



A Novel Method to Offload Neuropathic Ulcers of the Distal Phalanges in the Presence of First Ray Metatarsal Hypermobility

3 Case Reports

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ABSTRACT

BACKGROUND: The standard practice to heal neuropathic ulcers on the toes is to offload the affected areas with special types of therapeutic footwear including shoes and boots to reduce the amount of pressure on the wound. Once healed, the individual wears custom insoles to prevent the development of new wounds. In our practice, we found that some newly healed wounds will reulcerate despite wearing therapeutic footwear. We devised a method to prevent and offload neuropathic foot ulcers on the distal phalanges in the presence of first ray metatarsal hypermobility, a common problem associated with the development of wounds.

CASES: Three individuals with first ray metatarsal hypermobility and recurrent neuropathic ulcers demonstrated healing using a buttress constructed from a tampon placed under the plantar surface of the proximal interphalangeal joint. The buttress was successful in supporting the first ray metatarsal to keep it in proper alignment.

CONCLUSION: We found using a buttress was an effective nonsurgical intervention for these 3 individuals with first ray metatarsal hypermobility to prevent and offload neuropathic hallux ulcers.

KEY WORDS: Bandages, Diabetic foot ulcer, Neuropathy ulcer, Splints, Wound healing.

INTRODUCTION

One of the many complications of the diabetes epidemic is a 25% potential lifetime risk for developing a foot ulcer.¹ The standard practice to heal neuropathic ulcers on the toes is total offloading of the affected areas to eliminate pressure on the wounds.² Once healed the individual wears custom insoles to prevent the development of new wounds.² In our practice, we find some wounds will not stay healed despite individuals wearing therapeutic footwear, including those with first ray metatarsal hypermobility. Surgical correction of the first ray to place it in proper alignment is a common approach to stabilize the joint and eliminate the deformity, which is often associated with high pressure on the distal aspects of the toes leading to ulcers. However, not all individuals are candidates for surgical correction; thus, we sought to determine what nonsurgical

approaches exist for preventing ulcers for individuals with first ray metatarsal hypermobility.

In the healthy foot, each step places the body's weight on the first metatarsal head, located on the distal end of the first metatarsal bone (ray), one of the 5 long bones of the foot. The first metatarsal head articulates or joins with the first toe, also called the hallux, just below the "bend" of hallux's proximal interphalangeal joint (PIP). Normally the ray is locked into a downward plane placing the individual's weight on the metatarsal head and not the hallux. With hypermobility (excessive dorsiflexion or plantar flexion), the ray and metatarsal head elevate instead of locking into 1 of the 3 cuneiform bones located in the mid-foot; their purpose is to provide flexibility. The weight, intended for the metatarsal head, becomes transferred to the hallux in the presence of joint hypermobility, where a wound can develop near or on the distal tip due to excessive pressure.³ This gives the foot a flat profile (Figure 1).

One of the front-line treatments for first ray metatarsal hypermobility is surgical correction. This involves open fixation of the metatarsal to prevent hypermobility and collapse of the foot arch.³ However, not all individuals with hypermobility are surgical candidates such as those with uncontrolled diabetes mellitus, currently smoking, or acute exacerbations of chronic comorbidities. From trial and error we found that placing a firm buttress, such as a tampon, under the PIP aligns the hallux into its natural position (Figure 2). We theorized that the correction would place the proximal aspect of the metatarsal head in proper alignment with the cuneiform bone, locking the ray and preventing hypermobility. The weight would then be distributed to the metatarsal head instead of the hallux, and

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Figure 1. Flat foot profile from first ray hypermobility.

minimized over the site of the ulcer. This alignment, or correction, will decrease the amount of pressure on the ulcer to promote healing.

Case 1

A 45-year-old woman with a 25-year history of type 1 diabetes was receiving care in our clinic. Current hemoglobin A1c was 7.2%. Her weight is 104 kg/229 lb. She has a diagnosis of neuropathy in her feet and has a first ray hypermobility in the left foot. She presented with a wound on the left plantar hallux. She developed a wound while wearing therapeutic footwear (diabetic shoes) and custom insoles. Our treatment consisted of antimicrobial moist wound healing and placing a buttress taped under the PIP. Subsequently, the wound healed in 2 months. At discharge she was to obtain new insoles and to continue to wear the buttress. Unfortunately, she did not follow through with the prevention plan. Four months later she presented with a recurring wound. We restarted the antimicrobial moist wound healing dressing and placed the offloading buttress under the PIP. Once again she healed in 2 months. After discharge she wore her shoes, insoles, and the buttress. This was discontinued a month later due to loss of the shoes in a house flood. The wound reoccurred. The antimicrobial moist wound healing dressing with the buttress was initiated and the wound healed within 4 months. At discharge she had new diabetic shoes and insoles and was instructed to continue wearing the buttress. During a 1-year follow-up



Figure 2. Buttress placed under the proximal interphalangeal joint.

phone call, she reported that she stopped wearing the buttress and the wound reopened. She self-treated with the buttress and the wound healed. She now applies the buttress to the PIP joint and changes it every 2 days after her shower and wears custom insoles and shoes. The wound remains closed.

Case 2

A 42-year-old woman with idiopathic neuropathy sought care in our clinic for a wound on the right plantar hallux. There was no history of diabetes, injury, or infections to the feet. Her weight is 116 kg/256 lb. She has neuropathy in her feet with first ray hypermobility. The wound care plan was initiated and consisted of using a custom felt offloading insole and antimicrobial moist wound dressing. Over a 3-month period, there was minimal healing. We added the buttress placed under the PIP and the wound healed 2 months later. She stopped wearing the buttress and her custom insoles for unknown reasons and presented again in our clinic 4 months later with a recurrent wound. We reinstituted the moist wound dressing after healing and PIP offloading using the buttress. The wound healed in 4 months. After discharge she obtained new custom insoles and has remained healed for a year. She is no longer using the buttress, which suggests that part of the original treatment plan may have been compromised by an inadequate custom insole.

Case 3

A 62-year-old man with type 2 diabetes sought care for bilateral plantar hallux wounds. His hemoglobin A1c was 7.9% and weight 103 kg/227 lb. He had a diagnosis of neuropathy in his feet and first ray hypermobility. We started him on the buttress and regular shoes on both feet. The right hallux wound failed to heal despite using the buttress under the PIP for 2 months. The wound on the left hallux healed after 2 months except for a small opening due to osteomyelitis of the left toe. The wound remained stable for 11 months until the left hallux bone was partially resected for osteomyelitis. The individual now has custom insoles with regular shoes, and remains healed on both halluces and continues to wear the buttress.

DISCUSSION

These 3 case reports demonstrate that a buttress placed under the PIP provides support for first ray hypermobility and may improve healing of the hallux wounds. However, after the wounds healed, a major challenge was keeping them from recurring. All 3 individuals had custom insoles and neuropathic shoes obtained from orthotists. We approached the orthotists about building up a protuberance on the insole in the location of the PIP joint to replace the buttress. Orthotists and prosthetists follow a general principle of not putting protuberances or ridges anywhere on an orthosis or assistive device that comes in contact with the skin. This is partially related to the dynamic nature of each step a patient takes. There is no way to guarantee the patient places their foot on the protuberance correctly every time. These patients are usually insensate (loss of protective sensation) on their plantar foot due to neuropathy and cannot feel if there is too much friction or displacement.⁴ This forced us to consider a disposable buttress the patient can place under their PIP on a daily basis. One option considered was using crest pads, which are offloading pads for the second to fifth lesser toes.

However, most crest pads provide minimal support of the hallux, as they are designed for the lesser toes. Also, crest pads are generally unavailable over the counter in our area; thus, it would be difficult for individuals to go out and purchase them. From trial and error we devised a supportive buttress from a nonapplicator tampon that fits all these requirements. Our patients remained healed if they used this tampon, held in place with fabric tape under the PIP, and wore custom insoles and therapeutic shoes every day. This use of a tampon had the added benefit of forcing the individual to assess their feet on a daily basis.

In our experience we did not find maceration under the buttress or the development of new pressure injuries on the dorsum of the toes. The buttress was made from a nonapplicator tampon with the tail cut-off. This allowed patients easy access to the product and may have increased compliance. There are different sizes of tampons, so we had the patient experiment to see which size was most comfortable. Some patients opted to change the buttress daily while others found they could leave it in place for up to 2 days. Frequency of showering usually determined frequency of the buttress change. Using tampons was acceptable for our male patients, but we can see how some patients might be resistant to this option. In those situations having the patient manufacture their own buttress using rolled up mole skin may be a better option. More experience is needed to assist patients with buttress options.

CONCLUSION

Using a buttress, constructed from a tampon, is a potentially effective nonsurgical intervention for individuals with first ray metatarsal hypermobility to prevent and offload neuropathic hallux ulcers.



KEY POINTS

- Neuropathic changes to the foot can cause first ray hypermobility resulting in plantar ulceration.
- Using a buttress under the proximal interphalangeal joint may offload plantar hallux neuropathic ulcers, allow healing, and prevent recurrent ulceration.

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