Nonoperative Management of the Achilles Tendon Insertion

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KEYWORDS

• Nonoperative treatments • Insertional Achilles • Calcaneal enthesophyte
• Shockwave • Regenerative medicine • Platelet-rich plasma • Orthotics
• Physical therapy

KEY POINTS

- Insertional Achilles tendinopathy is thought of as a compression phenomenon with the posterosuperior calcaneus and the anterior aspect of the Achilles unlike midsubstance, which is more of a tension mechanism.
- Early treatment modalities to reduce pain are typically centered on immobilization for a short course followed by isometric exercises. Night splints or night braces have been shown to not be efficacious.
- To improve the blood flow, potentiate viable cells, and improve tenocyte formation, the author supports the utility of platelet-rich plasma, extracorporeal shockwave treatments, and other advanced modalities for this pathologic condition.

PATHOPHYSIOLOGIC INTRODUCTION

Clear definitions of Achilles pathology now exist and have been described by van Dijk and colleagues[1] based on anatomic location and histopathology to create a more uniform understanding of this disease process. We focus on insertional Achilles tendinopathy (IAT) defined as symptoms located at the insertion of the Achilles tendon onto the calcaneus, bone spurs, and calcifications in the tendon proper at the insertion site. Differential diagnoses may include retrocalcaneal bursitis or superficial calcaneal bursitis.

IAT has long been associated with several key mechanical contributing factors such as posterior muscle group tightness, pronation of the foot and calcaneus, large calcaneal enthesophytes, or spurs. Several investigators have discussed microtears within the tendon that failed to heal secondary to poor vascularity, which can lead to chronic pain. These tears are caused by excessive loading during aggressive exercise, uphill

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training, repetitive overuse, and/or reduced flexibility. Histologic analyses show poor healing and a lack of inflammatory cell response, which incites pain.[2] As excessive load increases with individual foot types, normal tendon becomes stress shielded and reactive tendinopathy occurs with tendon disrepair and degenerative tendinopathy.[3] These therapies play roles in the understanding of IAT and non-IAT as we try to understand the true pathophysiology and correction of these degenerative processes. Current trends in the understanding of the disease process are somewhat static with the addition of plantaris compression phenomenon,[4,5] which is described later, but our challenge has focused on minimally invasive less debilitating recovery processes focused on rehabilitation (**Fig. 1**).

CLINICAL PRESENTATION AND WORKUP

Patients can present with symptoms that have been described in other articles in this review but focus on distal Achilles tendinitis. Patient-reported symptoms include pain with exertional activities, pain after a period of rest, swelling, and pain with closed counter shoes. Often patients complain of pain at end range of dorsiflexion, that is, walking uphill or heel drops, and pain with zero drop shoes or barefoot-style footwear. Midportion, or midsubstance, Achilles tendinopathy is typically located 2 to 7 cm from the insertion whereby IAT is focused at the superior calcaneal insertion or at the distal calcaneus posteriorly. Upon physical examination, as expected, tenderness to palpation along the posterior superior margin of the calcaneus, edema noted as well to the area which may present on the medial lateral insertional flares of the tendon, if a superficial bursitis is present there will be a softer bursal tissue typically at the directly posterior margin. Pain with end range of dorsiflexion active and passive of the affected limb and with weight-bearing exercises.

Imaging typically constitutes standard 4 weight-bearing views of the foot, including a calcaneal axial view, to assess for various pathologies including progressive collapsing foot deformity, cavovarus deformity, tarsal coalitions, and tibiotalar and hindfoot arthritis. Clinicians will typically rule in posterior calcaneal enthesophytes with these radiographs to determine the longevity and severity of the pathology and potential need for surgical management. Furthermore, as technology has improved and nonoperative treatments are becoming popular, point-of-care ultrasound is an oft first line of advanced imaging, which can be performed quickly and routinely

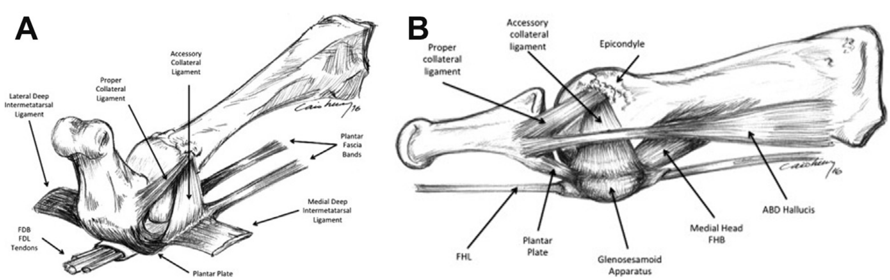

Fig. 1. Lateral weight-bearing foot radiograph with a focus on the posterior calcaneal enthesophyte, which is intratendinous at the Achilles insertion. *From* Caio Nery, Daniel Baumfeld, Hilary Umans, André F. Yamada, MR Imaging of the Plantar Plate: Normal Anatomy, Turf Toe, and Other Injuries, Magnetic Resonance Imaging Clinics of North America, Volume 25, Issue 1, 2017, Pages 127-144, ISSN 1064-9689, ISBN 9780323496537, https://doi.org/10.1016/j.mric.2016.08.007.

with a basic understanding of ultrasonic anatomy. If clinical symptoms continue despite nonoperative treatment or a better understanding of the patient's physiology is necessary, MRI is ordered and preferred. MRI typically allows for better visualization of the thickness of the tendon at the insertion as well as any outliers, which could include large amounts of bone marrow edema in the posterior superior calcaneal margin, stress fractures, bursal tissue, accessory soleus muscle, plantaris compression phenomenon, and posterior calcaneal fracture. These modalities will aid and guide treatment of IAT (Fig. 2).

PHASES OF TREATMENT

Pain Reduction

Because patients typically present after at least 6 to 8 weeks of at-home self-care, pain reduction is of utmost importance. These patients are on either side of the bell curve of activity, overuse phenomenon with runners or underuse and obese. Both are difficult to treat with their own challenges, but the former are often more difficult due to high expectations, need to return to sport activity, and lifestyle. The dysfunctional tendon at the insertion of the calcaneus is painful, and oral and topical anti-inflammatories combined with acetaminophen can assist. The author recommends acetaminophen 500 mg combined with 400 mg ibuprofen taken 3 times a day to begin treatment protocols and reduce tendon edema. Author recommends this course for approximately 4 weeks. This protocol also allows patient to begin isometric exercises, which is the functional exercise needed at this point in time. Isometric exercises help reduce pain and maintain Achilles tendon strength over this period. Simple calf raises on a flat surface repeated 3 to 5 times daily, which can be held for approximately 45 seconds, should be performed. Obviously aggravating cycles of Achilles tendon force should be removed, which include no running, jumping or box jumps, or impact activity for at least 3 to 4 weeks, but it may vary from patient to patient. The Achilles tendon is not to be stretched, passively, actively, or with bands or a night splint.

Fig. 2. Advanced imaging of posterior Achilles pain typically shows signal uptake anterior to the insertion and posterosuperior calcaneal edema on T2 MRI.

Oftentimes clinicians use a cam walker offloading boot to help with any difficulty with weight-bearing, but this also does not allow for functional recovery. The author recommends limiting the use of a Cam walker boot for 2 weeks before starting isometric exercises. After this phase of pain reduction modalities, approximately 4 weeks of the above-mentioned tools, the author recommends instituting advanced regenerative measures to include autologous injections (PRP, BMAC), nonautologous injections (HA), extracorporeal shockwave therapy (ESWT), percutaneous in-office procedures.

Intervention: Regenerative Therapies

At this phase in insertional Achilles tendinitis treatment, our goal is to change a chronic dysfunctional cytokine pathway and tendon disrepair to an acute inflammatory cell response that allows us to move forward with the next phase of building strength and return to sport.

AUTOLOGOUS INJECTIONS

Injections into the retrocalcaneal bursal tissue and around the calcaneal enthesophyte typically include platelet-rich plasma or bone marrow aspiration concentrate. The mechanism of action is increase in platelet activation at the site of injury, which causes growth factors, such as platelet-derived growth factor, to increase angiogenesis and macrophage activation at the site of injury. This increase in activation creates a process whereby the injection aids in local recruitment of macrophages and fibroblasts to repair damaged collagen, induction of angiogenesis, and blood vessel formation, as well as early inhibition of Cox-2.[6] Studies have waxed and waned over the last several years with a recent meta-analysis in 2018 revealing no significant difference in clinical outcome scores, tendon thickness, and color Doppler changes.[7] Erroi and colleagues[8] compared conservative treatment options commonly used: PRP and ESWT both combined with eccentric strengthening exercises. Visual analog scale (VAS) score and patient satisfaction improved in both studies over a 6-month follow-up. However, there was no statistically significant difference between the 2 combined treatments when compared with each other.[8] Iliac crest bone marrow aspirate injections have also been tabulated for treatment of recalcitrant cases. A recent study assessed 15 Achilles tendinopathies, 5 insertional, 8 noninsertional, and 2 combined, with an improvement over a 48-week follow-up. The investigators used a numeric rating system (NRS) pain score and recorded postoperative complications. No significant difference was seen between the various Achilles pathologies. Patients did demonstrate a statistically significant decrease in NRS pain score postoperatively.[9]

NONAUTOLOGOUS INJECTIONS

This category of injections would include high-volume injection (bupivacaine, normal saline, Depo-Medrol) and hyaluronic acid. A level 1 study assessing chronic Achilles tendinitis compared high-volume injection, PRP, and placebo in a randomized double-blinded prospective study. A total of 60 males were followed for 6 months with 3 arms of aforementioned treatment. Patients received 4 injections of the treatment as well as 12 weeks of daily eccentric strengthening program performed twice daily. The arm including the high-volume injection reported better patient outcomes in the short-term, although the 2 treatment arms plus eccentric strength training showed equivalent and best results at 6 months.[10] In a recent case series 29 patients with Achilles tendinitis received ultrasound-guided injections of hyaluronic acid, 40 mg/2.0 mL. Patient-reported outcomes were measured and recorded. Combined daily posterior chain strengthening exercises were recommended, and the patient followed a standard Alfredson protocol.[11] At 6-month follow-up personal satisfaction level was 69%, 48% of patients considered the result excellent, and AOFAS score improved from 71 to 90. There were no ruptures or complications. This study from Brazil adds to the body of knowledge that a nonautologous hyaluronic acid injection is a safe treatment option while improving function and reducing pain for 6 months. The exact mechanism of action is still being calculated in extra-articular roles; studies have shown a reduction in the inflammatory process and having a lubrication property.[12–16]

EXTRACORPOREAL SHOCKWAVE THERAPY

A concurrent treatment modality such as ESWT has been shown to be helpful in the treatment of IAT and non-IAT (**Fig. 3**). This regenerative option aims to enhance cell proliferation, migration, and secretory activity of tenocytes.[17] Also, ESWT can provide mechanical transduction, stimulating nitrous oxide and reducing pain and substance P and therefore inflammation. Studies to date have included too many variables or have been low level. A recent study examined the effectiveness of ESWT in the treatment of chronic IAT in a double-blind randomized sham controlled trial[18] the 2 groups being low-energy ESWT and sham arm. Radial shockwave of 2000 pulses was applied at the affected injury site once a week for 4 weeks with concurrent eccentric exercises. The patients were followed for 6 months. ESWT maintained significant improvements

Fig. 3. Extracorporeal shockwave therapy performed in conjunction with isometric exercises has been shown to be clinically efficacious.

in VAS at weeks 4 through 12. This study maintained no significant difference in VAS scores at 6 months. Another study compared ESWT in active versus nonactive patients with a 5-year follow-up. This level 3 study retrospectively compared 33 patients by self-reported activity. At 5-year follow-up, the active patient population had significantly lower mean VAS scores (0.3 vs 1.6) and significantly higher mean patient-reported outcome scores compared with the control group. Of note there was no significant difference between the 2 groups regarding the ultrasonographic assessment of the insertion sites.[19] The investigators found that "sports activity level is an important factor influencing long-term ESWT outcomes for IAT." A large, level 1, randomized controlled trial from Brazil assessed the challenges of differentiating variables. This study aimed to assess again, whether ESWT aids in the outcome of IAT treatment with eccentric exercises. A total of 119 patients were included and placed into 2 different treatment arms. The first treatment arm included eccentric exercises with ESWT, and the second treatment arm was a control group with a sham shockwave therapy unit. Patient-reported outcomes were followed over a period of 24 weeks. Both groups improved in patient-reported outcomes, although there was no between-group difference in any of the outcomes. The investigators found that ESWT did not potentiate the effects of eccentric strengthening in chronic IAT.[20]

A recent systematic review of nonoperative treatment modalities assessed 23 studies over the past 17 years. The investigators found that a combination treatment such as ESWT and eccentric exercises has a grade B recommendation versus isolated treatments. Superiority of 1 combination over another could not be confirmed, although support of the eccentric exercises in combination with more studies needed to confirm autologous injection therapy or other soft tissue treatments.[21]

MINIMALLY INVASIVE TREATMENTS

This section focuses on treatment modalities before returning to sport and activity, which include minimal incision treatments and evolving technologies that attempt to improve tendon function. These typically go hand in hand with regenerative medicine techniques during this phase of treatment before returning to sport. Again, IAT has taught us to treat this pathologic condition with a multiheaded approach and insert eccentric strengthening throughout the progress.

Two such technologies include radiofrequency coblation and ultrasonic percutaneous tenotomy.

The goal of radiofrequency coblation (aka microdebrider) is to induce degeneration of sensory nerve fibers, introduce long-term angiogenic responses, ablate pain without sacrificing the structure or strength of the tendon, and have an antinociceptive effect.[22,23] This treatment has been shown to improve VAS scores and a oh FAS score is at 6 months in chronic foot and ankle tendinosis including Achilles, peroneal and posterior tibial tendinitis[24] radiofrequency procedures may shorten the natural history of the disease process and hasten recovery. Radiofrequency coblation is typically performed in the office under local anesthesia or even in the operating room under moderate sedation. The author recommends using a prone technique, which allows full visualization of the proposed site. Preoperatively marking out the site of pain assists with topographic anatomy. The author also recommends using regenerative injections such as platelet-rich plasma or bone marrow aspirate concentrate during this procedure to assist with biologic improvements (**Fig. 4**). Multiple small incisions are made with an 18-gauge needle down to the level of the Achilles tendon through peritenon. The radiofrequency coblation wand is then inserted through each incision, and the tip is placed intrasubstance. A study of 47 cases with a mean follow-up of 8.6 months

Fig. 4. Ultrasound-guided platelet-rich plasma injection into the medial Achilles insertion and retrocalcaneal bursa.

showed a 15% reoperation rate and 12% rate of Achilles rupture. The investigators found that a high body mass index should raise caution for immediate weight-bearing and possibly delayed this protocol.[25] Most studies have focused on midsubstance Achilles tendinosis, and with higher rates of complications some surgeons have avoided aggressive radiofrequency coblation treatments. There are no specific head-to-head studies assessing open debridement versus radiofrequency coblation and eccentric exercises. This procedure or combination of procedures may possibly be best for high-risk patients with wound healing complications. Further studies are warranted to prove its effectiveness and efficacy.

Ultrasonic percutaneous tenotomy is typically performed as stated under ultrasound guidance. This technology depends on a cavitation principle whereby the goal is to remove or excise damaged or diseased tissue, which creates bubbles because of diseased cell lysis, and this is debrided with continuous suction irrigation. Very few studies exist in the literature, and most are case series or case reports. Some animal bench studies show improvements in collagenase after histologic analysis.[26] Similar to radiofrequency coblation, this process can be performed in a procedure room or under local anesthesia in the office. Patients are typically weight-bearing as tolerated in a cam walker boot for approximately 2 weeks while the tendon heals. After this, eccentric exercises are instituted in a controlled fashion with physiotherapy. Two studies recently highlighted a retrospective review of patient's home had ultrasonic percutaneous tenotomy's. The studies highlighted that a high learning curve is present and that with little experience clinicians can remove too much healthy tendon or fail to remove all of the pathologic tendon. There is also an increased risk of poor healing potential and vascularity. The investigators highlighted a 70% satisfaction rate with no ruptures documented. This study had a nearly 2-year follow-up postprocedure.[27,28] A recent systematic review of percutaneous ultrasonic tenotomies revealed very little evidence in the long term and only modest improvement in the short term[29] (Fig. 5).

Again, these treatments for IAT are typically used in conjunction, and more evidence is needed to fully support more invasive procedures. Phase 1 includes pain reduction with anti-inflammatories and oftentimes controlled isometric exercises. Phase 2 or intervention phase includes regenerative options to stimulate a chronic process and promote macrophage activity while promoting angiogenesis. If minimally invasive treatments are performed a period of immobilization is typically supported for 2–4 weeks depending on the case. As the team progresses into building strength and returning to sport, it is important to use physical therapy as a tool for guidance and progression.

Return to Sport/Activity

Progression into sport needs to be slow and progressive. The aforementioned treatments aimed to increase the vascularity and improve tendon function, and at this point strengthening needs to ensue. Eccentric insertional Achilles exercises are continued with avoidance of dorsiflexion loading. Patients are encouraged to perform 3 sets of 15 to 20 reps twice per day, 7 d/wk, 12 weeks with progression. Heavy load is progressed as symptoms resolve. Focusing on soleus and gastrocnemius strength work is important. Mild symptoms may occur during exercise, and as long as they are settling the day after, patients can resume exercise. The goal is to return to sport

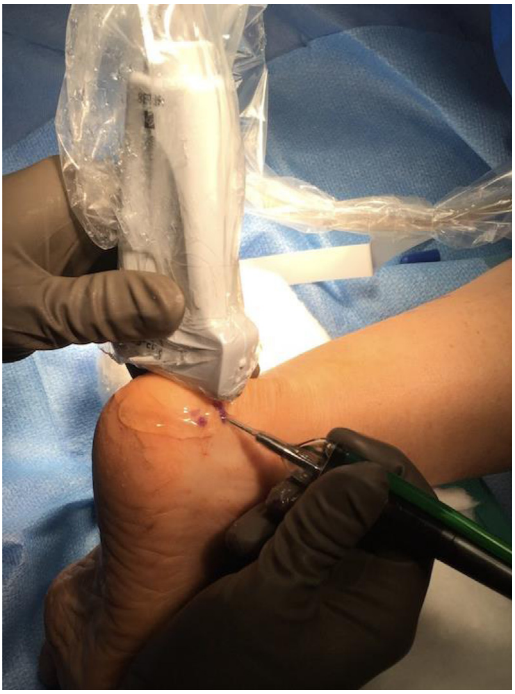

Fig. 5. Intraoperative view of ultrasound-guided percutaneous Achilles tenotomy, which attempts to remove damaged and diseased tendon from healthy tenocytes. More studies are needed to show efficacy.

after 6 weeks of treatment, but a gradual return is recommended especially to high-impact activities such as running. Obviously at this point appropriate shoe gear is implemented to have a larger heel counter and avoidance of “0 drop” or flat shoe gear. Various studies have proved the ineffectiveness of night splints, taping, and foot orthoses in the treatment of IAT.[30,31]

Nonoperative treatment of insertional Achilles tendinitis is challenging and poses daily struggles in many foot and ankle specialists’ offices. This tendinopathy is commonplace in the active and nonactive patient demographics. Specifically Taylor treatments are important and have been proved to include pain reduction, intervention of choice, and a slow progression to return to activity. More evidence is needed to support minimally invasive or percutaneous options described earlier. As with any foot and ankle tendinopathy or pathology, failure to concede to nonoperative treatment typically starts at around 6 months depending on the duration. At that point in time patients are typically ready for advanced, operative techniques. These will later be elucidated in detail.

CLINICS CARE POINTS

- Understand the nomenclature associated with Achilles tendinitis
- No more “Haglund deformity”
- Nonoperative treatment typically needs to fail over a course of 3 to 6 months before prior to surgical intervention
- Three phases of treatment: pain reduction, regenerative/reparative therapies, return to sport/activity
- Follow Alfredon protocol for Achilles tendinopathy
- Return to sport slowly and gradually, letting pain rest below a 5

DISCLOSURE

The author has nothing to disclose.

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