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Orthopaedic patients are at high risk of developing pressure damage (Wilson, 2002). Following a national orthopaedic prevalence audit carried out by the All Wales Tissue Viability Nurse Forum in 2007, a pressure ulcer prevalence of 15% was identified in the Trust (unpublished observations). The clinical areas of highest prevalence were identified as elective surgery and trauma admission wards. The research identified that patients were most susceptible to pressure damage on their sacral and heel region on the trauma admissions ward, with the heel region only being affected in the elective orthopaedic surgery ward. Following analysis of the audit data, it was identified that these two orthopaedic settings required different approaches in order to address the high pressure ulcer prevalence.

This article discusses the use of a foot protector (Repose® Foot Protector) as an intervention in managing the risk of pressure damage to heels in the elective orthopaedic surgery ward.

A literature review was conducted in order to identify the evidence for the practice of preventing heel pressure damage through using foot protection devices. The review sought to answer the question: how effective were different support surfaces and devices in preventing pressure ulcers on the heel? Following the review the Repose Foot Protector was evaluated over a six-month period on the elective orthopaedic surgery ward to assess its impact on reducing heel pressure ulcer formation in those undergoing

surgery. In a subsequent article, the audit data looking at pressure ulcer prevention strategies on the trauma admissions ward will be considered.

Literature review criteria

The search words used were based on a systematic review, entitled 'Pressure relieving devices for the prevention of pressure ulcers on the heel' (Scanlon and Stubbs, 2005). The search included the terms: pressure, heels, foot, devices, prevention, decubitus ulcers and pressure sores. MEDLINE, CINAHL, OVID and EMBASE were searched, as well as wound journals and conference proceedings from the European Pressure Ulcer Advisory Panel (EPUAP), European Wound Management Association and the Tissue Viability Society. In total 308 studies were identified, of which 297 were deemed irrelevant and excluded, and four relevant studies were unobtainable. The remaining seven studies met the prerequisite criteria and were included in the review.

Although there is a considerable wealth of literature regarding the effect of pressure relief support surfaces, such as mattresses (Scanlon and Stubbs, 2005), some were excluded as they were not specifically concerned with demonstrating the prevention of heel damage. Therefore, the review focused on articles that specifically aimed to reduce heel pressure damage by using a pressure-limiting device. The devices evaluated in the literature included different wound dressings (Zernike, 1994; Zernike, 1997; Bots et al, 2004; Nakagami et al, 2006), standard hospital pillows (Tymec et al, 1997), and specifically designed devices to off load pressure from the heel, such as: Eggcrate Foam (Zernike, 1994; Zernike, 1997), Foam Splint® (Zernike, 1994), Protector Boot® (Zernike, 1994), Bunny Boot®, Foot Waffle® (Tymec, 1997) and Repose Foot Protector (Price et al, 1999; Macfarlane and Sayer, 2006).

Literature review findings

The review identified that although the development of hospital-acquired heel pressure ulcers are a growing problem, they continue to remain under-researched (Halfens and Haalboom, 2001; Donnelly, 2001; Cullum et al, 2004; Scanlon and Stubbs, 2005). Additionally, although EPUAP and the National Institute of Health and Clinical Excellence provide general guidance in the prevention of pressure damage, there is no specific national guidance available regarding best practice in the prevention of pres-

ABSTRACT

An evaluation of the Repose® heel pressure ulcer prevention system was conducted in an orthopaedic setting to establish its clinical efficacy in reducing the incidence of heel pressure damage, following a literature review of appropriate pressure-reducing devices. The study involved patients from a 24-bed orthopaedic ward over a six-month period. The results showed that the use of the heel protector led to a significant reduction in the incidence of heel pressure ulceration from more than 6% to 0%. A significant reduction in cost was also identified. The results indicate that the use of a heel protector alongside individualized pressure ulcer prevention has a significant impact on preventing heel pressure damage.

KEY WORDS

Pressure ulcer reduction ♦ Pressure damage ♦ Prevention ♦ Orthopaedic ♦ Cost effectiveness

sure damage to the heel. The literature demonstrates that while pressure ulcers adversely affect the health and well being of vulnerable people in all types of health-care settings, certain groups of patients appear to be at increased risk. High-risk groups include older people and those who are ill or immobile, such as orthopaedic patients.

The shape of the foot makes heel ulceration difficult to manage; it has little fatty tissue to act as a cushion or protection from pressure, shear or friction over the calcaneum. Therefore, tissue damage occurs rapidly due to reduced mobility, sensory impairment and sedation (Wheeler, 1997). Thus, the heel can be identified as an area at high risk of pressure damage, with the potential to cause physical, social and psychological suffering (Versluisen, 1985; Young and Dobrzanski, 1992; Rintala, 1995; Tortu et al, 1997; Sprigel, 1990; Hopkins et al, 2005).

The literature search suggested that devices which remove pressure from the heel area are more effective in reducing pressure ulceration than devices that partially redistribute pressure, for example, static and dynamic mattresses. This may appear obvious. However, to date the author could not find any published research that demonstrated that devices which remove pressure from the heel area are more effective in reducing pressure ulceration than devices that partially redistribute pressure. Therefore, it is not possible to state if devices designed to remove all pressure from the heel are any more effective than mattresses, which purport to redistribute pressure. This article, therefore, seeks to provide supporting evidence of the pressure ulcer reducing effect of heel protectors.

Generally, within the clinical practice environment, practitioners endeavour to reduce pressure damage to the heel in two favoured ways:

- ♦Off-loading. This involves completely removing pressure from the heel, this can be achieved using devices such as pillows or leg splints
- ♦Provision of a support surface. This aims to reduce the amount of pressure sustained by the heel. It works on the principle that the area of contact the body has with the support surface is increased, thus reducing the magnitude of the interface pressure. There are many different types of support surfaces available, for example, foam, air-filled, gel-filled and air-particulate suspension/air-fluidized. This article, however, is only concerned in evaluating the effectiveness of Repose Foot Protectors.

Method

The intervention

Over an initial period of six months, all elective orthopaedic surgery patients from a 24-bed orthopaedic ward who underwent a knee or total hip replacement, were included in the evaluation of an inflatable pressure relieving foot protector. Frontier Medical supplied 10 pairs of Repose Foot Protectors for evaluation purposes.

The pressure-relieving properties of the product are achieved as the heel is supported above an air cushion resulting in close to zero pressure. The malleolar region is protected from pressure damage by the integrated com-

partments of the Repose Foot Protector, which are filled with air. The foot protector is made of thermoplastic polyurethane material, that can stretch and has vapour-permeable properties which reduce the risk of maceration (Wilson, 2002). It is constructed using a single air cell which is inflated using a hand pump with 'smart valve' technology which automatically closes when the internal pressure reaches 0.2psi. The Repose Foot Protector provides pressure redistribution across the whole area in contact with the device, this minimises deformation of underlying tissue, and reduces the risk of hypoxia and tissue damage.

Although there are many products available on the market for protection of the heel, the Repose Foot Protector was chosen due to being easy to use, not being a single patient use item, ease of cleaning, and in small study groups has demonstrated effectiveness in the prevention of pressure ulcers (Price et al, 1999; Macfarlane and Sayer, 2006). During the six month evaluation period the effectiveness of the Repose Foot Protector on every patient ($n = 501$) was monitored and documented to measure the incidence of heel pressure ulcer development (Figure 1). A protocol was developed alongside this evaluation and effectiveness was measured by the reduction in heel pressure ulcer incidence and ease of use.

Elective orthopaedic surgery intervention

To assess the success of using the Repose Foot Protector a baseline heel pressure ulcer incidence needed to be ascertained. Prior to the study it was identified that the overall incidence rate of heel pressure ulcer damage was 6% (Figure 1) (ABM University NHS Trust, unpublished observations).

Prior to the introduction of the Repose Foot Protectors the standard practice for all patients at risk of pressure damage, was either foot padding, using pads/wool and bandages to reduce friction and shearing—or film dressings applied to the heel region to reduce friction. Standard practice also included regular skin inspection and air-alternating mattress provision following a risk assessment using the Waterlow risk assessment tool. However, when the incident rate of 6% was considered, this standard practice did not demonstrate effective prevention of pressure damage to the heel for this patient group, and there was no consistency

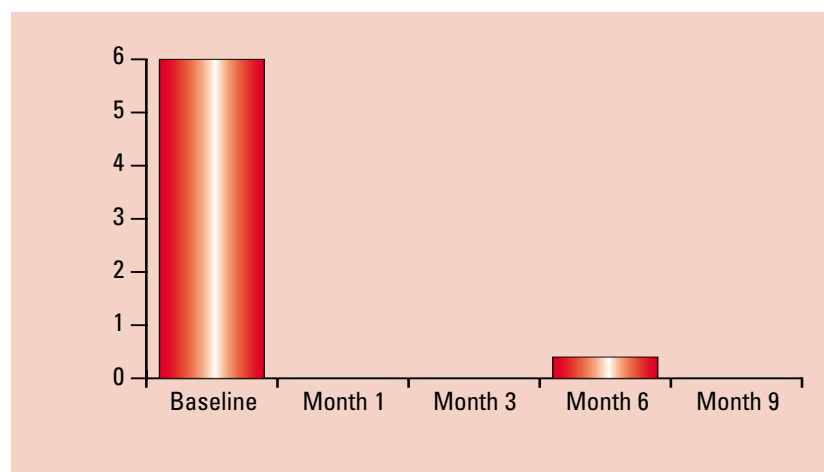


Figure 1. Reduction in incidence of pressure damage.

'There was a significant reduction in incidence rates of heel pressure ulcer formation from 6% to zero'

transfer to theatre, placed on them peri-operatively and kept in place for 72 hours post operatively. During this period the patients were on bed rest. The patients' details and skin assessments were recorded on the evaluation form. No patients were discharged from the ward with foot protectors.

The study included all orthopaedic patients who underwent lower limb, hip or knee surgery who were at risk of pressure damage. The only exclusion criteria were those patients deemed as being at such a risk they would require an alternating air mattress to reduce their pressure damage risk to the whole body. This criteria was decided as it was believed by the team that if the air mattress and the foot protector were used in conjunction, it would be impossible to identify which was the effective method in preventing pressure damage to the heel. This exclusion criterion resulted in one patient being excluded and consequently an air mattress with an integrated heel guard (Huntleigh Healthcare) was issued to them.

Before the experimental intervention commenced, all ward staff were given training in how to use and clean the product and how to complete the evaluation form. The standard practice of Waterlow risk assessment, daily skin inspections and the repositioning regime continued as normal.

Results

During the evaluation period there was a significant reduction in the incidence of heel pressure ulceration from more than 6% to 0%. An audit of this intervention three months after the study period revealed that the incidence of heel pressure damage had remained at zero (*Figure 1*). Interestingly, at six months, one patient who did not have a foot protector issued, due to lack of resources, developed heel pressure damage.

Cost benefits

This study has identified the clinical effectiveness of the intervention and analysed the potential cost effectiveness for the Trust in terms of clinical impact. *Table 1* shows the cost of the standard practice prior to the intervention, excluding the cost of air mattresses, which if included would have made this cost significantly higher. The cost of the intervention (purchasing of foot protectors), demonstrated a significant annual cost saving (£2092). If the projected costs of treating heel pressure damage and the costs to the patient are also considered, the benefits are even greater.

The staff identified that the product was easy to use, with the main criticism being the storage of pumps and staining of the foot protectors from iodine skin-prep used during surgery. The surgical team welcomed the improved clinical outcome and started to request that patients in theatre had the foot protectors provided.

in which method was used across the clinical area.

During the study the foot protectors were allocated to patients on

Conclusion

The ward involved in the evaluation has now developed a protocol which uses Repose Foot Protectors as first-line prevention for heel pressure damage, for all patients undergoing elective knee or hip replacement.

By using foot protectors, alongside individualized pressure ulcer prevention care this study has shown a significant improvement in preventing pressure damage to patients at high-risk of developing heel pressure ulceration. The findings of this article support the work by (Macfarlane and Sayer, 2006), showing that this intervention is very effective in terms of clinical outcome and results in considerable cost savings.

BJCN

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Table 1. Cost pre- and post-intervention

Cost pre-intervention:	Cost post-intervention:
Film dressings and heel pads	Repose foot protector 72 hours post operation
£3010	£918
(2007–2008)	

Foot Protector

Indicated to minimise risk of pressure damage to heels



- A significant improvement in skin condition and comfort ($p < 0.0001$)⁽¹⁾
- Significant reduction in incidence of heel pressure ulceration by 17%⁽²⁾
- May be used in bed or with feet elevated, easily secured with stocking or light bandage
- Can be used with other dynamic or static support surfaces
- Reduces impact of pressure, friction and shear
- The use of Repose Foot Protector type devices are recommended in the new NPUAP-GPUAP Pressure Ulcer Prevention and Treatment Clinical Guidelines 2009 for treating heel ulcers.⁽³⁾

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