

Abstract

Total contact casting is the gold standard for plantar foot ulcers but has been questioned in heel pressure ulcers. Current offloading of heel ulcers is typically removable offloading boots. We describe using a modified posterior splint to offload heel ulcers in non-weightbearing patients. The posterior splint is readily available and familiar to practitioners, with less of a learning curve than a total contact cast. As part of the dressing, the posterior splint is less likely to be removed and lead to increased compliance. We hypothesize that this can translate to improved healing of pressure ulcers at the heel.

Introduction

Total contact casting works because it is irremovable and removes pressure from the ulcerated area. Armstrong showed with his instant TCC trial that an irremovable walking boot gives similar outcomes with a total contact cast.¹ He concluded that an irremovable device is superior because it reduces patient noncompliance. A recent meta-analysis reaffirmed that irremovable offloading devices are superior to removable offloading devices.² One major difficulty with heel offloading boots such as the PRAFO, multipodus boot, and Prevalon boot is that they are frequently removed by patients and caregivers. An irremovable heel offloading device encourages increased compliance.³

We have had positive experiences with the heel offloading posterior splint (HOPS). The HOPS is a posterior splint applied in a normal fashion, but with offloading of the ulceration site. This is accomplished during the creation of the splint by applying padding such as a roll of kerlix over the ulceration while the splint hardens. After the splint has sufficiently hardened, this extra padding is removed, creating an offloading pocket for the ulceration.⁴ Rather than pressure being applied to a single area at the heel ulceration site, pressure is distributed throughout the foot and calf. Our method defers from previously described splints as we describe a method in which external or internal rotation of patient's foot position can be accounted for.

Technique

The HOPS has multiple benefits. It is custom fitted to the patient, which reduces issues with sizing of an offloading boot.

- The location of posterior offloading can be controlled by placing padding over the ulceration while the splint is formed (Figure 1).
- In patients with external or internal rotation, the splint can be modified to prevent such rotation by crimping the corners of the splint at the heel to keep the foot in a rectus position and keeping the splint flat against the bed (Figure 2).
- Posterior splints are readily available in hospitals and clinics, are easy to apply, with doctors and ancillary staff already familiar with their application.
- It can be used in conjunction with negative pressure wound therapy devices and advanced tissue grafts (Figure 3).
- It can be used to protect infected ulcerations and osteomyelitis.
- Once created, the device can easily be removed by home nursing staff for dressing changes.
- This device is ideal for wheelchair bound patients who rest their heel on the wheelchair or ground throughout the day (Figure 4).
- The splint can be applied in the operating room which ensures compliance after surgery and eliminates the economic burden of obtaining a PRAFO.

Figures



Figure 1. Post-operative imaging of the lower extremity. (a) Padding placed at the heel. (b) Padding is removed once the posterior splint is hardened.



Figure 2. HOPS used to prevent external rotation. By using a wider splint and keeping the splint flat at the angle, external and internal rotation can be prevented.



Figure 4. HOPS used in non-weight bearing patient with negative pressure wound therapy following partial calcaneotomy.



Figure 3. Hops used in wheelchair bound patient with a heel decubitus ulceration.

Discussion

The use of TCC for heel ulcers has been questioned. One study showed a 20% increase in pressure at the heel during gait in a TCC, which has led to hesitation using TCC with heel ulcers.⁵ In comparison to the total contact cast, the HOPS allows open access to the heel after application, which allows the medical staff to check that the ulceration is appropriately offloaded. The HOPS should also decrease iatrogenic complications. Some common complications of TCC include new ulcerations, maceration, and anterior leg abrasions.⁶ We expect less problems with new heel, malleolus, and toe ulcers due to less contact with rigid cast material; less complications from maceration due to more open construction; and less anterior leg abrasions as no hard material contacts the anterior leg. The HOPS theoretically should have fewer complications than TCC, especially when used in non-weightbearing patients.

The major limitation is that posterior splints are limited to patients who are non-weightbearing. Another limitation is that the splint likely has a shorter lifespan than a PRAFO. While we have not observed iatrogenic ulcerations from using a posterior splint, theoretically this could place excess pressure on the Achilles tendon and develop an ulceration over the midsubstance of the tendon. There is also still a risk of contralateral limb abrasion.

Application of the splint for heel ulcers is similar to application of a splint for any other indication. A dressing of the physician's choice can first be applied to the ulceration, including a negative pressure wound therapy device or cellular and/or tissue-based products for wounds. The leg and foot are then padded using webril. The posterior splint is then measured to size, accounting for extra material for the heel offloading portion. During application, any nearby material can be applied over the ulceration to offload the splint while the splint is drying. Common choices include extra rolls of webril, kerlix, or extra negative pressure wound therapy device sponge. The splint is then applied and wrapped with ACE bandage. After the splint has sufficiently hardened, the extra material is removed from the offloaded area. Subsequent dressing changes do not necessitate a new posterior splint.

Conclusion

The optimal offloading device should be cost effective, accessible, time friendly, and easy to apply with minimal staff training. The HOPS accomplishes all of these and can help non-weightbearing patients heal ulcerations, prevent infection, and preserve limbs. We hope that this introduction can lead to higher level of evidence studies to examine the HOPS as a viable offloading device for the appropriate patient.

References

1. Armstrong DG, Lavery LA, Wu S et al. Evaluation of removable and irremovable cast walkers in the healing of diabetic foot wounds: a randomized controlled trial. *Diabetes Care* 28: 551, 2005.
2. Morona JK, Buckley ES, Jones S et al. Comparison of the clinical effectiveness of different off-loading devices for the treatment of neuropathic foot ulcers in patients with diabetes: a systematic review and meta-analysis. *Diabetes/metabolism research and reviews* 29: 193, 2013.
3. Chakraborty PP, Ray S, Biswas D et al. A comparative study between total contact cast and pressure-relieving ankle foot orthosis in diabetic neuropathic foot ulcers. *Journal of diabetes science and technology* 9: 302, 2014.
4. Hsu RY, Lareau CR, Born CT. Novel Posterior Splinting Technique to Avoid Heel Ulcers. *Orthopedics* 36: 31, 2013.
5. Shaw JE, Hsi WL, Ulbrecht JS et al. The mechanism of plantar unloading in total contact casts: implications for design and clinical use. *Foot Ankle Int* 18: 809, 1997.
6. Owings TM, Nicolosi N, Suba J et al. Evaluating iatrogenic complications of the total-contact cast. *JAPMA* 106: 1, 2016.