Effects of Nerve Mobilization Exercise as an Adjunct to the Conservative Treatment for Patients with Tarsal Tunnel Syndrome

Yasemin Kavlak, PT, PhD,[a] and Fatma Uygur[b]

Abstract

Objective: This study was carried out with the aim of investigating the contribution of nerve mobilization exercises to the conservative treatment of tarsal tunnel syndrome.

Methods: In this clinical trial, 28 patients were randomly allocated into 2 groups. The control group was composed of 14 patients who were treated conservatively with a program consisting of physiotherapy and supportive inserts, whereas 14 patients in the study group were given nerve mobilization exercises in addition to the same treatment. Allpatients were followed up for 6 weeks. Before treatment, subjects were evaluated for muscle strength, range of motion, pain, sensory tests, and clinical manifestations of tarsal tunnel syndrome. The evaluations were repeated after 6 weeks.

Results: There was a significant difference in favor of posttreatment values for range of motion, muscle strength, and pain in both groups ($P < .05$). Intergroup comparisons showed no difference between the groups for these parameters. Significant results were attained in the study group for 2-point discrimination and light touch and Tinel sign after treatment ($P < .05$).

Conclusion: Patients in both groups showed improvement from conservative treatment. The results of the study group showed that nerve mobilization exercises have a positive effect on 2-point discrimination and light touch and Tinel sign. (J Manipulative Physiol Ther 2011;34:441-448)

Key Indexing Terms: *Tarsal Tunnel Syndrome; Tinel Sign; Nerve Mobilization Exercises*

Tarsal tunnel syndrome (TTS) is an entrapment neuropathy of the posterior tibial nerve and its branches, including the medial calcaneal, medial plantar, and lateral plantar nerves individually or collectively under the flexor retinaculum behind and below the medial malleolus of the ankle.[1-3] Nerve entrapment may occur at the distal portion of the posterior compartment of the leg, the retromalleolar ligamentous coverage (flexor retinaculum) at the ankle, and the anterior and posterior fibro-osseous tunnels exiting to the plantar aspect of the foot. Because the tibial nerve innervates the entire sole of the foot, the symptoms are usually spread throughout the sole of the foot and not localized to the heel.[3,4] The varied clinical presentation of TTS may occur because of varied sites of entrapment of the individual branches of the posterior tibial nerve.[3,5]

The symptom triad of pain, paresthesia, and numbness is the most common clinical presentation.[6] Patients typically complain of poorly localized, burning pain and paresthesia along the plantar surface of the foot and toes.[2] Typically, pain is worse during or after weight-bearing activities and improves with rest.[7,8]

Some of the common manifestations of TTS are positive Tinel sign, pain felt on provocation using passively maximally dorsiflexing, and everting the ankle while all the metatarsophalangeal joints were dorsiflexed and held in this position for 5 to 10 seconds.[9] In addition, the most common and objective symptom is diminished sensation.[10,11]

The results of a study by Bracilovic et al[12] support the hypothesis that eversion and inversion of the foot and ankle cause decreased compartment volume of the tarsal tunnel and increased tarsal tunnel pressure that may contribute to symptoms of posterior tibial nerve entrapment in TTS. Neutral immobilization of the foot and ankle may relieve symptoms of posterior tibial nerve entrapment in TTS by

[a] Assistant Professor, Prosthetics and Orthotics Unit, Health Services Vocational Schools, Eskisehir Osmangazi University, Eskisehir, Turkey.

[b] Professor, Department of Physical Therapy and Rehabilitation, Faculty of Health Sciences, Hacettepe University, Ankara, Turkey.

Submit requests for reprints to: Yasemin Kavlak, PT, PhD, Prosthetics and Orthotics Unit, Health Services Vocational Schools, Eskisehir Osmangazi University, Meselik, 26480, Eskisehir, Turkey (e-mail: *ykavlak@hotmail.com*).

Paper submitted August 9, 2010; in revised form March 30, 2011; accepted April 4, 2011.

0161-4754/$36.00

doi:10.1016/j.jmpt.2011.05.017

minimizing pressure on the nerve and maximizing tarsal tunnel compartment volume available for the nerve. The mean tarsal tunnel volume was significantly greater when the foot and ankle were in neutral position (21.5 ± 0.9 cm^3) than in either full eversion (18.0 ± 0.9 cm^3, $P < .001$) or inversion (20.3 ± 1.0 cm^3, $P < .001$).[12]

Conservative treatment of plantar heel pain may include rest, nonsteroidal anti-inflammatory drugs, corticosteroid injections, extracorporeal shock wave therapy, laser, local anesthetic injections, heel pads and heel cups, night splints, medial longitudinal arch supports, strapping, foot orthoses, soft-soled shoes, stretching exercises for the Achilles tendon and plantar fascia, ultrasound, and casting.[8]

Management of these patients include treatments directed toward reducing pain, inflammation, and tissue stress as well as restoring muscle strength, flexibility, lower-extremity mobility, and restoring soft tissue mobility of the lower extremities. Neural mobilization may be used for restoring soft tissue mobility. Nerve-gliding (NG) exercises have been used to attain neural mobilization for the treatment of carpal tunnel syndrome with contradicting results.[13-16]

There are a limited number of case studies that have applied nerve mobilization techniques in the treatment for patients with plantar heel pain of neural origin. Shacklock[17] used knee extension movements in supine position in a patient with a neuropathy of the medial calcaneal nerve and tibial nerve at the tarsal tunnel. Meyer et al[18] performed knee extension movements in a slump position in a patient with a possible entrapment of the medial calcaneal nerve and tibial nerve at the ankle and/or at the arch of the soleus muscle. Both case studies reported positive outcomes with no adverse effects.

At present, there is no randomized clinical study in the literature investigating the effectiveness of nerve mobilization exercises in the conservative treatment of TTS. This preliminary study was carried out with the aim of investigating the contribution of nerve mobilization exercises on outcome measures for the conservative treatment for patients with TTS.

Methods

The study was carried out at the Orthotic Rehabilitation Department of Hacettepe University, Ankara. The clinical trial registration number was received from the Eskisehir Osmangazi University Ethical Committee, its protocol number is PR-10-11-02-01, and its approval number is 2010/266. Forty-three patients who were diagnosed as having TTS by an orthopedic surgeon were assessed for eligibility during a period of 16 months. Patients were considered eligible if they met inclusion and exclusion criteria. Inclusion criteria were as follows:

1. to be classified by the orthopedic surgeon as not having an indication for surgery;
2. to be at a cooperative to understand the aim of study, to give informed consent, and to understand and follow the directions of the exercise protocols;
3. to be able to attend therapy and follow-up sessions; and
4. to be older than 18 years.

Exclusion criteria were as follows:

1. having comorbidities or orthopedic or postural problems that could confound the outcomes;
2. having other entrapment neuropathies;
3. having undergone surgery related to the lower extremity or lumbar spine;
4. regularly taking alcohol every evening; and
5. smoking addiction.

The subjects of the study consisted of 28 consecutive patients who were allocated to the study or control group by randomization of even and single numbers in sealed envelopes carried out by a colleague unaware of the nature of the study. However, after this allocation, although the patients were blind to which group they were in, the assessor was not blind. After allocation, there were no dropouts from the study. The same physiotherapist carried out all the assessments. The assessor was experienced in treating and assessing foot and ankle problems and did not require undergoing a particular training for consistency. The study was reviewed and approved by the University Dissertation Review Committee, and informed consent was obtained from all the patients.

A home exercise program of 6 weeks duration was given to all the patients in both groups. This program included gastrocnemius stretching, strengthening the weak muscles, ice application, bandaging, medial arch supports, and wedges as necessary. The weak muscles were strengthened starting from 5 repetitions and adding 2 repetitions each week and giving incremental resistance by means of changing the color of therabands. Medial arch supports were given to patients who had a low navicular tubercle, and medial wedges were given to patients with pronation deformities. Bandaging was given to patients who had edema and pain in their ankles. All the patients came in for controls every 10 days for 6 weeks. During these control visits, compliance with and correct application of therapy program were checked. In addition to this program, the patients in the study group were given tibial nerve mobilization exercises as described by Meyer et al[18] to be carried out each day. The physiotherapist assisted the patient with nerve mobilization exercises during the first week, after which the patients continued on their own.

The patients were instructed to perform exercises in positions that enhance nerve mobilization in a slow, controlled manner. As described by Meyer et al,[18] neural mobilization was performed in a slump position with