Ankle and Foot Disorders

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Physical Modalities

ORTHOTICS

Orthotics, especially ankle-foot orthotics (AFOs) have been used for treatment of foot drop. (Hausdorff 08)

Recommendation: Ankle-foot Orthotics for Treatment of Foot Drop

Orthotics, especially ankle-foot orthotics (AFOs) are recommended for the treatment of foot drop.

Strength of Evidence – **Recommended, Insufficient Evidence (I)**
Level of Confidence - Moderate

Rationale for Recommendation

Although there are no quality trials, ankle-foot orthotics for foot drop have been used successfully for many years and thus they are recommended since they facilitate walking ability. Evaluation for orthotics should include evaluation of the footwear that is to be worn by the patient, including the nature of the fore-soles. Fronts of shoes and boots can catch on carpets and low-lying irregular surfaces, and modifications of shoes and boots may mitigate slip, trip, and fall risks posed by footwear.

Evidence for use of Orthotics

There is 1 low-quality RCT in Appendix 1. (Hausdorff 08)

TAPING

Taping has been used for treatment of foot drop. (Vicenzino 00)

Recommendation: Taping for Treatment of Foot Drop

There is no recommendation for or against the use of taping for the treatment of foot drop.

Strength of Evidence – **No Recommendation, Insufficient Evidence (I)**
Level of Confidence – Low

Rationale for Recommendation

There are no quality trials and thus there is no recommendation for or against the use of taping. Generally, braces are used for foot drop.

Evidence for the Use of Taping

There is 1 low-quality RCT in Appendix 1. (Vicenzino 00)

Tarsal Tunnel Syndrome (TTS)

General Approach and Basic Principles

Tarsal tunnel syndrome (TTS) is a relatively infrequent condition defined as an entrapment neuropathy of the tibial nerve or one of its branches from its entry point under the flexor retinaculum below the medial malleolus to the end of its lateral and medial plantar and posterior calcaneal branches, which innervate the base of the foot. Anatomically, the lateral plantar nerve (similar to the ulnar nerve) innervates the 5th and lateral half of the 4th toe, as well as most of the deep muscles of the foot. The medial plantar nerve (similar to the median nerve of the wrist), innervates the great toe, 2nd and 3rd toes, and the medial aspect of the 4th toe. Often compared to carpal tunnel syndrome (CTS) in the literature, the anatomical characteristics of the tunnel and the accompanying tunnel contents are markedly different from the wrist. The position of the tibial nerve and vessels are relatively fixed in a compartment lying between two tendons, the flexor digitorum longus tendon superiorly and the flexor hallucis longus tendon inferiorly, with the flexor retinaculum forming the roof of the tarsal tunnel. Any excessive fat, mass, adjacent tenosynovitis, flexor retinaculum fibrosis, varicose veins, arthritides, compartment edema or space occupying object can hypothetically result in compression or traction of the tibial nerve.

Work Relatedness

There are no population-based or other quality epidemiological studies to determine the incidence or prevalence of tarsal tunnel syndrome. There are multiple possible etiologies conjectured for TTS, including trauma or fracture,(321) (Myerson 95) flexor tendon tear,(322) (Mezrow 02) ganglion,(323, 324) (DiStefano 72, Ng 04) accessory muscle,(325) (Cheung 99) venous anomalies or dilatation of the vessels in the neurovascular bundle(326) (Keck 62) and adjacent arthrosis, bone callous or osteophytes.(327) (Linscheid 70) One case-review study suggests idiopathic cases characterized by minimal trauma through normal weight-bearing activities are strongly associated with pes planus and benign joint hypermobility.(328) (Francis 87) Another case report suggests rheumatoid arthritis as a possible etiology, particularly when there is also a report of carpal tunnel syndrome.(329) (Lloyd 70) There are no quality epidemiologic studies for occupational causality of TTS. The available literature and case reports largely did not consider risk by occupation or activity.

Initial Assessment

TTS is often described as a complex condition difficult to diagnose and treat. This complexity is in part related to similar presentation of plantar and ankle pain as other foot and ankle disorders. In addition, anatomic variation in innervations of the plantar foot by the several nerves may result in variation of sensory and pain patterns, as well as variation in the level of bifurcation of posterior tibial nerve and artery as it traverses through the tunnel.(330) (Bilge 03)

Medical History

TTS is described by the constellation of symptoms of intermittent tingling, numbness or burning paresthesias in the any of toes and the plantar surface of the foot. Case histories are mostly non-specific to exact dermatomal distribution of symptoms. As both medial and lateral plantar nerves travel in the same tunnel but may bifurcate and have lesions at different levels, impingement could theoretically cause symptoms in either one of the distributions or both distributions. There may also be a sensation of ankle pain, tightness and cramping. There may be a worsening of symptoms throughout the day with prolonged standing or walking, opposite of plantar fasciitis. Pain at night is also common which is similar to median nerve impingement at the carpal tunnel. There may be proximal radiation to the calf and leg with advanced nerve compression.(327, 331-333) (DeLisa 83, Edwards 69, Goodgold 65, Linscheid 70) Similar to CTS patients being asked to complete a hand diagram to locate and rate symptoms, practitioners may ask patients to complete a foot diagram (Foot Wong-Baker Pain FACES Intensity Scale), which may be identify the different branches of the posterior tibial nerve that may be involved. Nerve identification is often useful in pre-treatment and follow-up evaluations.(334) (Gondring 08)

Physical Examination

Physical findings reported in patients with clinical are minimal and include a Tinel's sign over the tarsal tunnel, local tenderness behind the medial malleolus, altered sensation of the plantar surface, and weakness of foot muscles as evidenced by reduced ability to fan the toes.(327, 335) (Kinoshita 01, Linscheid 70) Evidence of pes planus, ankle trauma or bone deformity, arthritis, gout, edema, or palpable mass may increase the suspicion of TTS and support further diagnostic testing. Injection of the tarsal tunnel with lidocaine that provides pain relief is suggested in the literature, but is non-specific for nerve impingement as other disorders distal to the injection site are likely to similarly respond to an anesthetic nerve block. Inflation of a sphygmomanometer about the thigh to just above venous pressure may increase symptoms of the foot.(327, 336) (Linscheid 70, Lam 67)

One examination maneuver proposed for TTS is the "dorsiflexion-eversion test," during which the examiner, with the patient seated and non-weight bearing, maximally dorsiflexes the ankle, everts the foot, and extends the toes maintaining the position for 5 to 10 seconds while tapping over the region of the tarsal tunnel to determine if a positive Tinel sign is present or if the patient complains of local nerve tenderness. This test was performed on 50 normal and 37 (44 feet) treated operatively for tarsal tunnel syndrome.(335) (Kinoshita 01) In the normal groups, no signs or symptoms were produced by the test. In

the 44 symptomatic feet, the test increased numbness or pain in 36 feet (sensitivity 0.81, specificity 0.99). One issue with this examination maneuver is that there is no reliable standard of comparison. For example, electrophysiological studies, often considered a standard for locating nerve compression, is not reliable in TTS; and finding that persons who are awaiting an operation have discomfort more-easily provoked in the area of the operation than do persons who are not awaiting an operation may be fallacious. Thus, results of the dorsiflexion-eversion test should be interpreted with caution. A differential diagnosis for TTS should include interdigital neuroma, peripheral neuropathy, tenosynovitis, plantar fasciitis, plantar calluses, acute strain of the medial longitudinal arch, and peripheral vascular disease.(329) (Lloyd 70)

Diagnostic Criteria
There are no well-established standard diagnostic criteria for TTS. Clinicians should maintain a high level of suspicion for TTS in patients presenting with pain and paresthesias of the plantar foot that worsen with prolonged standing and walking, or cause interruption of sleep.

Special Studies, Diagnostic and Treatment Considerations
ELECTRODIAGNOSTIC STUDIES

1. *Recommendation: NCS for Diagnosis and Pre-operative Assessment of TTS Patients*
   Nerve conduction studies (NCS) are recommended for confirming the diagnosis of entrapment of the tibial nerve at the ankle for cases that do not improve with conservative treatment or if considering surgical release after excluding the possibility of other causes such as polyneuropathy and radiculopathy.

   Strength of Evidence – **Recommended, Insufficient Evidence (I)**
   Level of Confidence – High

2. *Recommendation: NCS for Initial Evaluation of TTS Patients*
   NCS is not recommended for the initial evaluation and most TTS patients as NCS does not change the management of the condition during the first 4 to 6 weeks while conservative therapy is being tried.

   Strength of Evidence – **Not Recommended, Insufficient Evidence (I)**
   Level of Confidence – High

3. *Recommendation: EMG for Initial Evaluation, Diagnosis or Pre-operative Assessment of TTS Patients*
   There is no recommendation for or against the use of EMG for initial evaluation, diagnosis or pre-operative assessment of TTS patients. Electromyography (as distinguished from a nerve conduction study) is not generally recommended as there is no quality evidence demonstrating the utility of EMG in the diagnosis of TTS.

   Strength of Evidence – **No Recommendation, Insufficient Evidence (I)**
   Level of Confidence – Low

Rationale for Recommendations
There are no quality trials evaluating the efficacy of electrodiagnostic methods, or how they affect the treatment outcomes of suspected TTS. A review of 317 articles by a task force of the American Association of Neuromuscular and Electrodiagnostic Medicine (AANEM) on the role of nerve conduction studies (NCS) and electromyography in the diagnosis of tarsal tunnel syndrome found only four studies meeting evidence criteria set by their panel.(337) (Patel 05) The review found nerve conduction studies were abnormal in some patients with suspected tarsal tunnel syndrome, although the study sizes were small in each case. Similar to CTS, sensory conduction was more likely to be abnormal than motor studies. AANEM recommendations for confirming tibial mononeuropathy at the level of the tarsal tunnel

in patients with clinically suspected tarsal tunnel syndrome include: 1) tibial motor responses recorded over the abductor hallucis and abductor digiti minimi pedis muscles demonstrating prolonged distal onset latency; 2) medial and lateral plantar mixed NCSs demonstrating prolonged peak latency or slowed conduction velocity across the tarsal tunnel; and 3) medial and lateral plantar sensory NCSs demonstrating slowed conduction velocities across the tarsal tunnel and/or small amplitude or absent responses.

There is no quality evidence demonstrating the utility of needle EMG or surface EMG assessment in the diagnosis of TTS. Although this technique is used by many foot surgeons to confirm the diagnosis of tibial nerve impingement at the ankle, the utility as an early diagnostic test is not well defined. There is no well described benefit of EMG versus NCS or other tests, although by analogy to CTS, a utility for EMG for TTS is doubtful. Analyses of needle EMG by AANEM concluded with no recommendation for the use of EMG in diagnosis of TTS. Therefore, NCS is recommended for diagnosis of entrapment of the tibial nerve at the ankle and for pre-operative assessment, but is not recommended for initial evaluation and most TTS patients. There is also no recommendation for or against the use of EMG for initial evaluation, diagnosis or pre-operative assessment of TTS patients.

MRI

MRI is commonly used to examine musculoskeletal disorders and injuries of the foot and ankle and is increasingly being recognized as the modality of choice for assessment of pathologic conditions.(338) (Rosenberg 00)

1. *Recommendation: MRI for Diagnosis of TTS*
   MRI is recommended for the diagnosis of select cases of clinically suspected TTS that has failed conservative management or if a mass lesion is suspected.

   Strength of Evidence – **Recommended, Insufficient Evidence (I)**
   Level of Confidence – Low

2. *Recommendation: Routine Use of MRI to Diagnose TTS*
   The routine use of MRI is not recommended for the initial evaluation of TTS.

   Strength of Evidence – **Not Recommended, Insufficient Evidence (I)**
   Level of Confidence – High

Rationale of Recommendations

There are no quality studies evaluating the efficacy of MRI in identifying tarsal tunnel syndrome. However, MRI has taken a much more prominent role in recent years because of superior soft tissue resolution and the ability to noninvasively visualize the osseous structures, cartilage, and soft tissues. High-resolution of the tarsal tunnel allows visualization of the tibial nerve and plantar nerves in nearly their entire length, allowing demonstration of nerve compression by an adjacent structure.(339) (Campbell 06) The reviewed surgical case reports of TTS frequently implicate space occupying lesions impinging the tarsal fibro-osseous tunnel. MRI may have unique ability to visualize the described anomalies such as accessory muscles, venous dilation, ganglion cysts, neurilemoma, posttraumatic fibrosis and tenosynovitis. However, the presence of abnormal MRI findings in the lower legs of asymptomatic persons is unknown, so predictive values of abnormal findings, particularly minor abnormal findings, is unknown. Further, MR imaging demonstrated the presence and extent of impinging lesions in 17 of 19 patients who underwent surgery.(340) (Finkel 94) MRI is a moderate cost option with few side effects and is non-invasive with a high potential to direct treatment.

ULTRASOUND

Ultrasound has been described for both diagnostic purposes in identifying lesions (ganglion cysts, accessory muscle), as well as guiding interventional therapies (cyst aspiration), and requires a high level of expertise for successful nerve imaging.