



Treatment of an Unusual Foot Neuropathy in a College Aged Runner: A Case Study

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Abstract

Although relatively rare, nerve entrapments of the foot have been described in the literature. In such cases, however, they have typically been associated with a biopsy, or following surgery or trauma. This paper describes a patient with an apparent sural nerve entrapment related to running in the absence of the above-described situations. This case also describes the use of arch taping to aid diagnosis and guide subsequent treatment using foot orthoses.

Keywords: Nerve entrapment; Foot orthotics

Introduction

Entrapment neuropathies involving the foot are relatively rare [1], but can involve one of five different nerves; Tibial, Deep Peroneal (Fibular), Superficial Peroneal (Fibular), Sural, and Saphenous. Depending on the location and severity of the entrapment, these conditions may be managed with non-surgical interventions [2]. Those involving the tibial nerve in the tarsal tunnel are the most common and have sometimes been referred to as “Joggers Foot” because of the repetitive compressive force exerted on the flexor retinaculum during running [1,3-5]. Much less common are entrapment neuropathies involving the lateral aspect of the leg and foot, which may be caused by either the Peroneal (Fibular) or Sural nerves [5].

The current case report describes a 24 year-old runner with recurring lateral foot numbness and paresthesia and the successful non-surgical management of the condition with foot orthoses. The case report further describes the use of adhesive strapping of the foot to aid in diagnosis and guide foot orthotic fabrication.

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Case Presentation

Relevant history

The patient described in this case report was a 24 year-old female recreational runner (~20 miles/ week) with the chief complaint of bilateral paresthesia over the lateral forefoot (Right > Left) after running distances greater than three miles. The patient reported that she initially noticed the onset of numbness while she was running on the high school cross-country team as a sophomore. She reported that the numbness was initially restricted to the dorsal-lateral foot, but increased with further running to include the mid-lateral calf and leg. The patient indicated that her symptoms were restricted to sensory loss only and denied any motor involvement. The patient reported that these symptoms would typically subside within 10 minutes after she stopped running, regardless of the distance that she ran.

Other than three lateral ankle sprains to her right ankle, which were all managed conservatively, the patient had no history of trauma to her feet. She reported that while in high school, her arches had been taped by the local athletic trainer using the “cross-x” technique, similar to that described by McPoil and McGarvey [6]. Unfortunately, this taping did not alter her symptoms. The patient did utilize foot orthotics she had purchased at a local retail store, which helped, but did not alleviate her symptoms enough to allow her to run long distances without the numbness returning.

Physical examination

Examination by the physical therapist consisted of first, screening the patient’s lumbar spine as a possible source of her symptoms. The patient’s lower extremity joints had normal range of motion bilaterally and her muscles all tested strong and painless. With the exception of her feet exhibiting a pronated foot posture in standing (FPI: L=+6; R=+7) [7] (Figure 1), there were no other lower extremity mal-alignments noted, including genu varum, genu valgum, excessive femoral



Figure 1: The patient's standing foot posture (fpi: l=+6; r=+7).



Figure 2: The dorsal arch height change measured following the application of the tape.

anteversion, or increased tibial torsion during standing and walking. The shoes that the patients used for running were new, showed no signs of excessive wear, had adequate cushioning, fit well and did not restrict her forefoot width. Because the patient's complaint of paresthesia was transient in nature and resolved fairly quickly after her cessation of running, it was felt that electrodiagnostic testing would not be of significant value in making a definitive diagnosis.

Because the patient indicated that the "over-the-counter" foot orthoses, which she was currently using, had provided some relief, the effect of her foot posture during running as a source of her symptoms was investigated further. To do this, the patient's arches were first taped using the "low-Dye" technique previously described in the literature using two-inch cloth athletic tape applied directly to the skin [8,9]. The modified reverse-six taping technique was then applied to further alter the posture of the foot by raising the medial longitudinal arch and therefore control the amount of foot pronation during running [10]. The effect of applying each of these two taping techniques resulted in raising the patient's dorsal arch height by 3.9mm measured using procedures described by McPoil et al. [11] (Figure 2). The patient was then asked to run at least three miles to determine if the altered foot posture resulting from the application of the tape altered her symptoms. The patient returned the next day and indicated that while the tape was applied she had been able to run without numbness or paresthesia. The above procedure was then repeated in order to insure that altering her foot posture with tape had altered her symptoms. Because the patient's symptoms resolved when her medial longitudinal arch was raised and overall foot pronation was limited by the application of the tape, it was deduced that the cause of her symptoms were related to her foot posture and excess pronation. It was further deduced that if foot orthoses could provide



Figure 3: The patient standing on the foot orthoses fabricated to replicate the dorsal arch change produced by the tape. note the additional material in the medial longitudinal arch region.

a similar change in foot posture and motion control, they would be a more permanent solution to her problem.

Intervention

Due to the immediate resolution of the patient's symptoms by taping her arches, foot orthoses were fabricated to duplicate the tape's effect of raising the patient's medial longitudinal arch. The foot orthoses utilized to accomplish this consisted of a polyurethane base shell with a foam top cover. Material (Plastazote I) was added to the medial longitudinal arch in order to replicate the 3.9 mm change in the height of the dorsal arch that was produced by the tape. See Figure 3. No "break-in" period was used once they were deemed comfortable during the initial fitting. Since being fitted with the above constructed foot orthoses, the patient has reported that she no longer has had any episodes of paresthesia or numbness in her feet during running while using the foot orthoses.

Discussion

Because no electrodiagnostic testing was performed on the patient, the actual nerve involved cannot be determined with complete certainty and is therefore a limitation to the current case. Because the patient's symptoms resolved relatively quickly after running, it was felt that such testing was not warranted. However, based on the reported distribution of the patient's symptoms, the dorsal lateral branch of the sural nerve is a logical conclusion as the nerve most likely affected by her running. Although sural nerve compression has been reported in the literature, its cause is generally that of a mass lesion, scar tissue, ganglia or trauma and not from exercise alone [1,3,12]. In such situations, however, the pain and paresthesia are generally much more proximal than that seen in the current patient [13]. Because of the nerve's distribution, however, it could result in paresthesia or numbness over the lateral ankle and foot [3,4]. Sural nerve impingement has also been attributed to ill-fitting footwear [14]. The current patient case is somewhat unusual since the distribution of symptoms was primarily along the lateral foot, her footwear was not restrictive and there was no history of trauma or surgery. Certainly, if clinicians are presented with a similar case, electrodiagnostic testing should be considered to aid in their diagnosis of the problem.

Taping the foot in order to raise the medial longitudinal arch and limit calcaneal eversion served to help determine if excess pronation of the foot during running was the cause of the patient's symptoms. Because altering the patient's foot posture and motion

during running through the use of tape alleviated her symptoms, it is reasonable to assume that excessive foot pronation resulted in the impingement of the dorsal sural nerve as it courses behind the lateral malleolus and along the lateral aspect of the foot.

The use of foot and arch taping has been advocated and described in the literature as an effective method of determining whether foot posture or foot motion play a role in various lower extremity injuries [15-18]. Further, Meier and colleagues effectively used the same taping procedures described in this case study to fabricate foot orthoses in order to manage a variety of lower extremity injuries [19]. Although the taping procedures used in this case eliminated the patient's symptoms, it was not considered a practical solution since she would have to be taped each time that she wished to run. As such, a more permanent solution was sought to accomplish the same thing that the tape did, namely raise the medial longitudinal arch and limit excess calcaneal eversion during running. As such, foot orthoses were constructed in order to accomplish the same thing that the tape did, which was raise the medial longitudinal arch and limit excess calcaneal eversion. To accomplish this, the amount that the medial longitudinal arch was raised with the application of the tape was used to ensure that the foot orthoses that was fabricated accomplished the same thing. It reasonable to assume that other types of foot orthoses could have a similar effect providing that resulted in the same change that was seen with the application of the tape.

As illustrated in this case study, determining if a person's foot posture or movement is related to their chief complaint can be challenging. In such situations, foot taping can be utilized successfully as a cost effective method to determine if foot motion control is warranted. If so, a method of controlling such motion without the use of tape can be considered. In the present case, this was accomplished with the use of foot orthoses that altered the patient's foot posture the same amount that taping did, thus alleviating of their symptoms.

Conclusion

This case study describes the management of a patient with lateral foot numbness during running using taping as a way to confirm that altering foot posture and motion was the cause of her symptoms. Further, it illustrates how the change in foot posture from taping can be used in guiding the fabrication a foot orthosis.

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