
Plantar Heel Pressure Relief from the MPO Active 2000[®] Ambulatory Splint*

Geraldine Glanville and Craig Payne

Summary

Heel ulcers are a significant and costly problem that require pressure relief for healing. The MPO Active 2000[®] splint was designed to provide both ambulatory and in-bed pressure relief for heel ulcers to facilitate repair. The aim of this study was to determine the pressure reduction under the foot during ambulation using the MPO Active 2000 splint. Fifteen healthy volunteers (mean age 22 years) were recruited. Pressure under the heel during ambulation was measured both in plain canvas shoes and with the MPO Active 2000 splint. The Novel PedarTM in-shoe plantar pressuring measuring system was used. Peak pressure under the heel wearing the MPO Active 2000 splint was 17 per cent less than in the shoes – 269.3Kpa (± 47.4) vs 224Kpa (± 39); $p < 0.01$. There was no change in forefoot pressure – 296.0Kpa (± 69) vs 287.3 (± 101); $p = 0.79$. The MPO Active 2000 splint should be considered as a modality to reduce heel pressure in patients with heel ulcers.

Introduction

Up to 17 per cent of acute care hospital patients have been reported as developing pressure ulcers¹ with 78 per cent occurring in the sacrum and heel². For pressure ulcers to heal, pressure relief is considered vital^{3, 4, 5}. The efficacy of pressure relief methods for heel ulcers during bed rest has been well documented⁶, and clinical practice guidelines for the prevention and treatment of heel ulcers are generally in place⁷.

Guin, Hudson and Gallo⁸ investigated heel pressure relief for six different devices. A wide variation was found in the

amount of pressure relieved, the cost of the device and the ease of use of the device. Devices included in the study were the Bioclinic eggcrate booties, L'Nard Multi-Podus splint, Lunax boot, the Posey heel protector, Roho heel protector and Stryker Air-Shu. The L'Nard Multi-Podus splint was the most effective at relieving pressure in the elevated prone position in bed.

Tymec, Pieper and Vollman⁴ compared hospital pillows and the Foot Waffle. They found that the pillows were four times less likely to suspend the heel off the bed. However, a major limitation with all of the previously investigated devices is that they do not provide pressure relief during ambulation.

Keeping patients ambulatory during the healing process is considered important, however, pressure relief under the heel is problematic as it is a prime weight bearing area of the foot. Weight bearing can be painful and significantly impair healing. To relieve plantar pressures during ambulation, several methods such as total contact casts, walkers and therapeutic footwear are available. These modalities have been shown to be effective at reducing ambulatory plantar pressures^{3, 9} but they are not suitable for pressure relief during bed rest for heel ulcers.

A development of the L'Nard Multi-Podus splint is the recently available MPO Active 2000 splint (Figure 1), which has been designed in an attempt to relieve heel pressure during weight bearing rehabilitation and bed rest. The original has been modified by the addition of a foot plate to better facilitate ambulation. This should enhance its usefulness through its

Geraldine Glanville BPod(Hons)

Craig Payne DipPod(NZ) MPH

***Department of Podiatry
School of Human Biosciences
La Trobe University
Bundoora, Victoria, 3083***

***Telephone: (03) 9871 3394
Facsimile: (03) 9870 9123
E-mail: gerryglanville@hotmail.com***

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Figure 1. The MPO Active 2000 splint with the Pedar in-shoe pressure measuring system for data collection.



versatility. It is a padded foot and ankle splint that aims to cradle the heel, providing pressure relief. It is easy to use compared to some other pressure relieving modalities and a previous version has been shown to provide good heel pressure relief during bed rest⁸. The aim of this study is to investigate the pressure under the foot during ambulation with the MPO Active 2000 splint.

Method

Normal healthy undergraduate students were recruited at La Trobe University. Approval was obtained from the Faculty of Health Sciences Human Ethics Committee and informed consent was obtained from each participant. Each subject had the length of their feet measured and was then fitted with a pair of canvas shoes. Dynamic plantar pressures were then recorded while walking using the Novel PedarTM in-shoe pressure measuring system. The MPO Active 2000 splint was then fitted in accordance with the instructions from the manufacturer and dynamic plantar pressures again measured (Figure 2).

In both situations, data was recorded for 10 steps which was considered appropriate to reduce the variability. The recorded plantar pressures for each step of each subject were averaged for analysis. A mask was created over the heel and forefoot regions for the Novel WinTM software to calculate the mean peak

pressure in the regions.

Results

A total of 15 subjects (8 female and 7 male) with a mean age of 22.6 years (± 5.2) were recruited. The mean weight of the subjects was 67.8kg (± 13). The results are presented in Table 1.

Peak plantar pressures in the heel wearing the canvas shoes were 269.3KPa (± 47.7). With the MPO Active 2000 splint they were 224KPa (± 39). The 45.3KPa difference was significant ($p < 0.01$) and represented a 17 per cent reduction in plantar pressure. Peak plantar pressures under the forefoot wearing the canvas shoes were 296.0KPa (± 69) and with the MPO Active 2000 splint they were (287.3KPa (± 101)). The 9.3KPa difference was not significant ($p = 0.79$).

Discussion

This study has shown that the MPO Active 2000 splint can reduce ambulatory heel pressure under the heel. Total contact

Figure 2. Experimental set up prior to data collecting with the Pedar in-shoe pressure measuring system.



Table 1. Peak pressures wearing canvas shoes and the MPO Active 2000 splint.

	Forefoot	Heel
Canvas shoes	296.0KPa (± 69)	269.3KPa (± 47.7)
MPO Active 2000 splint	287.3KPa (± 101)	224.0KPa (± 39)
p	0.79	<0.01

casts have also been shown to reduce plantar pressures and they also allow ambulation. Lavery, Vela and Fleischli⁹ reported a 33 per cent reduction in heel pressure with the use of total contact casts compared to canvas shoes in neuropathic subjects with diabetes who are known to have higher plantar pressures. This is greater than the amount reported here.

Total contact casting may have some disadvantages where bed rest is concerned. It may not be appropriate for patients with peripheral vascular disease due to the danger of new pressure sites developing from the cast. As peripheral vascular disease is often a key aetiological component of pressure ulcers, the MPO Active 2000 splint may be more appropriate than the total contact cast for pressure relief.

No information is yet available on the durability of the MPO Active 2000 splint when used for prolonged ambulation. In practical terms, the advantage of the MPO Active 2000 splint is its dual use, for ambulatory pressure relief as well as being very appropriate and easy to apply for bed rest heel pressure relief.

This study could be seen as limited in that the subjects were

healthy undergraduate students with a mean body weight of 67.8kg and were not necessarily representative of the population that would develop ulcers under the heel. It could be speculated that other groups with different pathologies might experience different amounts of pressure relief compared to the population studied here. Further research in those groups that could benefit from the MPO Active 2000 splint is needed.

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