



Non-insertional Achilles tendinopathy

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- Non-insertional Achilles tendinopathy is a degenerative condition characterised by pain on activity.
- Eccentric stretching is the most effective treatment.
- Surgical treatment is reserved for recalcitrant cases.
- Minimally-invasive and tendoscopic treatments are showing promising results.

Keywords: Achilles tendinopathy; non-insertional, aetiology; clinical presentation; non-operative treatment; operative treatment

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Introduction

Non-insertional Achilles tendinopathy is one of a number of overuse conditions. The term ‘tendinosis’ was used by Puddu¹ in 1976 to describe the histological degenerative changes of this condition. These include loss of the normal collagenous architecture and replacement with an amorphous mucinous material, hypercellularity, increased glycosaminoglycans and neovascularisation.²⁻⁴ It was previously thought that inflammation was not an important factor in the disease;⁴⁻¹¹ however in recent years, the importance of inflammation in the tendinopathological process has been under re-evaluation, and it is now thought that the inflammatory process is a contributory factor to the development of tendinopathy.^{12,13} As the disease is a combination of both inflammation and degeneration, the term ‘tendinopathy’ is preferred to the previously-used term ‘tendinitis’.^{14,15} The area of degeneration typically occurs between 2 cm and 6 cm from the insertion of the Achilles into the calcaneus. It is probably most accurate to describe the degenerative process as a failed healing response.¹⁶

Tendinopathy is the commonest pathological condition affecting the tendo Achilles and represents between 55% and 65% of disorders.¹⁷⁻¹⁹ The incidence of this and other overuse injuries is rising as more people regularly participate in recreational and competitive sports, and the

duration and intensity of training regimes increase.²⁰⁻²² The incidence of Achilles tendinopathy has been reported to be as high as 37.3 per 100 000 in some European populations.²³⁻²⁷ Intrinsic factors such as lower limb malalignment, leg length discrepancy²⁸⁻³⁰ and limited ankle dorsiflexion,³¹⁻³² as well as extrinsic factors such as training errors and drugs including steroids and fluoroquinolones,³³⁻³⁵ have been shown to contribute to the development of non-insertional Achilles tendinopathy.²⁰

Presentation

Athletes, whether elite or recreational, are the most common group to present with non-insertional Achilles tendinopathy. The condition has been described in association with many different sporting activities, but it is middle- and long-distance runners who have the greatest susceptibility to it.^{18,20,36-40} The annual incidence in high-level club runners was found to be between 7% and 9% in a study by Lysholm and Wiklander.⁴¹ Athletic activity is not, however, the only predisposing factor to the development of Achilles tendinopathy. In one series, 18 of 58 patients with achillodynia had no direct association with sports or vigorous physical activity.¹¹ Another retrospective study also found various statistically significant correlations between tendinopathy and diabetes mellitus, obesity and hypertension.⁴²

The major symptom in non-insertional Achilles tendinopathy is pain, which can significantly interfere with function and especially athletic activity. As with other tendinopathies and fasciopathies (plantar fasciitis and Jumper’s knee, for example), the pain is often at its most intense on first moving after a period of rest. A diagnosis of Achilles tendinopathy can usually be made clinically on the basis of history and presentation. Patients often present with pain and swelling on the posteromedial side of the tendon (Fig. 1) and tenderness can usually be elicited with palpation over the swelling.⁴³

Tests for non-insertional Achilles tendinopathy can be divided into palpation tests (tendon thickening, crepitus, pain on palpation, the Royal London Hospital (RLH) test, the painful arc sign), and tendon loading tests (pain on



Fig. 1 Posteromedial swelling of the Achilles tendon due to tendinopathy.

passive dorsiflexion, pain on single heel raise and pain on hopping).

The painful arc sign, in which a sensitive swelling moves upon ankle movement, indicates tendinopathy rather than paratendonitis.⁴⁴ In the RLH test there is a swelling that is most painful on ankle dorsiflexion.⁴⁵ Maffulli et al studied the sensitivity and specificity of palpation, the painful arc sign and the RLH test in 2003 and found that all three tests had good interobserver agreement. The study proposed that these three tests be used in the clinical diagnosis of non-insertional Achilles tendinopathy.⁴⁶ However, there has been concern about selection bias in that paper due to the distinct patient population studied (male athletes waiting for surgery).^{45,47} A later study by Hutchinson et al in 2013 which studied the ten clinical tests mentioned above found only two of the tests (location of pain and pain to palpation) to be sufficiently reliable and accurate for clinical use.⁴⁵ A 2014 meta-analysis concluded that the most appropriate clinical reference standard for diagnosis of Achilles tendinopathy needed further investigation.⁴⁷

Imaging

Imaging techniques including ultrasound and magnetic resonance imaging (MRI) scans^{48,49} can occasionally be useful to identify the nature, location and extent of a lesion. Ultrasound may be particularly useful with the addition of power Doppler sonography (Fig. 2), as the pain in Achilles tendinopathy seems to be related to areas of neovascularisation.^{2,50,51} It has been shown that new, pain transmitting nerve endings (neonerves) grow into the tendon with the new vessels, and those treatment modalities which reduce the amount of neovascularisation can lead to a reduction in symptoms.⁵²⁻⁵⁶ Equally, treatments that have proven to be clinically effective have subsequently been shown to reduce neovascularisation within the tendon, although the quality of evidence for

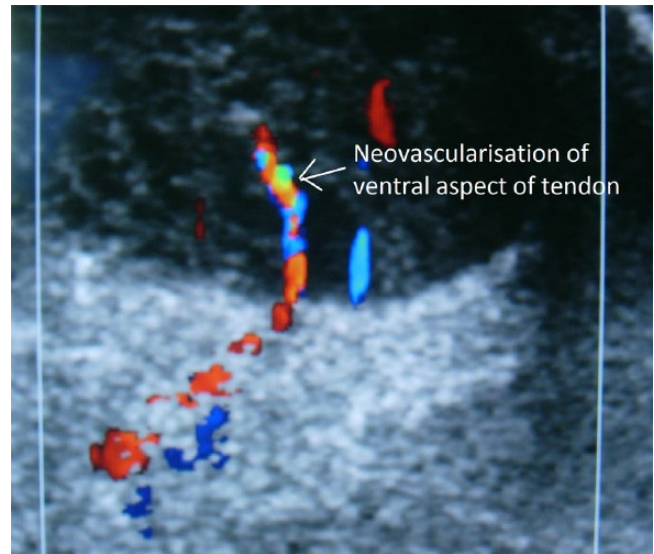


Fig. 2 Ultrasound scan showing ventral neovascularisation within the transverse section of the Achilles tendon on colour Doppler.

this has recently been challenged.⁵⁷⁻⁵⁹ Ultrasound may also be used to guide the various injection therapies available.

Both ultrasound and MRI scans have traditionally been considered to have similar accuracy in the diagnosis of Achilles tendinopathy. Furthermore, the severity of radiological pathology also correlates positively with patients' symptoms.⁴⁸ Few studies have compared ultrasound with MRI in the diagnosis of Achilles tendinopathy. Early studies seem to indicate that MRI scans are better for characterising degeneration in the tendo Achilles.^{60,61} However, later research has shown equal⁶² or better accuracy with ultrasound when compared with MRI scans in the detection of tendinopathy. Of note, greyscale ultrasound was found to be more sensitive, whereas colour Doppler ultrasound had higher correlation with patients' symptoms.⁶³ We recommend ultrasound as it is generally more cost-effective.

Newer imaging modalities such as ultrasound tissue characterisation and sono-elastography have yielded promising initial results in improving sensitivity, specificity and accuracy in diagnosis.⁶⁴⁻⁶⁶ Further studies may be needed to investigate their role and application in the management of Achilles tendinopathy.

Non-operative treatment

The mainstay of management in non-insertional Achilles tendinopathy is conservative, and surgery should only be considered once such conservative measures have failed. The first step may be to remove the precipitating factors by resting or modifying training regimes. Foot and ankle



Fig. 3 a) Starting position for eccentric exercise: ankle in neutral with slight knee flexion. b) Second position: ankle dorsiflexed with slight knee flexion. c) Finishing position: ankle dorsiflexed with extended knee.

malalignment may be addressed by orthotics, while decreased flexibility and muscle weakness may be treated by appropriate physiotherapy.

Eccentric exercises (Fig. 3) have been shown to be the most effective treatment for non-insertional Achilles tendinopathy. In Alfredson's protocol (the most commonly-used treatment), exercises are performed in three sets of 15 repetitions, twice a day for 12 weeks.⁶⁷

This regime was demonstrated in a 2009 systematic review,⁶⁸ and confirmed in a 2012 meta-analysis which outlined the best pooled data supporting eccentric exercises, with the majority of the studies adopting Alfredson's protocol.⁶⁹ Alfredson and other Scandinavian authors have reported excellent results in prospective RCTs.^{70,71} Outside Scandinavia, investigators have also found eccentric strengthening to be an effective non-operative intervention in the treatment of non-insertional Achilles tendinopathy; however the proportion of good and excellent results is definitely lower.⁷²⁻⁷⁴

At present, eccentric strengthening has become the treatment of choice for non-insertional Achilles tendinopathy, with the greatest amount of evidence for its effectiveness. It requires a motivated patient but no special or expensive equipment, and has been hailed as "probably the greatest single advance in the management of this condition in the past 20 years".⁷⁵

While the most common exercise procedure is Alfredson's protocol, isolated eccentric exercises may not work in all patients.⁷⁴ Other eccentric protocols such as eccentric-concentric progressing to eccentric (Silbernagel combined)⁷⁰ and eccentric-concentric (Stanish and Curwin),⁷⁶ have been described. In a recent systemic review, the Silbernagel combined type exercise was found

to have results equivalent to the traditional Alfredson's protocol.⁷⁷ Isotonic, isokinetic, and concentric loading have also been described, but found to be inferior to the eccentric-type exercises.⁷⁸⁻⁸⁰ In a prospective randomised controlled study, Rompe et al⁸¹ showed that eccentric strengthening plus repetitive low-energy shock-wave therapy (ESWT) was better than eccentric strengthening alone in terms of Victorian Institute of Sports Assessment - Achilles (VISA-A) scores and pain ratings at four months. The proportion of patients who were 'completely recovered' or 'significantly improved' on the Likert scale was also significantly better in the combined therapy group (82%) compared with 56% in the strengthening alone group.

Where available, ESWT should probably be the second-line treatment. When compared with eccentric strengthening in a RCT, it showed similarly favourable outcomes in Achilles tendinopathy, with around a 60% of the patients completely recovered or significantly improved in both of the treatment groups. The results were significantly better than those in the 'wait and see' control group.⁷³ The success rate of 60% was lower than that seen in other studies evaluating eccentric strengthening, but this may be because one third of the patients in this study were not athletic and results are known to be worse in those individuals.⁷⁴

ESWT is normally performed three times spaced at one week apart, with 2000 pulses with a pressure of 2.5 bars and a frequency of eight pulses per second. The area of maximal tenderness is treated in a circumferential pattern, starting at the point of maximal tenderness.^{73,81}

There appear to be two aspects to the clinical response to shock-waves: one on tissue healing and the other on pain transmission. In the peripheral nervous system, ESWT leads to selective dysfunction of sensory, unmyelinated

nerve fibres either directly or through the liberation of neuropeptides. Changes in the dorsal root ganglion have also been reported, implicating both a central and peripheral nervous system role in mediating shock-wave-induced long-term analgesia.⁸² Increased levels of tissue healing factors TGF- β 1 and IGF-I expression have been shown after ESWT in a rat tendinopathy model⁸³ and a significant decrease in some interleukins⁸⁴ and matrix metalloproteinases (MMPs) have been shown after shock-wave treatment on cultured tenocytes.⁸⁵

In a recent systemic review, there was moderate evidence for equal short-term benefit when compared with eccentric loading, and moderate evidence of superior outcomes when combined with eccentric loading rather than eccentric loading alone.⁸⁶ There is, therefore, both basic science and clinical evidence to recommend ESWT as a second-line or adjuvant treatment to an eccentric stretching programme.

Various injection therapies have been proposed in the treatment of non-insertional Achilles tendinopathy.⁸⁷ In a recent systemic review,⁸⁸ only ultrasound-guided sclerosing polidocanol injections seemed to yield promising results. However, these results do not appear to have been duplicated outside Scandinavia.⁸⁹ The use of platelet-rich plasma (PRP) in the treatment of many different conditions seems to be growing exponentially, especially among sports medicine physicians. Despite the basic science theories for its effectiveness, the only well-designed RCT published on PRP in Achilles tendinopathy showed no significant difference in pain or activity level in patients with chronic Achilles tendinopathy between PRP and saline injection at six, 12 or 24 weeks when combined with an eccentric stretching programme.⁹⁰ A one-year follow-up study of the same group of patients⁹¹ again showed a lack of differentiation between the groups, while yet another paper also demonstrated no difference in the ultrasonographic appearance of the tendons either.⁹²

Operative treatment

Despite what is written above, between one quarter and one third of patients will fail conservative treatment and require surgical intervention.⁹³ Open surgery for non-insertional Achilles tendinopathy has traditionally involved a large incision and excision of all of the tendinopathological tissue, with or without augmentation with a tendon transfer (commonly flexor hallucis longus (FHL)).⁹⁴

Open surgery has shown varying success rates of between 50% and 100%,⁹⁵⁻⁹⁸ with surgery for intratendinous lesions and late-presenting lesions showing significantly fewer good to excellent results.^{99,100} The main concern with open surgery is the risk of complications. In a large series of 432 consecutive patients from a specialist centre there was an overall complication rate of 11%.¹⁰¹ Surgical complications may

include skin edge necrosis, wound infection, seroma formation, haematoma, fibrotic reactions or excessive scar formation, sural nerve irritation or injury, tendon rupture and thromboembolic disease. Minimally-invasive procedures aim to reduce these risks.¹⁰²

As mentioned above, the pain in non-insertional Achilles tendinopathy appears to be related to the neurovascular ingrowth which comes in from the fat pad anterior to the tendon. Minimally-invasive therapies which strip the paratenon from the tendon, either directly¹⁰³ or indirectly with high-volume fluid injection,¹⁰⁴ have shown promise in relieving the symptoms of non-insertional Achilles tendinopathy. Ventral scraping of the tendon through an ultrasound-guided, minimally-invasive approach has produced good initial results.¹⁰⁵ In one study, this procedure has interestingly also shown improvement of tendinopathy in the contralateral tendon.¹⁰⁶ Multiple percutaneous longitudinal tenotomies, which can be performed under ultrasound guidance, have also been described with good results and with the further advantage of being able to perform the procedure under local anaesthesia in the outpatient setting.^{40,107}

Tendinoscopy allows ventral scraping to be done under direct vision. Promising initial¹⁰⁸ and even longer-term results (mean seven year follow-up) with no complications have been reported for endoscopic paratenon debridement and longitudinal tenotomies.^{109,110}

It has also been noted that patients most often present with symptoms and swelling on the medial side of the tendon, which lead to the postulation that the plantaris insertion or its association with the Achilles plays a role in the symptomatology and/or development of the condition, and that releasing or excising it may be an important part of the treatment.¹¹¹ Both tendinoscopic and minimally-invasive open debridement with resection of the plantaris tendon have also shown promising results with minimal complications in both elite athletes and regular patients with non-insertional Achilles tendinopathy.^{43,112-115}

There have been no head-to-head comparisons between the different minimally-invasive approaches and therefore it is unclear whether it is necessary to perform longitudinal tenotomies or to excise the plantaris tendon. However all of the procedures strip the anterior paratenon, so this aspect would appear to be important. All show good results and minimal complications; therefore, minimally-invasive surgical treatment would appear to be a useful intermediate step between failed conservative treatment and formal open surgery.

Conclusion

Non-insertional Achilles tendinopathy is a painful and debilitating condition that can affect athletes and non-athletes

alike. It is not an inflammatory but a degenerative condition, the histology of which is best described as a failed healing response. The majority of patients will respond to conservative treatment, with eccentric stretching being the safest, cheapest and most effective modality which should therefore be the first line of treatment. For patients who fail conservative treatment, minimally-invasive techniques are showing promising results with low complication rates and may be a good option before considering formal open surgery.

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CONFLICT OF INTEREST

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