Pressure-reducing pads effectively prevent and reverse signs of category 1 pressure damage

Aaron Knowles, Richie Skinner, Steve Young, Sylvie Hampton

The strategic prevention of pressure damage is a key part of preventative care delivery when dealing with patients at increased risk of pressure ulceration. This article reports on the interim results of a four-week evaluation, which was carried out to determine the ability of KerraPro® Heel pressure-reducing pads to reduce pressure, prevent further damage and improve viability of damaged skin in patients with category 1 pressure damage. Its performance was also compared with the usual pressure-relieving product used. High frequency diagnostic ultrasound scans were performed at the start and completion of the evaluation to determine the condition of the damaged skin and to capture any subclinical changes, e.g. the development of oedema associated with inflammatory skin changes. Results in all five patients demonstrated that KerraPro Heel was effective at preventing deterioration and improving the skin condition of patients with category 1 pressure damage, and was more effective at resolving oedema over the course of the four-week evaluation than the usual pressure-preventing products.

KEYWORDS: Pressure ulcers ■ KerraPro® Heel pressure-reducing pads

Ongoing changes to the NHS (Department of Health [DH] 2010a–c) mean that clinicians responsible for the delivery of wound care need to reduce expenditure while meeting the increasing demand for the provision of quality care (DH 2010a–c). The high impact action (HIA), Your Skin Matters, identified no avoidable pressure ulcers in NHS care settings as a vital improvement to the quality of patient experience and cost-effectiveness (NHS Institute for Innovation and Improvement, 2010).

Treating pressure ulcers represents a significant cost to the health and social care system in the UK. They occur in any patient but are more likely in high-risk groups, such as the elderly, people who are obese, malnourished or have continence problems, and people with certain skin types. As the population is ageing and living longer, so are the number of nursing and care home residents with multiple comorbidities and other factors, such as immobility, which put them at increased risk of pressure ulceration.

It has been estimated that 20% of people in nursing and residential homes may be affected by pressure ulceration, although figures are difficult to obtain in this population, compared to between 4% and 10% of patients admitted to hospital, and 30% of the population in general (Clark et al, 2004).

Dealey et al (2012) determined that at 2011 prices the cost of healing a category 1 pressure ulcer was £1,214, with this figure reaching £14,108 for a category 4 ulcer (Table 1).

It is clear from these figures that the most obvious action in terms of both reducing costs and improving patient experience is to prevent pressure damage from occurring in the first place. A category 1 ulcer can cost more than £1,000 to resolve. Moreover, once the damage has occurred, the patient is quickly put at risk of developing complications that delay healing and send costs spiralling. The presence of pressure ulcers has been associated with an increased risk of secondary infection (Bo et al, 2003); an ulcer that develops cellulitis adds between £1,380 and £3,722 to costs of care, while osteomyelitis can add £30,000 per episode (Dealey et al, 2012).

Against this backdrop, successful outcomes require a strategic approach to preventative care delivery built on evidence-based practice that includes the use of pressure-reducing products, along with risk assessment, mobilisation, repositioning, nutritional and skin assessment (Costa, 2013). These are high-sensitivity areas of care, where professional input can determine the risk of developing pressure ulcers. Although the earliest phases of pressure ulcer development may show no outwardly visible signs of damage, they can develop quickly, sometimes within the hour and, in vulnerable groups, progress can be life-threatening (National Institute for Health and Clinical Excellence [NICE], 2005; Costa, 2013).

KerraPro® Pressure Reducing Pads (Crawford Healthcare; Knutsford) can be used to dissipate pressure and protect intact or recently healed skin from pressure damage. The pads are available in a range of shapes and thicknesses to protect skin over bony prominences.
which is vulnerable to pressure damage. As they can be washed with soap and water, they can be reused on the same patient for as long as required, making them cost-effective as part of a holistic care plan to prevent pressure ulceration.

EVALUATION

This article describes the interim results of a four-week evaluation of KerraPro Heel pressure-reducing pads (Figure 1), which was carried out on five care home residents, with category 1 pressure damage to the heel, to:

- Determine the pad’s ability to reduce pressure
- Prevent further pressure damage
- Improve viability of damaged skin.

In addition, the performance of KerraPro Heel pressure-reducing pads was compared with the pressure-relieving product usually used.

METHODS

The patients who were recruited had a Waterlow score of 15 or more (http://www.judy-waterlow.co.uk/downloads/Waterlow%20Score%20Card-front.pdf), no greater than category 1 pressure damage to the heel(s) (Table 1), no signs of infection and were able to give informed consent to participate in the evaluation.

Once enrolled, subjects were assessed and their most damaged heel was treated for four weeks with a KerraPro Heel pressure-reducing pad (the same pad was used throughout the four-week evaluation, being washed, dried and reused), while the other heel was treated with usual pressure relief.

Skin condition was assessed on enrolment, then once a week to check for improvement/deterioration in skin integrity and the presence of erythema and/or palpable oedema, and to ensure that the products were being used and positioned correctly.

High frequency diagnostic ultrasound scans were performed at the start and completion of the evaluation (at the end of week four) to determine the condition of the damaged skin and capture any subclinical changes, such as the development of oedema (observed as red pixellation) as a result of inflammatory processes relating to category 1 pressure damage, and to detect any subsequent improvement/deterioration of tissue.

In addition to imaging of the damaged area, ultrasound scans of undamaged normal skin adjacent to the site of injury were performed to act as a control (Figure 2) and give a measure of how far from normal the tissues were at the start of the evaluation and how they had progressed back towards the uninjured state as the study advanced.

Each scan was analysed using a form of pixel distribution analysis, where pixels below a certain intensity were classed as low echogenic pixels (LEP). The ratio of LEP to total pixel count (TP; LEP:TP) reflected changes in dermal water content as a proxy for determining inflammation levels in the dermis, enabling

| Table 1: Categories of pressure ulcer (EPUAP and NPUAP, 2009) |
|------------------------|-------------------------------------------------------------|
| Category 1             | Intact skin with non-blanchable redness of a localised area usually over a bony prominence. Darkly pigmented skin may not have visible blanching, its colour may differ from the surrounding area. The area may be painful, firm, soft, warmer or cooler as compared to adjacent tissue. Category I may be difficult to detect in individuals with dark skin tones. May indicate ‘at-risk’ persons. |
| Category 2             | Partial thickness loss of dermis presenting as a shallow open ulcer with a red pink wound bed, without slough. May also present as an intact or open/ruptured ulcer/filled or serosanguinous filled blister. Presents as a shiny or dry shallow ulcer without slough or bruising*. This category should not be used to describe skin tears, tape burns, incontinence-associated dermatitis, maceration or excoriation. *Bruising indicates deep tissue injury. |
| Category 3             | Full thickness tissue loss. Subcutaneous fat may be visible but bone, tendon or muscle are not exposed. Slough may be present but does not obscure the depth of tissue. May include undermining and tunneling. The depth of a Category/Stage III pressure ulcer varies by anatomical location. The bridge of the nose, ear, occiput and malleolus do not have (adipose) subcutaneous tissue and Category/Stage III ulcers can be shallow. In contrast, areas of significant adiposity can develop extremely deep Category/Stage III pressure ulcers. Bone/tendon is not visible or directly palpable. |
| Category 4             | Full thickness tissue loss. Subcutaneous fat may be visible but bone, tendon or muscle are not exposed. Slough may be present but does not obscure the depth of tissue. May include undermining and tunneling. The depth of a Category/Stage III pressure ulcer varies by anatomical location. The bridge of the nose, ear, occiput and malleolus do not have (adipose) subcutaneous tissue and Category/Stage III ulcers can be shallow. In contrast, areas of significant adiposity can develop extremely deep Category/Stage III pressure ulcers. Bone/tendon is not visible or directly palpable. |
oedema present in damaged tissue to be measured (Gniadecka, 1996; Gniadecka and Quistorff, 1996). The Episcan scanner (Longport International Ltd, Reading) operating at a frequency of 15MHz gave an axial resolution of 65um.

RESULTS

This article presents the interim results for the first cohort of patients completing the four-week evaluation (n=5). At baseline, ultrasound scans of all heels with category 1 pressure damage revealed the presence of oedema, seen as a large amount of red pixellation, compared with the large amount of blue pixellation observed in the normal skin control scans. After four weeks of treatment with KerraPro Heel, the damaged heels of all five patients showed improvement and a return to a near normal tissue state.

Patient 1: MF
For patient MF, the injured tissue on the right heel on day 0 revealed a large number of red pixels on scanning, indicating the presence of oedema (Figure 3b). After four weeks of treatment with KerraPro, the skin had returned to normal (Figure 3c). These findings were also observed on the left heel (Figures 4b,c) that was protected using Aderma dermal pads (Smith & Nephew, Hull), but were not as pronounced as on the right. LEP:TP ratios revealed that on day 0 the injury to the right, treatment heel (KerraPro) was worse...
than the left heel (Figure 5). Despite this, after four weeks of treatment the LEP:TP ratio had returned to that of the normal tissue, while the left heel moved towards the normal state at a slower rate.

Patient 2: SH
Patient SH had a large degree of oedema present at day 0 on the right heel (red pixels) (Figure 6b), which returned to a normal state following four weeks of treatment with KerraPro (Figure 6c). As dictated by the protocol, the control (left) heel was left unpadded and continued with the standard treatment regimen of repositioning. Over time, a reduction of oedema was seen, but not as dramatically as with the treatment heel (Figure 7). These findings are supported by the LEP:TP ratio (Figure 8), which showed a return to normal with KerraPro treatment over four weeks, while the left heel remained oedematous and did not show much improvement from the start to the end of the evaluation.

Patient 3: BN
Patient BN had an elevated number of red pixels at day 0, indicating the presence of oedema (Figure 9b). After four weeks of treatment with KerraPro, the skin condition was uninjured (Figure 9c). These findings were the same on the left heel which was also managed using KerraPro Heel (Figures 10b, c). LEP:TP ratios (Figure 11) revealed that oedema was worse in the right heel at day 0. However, by the end of the evaluation, both heels had returned to a normal tissue state.

Patient 4: DH
Patient DH had an elevated number of red pixels at day 0, indicating the presence of oedema (Figure 12b). After four weeks of treatment with KerraPro Heel, the skin condition had returned to an uninjured state (Figure 12c). These findings were the same on the left heel also treated with KerraPro Heel (Figure 13b, c). LEP:TP ratios (Figure 14) revealed that oedema was worse in the right heel at day 0, but by the end of the evaluation both heels had returned to a ratio beneath the normal tissue state, indicating the presence of subclinical oedema beyond the heel site at the start of the evaluation.
Patient 5: EW
Patient EW had an elevated number of red pixels at day 0, indicating the presence of oedema (Figure 15b). After four weeks of treatment with an unspecified pad, the skin remained oedematous (Figure 15c). Conversely, on the left heel (Figure 16b, c) which was treated with KerraPro Heel, the oedematous tissue seen on day 0 resolved after four weeks. LEP:TP ratios (Figure 17) revealed that oedema was similar in both heels at day 0. However, by the end of the evaluation, the heel treated with KerraPro Heel had seen a dramatic reduction in oedema levels to below the normal tissue level, whereas the right heel showed no reduction and a slight worsening of oedema over time.

CONCLUSIONS
The interim results of this 15-patient evaluation into the effectiveness of KerraPro Heel pressure-reducing pads at preventing deterioration and promoting improvement in skin condition of patients with category 1 pressure damage to the heel, indicate that KerraPro Heel pressure reducing pads effectively prevent pressure damage, while having a positive effect on tissue recovery.

This was demonstrated by the decrease in oedematous tissue over time and a restoration to normal uninjured skin, LEP:TP ratios for the five patients confirmed that KerraPro Heel pressure-reducing pad was more effective at resolving oedema over the course of the four-week evaluation, compared with the usual treatment given (Aderma, n=1; No pad, n=1; Unnamed pad, n=1; KerraPro, n=2); findings which were reflected in the comparative ultrasound scans (Figures 3–17).

The use of ultrasound was helpful in detecting the sub-clinical skin changes that occur in the earliest phases of pressure damage.
ulcer development, and also confirmed clinical assessment based on erythema intensity, nature (blanching/non-blanching) palpable oedema and sensitivity/pain, as well as the subjects’ position and heel condition (e.g. atrophy of heel pad, skin presentation, vascular or venous signs).

Furthermore, using one pad per patient for the duration of the study demonstrated cost-effectiveness, compared with the usual interventions, where more frequent replacements are needed. In this evaluation, it was found that the other pads used tended to last between five and 14 days before starting to split, thus reducing their effectiveness and potentially causing high pressure areas. Similar outcomes in the remaining 10 patients will strengthen the significance of these findings.

However, the findings from this interim report show that KerraPro is a cost and clinically-effective pressure-reducing product that can be used in a care home setting to reduce the development of preventable pressure ulceration.

REFERENCES


Figure 14. Bar chart showing change in heel LEP:TP ratio over 28-day period in patient DH.

Figure 15. (From left to right) a. Normal uninjured skin (right heel); b. injured skin (right heel), day 0 (other pad); c. injured skin (right heel) treated with other pad, day 28.

Figure 16. (From left to right) a. Normal uninjured skin (left heel); b. injured skin (left heel), day 0; c. injured skin (left heel) treated with KerraPro Heel, day 28.

Figure 17. Bar chart showing change in heel LEP:TP ratio over 28-day period in patient EW.