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Peroneal tendinopathy in resolved Charcot foot – management with foot orthoses: A case report

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This case report presents an occurrence of painful peroneal tendinopathy in a high risk diabetic foot following Charcot neuroarthropathy, managed using foot orthoses. Self-reported pain intensity was assessed using the 11-point numeric pain rating scale (NRS-11). Peak plantar pressures were assessed using the Pressure Guardian system for three conditions: 3.2mm poron inlay (control), custom foot orthosis, and custom foot orthosis with lateral wedge. Following addition of lateral wedging to the existing foot orthoses, pain reduced to a satisfactory level for the subject. Plantar pressure measurement showed that the addition of lateral wedging did not increase peak plantar pressures above 200kPa, a proposed dangerous level of pressure. Additionally, the foot orthoses still successfully reduced peak plantar pressures to below 200kPa, compared to walking without them. Peroneal tendinopathy should be considered as a possible cause of lateral ankle pain in neuropathic diabetic feet. Lateral wedging can be considered as one option to reduce pain in peroneal tendinopathy, and may not compromise the protective effect of foot orthoses in high risk feet.

Keywords: Charcot, foot, peroneal, tendinopathy, orthoses, insoles

Pain can be present even in a diabetic foot with neuropathy. Causes of pain in this group could include painful diabetic neuropathy [1–3] and Charcot neuroarthropathy (CN) or 'Charcot foot' [4]. The cause of the pain should be determined to inform appropriate management.

Tendinopathy may also occur and cause pain in the neuropathic diabetic foot. There is a higher risk of tendinopathy in diabetes [5–7]. Chronic ankle instability or 'hind foot varus' have been suggested as predisposing factors to developing peroneal tendinopathy [8]. In theory the ground reaction force on an inverted heel deviates medially, causing an increased ankle inversion moment which must be opposed by the peroneal muscles. A more supinated foot may develop as a result of CN [9,10].

It has been proposed that the conservative management of peroneal tendinopathy may include protection, relative rest, ice, compression, elevation, medications, and rehabilitative exercise modalities (PRICEMM) in addition to foot orthoses and strengthening of ankle evertors [11]. There is limited evidence on the role of foot orthoses in peroneal tendinopathy. Some work has shown that foot orthoses alter peroneal muscle activity in runners with overuse injury symptoms [12] and in adults with chronic ankle instability [13]. A foot orthosis with a 10 degree lateral wedge has been shown to increase pronation at the rearfoot and reduce the ground reaction force magnitude, suggesting increased shock attenuation by the foot and ankle[14]. This case study presents a case of painful peroneal tendinopathy, which developed in a foot following CN and was

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subsequently managed using foot orthoses (FOs). The CARE guidelines for reporting of case studies was followed [15]. Written informed consent was obtained for the publication of the materials in this article.

Methods

The subject was a 60 year-old male with type 2 diabetes with a history of CN affecting both feet. The CN resolved 8 months previously. There was a history of superficial ulceration (Texas grade A1) [16] to the left plantar 1st metatarsal-phalangeal joint and 1st tarso-metatarsal joint, both resolved for 8 months with the use of custom foot orthoses at the time of presentation with a primary concern of right foot pain.

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There was sensory neuropathy, with only 1 out of 10 sites tested with a 10g monofilament being detected (Plantar 1st and 3rd toes, plantar 1st, 3rd and 5th metatarsal-phalangeal joints bilaterally). Circulation was good with triphasic posterior tibial pulses. Passive joint ranges of motion at the foot and ankle was generally good bilaterally except reduction in midtarsal movement on the left, and reduced extension at the left 1st metatarsal-phalangeal joint (45 degrees) compared to the right (60 degrees). Foot posture was rated using the foot posture index (FPI-6)[17] as +9 on the left and +3 on the right, indicating a highly pronated foot on the left and a relatively less pronated foot on the right (Figures 1 and 2). The FPI-6 differential of 6 points exceeds both normal values for foot asymmetry and mean asymmetry reported in a CN group [10,18]. The patient presented reporting a 6 week history of right foot pain, indicating the lateral ankle. This developed despite an existing 6mm lateral flare/float addition to the right heel, intended to resist ankle inversion. Pain intensity was reported as 7/10 on the numeric rating scale (NRS-11).

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Palpation of the peroneal tendons posteriorly to the lateral malleolus reproduced the pain experienced during walking. A portable ultrasound system was used by the author at this stage, indicating some fluid in the peroneal tendon sheath.

Figure 1 Left and right feet (anterior and posterior view).

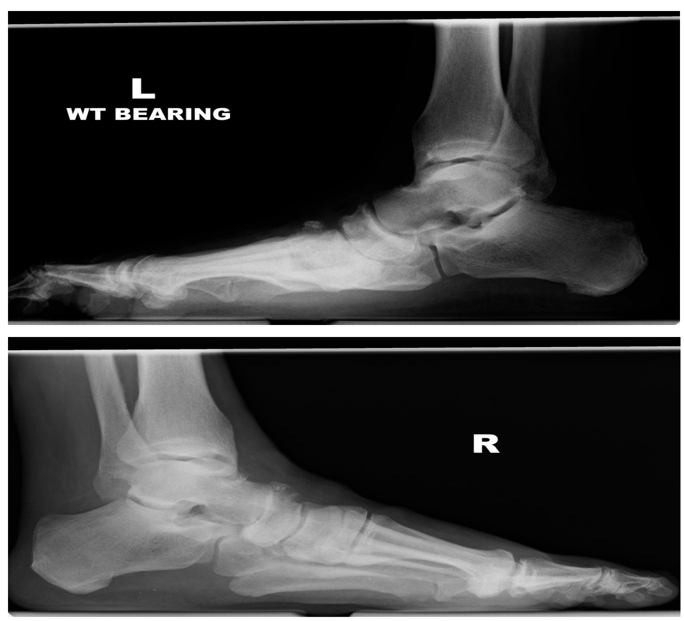

Figure 2 Lateral radiographs of left and right feet.

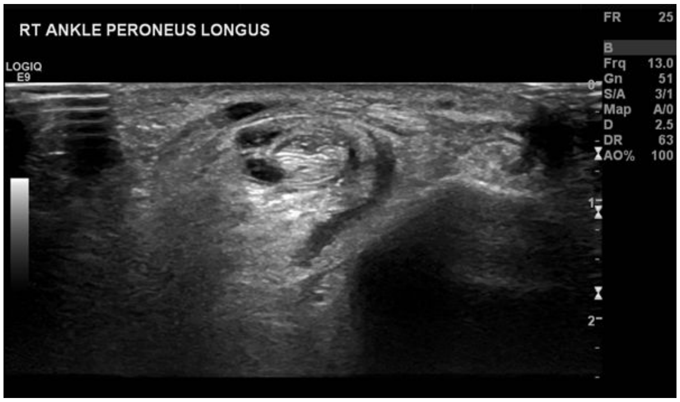

Figure 3 Cross sectional ultrasound image of peroneus longus showing fluid within the tendon sheath.

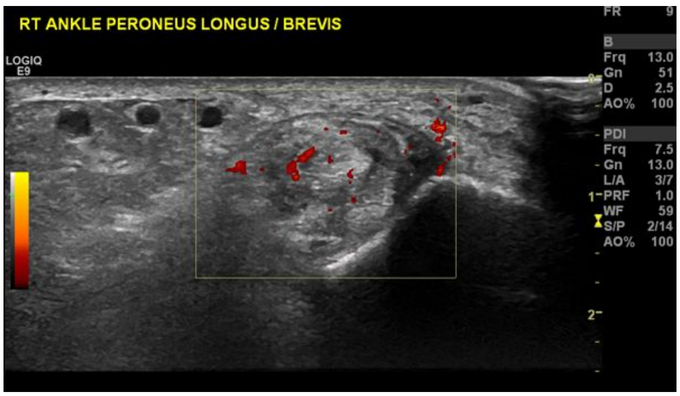

Figure 4 Cross sectional ultrasound image of peroneus longus and brevis using power Doppler to show hyper vascularity in the tendons.

Figure 5 Left and right foot orthoses, plantar view.

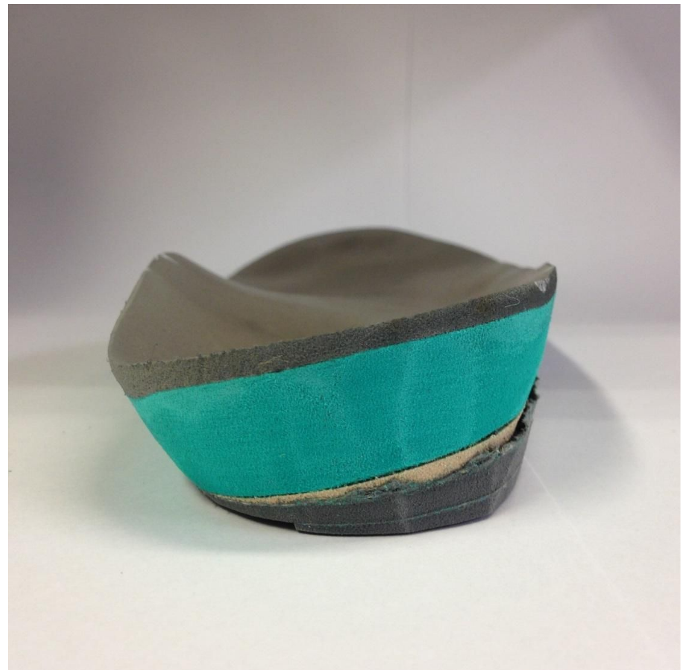

Figure 6 Right foot orthosis, posterior view.

Referral to radiology for a definitive evaluation was made, which confirmed the diagnosis of peroneal tendinopathy (Figures 3 and 4). The report identified fluid in the common peroneal tendon sheath, in keeping with tenosynovitis, and marked thickening of the peroneus brevis tendon at the insertion, in keeping with tendinosis.

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The existing FOs consisted of a 3mm thick base with 50 shore A Ethylene-vinyl acetate (EVA) at the proximal half and 30 shore A EVA at the distal half. There are 'plugs' under the right cuboid region, left 1st metatarsal-phalangeal joint and 1st tarso-metatarsal joint where the base material has been replaced with grey poron (Poron 4000, Algeos, Liverpool). 6mm grey poron is used as a top cover, giving a total 9mm base thickness (Figure 5).

Lateral heel wedging (3 degrees) was added to the existing foot orthoses, however the patient reported no immediate change. A further 5 degrees (8 degrees total) was added on the same day – the patient reported that the pain reduced to 1/10 immediately.

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At review 8 weeks later, the patient reported that the pain had reduced to 0/10 24 hours following the addition of the lateral wedge. However, 72 hours after the addition of the lateral wedge the pain returned to 4/10. At this stage, the lateral heel wedge was increased to 12 degrees (Figure 6) and extended to the midfoot. The patient again reported an immediate reduction from 4/10 to 0/10.

To ensure that the aggressive wedging added was not causing high pressures in other areas of the foot, in-shoe pressure measurement was used. Comparisons were made with a 3mm poron inlay only, the custom foot orthosis only, and the custom foot orthosis with 12 degree wedge (Table 1).

Sensor location	Peak pressure (kPa) ï 3mm poron inlay	Peak pressure (kPa) ï custom foot orthosis	Peak pressure (kPa) ï custom foot orthosis with 12 degree lateral wedge
Lateral plantar heel	71	28	32
Medial plantar heel	69	18	8
Lateral plantar midfoot (Charcot deformity)	244*	94	133
Plantar 1st metatarsal-phalangeal joint	28	33	31

Table 1 Peak plantar pressures (*Indicates a peak pressure value exceeding the proposed dangerous level of 200kPa).

Considering 200kPa as a dangerous level of pressure [19], the custom FO reduced the lateral plantar midfoot (Charcot deformity) pressure to below this level. Following the addition of the lateral wedge, all plantar pressures tested remained below the 200kPa level. Some increase in pressure at the lateral midfoot was measured, reflecting the extension of the wedge to the midfoot. Slight increase in pressure was seen at the lateral heel, which seems to indicate that the centre of pressure was moved laterally by the lateral heel wedge.

At a second review appointment 6 weeks later, the pain had returned back to 4/10. The patient declined any other management and was happy to continue using the laterally wedged foot orthoses. At a third review 8 weeks later, the pain was slowly reducing and now rated as varying between 2/10 and 4/10.

Discussion

This case study illustrates a relatively successful outcome in reducing pain associated with peroneal tendinopathy, using FOs only. The initial pain level of 7/10 was reduced by at least 3 points, which exceeds reported minimal clinically important difference (MCID) values [20]. Of interest is the fact that the patient reported marked immediate effects following the addition of lateral wedging to the existing FOs. This initial effectiveness tended to reduce over time, with pain levels increasing again. One possible explanation for this reduction in initial success may be some compression of the orthoses, which were not made with rigid plastic. The outcome may have been more successful if accompanied by other approaches such as physical therapy, however in this case due to patient preference only one approach was used.

Following initial use of a lateral wedge at the heel only, longer term reductions in pain were achieved by extending the wedge to the midfoot. The extension of the wedge to the midfoot has a logical anatomical basis, as the insertion of the peroneus brevis is distal to the heel, at the base of the 5th metatarsal. It is therefore logical to apply the opposing force in this area. The angle of the lateral wedge also needed to be increased to maintain pain reduction. A systematic effect of altering heel wedge geometry on external forces acting on the foot has been shown by Sweeney [21] although this relates to medially positioned wedging. The need for these small adjustments highlights the importance in this case not just of selecting an appropriate modification, but also the size and location of the modification.

Applying relatively aggressive wedging to orthoses for feet at risk of ulceration may be controversial, as traditional approaches to designing FOs for high risk feet often focus on accommodation, rather than altering function of the foot. In this case, use of pressure measurement enabled verification that pressure levels were brought below 200kPa by the FOs, and that this reduction persisted despite the addition of a large lateral wedge. This indicates that aggressive FO designs may be safely used in high risk diabetic feet. However pressure measurement should ideally be used to assess the effectiveness and safety of any orthotic prescription in the context of a high risk foot.

The cause of the tendinopathy in this case is uncertain. The right foot and ankle may have become more prone to inversion as a result of changes to the bony architecture following CN. This may have in turn caused increased inversion moments at the rearfoot, and hence more stress on the peroneal tendons. Neuromuscular control may also be a factor, as the timing of muscle activation has been shown to be altered in diabetic patients [22].

This case report has illustrated that lateral wedging up to 12 degrees may be safe and not compromise the protective function of a FO in a high risk diabetic foot. Clinicians should consider peroneal tendinopathy as a possible cause of lateral ankle pain in neuropathic diabetic feet. Clinicians may consider orthosis wedging as one option to reduce pain in peroneal tendinopathy, in addition to other approaches.

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