EDITORIAL

Insertional and mid-substance Achilles tendinopathies: eccentric training is not for everyone – updated evidence of non-surgical management

Achilles tendinopathy (AT) (pain and dysfunction in the tendon) is a prevalent condition across the lifespan in both active and sedentary people, and can occur in the mid tendon, tendon insertion to the calcaneus and peritendon. The loading that induces pathology in these three tendon areas are unique, and treatment should include ameliorating excess loads.

There are many conservative treatment options for managing Achilles tendon pain, these non-surgical management can include exercise and progressive loading strategies, injection therapies, electrotherapeutic/physical therapy modalities, external support and manual therapies. This review summarises the evidence for managing Achilles tendon pain, the effects on non-clinical outcomes such as imaging and performance are not included.

Exercise

Midsubstance AT

Eccentric exercise was first proposed in early 1980’s [1] with a landmark case series published in 1998 [2]. Despite only having 15 participants this exercise protocol has become the clinical standard. Exercise is a critical component of any tendon intervention as it changes mechanical properties of the tendon, and increases the stiffness of the tendon [3] that allows it to act efficiently like a spring. There is limited evidence for what exercise is most effective, several systematic reviews on the evidence for exercise have shown that exercise efficacy was variable (Table 1).

Long term recovery

One year outcomes after intervention were reported to be good [13], while outcomes were mixed at 8 years [14]. Nearly one third (29%) had to be operated on during the follow-up period but most were asymptomatic and/or back to full activity. Outcomes after the Alfredson protocol were variable at 5 years, with half receiving other treatments [15].

Insertional AT

Compressive loads are seen at the insertion at the contact point of the tendon against the superior calcaneus. Ameliorating these loads can improve outcomes [16]. A systematic review [17], reported mixed findings of exercise interventions in comparison with other interventions. Three studies investigated eccentric training using varied exercise prescription (Table 2).

Injection therapies

Midsubstance AT

There is insufficient evidence from randomized controlled trials published prior to 2015 to draw conclusions about the use of injection therapies for Achilles tendinopathy [20]. High volume injection [21,22] or sclerotherapy [23] placed on the ventral paratenon portion of the Achilles tendon under ultrasound guidance is showing promising results, while dry needling is questionable [22] with more investigation needed (Table 3).

Insertional AT

For insertional AT, fluoroscopically-guided or ultrasound-guided corticosteroid injections are effective in reducing symptoms and improving function [25,26] and are recommended for non-athletic populations [27] (Table 4).

Other interventions

Physical modalities/electrotherapy

Most research has investigated physical modalities as adjuvants to exercise programs for the management of AT (Table 5).

Manual and soft tissue therapy

The literature investigating the effects of manual therapy in patients with AT is sparse. Augmented Soft Tissue Mobilization (Astym) plus eccentric loading was more effective than eccentric loading in patients with insertional AT only at improving function during both short and long term follow-ups periods [34]. Future research should compare manual therapy and loading both in combination and alone.

External support

Daily use of bracing did not provide any additional benefit to eccentric exercises [35]. There is limited and conflicting evidence that kinesiology tape can reduce symptoms in individuals with midsubstance AT [36]. Antipronation tapping may be an effective strategy to predict symptomatic response to the use of foot orthoses [37]. Night splints provide inferior improvements in pain and function when compared with an eccentric tendon loading program and
do not provide any additional benefit when added to an eccentric program \cite{38-40}.

**Orthotics and insoles**

Customized foot orthoses are no more effective than sham foot orthoses for reducing symptoms and improving function in people with mid-portion AT undergoing an eccentric calf muscle exercise program \cite{41}.

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**Table 1. Summary of reviews of treatment for mid-portion AT.**

<table>
<thead>
<tr>
<th>Review</th>
<th>Included</th>
<th>No of studies</th>
<th>Outcomes</th>
<th>Authors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eccentric exercise</td>
<td>Clinical studies</td>
<td>7</td>
<td>Short term clinical benefits, long term benefits unclear</td>
<td>Satyendra \cite{4}</td>
</tr>
<tr>
<td>Eccentric exercise – clinical outcomes</td>
<td>Randomised clinical studies</td>
<td>9</td>
<td>Promising, magnitude of effect uncertain</td>
<td>Kingma \cite{5}</td>
</tr>
<tr>
<td>Eccentric exercise - pain and strength</td>
<td>Randomised clinical studies</td>
<td>11</td>
<td>Questionable evidence for eccentricity on pain and no evidence for strength over control</td>
<td>Wasielewski \cite{6}</td>
</tr>
<tr>
<td>Eccentric exercise</td>
<td>Randomised clinical studies</td>
<td>4</td>
<td>Non-significant effect on pain. Return to activity/satisfaction better in eccentric exercise</td>
<td>Woodley \cite{7}</td>
</tr>
<tr>
<td>Exercise dosage</td>
<td>Randomised clinical trials</td>
<td>3</td>
<td>Effective dosage unclear as adherence not reported</td>
<td>Meyer \cite{8}</td>
</tr>
<tr>
<td>Non-operative treatments</td>
<td>Randomised clinical studies</td>
<td>16</td>
<td>Eccentric superior to wait and see, concentric and night splints and equivalent to ESWT</td>
<td>Magnussen \cite{9}</td>
</tr>
<tr>
<td>Physical therapies</td>
<td>Randomised clinical studies with exercise as a primary or comparator intervention</td>
<td>19</td>
<td>Eccentric, better outcomes than concentric exercise. Rest is on other interventions</td>
<td>Sussmilch-Leitch \cite{10}</td>
</tr>
<tr>
<td>Loading programmes</td>
<td>Randomised and controlled clinical studies</td>
<td>23</td>
<td>Combined programmes including eccentric component clinically effective</td>
<td>Habets \cite{12}</td>
</tr>
<tr>
<td>Exercise protocols</td>
<td>Controlled/comparator clinical studies</td>
<td>14</td>
<td>Unclear what exercise variations are helpful</td>
<td></td>
</tr>
</tbody>
</table>

**Table 2. Summary of exercise management for insertional AT.**

<table>
<thead>
<tr>
<th>Intervention</th>
<th>Comparator</th>
<th>Outcome</th>
<th>Authors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eccentric exercise with out dorsi-flexion</td>
<td>Case series</td>
<td>Good outcomes</td>
<td>Jonsson \cite{16}</td>
</tr>
<tr>
<td>Stretching</td>
<td>Continuous or intermittent</td>
<td>Both protocols increased</td>
<td>Porter \cite{18}</td>
</tr>
<tr>
<td>Stretching</td>
<td>Stretching and eccentric exercise (2 x 15)</td>
<td>Both groups improved, no difference between groups</td>
<td>Kedia \cite{19}</td>
</tr>
</tbody>
</table>

**Table 3. Summary of injection therapies for midsubstance AT.**

<table>
<thead>
<tr>
<th>Intervention</th>
<th>Comparator</th>
<th>Outcome</th>
<th>Authors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eccentric exercise with high volume injection (steroid, saline, and local anaesthetic) &amp; PRP injections</td>
<td>Eccentric exercise with placebo injection</td>
<td>Good outcomes (better with high volume injection than PRP and better than placebo)</td>
<td>Boesen \cite{21}</td>
</tr>
<tr>
<td>Sclerotherapy</td>
<td>Placebo, eccentric and surgery</td>
<td>Better outcome than eccentric training and surgery</td>
<td>Morath \cite{23}</td>
</tr>
<tr>
<td>High-volume injection (10 mL of 1% lidocaine combined with 40 mL of saline) to anterior tendon area</td>
<td>Low-volume injection (10 mL of 1% lidocaine combined with 20 mL of saline) to anterior tendon area</td>
<td>Better outcome high volume injection</td>
<td>Wheeler \cite{22}</td>
</tr>
<tr>
<td>Leukocyte-rich Platelet-rich plasma (PRP)</td>
<td>Saline, local anaesthetic, corticosteroid, or dry needling</td>
<td>Better outcome with Leukocyte-rich PRP</td>
<td>Fitzpatrick \cite{24}</td>
</tr>
</tbody>
</table>

**Table 4. Summary of injection therapies for insertional AT.**

<table>
<thead>
<tr>
<th>Intervention</th>
<th>Comparator</th>
<th>Outcome</th>
<th>Authors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fluoroscopically guided retrocalcaneal bursa steroid/anaesthetic injection</td>
<td>No control</td>
<td>Good short term outcomes (substantial decrease of pain) no complications</td>
<td>Srivastava \cite{26}</td>
</tr>
<tr>
<td>Ultrasound-guided retrocalcaneal bursa corticosteroid injection</td>
<td>No control</td>
<td>Large decrease of pain – no complications</td>
<td></td>
</tr>
</tbody>
</table>

**Table 5 Summary of physical modalities for AT.**

<table>
<thead>
<tr>
<th>Intervention</th>
<th>Comparator</th>
<th>Outcome</th>
<th>Authors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low level laser therapy with eccentric training</td>
<td>Eccentric exercise</td>
<td>Good outcomes midsubstance AT (dose response)</td>
<td>Stergioulas \cite{28}; Tumilaty \cite{29}; Rompe \cite{30}; Rasmussen, \cite{31}; Neeter et al. \cite{32}</td>
</tr>
<tr>
<td>Extracorporeal Shock Wave Therapy</td>
<td>Eccentric exercise</td>
<td>Better outcome than eccentric training</td>
<td></td>
</tr>
<tr>
<td>Intonophoresis with dexamethasone with concentric-eccentric tendon loading and stretching program</td>
<td>Control group (saline)</td>
<td>Improvements of pain during physical activities 1-year follow up</td>
<td></td>
</tr>
<tr>
<td>Therapeutic ultrasound</td>
<td>Eccentric exercise</td>
<td>No better than placebo</td>
<td>Chapman-Jones and Hill \cite{33}; Neeter et al. \cite{32}</td>
</tr>
<tr>
<td>Microcurrent therapy and eccentric exercise</td>
<td>Eccentric exercise</td>
<td>Greater improvements in pain up to 1 year with microcurrent</td>
<td></td>
</tr>
</tbody>
</table>

**Table 5. Summary of physical modalities for AT.**

A short term treatment of only 4 weeks of physiotherapy consisting of deep transverse friction and ultrasound in combination with sensory motor and eccentric loading, as well as insoles with longitudinal arch support might result in reduction in pain in most patients with AT, even without reducing running mileage \cite{42}. Significant benefit of an insole compared to no treatment was found but no significant difference compared to physiotherapy \cite{42}. However, effectiveness of single measures was not clarified and the sample size was small (28 subjects completed the trial) \cite{42}.
Discussion

The literature supports AT management using loading protocols with other modalities used synergistically to reduce pain. Exercise programs have the advantage of benefiting the tendon (patellar tendon [43]), the muscle [44], as well as the cortical control of that muscle (again the patellar tendon [45]), which may lead to improvements in function and a positive clinical outcome. Progressive muscle/tendon loading appears to be beneficial, although it is unclear exactly which program and progressions are superior and may lead to better patient adherence, satisfaction and outcomes to treatment [46]. The right loading may depend on individual factors such as pain, function, age, site of tendinopathy and access to equipment. Control and wait and see groups do poorly [47] as do other passive treatments such as ice [48], unless there is a loading component. Isometric loading protocols such as five 45-s isometric contractions at 70% of maximal voluntary contraction against resistance with 15 s rest can induce immediate analgesia in the patellar tendon [49], although there is little evidence for the Achilles tendon [50].

Research in Achilles tendinopathy is constrained by issues of small numbers in research, blinding of research personnel leading to methodological scores that are variable, and many studies score low to moderate on quality tools. Outcomes measures must be tendon specific, rather than generic foot and ankle scores that are likely less sensitive to changes in tendon symptoms [19].

In summary, AT rehabilitation should be based on progressive loading of the muscle-tendon unit and the lower extremity (kinetic chain). However, the optimal protocol of exercise loading needs further investigation. Electrotherapeutic modalities, manual therapy techniques, bracing/taping and acupuncture should not be substitute but instead adjuncts to exercise programs. Further research is needed to find out which treatment strategy, combined with progressive exercise loading will provide the best results in the rehabilitation of Achilles tendinopathy.

References


