity so that collagen fibers are no longer aligned with each other and sometimes fail to link together to facilitate load-bearing; an increase in ground substance (the material between the body's cells); and a haphazard increase of vascularization[2,3,5]. These vascular structures "do not function as blood vessels" and "are not associated with increased healing[2]." The appearance of the tendon shifts from a reflective, "white, glistening and firm" surface to a "dull-appearing, slightly brown and soft" surface (mucoid degeneration)[2,3].

These changes result in a loss of strength in the tendon and increase the bulk of the tendon, both of which contribute to the cycle of injury and can set the stage for secondary conditions, such as tendinitis and nerve impingement. My study leads me to believe that, in the forearm and wrist, tendinosis can result in secondary carpal tunnel syndrome; this is because the thickening of the tendons with excess ground substance and the swelling of the surrounding tissue crowds and compresses the median nerve.

There is a prevalent supposition that tendinosis begins with tendinitis, which then instigates a healing process that changes the collagen and weakens the tendon, becoming tendinosis. Perhaps this supposition exists because the stages of soft-tissue healing are generally listed as, in short: inflammation response, regeneration (collagen production), and remodeling (strengthening the collagen in the direction of the forces placed upon it). In one article, tendinitis is cited as the first stage of a tendinopathy; tendinosis is cited as the second stage and rupture as the third stage. The fourth stage is described as a combination of stages 2 and 3, along with fibrosis and calcification[2].

The suggestion that tendinitis precedes tendinosis is at odds with the fact that a healthy tendon is up to twice as strong as the muscle, making the body of the tendon unlikely to tear before the muscle unless the tendon has already been weakened by degenerative changes[6].

The idea that tendinitis is the first stage of tendinosis seems to presume that micro-tears and inflammation are a precursor to collagen degeneration. Histopathologic analyses show that torn fibers, scar tissue, and calcification are only found in conjunction with tendinosis some of the time, and inflammatory cells are rarely found in conjunction with tendinosis, supporting the hypothesis that tendinitis occurs secondarily to tendinosis[1,2,3,5,7]. Excessive and/or repetitive tensile forces on the tendon are likely what instigate the chemistry of degenerative changes associated with tendinosis[8]. Arnoczky *et al.* have reportedly shown that tensile forces placed on the tendon are directly related to persistent activation of a stress activated protein kinase (c-Jun N-terminal kinase (JNK)); the persistent activation of JNK has been related to the initiation of programmed cell death[8].

The most important reason to distinguish between tendinitis and tendinosis is the differing treatment goals and timelines. The most prominent treatment goal for tendinitis is to reduce inflammation, a condition that isn't present in tendinosis. In fact, some treatments to reduce inflammation are contraindicated with tendinosis. Ibuprofen, a nonsteroidal anti-inflammatory, is associated with inhibited collagen repair[9]. Corticosteroid injections inhibited collagen repair in one study, and were found to be a predictor of later tendon tears[3,4,10].

The healing time for tendinitis is several days to 6 weeks, depending on whether treatment starts with early presentation or chronic presentation[3]. Khan et al.[3] state that treatment for tendinosis recognized at an early stage can be as brief as 6–10 weeks; however, treatment once the tendinosis has become chronic can take 3–6 months. It is suggested by Rattray and Ludwig[10] that effective treatment might take up to 9 months once the tendinosis is chronic. Knowing these timelines is part of creating an effective treatment plan. Khan[3] reportedly suggests that tendons "require over 100 days to make new collagen." Given this claim, treating chronic tendinosis for a matter of weeks would provide little benefit to the long-term repair of the tendon.

It is a matter of coincidence that some of the separate treatment goals for tendinitis and tendinosis result in overlapping beneficial treatment methods. For example, deep-friction treatments are beneficial for both conditions, but for very different reasons. In the case of tendinitis, deep friction serves to reduce adhesions and create functional scar tissue once inflammation has subsided. In the case of tendinosis, deep-friction treatments serve to stimulate fibroblast activity and collagen production[11]. Lucky concurrence of treatment recommendations is not to be substituted for a thorough understanding of which condition is being treated. Accurate assessment techniques and knowledge of the relevant condition will result in the most appropriate application of treatment.

The primary treatment goals for tendinosis are to: break the cycle of injury; reduce ground substance, pathologic vascularization, and subsequent tendon thickening; and optimize collagen production and maturation so that the tendon regains normal tensile strength[3].

Massage therapists must be aware of their own skill set in applying treatment recommendations and educating patients about self-care. Referring patients to a physical therapist, primary medical provider, or other specialist may be beneficial to the patient, depending on the therapist's level of training.

Treatment and self-care recommendations for tendinosis include:

1. **Rest**. People with low-grade tendon injuries often find it difficult to rest as much as is necessary, especially as symptoms subside[3]. With repetitive work tasks, the patient is recommended to take a break for one minute every 15 minutes and a five-minute break every 20–30 minutes[12]. This reduction isn't much considering its role in preventing long-term pain and disability. Some people will need to rest even more than this at the start of treatment. The patient should be advised to stay aware of their body as it heals. If the activity they are engaging in is causing pain, then they are probably doing too much.
2. **Adjust ergonomics and biomechanics**. Small changes can make a big difference. With regard to ergonomics, for example, cashiers are encouraged to press the register keys as lightly as possible, and computer users should be sure their wrists are resting in a neutral position while typing. Larger companies and government organizations often have an ergonomic specialist available to consult with employees about their workstations. Physical therapists are experts at recognizing and adjusting improper biomechanics that might be causing injury.
3. **Use appropriate support**. Physical therapists can also recommend appropriate support to reduce tensile stress on the tendon, such as bracing or taping[3].
4. **Stretch and keep moving, though conservatively**. Lightly stretching and moving the affected area through its natural range of motion while minimizing pain will prevent shortening of the related muscles (preserving active range of motion and flexibility). It can also increase circulation, thereby assisting the healing process. Stretching can also elongate the muscle-tendon unit, reducing the tension placed on the tendon during activity, thereby reducing the chemical changes that cause degeneration[8,13,14].
5. **Apply ice**. Ice causes vasoconstriction and is thought to address the abnormal neovascularization of the tendon tissue[3]. Clinical experience indicates that icing is helpful for tendinopathies even though the reason why it works is not yet fully understood[3]. Use ice for 15–20 minutes several times a day (allowing for at least 45 minutes in between icing session), and after engaging in activities that utilize the tendon[7,15].
6. **Eccentric strengthening**. An eccentric strengthening regimen done 1–2 times daily for 12 weeks has been clinically proven to be a very successful treatment for tendinosis, especially when the exercises are performed slowly[2,3,5,16]. Eccentric strengthening is "lengthening a muscle while it is loaded and contracting[17]." For example, lengthening one's bicep while holding a dumbbell in one's hand would stimulate eccentric contraction. Eccentric strengthening effectively stimulates collagen production, improves collagen alignment, and stimulates collagen cross-linkage formation, in turn improving tensile

strength[5]. Eccentric strengthening might also help to reduce ground substance and tendon volume (swelling/thickening)[2]. It has also been proposed that part of the benefit of eccentric strengthening is the stretching involved, as described above. It can be helpful to consult with a physical therapist to maximize the benefit of strengthening exercises and to minimize the possibility of re-injury.

7. **Massage.** Massage stimulates circulation and cell activity, especially when done at the appropriate depth. Deep-friction massage applied to the tendon serves to stimulate fibroblast activity and generate new collagen. Stasinopoulos and Johnson[18] report that applying deep-friction to the tendon for at least ten minutes after the numbing effect has been achieved results in reduced pain and increased strength and mobility. Lowe[11] states that he has found it effective to apply friction to the tendon in multiple short bursts of 20–30 seconds interspersed with other techniques; this strategy allows for mobilization of the tissue while minimizing discomfort for the patient. Myofascial techniques and trigger-point therapy can reduce fascial restrictions, scar tissue, and trigger points in the muscle connected to the tendon, relieving tension on the tendon. Myofascial techniques, lengthening deep-tissue techniques, stretching and active-release techniques can reset muscle memory to a more lengthened position, reducing the tension placed on the tendon during activity. A variety of massage techniques can decrease overactive pain messages from sympathetic nervous system firing, increase circulation, and improve overall tissue health[10,11,19].
8. **Nutrition**. Vitamin C, manganese, and zinc are all important for the synthesis of collagen production[20]. Vitamin B6 and Vitamin E have also been linked to tendon health[21]. Patients might benefit from talking with their primary health care provider or a nutrition specialist to be sure their intake of these nutrients is sufficient.

While the cellular damage is unlikely to be reversed completely, these treatments and self-care recommendations can increase the strength of the tendon by stopping the cycle of injury, introducing healthy collagen into the area, addressing unhealthy vascular changes, and decreasing the over-abundance of ground substance. Proper treatment of tendinosis should eliminate or significantly decrease pain, increase range of motion, increase strength, and return the patient to pain-free, normal daily activities.

Tendinosis causes tissue changes that make the tendon more prone to injury, so it is important that the patient continue to take care of the compromised tendon once the initial phase of treatment is complete. Ongoing massage, stretching, strength training, and warming up before starting work or exercise can help to prevent re-injury and keep the tissue as healthy as possible.

CONFLICT OF INTEREST NOTIFICATION

The author declares there is no conflict of interest.

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Corresponding author: Evelyn Bass, LMT, Department of Massage, Southeast Medical Clinic, 641 W. Willoughby Ave. Ste, 201 Juneau, AK 99801
E-mail: evelyntherese@gmail.com