Achilles Tendinopathy

Indexing Metadata/Description

- **Title/condition:** Achilles Tendinopathy
- **Synonyms:** Achilles tendinosis; chronic Achilles tendinitis; tendinitis, Achilles; tendinopathy, Achilles
- **Anatomical location/body part affected:** Achilles tendon, typically within 6 cm of insertion
- **Area(s) of specialty:** Aquatic Therapy, Orthopedic Rehabilitation, Sports Rehabilitation
- **Description** *(1,2,3,4)*
  - There are 2 main forms of Achilles tendinopathy (AT), differentiated by site, presentation, and pathology. Treatment should be guided by the specific form
    - **Insertional AT**
      - Posterior heel pain and tenderness at insertion on calcaneus
      - Characterized by inflammation in the acute stage (tendinitis)
      - The retrocalcaneal and/or pre-Achilles bursae may also be involved (tendinobursitis)
    - **Noninsertional AT** (also called midportional or midsubstance AT)
      - Usually a chronic condition at presentation
      - Pain and tenderness along tendon, approximately 2 to 6 cm proximal to insertion where there is a region of hypovascularity
      - Characterized by degeneration of the tendon (tendinosis, noninflammatory), but may be accompanied by paratendinitis
  - The noninsertional, tendinosis form of AT is likely caused by repetitive mechanical overloading and is more common in joggers and competitive runners
  - This review highlights the noninsertional form of AT and focuses on 3 effective therapeutic approaches: low-level laser therapy, eccentric exercise loading, and shock wave treatment
- **ICD-9 codes**
  - 726.71 Achilles bursitis or tendinitis
- **ICD-10 codes**
  - M76.6 Achilles tendinitis

(ICD codes are provided for the reader’s reference, not for billing purposes)

- **G-Codes**
  - **Mobility G-code set**
    - G8978, Mobility: walking & moving around functional limitation, current status, at therapy episode outset and at reporting intervals
    - G8979, Mobility: walking & moving around functional limitation; projected goal status, at therapy episode outset, at reporting intervals, and at discharge or to end reporting
    - G8980, Mobility: walking & moving around functional limitation, discharge status, at discharge from therapy or to end reporting
  - **Changing & Maintaining Body Position G-code set**
    - G8981, Changing & maintaining body position functional limitation, current status, at therapy episode outset and at reporting intervals
–G8982, Changing & maintaining body position functional limitation, projected goal status, at therapy episode outset, at reporting intervals, and at discharge or to end reporting
–G8983, Changing & maintaining body position functional limitation, discharge status, at discharge from therapy or to end reporting

• **Self Care G-code set**
  –G8987, Self care functional limitation, current status, at therapy episode outset and at reporting intervals
  –G8988, Self care functional limitation, projected goal status, at therapy episode outset, at reporting intervals, and at discharge or to end reporting
  –G8989, Self care functional limitation, discharge status, at discharge from therapy or to end reporting

• **Other PT/OT Primary G-code set**
  –G8990, Other physical or occupational primary functional limitation, current status, at therapy episode outset and at reporting intervals
  –G8991, Other physical or occupational primary functional limitation, projected goal status, at therapy episode outset, at reporting intervals, and at discharge or to end reporting
  –G8992, Other physical or occupational primary functional limitation, discharge status, at discharge from therapy or to end reporting

• **Other PT/OT Subsequent G-code set**
  –G8993, Other physical or occupational subsequent functional limitation, current status, at therapy episode outset and at reporting intervals
  –G8994, Other physical or occupational subsequent functional limitation, projected goal status, at therapy episode outset, at reporting intervals, and at discharge or to end reporting
  –G8995, Other physical or occupational subsequent functional limitation, discharge status, at discharge from therapy or to end reporting

<table>
<thead>
<tr>
<th>G-code Modifier</th>
<th>Impairment Limitation Restriction</th>
</tr>
</thead>
<tbody>
<tr>
<td>CH</td>
<td>0 percent impaired, limited or restricted</td>
</tr>
<tr>
<td>CI</td>
<td>At least 1 percent but less than 20 percent impaired, limited or restricted</td>
</tr>
<tr>
<td>CJ</td>
<td>At least 20 percent but less than 40 percent impaired, limited or restricted</td>
</tr>
<tr>
<td>CK</td>
<td>At least 40 percent but less than 60 percent impaired, limited or restricted</td>
</tr>
<tr>
<td>CL</td>
<td>At least 60 percent but less than 80 percent impaired, limited or restricted</td>
</tr>
<tr>
<td>CM</td>
<td>At least 80 percent but less than 100 percent impaired, limited or restricted</td>
</tr>
<tr>
<td>CN</td>
<td>100 percent impaired, limited or restricted</td>
</tr>
</tbody>
</table>

Source: [https://www.cms.gov](https://www.cms.gov)

› **Reimbursement**: Reimbursement for therapy will depend on insurance contract coverage. No special agencies are applicable for this condition. No specific issues or information regarding reimbursement have been identified

› **Presentation/signs and symptoms**
  • History of chronic (at least 4 weeks) activity-related heel cord pain
  • Nagging ache, at its worst during the first few steps after non-weight-bearing
  • Tenderness and thickening of the Achilles tendon, proximal to insertion
  • Reduced walking tolerance and capacity for running and jumping
  • Limited flexibility and increased pain on stretching calf, running uphill, heel walking, or raising toes (as in descending steps)
  • Calf muscle warm-up decreases pain and stiffness
Causes, Pathogenesis, & Risk Factors

› **Causes** *(1,2)*
  - Insertional AT (i.e., focal tenderness at or near calcaneal insertion) is associated with excessive pressure on the tendon (e.g., due to a tight heel counter of shoe) or microtearing at the calcaneal attachment with new physical activity (e.g., jumping, running, hiking, weight lifting with legs, calf stretching).
  - Cumulative microtrauma from repetitive overloading (e.g., overtraining) is the presumptive mechanism of injury in noninsertional AT.
  - In chronic cases, repetitive injury appears to prevent normal healing; a degenerative, noninflammatory condition develops in the weakened tendon fibers and paratendon.

› **Pathogenesis**
  - The hallmarks of AT are a failed healing response and collagen fiber disorientation.
  - Histological findings include haphazard proliferation of tenocytes, degeneration in tendon cells, disruption of collagen fibers, and a subsequent increase in noncollagenous matrix *(3)*. The increased matrix remodeling weakens tendinopathic tendons, making them more susceptible to reinjury *(2,3)*.
  - Local tissue hypoxia and impaired metabolism probably contribute to noninflammatory collagen disorientation that weakens tendon fibers *(1)*.
  - Advanced cases show increased capillary circulation in the paratendon. This neovascularization clearly develops along with the collagen degeneration and decreased tensile strength *(1,4)*.
    - Eccentric exercise therapy for AT has been associated with decreased capillary paratendon blood flow *(5)*.
    - Proinflammatory molecules (i.e., interleukin 1B, prostaglandin E2, nitric oxide) contribute to pain in the acute stage of injury, whereas the neurotransmitter glutamate appears linked to the mediation of pain in degenerated tendons *(2)*.
  - The microvascular volume of the Achilles tendon becomes elevated in subjects with AT when compared to healthy controls. *(43)* Pain appears to precede the hyper-microvascular response in the abnormal tendons. *(6)*. In a case study, pain scores correlated directly with the overall volume of neovascularization *(7)*.

› **Risk factors**
  - Insertional AT (i.e., focal tenderness at or near calcaneal insertion) is more common in older, more sedentary individuals *(8)*.
  - Noninsertional AT is common in athletes who participate in running and jumping sports *(9)*.
    - Classical ballet dancers are reported to be at risk for AT due to high demands for positions in which the Achilles tendon is tightened or stretched *(10)*.
  - Intrinsic factors weakly associated with increased risk of AT include older age, Achilles tendon malalignment, subtalar hyperpronation, decreased passive dorsiflexion, lateral ankle instability, pes cavus, decreased tendon vascularity, and hyperlipidemia *(11,12,13)*.
  - Use of fluoroquinolone antibiotics may also increase risk *(12,13)*.
  - Changing from high- to low-heeled shoes.
  - Training errors (e.g., rapid increase in run training distance, intensity, frequency; incomplete recovery between workouts), hill running, running on cambered roads *(1,2)*.
  - Comorbid diseases/conditions associated with AT include obesity, hyperlipidemia, hypertension, and diabetes *(13)*.
  - Recent research suggests that a predisposition to midportional AT may be detectable in asymptomatic runners using Doppler sonography *(14)*.
    - Based on a study conducted in Germany.
    - 634 runners were followed up for a period of 1 year.
    - Detection of intratendinous microvesicles in the Achilles tendons of healthy runners was associated with development of tendinopathy.

**Overall Contraindications/Precautions**

› A healthy Achilles tendon has greater tensile strength than fibers of the gastrocnemius and soleus muscles *(9)*. Current opinion is that AT predisposes to weakening of the calf muscle-tendoncomplex *(1,4,11,12)*. To reduce the risk of...
exercise-related partial and complete tears, gradually introduce and slowly progress exercises that may lengthen the muscle-tendon complex (e.g., stretching, eccentric training)\(^{(15)}\).

- The duration of postoperative immobilization should be minimized to prevent weakening secondary to disuse.
  - Postoperative protocols vary depending on procedure performed.
  - After repair of a complete tear, the patient is often placed in a protective boot, non-weight-bearing for 6 weeks, followed by weight-bearing as tolerated for 4-6 weeks.

**Examination**

- **History**
  - **History of present illness/injury:** Patients usually report 4 weeks or more of sharp, nagging pain above heel, especially with first steps after sitting; initially pain and stiffness localized to distal Achilles tendon; limited ankle flexibility in heel walking; and inability to stand on heels.
  - **Mechanism of injury or etiology of illness:** Document possible cause(s) of AT. Do regular activities involve stair climbing, uphill walking, running, or jumping? How are symptoms progressing up to this point?
  - **Course of treatment**
    - **Medical management:** Conservative treatment (including physical therapy interventions) is usually attempted before surgical consult.
    - **Surgical management:** As compared to open surgery, minimally invasive techniques that strip neovessels in AT may allow faster recovery and quicker return to sports\(^{(3)}\).
    - **Medications for current illness/injury:** Determine what medications clinician has prescribed; are they being taken? Are they effective?
      - Corticosteroid injections are not recommended for this condition.\(^{(49)}\) However, researchers in Denmark concluded that patients with Achilles tendinopathy who are not able to initially participate in exercise or advance with exercise alone may benefit from glucocorticosteroid injections used to facilitate cautious exercise\(^{(51)}\).
      - Nonsteroidal anti-inflammatory drugs (NSAIDs) are commonly used, although there is insufficient evidence to support their effectiveness\(^{(10)}\).
    - **Diagnostic tests completed:** Ultrasonography and MRI may supplement the clinical assessment and may influence the treatment plan if partial tears of the Achilles tendon are disclosed,\(^{(3)}\) but imaging studies can appear normal. Radiographs may be useful in diagnosing associated bony abnormalities and identifying the presence of intratendinous calcific deposits and ossification\(^{(70)}\).
    - **Home remedies/alternative therapies:** Document any use of home remedies (e.g., ice or heating pack) or alternative therapies (e.g., acupuncture) and whether or not they help.
    - **Previous therapy:** Document whether patient has had occupational or physical therapy for this or other conditions and what specific treatments were helpful or not helpful.
    - **Aggravating/easing factors** (and length of time each item is performed before the symptoms come on or are eased): Patients may report pain with first steps after sitting, with standing on their heels, and with climbing stairs, running, jumping, or walking. Pain is commonly eased with warm-up prior to activity.
    - **Body chart:** Use body chart to document location and nature of symptoms. Pain is commonly located above the heel, on the distal Achilles tendon.
    - **Nature of symptoms:** Document nature of symptoms (constant vs. intermittent, sharp, dull, aching, burning, numbness, tingling). Patient commonly reports sharp, nagging pain and stiffness.
    - **Rating of symptoms:** Use a visual analog scale (VAS) or 0-10 scale to assess symptoms at their best, at their worst, and at the moment (specifically address if pain is present now and how much).
    - **Pattern of symptoms:** Document changes in symptoms throughout the day and night, if any (A.M., mid-day, P.M., night); also document changes in symptoms due to weather or other external variables. Pain is usually related to type of activity rather than time of day.
    - **Sleep disturbance:** Document number of wakings/night.
    - **Other symptoms:** Document comorbid symptoms that could exacerbate the condition and/or symptoms that could be indicative of a need to refer to physician (dizziness, bowel/bladder/sexual dysfunction, saddle anesthesia). Associated conditions may include rheumatoid arthritis, gout, pseudogout, subtalar malalignment, restless leg syndrome.
    - **Barriers to learning**
      - Are there any barriers to learning? Yes __ No __
- If Yes, describe_________________________

• Medical history
  – Past medical history
    - Previous history of same/similar diagnosis: Past history of Achilles trauma? Prior treatment for Achilles pain or general lower extremity injuries and outcome of treatment
    - Comorbid diagnoses: Ask patient about history of other problems (e.g., diabetes, cancer, heart disease, complications of pregnancy, psychiatric disorders, orthopedic disorders). Hyperlipidemia increases the risk of AT\(^{13}\)
    - Medications previously prescribed: Obtain a comprehensive list of medications prescribed and/or being taken (including over-the-counter drugs). Use of fluoroquinolone antibiotics may increase risk of AT\(^{12,13}\)
    - Other symptoms: Ask patient about other symptoms that may necessitate immediate referral to physician

• Social/occupational history
  – Patient’s goals: Document what the patient hopes to accomplish with therapy and in general
  – Vocation/avocation and associated repetitive behaviors, if any: Does the patient participate in recreational or competitive sports? Insertional AT (focal tenderness at or near calcaneal insertion) is more common in older, more sedentary individuals\(^{8}\) whereas noninsertional AT is more common in athletes who participate in running and jumping sports\(^{9}\)
  – Functional limitations/assistance with ADLs/adaptive equipment: Common functional limitations include stair climbing, walking, running, and jumping. Patient may report use of assistive device for ambulation
  – Living environment: Identify if there are barriers to independence in the home (e.g., stairs, number of floors in home, caregivers). Are any modifications necessary?

› Relevant tests and measures: (While tests and measures are listed in alphabetical order, sequencing should be appropriate to patient medical condition, functional status, and setting)
  • Anthropometric characteristics: Measure calf circumference for swelling. Measure for leg length discrepancy
  • Assistive and adaptive devices: Assess need for (and proper fit) of crutches, cane, or walker, if applicable, for protected ambulation
  • Circulation: Pedal pulses should be equal bilaterally
  • Cranial/peripheral nerve integrity: Sensation in the distribution of the sural nerve should be intact
  • Gait/locomotion: Inspect gait for deviations including increased double limb support, and reduced push-off, stride length and step length; and lack of full knee extension at mid-stance. Assess for compensatory pelvic shift to reduce weight on injured leg in standing and walking\(^{47}\)
  • Joint integrity and mobility: Assess passive accessory movement of the talocrural and subtalar joints
  • Muscle strength: Assess strength of entire lower extremity including ankle plantarflexors and dorsiflexors. Also assess gluteus medius/maximus strength as male runners with AT have been observed to have altered neuromotor control of these muscles\(^{42}\). Compare to uninvolved side. Measure calf circumference for atrophy. Manual muscle testing may not reveal weakness because the force required to elicit pain is generally higher than the resistance used to assess strength\(^{1}\)
  • Observation/inspection/palpation: Assess for thickening, adhesions, exostosis or nodules that accompany AT. Crepitation (“wet leather” sign) in the Achilles tendon may be palpable with passive ankle motion. In noninsertional AT, tenderness is usually found 2 to 6 cm proximal to the calcaneal attachment\(^{9,12}\). The point of maximum tenderness should move up and down the leg with ankle dorsiflexion and plantarflexion\(^{9}\). The reliability of using palpation as a clinical guide has been confirmed by a study that found there was an anatomical association between the sites of subjectively defined pain, clinically palpated tenderness, tendon thickness and neovascularization\(^{16}\)
  • Posture: Assess alignment of the affected leg, Achilles tendon, and foot in barefoot standing (with side-by-side comparison to uninvolved side) and also for pelvic shift to unweight affected leg. Assess subtalar alignment for hyperpronation (e.g., navicular drop test or subtalar neutral in non-weight-bearing)
  • Range of motion: Assess for provocation of pain with passive ankle dorsiflexion using VAS. Assess active and passive ROM at talocrural joint, especially the stiffness/flexibility of calf muscles in dorsiflexion and forward lunge or wall lean. Assess flexibility of the calf complex in standing with the foot in pronation and supination (using a wedge, if necessary, to evert and invert the subtalar joint), noting the pain response for each position
  • Reflex testing: Patellar and Achilles tendon reflexes are usually intact and equal bilaterally. An abnormal Achilles tendon reflex indicates an unusual complication or preexisting neurological problem
  • Sensory testing: Assess talocrural joint proprioception
• **Special tests specific to diagnosis**
  – Provocative tests such as 1-leg squats and drop (plyometric) jumps may reproduce pain and/or patient symptoms
  – Victorian Institute of Sports Assessment – Achilles (VISA-A) questionnaire – a questionnaire specifically validated for this diagnosis[(12)]
    - Scores range from 0 to 100, with asymptomatic people expected to score 100
    - A systematic review that included 26 studies containing 1,136 individuals, suggests that an excellent result for AT is a score of 90, and could be considered full recovery from AT
  – Thompson’s calf squeeze to rule out rupture (see Clinical Review…Achilles Tendon Rupture; Accession Number: 5000005213)
  – Lower Extremity Functional Scale (LEFS)
  – Foot and Ankle Outcome Score (FAOS)

**Assessment/Plan of Care**

› **Contraindications/precautions**
  • Only those contraindications/precautions applicable to this diagnosis are mentioned below, including with regard to modalities. Rehabilitation professionals should always use their professional judgment in their assessment and treatment decisions
    – Clinicians should follow the guidelines of their clinic/hospital and what is ordered by the patient’s physician. The summary presented below is meant to serve as a guide and does not replace orders from a physician or the specific protocols of the treatment clinic
    – Current opinion is that AT predisposes to weakening of the calf muscle-tendon complex.[1,2,3,12] To reduce the risk of exercise-related partial and complete tears, gradually introduce and slowly progress calf muscle eccentric training.[15] Avoid aggressive Achilles tendon stretching in early rehabilitation
  • Contraindications/ precautions to use of modalities,(18)
    – **Low-level laser therapy (LLLT) contraindications**
      - Do not use laser with pregnant women, patients with epilepsy, or patients with infections
      - Do not use over the unclosed fontanelles of children
      - Do not use over cancerous lesions, the mediastinum, areas of impaired sensation, sympathetic ganglia, the vagus nerve, the gonads, the cornea, endocrine glands, or hemorrhaging lesions
    – LLLT precautions
      - Goggles with an appropriate optical density rating should be worn by the patient
    – **Cryotherapy contraindications**
      - Raynaud’s syndrome
      - Cryoglobulinemia
      - Cold urticaria
      - Paroxysmal cold hemoglobinuria
      - Impaired circulation
      - Over area of nerve regrowth
    – Cryotherapy precautions
      - Hypertension
      - Hypersensitivity to cold
      - Over an acute wound
      - Over superficial nerves
    – **Whirlpool contraindications**
      - Certain dermatologic conditions (e.g., ichthyosis, infection)
      - Venous ulcers
      - Tissues damaged by radiation therapy
      - Peripheral vascular disease
      - Respiratory impairment
      - Surgical incisions/skin grafts
      - Malignancy
      - More than half-body immersion during pregnancy
Whirlpool precautions (*some are only relevant if entire body is immersed)
- Cardiac insufficiency
- Impaired sensation
- Impaired mental status
- Unstable blood pressure
- Cold hypersensitivity
- Alcohol consumption (prior to therapy)*
- Decreased strength/ROM/endurance/balance*
- Urinary/fecal incontinence*
- Fear of water*
- Respiratory impairments
- Avoid warm/hot water if patient is pregnant or has multiple sclerosis, increased risk of hemorrhage (e.g., on anticoagulant medications), impaired thermal regulation, acute inflammation, fever, edema, thrombophlebitis, or acute rheumatoid arthritis
- Seasickness
- Epilepsy*

Aquatic therapy contraindications/precautions
- Fear of water
- Avoid warm/hot water if patient is pregnant or has multiple sclerosis, increased risk of hemorrhage (e.g., on anticoagulant medications), impaired thermal regulation, acute inflammation, fever, edema, thrombophlebitis, or acute rheumatoid arthritis
- Epilepsy
- Cardiovascular or pulmonary disease
- Open wounds, catheters, colostomies, IVs, G-tubes
- Urinary or fecal incontinence
- Certain dermatologic conditions (e.g., ichthyosis, infection)
- Venous ulcers
- Tissues damaged by radiation therapy
- Peripheral vascular disease
- Respiratory impairment
- More than half-body immersion during pregnancy

Thermotherapy contraindications
- Decreased circulation
- Decreased sensation
- Acute/subacute traumatic and inflammatory conditions
- Skin infections
- Impaired cognition or language barrier
- Tumor
- Tendency for hemorrhage or edema
- Heat rubs

Electrotherapy contraindications/precautions
- Do not place electrodes near:
  - Carotid bodies, cardiac pacemakers or implantable cardioverter defibrillators, phrenic nerve or urinary bladder stimulators, phrenic nerve, eyes, gonads
- Osteomyelitis
- Hemorrhage
- Impaired sensation, mental status, communication
- Cardiovascular disease
- Malignancy
- Dermatological conditions
- Proximity of electromagnetic radiation
- In pregnant women, near the pelvis, lumbar spine, hips, abdomen
- In patients with stroke or seizures, near the neck
- History of spontaneous abortion in pregnant women

- **Therapeutic ultrasound contraindications; do not use:**
  - Over the region of a cardiac pacemaker
  - Over the pelvis, abdominal and lumbar regions during pregnancy
  - Over the eyes or testes
  - In an area with infection or bleeding
  - If a tumor or malignancy is present in the area
  - In the area of a deep vein thrombosis (DVT) or thrombophlebitis
  - Over the heart, stellate or cervical ganglia
  - Over epiphyseal plates

- **Therapeutic ultrasound precautions**
  - Sensory deficits
  - Ineffective communication skills in a patient (e.g., impaired cognition, language barrier)
  - Circulatory impairments
  - Plastic or metal implants
  - Note: Always decrease ultrasound intensity if the patient complains of discomfort

• **Diagnosis/need for treatment:** Chronic Achilles tendon injury with antalgic gait and physical impairments (e.g., dorsiflexion ROM, plantarflexion strength/endurance, tenderness on palpation, pain-restricted participation in work or sport)

• **Rule out**
  - Tibial stress fracture
  - Posterior tibialis tendonitis
  - Pre-Achilles bursitis
  - Retrocalcaneal bursitis
  - Plantaris tendonitis
  - Achilles partial rupture
  - Haglund deformity (“pump bump”)

• **Prognosis**
  - With early nonoperative intervention, most patients with AT return to prior activity with minimal or no disability

• **Referral to other disciplines**
  - Refer to sports psychologist if necessary

• **Other considerations**
  - Current opinion is that AT should initially be managed nonoperatively for at least 3 to 6 months
  - Initially, determine if symptoms decrease with any of the following:
    - Complete avoidance of the aggravating activity
    - A trial of decreased intensity, duration, and frequency of usual physical activity
    - Cross-training that unloads the affected leg
  - Surgery may be considered as a last resort for patients whose pain is not relieved by nonoperative treatment. Surgical options may include the following:
    - Resection of prominent tuberosity
    - Debridement of bursa
    - Excision of thickened scarred peritenon
    - Removal of accessible calcific deposits within tendon
  - Platelet-rich plasma injection has been reported to provide short-term symptomatic improvements

• **Treatment summary**
  - Results of recent systematic reviews indicate that eccentric loading exercises and shockwave therapy (SWT) are the most effective physical therapy treatments to improve signs and symptoms associated with Achilles tendinopathy. Moderate evidence was reported for the efficacy of splinting/bracing, active rest, low-level laser therapy, and concentric exercises
  - Meta-analyses favored the addition of laser therapy to eccentric exercise
  - No differences were found between the effects of eccentric exercise and the effects of SWT
There is insufficient evidence to determine which method of physiotherapy is most appropriate for chronic midportional AT. Further well-designed randomized controlled trials are needed.

LLLT may expedite recovery time from chronic AT when combined with an eccentric exercise regimen.

Based on a randomized controlled trial:
- 40/52 patients completed the study; all patients had a diagnosis of chronic AT.
- Patients were randomized to either eccentric exercises with LLLT or eccentric exercises with placebo laser treatment.
- LLLT was administered at 820 nm over 12 sessions, treating 6 points on the Achilles tendon with a power density of 60 mW/cm² and a total dose of 5.4 J per session.

Results:
- Patients receiving LLLT had results at 4 weeks of treatment comparable to those obtained at 12 weeks for the placebo group.
- During physical activity, pain levels of patients receiving LLLT were significantly lower than those of the placebo group at 4 weeks of treatment.
- Secondary outcomes of morning stiffness, active dorsiflexion, palpation tenderness, and crepitation were significantly improved with LLLT versus placebo.

There is no benefit in adding LLLT to eccentric exercise for the treatment of AT.

Based on a randomized controlled study (20 participants):
- Participants were randomized to either LLLT (810 nm, 100 mW, applied to six points on the tendon for 30 s, for a total dose of 3 J per point and 18 J per session) or placebo; all patients performed an eccentric exercise program for 12 weeks.
- Evaluation of outcome scores (VISA-A questionnaire, VAS) were performed at baseline, 4, 12, and 52 weeks.
- At 4 weeks VISA-A questionnaire scores favored the placebo group. Thereafter, there were no significant differences between the two groups at any evaluated time point.
- The addition of LLLT with the used parameters to eccentric exercise for the treatment of AT is not supported.

Low-energy SWT and eccentric loading were each more effective than conventional therapeutic exercises for reducing pain in chronic AT.

Based on randomized controlled trial:
- Seventy-five patients; all had failed 3 conservative therapies.
- Three study groups:
  - Eccentric loading
  - SWT
  - “Wait-and-see” (with conventional exercises)
- At 4 months, VISA-A scores for the eccentric loading and SWT groups improved significantly when compared to those of the “wait and see” group.

SWT may be more effective than eccentric loading in the treatment of chronic AT.

Based on a randomized controlled trial:
- Fifty patients with chronic recalcitrant noninsertional AT.
- Two treatment groups: eccentric loading (n = 25) and repetitive SWT (n = 25).
  - Eccentric loading group was provided with daily eccentric exercise regimen and trained appropriately.
  - SWT was administered 3 times, with 1 week in between each treatment. 2000 pulses were applied at a pressure of 2.5 bars at 8 pulses per second.
- 45/50 participants completed the follow-up at 4 months.
- Seven patients in the eccentric group and 16 patients in the SWT group reported they were completely or significantly recovered at 4 months.
- The SWT group demonstrated significantly greater improvements in all outcome measures compared to the eccentric exercise group.

The combination of eccentric loading and repetitive low-energy SWT may be more effective in the short term than eccentric loading alone.

Based on a randomized controlled trial:
- Sixty-eight patients with chronic recalcitrant (> 6 months) noninsertional AT.
- Two treatment groups: eccentric loading (n = 34) and eccentric loading with repetitive SWT (n = 34).
  - Eccentric group was provided with daily eccentric exercise regimen and trained appropriately.
- SWT was administered 3 times, with 1 week in between each treatment. 2000 pulses were applied at a pressure of 2.5 bars at 8 pulses per second
- Nineteen of 34 patients in the eccentric loading-only group (56%) and 28 of 34 patients in the eccentric loading plus SWT group (82%) had a Likert scale of 1 or 2 points ("completely recovered" or "much improved") at 4 months follow-up
- However, there was no significant difference between groups at 1 year from baseline
- A systematic review identified 3 high-quality randomized controlled trials of eccentric loading for the treatment of noninsertional AT and concluded that “these studies leave no doubt that they (i.e., eccentric exercises) should be included in conservative rehabilitation of this disorder.” However, the review revealed no definitive evidence on the comparative efficacy of the various dosages of eccentric training used. Additionally, authors of another systematic review recommended that clinicians consider an eccentric-concentric loading exercise program in conjunction with or as an alternative to an isolated eccentric loading exercise program. No specific protocol can, therefore, be recommended
- The addition of eccentric training to conservative therapy may be more effective than conservative management alone
- Based on a pilot study
  - Twenty-five subjects with AT were randomly assigned to an eccentric training group (n = 13) or a conservative management group (n = 12) and received 12 weeks of therapy
  - Conservative management consisted of deep friction massage (DFM) and ultrasound administered at 1 MHz continuously at 1.0 W/cm² for 5 minutes. Ultrasound and DFM were administered 6 times, with 1 week in between treatments. A stretching regimen was provided during the ultrasound and DFM treatment, and was continued for the remainder of the 12 weeks
  - The eccentric group underwent eccentric exercise loading in addition to the conservative therapy
  - Outcomes were measured every 4 weeks using the VISA-A questionnaire to assess overall functional change
  - Although the conservative group improved, the eccentric group improved significantly more
- Eccentric training and heavy slow resistance training both result in equally good, lasting outcomes in patients with chronic midportion Achilles tendinopathy
- Based on a randomized controlled trial conducted in Denmark
  - Fifty-eight athletes were randomized to receive either eccentric or heavy slow resistance training for a duration of 12 weeks
  - Exercises
    - The eccentric group performed 3 sets of 15 reps, eccentric loading of the Achilles while standing on a step. The exercise was performed once with straight knees and once with bent knees, 2 times per day, 7 days per week for 12 weeks. Load was gradually increased by use of a weighted backpack as tolerated by pain
    - The heavy slow resistance group performed heel raises with bent knees in the seated calf raise machine, heel raises with straight knee in the leg press machine, and heel raises with straight knees standing on a disc with a barbell on shoulders. The patients performed 3 sets of 15-repetition maximum (RM) in week 1, 3 sets of 12 RM in weeks 2 and 3, 4 sets of 10 RM in weeks 4 and 5, 4 sets of 8 RM in weeks 6 to 8, and 4 sets of 6 RM in weeks 9 to 12
  - Outcome measures were assessed at 0, 12 weeks and at the 52-week follow-up and included tendon pain assessment (VAS), function and symptoms (Victorian Institute of Sports Assessment – Achilles), tendon swelling, tendon neovascularization, and treatment satisfaction
  - Both groups showed significant improvements in the Victorian Institute of Sports Assessment – Achilles, VAS, reduction of tendon thickness, and neovascularization
  - Average exercise compliance was 78% in the eccentric training groups versus 92% in the heavy slow resistance group
  - Alfredson protocol for eccentric training may be an effective method of exercise intervention
    - Consists of 3 sets of 15 repetitions of heel drops with knee straight and 3 sets of 15 repetitions with knee slightly flexed
    - Various factors such as rate, load and frequency need clarification
    - Results with this protocol have not been as good with nonathletes as with athletes, suggesting that there might be a motivation compliance factor. One possible reason for the disparity in compliance between athletes and nonathletes is that the goal with the Alfredson protocol is to complete 180 repetitions a day, even if pain is experienced. However, in a randomized controlled trial comparing the outcomes from the Alfredson protocol versus a “do-as-tolerated” protocol of the same exercises, no significant difference between the two was found
Literature has suggested that treatment with exercise should be performed for 12 weeks and if the patient does not recover other treatment options should be sought. In a study that included only patients who were not athletes eager to get back to their sport, improvement continued for over 1 year. At 5 year follow up the majority of patients who had been treated with exercise alone had recovered fully. Those patients who had not fully recovered were found to have greater fear of movement. Patients had been instructed to perform heel rises even though they were painful. Patients fearful of moving through pain were likely to have performed the exercise with less intensity.

Level of physical activity before injury did not appear to have any effect. Results of a study of a modified eccentric training program indicated that good results can be obtained with a shorter program. A total of 190 patients with chronic AT participated. The program was shortened from 12 weeks to 6 weeks. The length of each eccentric stretch was increased to 15 seconds. Pain assessed by VAS was reduced, and satisfaction was rated as excellent by 80% of the patients. Mean time to return to premorbid activity level was 10 weeks. Insertional tendinopathy patients were also included. Results were better for patients with noninsertional tendinopathy compared to those with insertional tendinopathy.

A study of patient preferences for treatment of AT found that patients preferred a program of shorter duration. When faced with multiple treatment options patients preferred an exercise based treatment that could be done at home over receiving injections in a doctor’s office. Identified treatment preferences also included:

- lower cost
- increased chance of success
- decreased chance of side effects

The addition of a AirHeel Brace to eccentric training does not appear to provide a therapeutic advantage over eccentric exercises alone.

Based on a systematic review of randomized controlled trials, whole-body vibration training may be a viable alternative or complementary intervention for patients with AT not responding well to an eccentric exercise program. A randomized clinical trial

- Fifty-eight patients with AT were randomly assigned to 12 weeks of either whole-body vibration training, eccentric strengthening, or a wait-and-see approach
- Outcome measures involved a Likert scale, VAS, isokinetic measurements, and sonography
- Results from the whole-body vibration training group were comparable to the eccentric training group, but with a fewer number of treatment sessions. Both groups did better than the wait-and-see approach. Whole-body vibration training was especially effective in those with insertional AT.

Joint mobilization may be useful to address ROM limitations prior to implementing an eccentric training program.

A case of a patient who was unable to complete one repetition of eccentric calf muscle training without disabling pain until manual therapy was implemented has been reported.

After joint mobilization addressing talocrural dorsiflexion deficits, the patient was able to start eccentric calf training.

<table>
<thead>
<tr>
<th>Problem</th>
<th>Goal</th>
<th>Intervention</th>
<th>Expected Progression</th>
<th>Home Program</th>
</tr>
</thead>
</table>


<table>
<thead>
<tr>
<th>Achilles pain on weight bearing</th>
<th>Minimal or no pain on unassisted ambulation</th>
<th><strong>Therapeutic and mechanical modalities</strong></th>
<th>Joint and soft tissue mobilization techniques may help to decrease pain</th>
<th>Provide patient with written instructions on the appropriate use of ice, avoidance of aggravating activities and proper footwear</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Iontophoresis, ((13)) ice pack, or cold whirlpool to control pain</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Although cryotherapy is widely used for analgesia, there is no evidence that it is an effective treatment for AT((10))</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Low-energy SWT</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Low-level laser therapy</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
|  |  | **Patient education**  
Activity modification, correction of biomechanical and training errors  
(Please see Treatment summary, above) |  |  |
| Antalgic gait (possibly requiring assistive device) | Normal gait without assistive device | **Functional training**  
Unload stress with appropriate assistive ambulatory device in cases with severe antalgic gait. Taping to support the Achilles tendon may be effective in reducing stress and may help improve antalgic gait\((13)\)  
Correct hyperpronation with foot orthotics or motion control athletic shoes  
Gait training to correct deviations | Gait training without assistive device | Provide patient with written instructions for safe use of foot orthotics including gradually increasing time used to avoid further pain |
<table>
<thead>
<tr>
<th>Restricted ankle ROM and flexibility</th>
<th>Full ankle ROM and flexibility</th>
<th><strong>Functional training</strong></th>
<th>Home stretching program</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initiate active and active-assistive ROM in a pain-free range</td>
<td>Progress as appropriate to Achilles stretches</td>
<td>Augmented soft tissue mobilization (deep friction massage followed by passive and active stretching) may help activate fibroblastic collagen remodeling[^34^]</td>
<td></td>
</tr>
<tr>
<td>Warm whirlpool or heating agent to increase local tissue temperature and relax calf muscle prior to exercise therapy</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Therapeutic ultrasound may increase tissue elasticity prior to manual therapy; however, evidence is lacking to support its use or other electrotherapeutic modalities specifically for treating AT</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Night splinting for chronic noninsertional AT did not provide additional benefit when combined with an eccentric exercise program[^35^]</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Therapeutic strategies

**Reduced lower extremity strength**

- Introduce pool and/or low-impact exercises during the protection phase of early rehabilitation\(^{(36)}\)
- Progress to land-based eccentric strengthening and stretching exercises for both insertional and noninsertional AT\(^{(15,37)}\)
- Stretch-contract-relax-stretch technique works best with prolonged contractions (30 seconds)
- Load may be increased by having patient wear backpack during eccentric exercises
- Continuing Achilles tendon-loading activity, such as easy running and jumping, during the first 6 weeks of rehabilitation was found to be equally as effective as active rest at 12 months follow-up\(^{(38)}\)

**Normal lower extremity strength**

- **Home strengthening program**
  - Include two-legged heel raises to regain calf strength once flexibility is regained (after few days to weeks) with gradual shifting of weight from uninjured to injured leg

### Home strengthening program

- **Introduce pool and/or low-impact exercises during the protection phase of early rehabilitation**\(^{(36)}\)
- **Progress to land-based eccentric strengthening and stretching exercises for both insertional and noninsertional AT**\(^{(15,37)}\)
- **Stretch-contract-relax-stretch technique works best with prolonged contractions (30 seconds)**
- **Load may be increased by having patient wear backpack during eccentric exercises**
- **Continuing Achilles tendon-loading activity, such as easy running and jumping, during the first 6 weeks of rehabilitation was found to be equally as effective as active rest at 12 months follow-up**\(^{(38)}\)

### Deficits in functional capacity for regular activities

- **Return to prior activity level**
- **Eccentric loading exercise appears more effective for pain management and restoring function in noninsertional AT than conventional exercise therapy**\(^{(15,29)}\)
- **Introduce high-impact exercises for athletes returning to sport**
- **Instruct patient in total body endurance activities applicable to patient’s activity level**

### Desired Outcomes/Outcome Measures

- **Desired outcomes and related outcome measures**
  - Relief of tendon pain and tenderness
    - VAS, 0-10 scale
  - Increased ROM (ankle dorsiflexion)
    - Goniometry
  - Increased strength (ankle plantar flexors)
    - Manual muscle testing
  - Recovery of normal function in daily and recreational activities
    - LEFS, FAOS, VISA-A questionnaire\(^{(39)}\)
References are rated using the following codes, listed in order of strength:

<table>
<thead>
<tr>
<th>Code</th>
<th>Rating</th>
<th>Example</th>
</tr>
</thead>
</table>

References


