The role of innovation in heel pressure ulcer prevention

KEY WORDS
- Pressure ulcer prevention
- Pressure-redistribution
- Product design

The scale and the cost of pressure ulcers (PUs) means that prevention has become a key quality of care indicator in the UK, with a zero tolerance approach adopted by the NHS. This places increased pressures on clinicians to implement PU prevention strategies that aim to reduce the number of avoidable PUs. However the provision of high-quality care is often challenged by financial and time constraints, as well as access to and selection of the right pressure-redistributing equipment. The recent recommendations for PU prevention from NICE (2014a) include methods for identification and risk assessment and the appropriate preventative measures that should be applied. Innovation in product design, along with the adoption of standard protocols, can play a key role in helping clinicians deliver these recommendations, ensuring high standards of care.

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DECLARATION
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Pressure ulcers (PUs) represent a major economic burden to healthcare facilities and, over the past 20 years, a strong emphasis has been placed on early detection and prevention (Gunningberg et al, 2011). The financial pressures on healthcare providers is significant with data from a range of healthcare settings indicating a prevalence rate of PUs from 4.7% to 32.1% for hospital populations, 4.4% to 33.0% for community-care populations, and 4.6% to 20.7% for nursing-home populations (Reddy, 2011). Further data show that between 4–10% of patients will develop a PU following admission to hospital (RCN, 2005).

The UK is estimated to spend 4% of the annual national healthcare budget on prevention and treatment of PUs (Clark, 2007). Dealey et al (2012) reported the daily costs of treating a PU to range from £43 to £374; these costs are in addition to the cost of standard of care. The development of a PU can increase the inpatient length of stay of between 5–8 days per PU (Dealey et al, 2012). PUs also have a significant impact on patient quality of life and morbidity (Wounds UK, 2013).

CAN PRESSURE ULCERS BE AVOIDED?

Anecdotally, 95% of PUs have been quoted as being avoidable with appropriate intervention, and there has been a belief that the majority of hospital-acquired PUs can, and should be prevented. This definition recognises that there are certain circumstances and clinical conditions that may result in the unavoidable development of a PU (Guy et al, 2013). It also recognises that there are certain accepted preventative strategies that need to be in place to prevent a PU occurring. However, a recent publication by Downie et al in 2012 presented the results from five UK acute hospitals who collectively pooled data on hospital-acquired Category III and IV PUs. Analysis revealed that 43% of Category III PUs and 50% of Category IV PUs were avoidable, much lower than the 95% previously reported (Downie, 2012). Improvements in the reporting, documentation, and investigation of pressure damage can make the process of determining PU avoidability more accurate. In addition, evaluation of preventative strategies is needed to clearly show whether the development of a PU, despite the use of certain interventions, is unavoidable.

DRIVERS FOR PREVENTION

PU prevention and patient safety have become a key objective within the UK where the NHS has adopted a zero tolerance approach. The Harm Free Care initiative in England (www.harmfreecare.org) focuses on providing harm-free care to all patients and includes prevention of PUs as one of its main four areas of focus.

The National Safety Thermometer records the prevalence of PUs on a monthly basis and data suggest that a 30–50% reduction in prevalence should be achievable (Delivering the NHS Safety Thermometer, 2012). Similarly, the Scottish Patient Safety Programme (SPSP) was launched in January 2008 to reduce avoidable harm to patients in NHSScotland by improving the safety of patient care at all points of delivery. In 2012, PU prevention became a key priority area with an aim "to reduce harm from a PU by reliable delivery of risk assessment and evidence-based interventions"(www.scottishpatientsafetyprogramme.scot.nhs.uk). In Wales, the 1000 Lives Plus campaign aims to improve patient safety and increase healthcare quality with a reduction in PUs a key priority (1000 Lives Plus, 2013). In Northern Ireland, the Patient Safety Forum and the Public Health Agency are working closely with healthcare trusts to offer advice and a PU prevention programme (Public Health Agency, 2012).

The CPR for Diabetic Foot Ulcer initiative (Check, Protect, Refer), recently introduced in Scotland, aims to achieve the same outcome and reduce the occurrence of new foot ulcers for patients with diabetes, while in hospital. A national audit conducted in November 2013 of 1,048 in-patients with diabetes in 12 out of the 14 Health Boards across Scotland revealed that 2.4% of inpatients with diabetes developed a new foot ulcer while in hospital. It also highlighted 57% of patients had not had their feet checked, and 60% of patients at risk of developing a foot ulcer had no pressure relief in place (Stang and Leese, 2014).

The length of stay for a patent with a diabetic foot ulcer is on average 13 days longer than a patient without one, at an average cost of £650 per bed day place. From this it was calculated that if the 226 patients in the national audit who had no pressure relief in place, had received appropriate pressure relief, at a maximum cost of £100 per patient, the saving would have been £180,200 per 1000 patients (assuming it is possible to prevent all new ulcers from developing). Even assuming a 75% success rate, the cost saving by carrying out effective prevention would be £135,150 per 1000 patients (Stang and Leese, 2014). Diabetes UK is currently looking at adopting 'CPR' for diabetic feet as their inpatient campaign for 2016.

The National Institute for Health and Care Excellence (NICE) published a costing statement on PUs in April 2014 that considers the cost implications of implementing the recommendations made in the latest PU prevention and management guidelines (NICE, 2014a; 2014b). Organisations are advised to assess patients for PU risk on admission to hospital or care homes and other NHS settings. Recommendations include frequency of repositioning and the use of high specification foam mattresses and other equipment to help reduce hospital length of stay, nurse time and daily costs of treating PUs (NICE, 2014a).

NICE suggest that the use of successful prevention strategies and comprehensive clinical guidelines, the prevalence of PUs, and the subsequent cost to the healthcare service could be greatly reduced. There is a strong economic case for improving selection and use of pressure-redistributing devices to address the challenges for improved patient care that is cost-effective. While pressure-redistributing surfaces are considerably more expensive than a standard hospital mattress, the cost of treatment is higher so their correct use can help reduce healthcare costs (NICE, 2014b).

ADOPTING PREVENTIVE STRATEGIES

Those at high risk or with early signs of pressure damage should be started on a PU prevention programme that includes pressure redistribution. The Harm Free initiative provides care bundles known as SKIN or SSKIN (*Box 1*) aimed at helping guide healthcare professionals on the strategies that should be employed to reduce the occurrence of PUs (Whitlock et al, 2011).

Box 1. SSKIN care bundle
Support surface Use an appropriate pressure redistribution support surface and reassess as the patient's needs change
Skin inspection Check entire skin regularly, with particular emphasis over bony prominences, and document in patient's healthcare records
Keep moving Implement a turn/reposition schedule and optimise/encourage independent movement. Refer to occupational therapist/physiotherapist when appropriate
Incontinence and moisture Ensure appropriate management of incontinence (urinary and faecal), perspiration or exudate in conjunction with a structured skin care programme to maintain skin integrity
Nutrition and hydration Encourage individuals to eat and drink regularly and assist patients when necessary. Refer to dietitian when appropriate

Prevention strategies that incorporate a SSKIN or similar care bundle should consider:

- The type of equipment required to redistribute and prevent tissue damage, based on individual patient needs.
- Skin integrity should be inspected daily in at risk individuals and an appropriate skin care regimen implemented to maintain skin health.
- A repositioning schedule should be used for patients at risk of PU development; this should include those who are bedridden and require help to move, as well as those who are able to reposition themselves and use seating (Berry, 2015).
- Incontinence and moisture can lead to skin breakdown requiring frequent cleansing and skin care to keep the skin clean and dry.
- The nutritional status and hydration of the patient must be assessed as studies have demonstrated a strong correlation between malnutrition and skin vulnerability to the effects of pressure (Coleman et al, 2013).

SELECTION AND USE OF PRESSURE-REDISTRIBUTING EQUIPMENT

One of the major risk factors for PU development is patient immobility, with either a reduction or complete loss of spontaneous movement. The heel is at particular risk due to its posterior prominence and lack of padding over the calcaneus, and is the second most common anatomical site for the development of ulcers (Black, 2012). Gefen found that the pressure on the fat pad of the heel when positioned at 90 degrees to the leg during bedrest is higher than when the foot is turned onto the side (Gefen, 2010).

An immobile patient can experience long periods of unrelieved pressure when confined to bed. This can lead to occlusion of blood and lymph vessels under the skin through compression, shear stress (distortion) and tensile stress (stretching of vessels), all of which reduce the blood flow and availability of oxygen and nutrition in the tissue and lead to hypoxia (Gefen, 2008; Bansal et al, 2005).

Furthermore, there is now a greater understanding of the impact temperature and humidity can have on the development of PUs (Yusuf et al, 2015). Small increases in temperature of as little as 1°C will raise the metabolic rate of cells and induce a sweat response (Phillips, 2014) at a time when hypoxia is occurring and blood flow is reduced. The increased sweat results in excess moisture which can weaken skin and make it more vulnerable to skin breakdown. Conversely if the temperature falls below 36°C, there is reduced blood flow to the skin, increasing the risk of pressure damage (Clark et al, 2010). The use of an effective pressure redistribution device can alleviate these factors and prevent the formation of a PU.

The evidence base highlights the importance of using suitable support surfaces in patients at risk of a PU and for the treatment of an active ulcer. The Cochrane review of pressure-redistributing surfaces concluded that patients at high risk of developing a PU should receive a higher specification foam mattress rather than a standard hospital foam mattress (McInnes et al, 2015). An earlier systematic review of 49 randomised controlled trials by Reddy et al (2006) concluded that the use of a pressure-redistributing support surface was more beneficial than a standard mattress; Agostini and colleagues (2001) also presented evidence that specially designed support surfaces effectively prevent PU development.

NICE further supports these recommendations stating that all at-risk patients should have access to appropriate pressure redistributing surfaces and strategies 24 hours a day (NICE, 2014a). Furthermore they state a high specification foam mattress for adults with an existing PU and the use of a dynamic support surface should be considered.

Despite evidence and cost analysis showing pressure-redistributing devices can help prevent PUs, reduce the length of hospital stay and reduce healthcare costs, challenges remain around supply and demand of adequate pressure redistribution for all at-risk patients. Standardising the availability and use of suitable equipment can help to overcome these challenges.

HOW CAN INNOVATION HELP?

Prolevo (Medicare Innovations) is an range of pressure redistribution products for use in the prevention or treatment of pressure-related injuries. These products have been designed in collaboration with podiatrists, tissue viability nurses and infection control specialists and are intended specifically to prevent avoidable PUs of the heel and plantar surface. The products can be wiped clean and the materials used in the design ensure excess moisture is controlled.

The range includes products specifically designed for prophylactic use and for use in patients with active

foot ulceration. Each device within the range has been developed to ensure that, following patient assessment, the correct product can be used at all times according to the patient's needs using a simple algorithm (*Figure 1*).

Heel ulcer prevention

The HeelSafe over-mattress pressure redistribution pad can be used to reduce interface pressures on the heel and ankle areas for patients at risk of bed-related heel PUs, including patients with conditions such as diabetes or vascular impairment. These inflatable pads can be strapped to the existing hospital mattress. This allows ambulatory patients to get in and out of bed without nursing assistance and avoids the need for heel prevention boots/devices, which need to be removed each time a patient gets out of bed. This can also help to eliminate the risk of falls, and maximise patient mobility and concordance.

For non-ambulatory patients, the FootSafe prevention boot can be used in those at high risk of developing a heel ulcer. This can be easily adjusted and has an inspection gate for skin assessment. For those not able to tolerate wearing heel prevention boots/fixed devices, the HeelSafe over-mattress pad can also be used for non-ambulatory at-risk patients.

Plantar surface pressure damage prevention

Often plantar surface injuries occur in patients confined to bed where they have slipped down and their feet are pressing against the footboard. The SoleSafe bed end pressure redistribution pad is an inflatable pad that can attached to the footboard, providing protection to the soles of the feet. The SoleSafe pad can be used in combination with the HeelSafe overlay for maximum protection.

Treatment of active ulceration

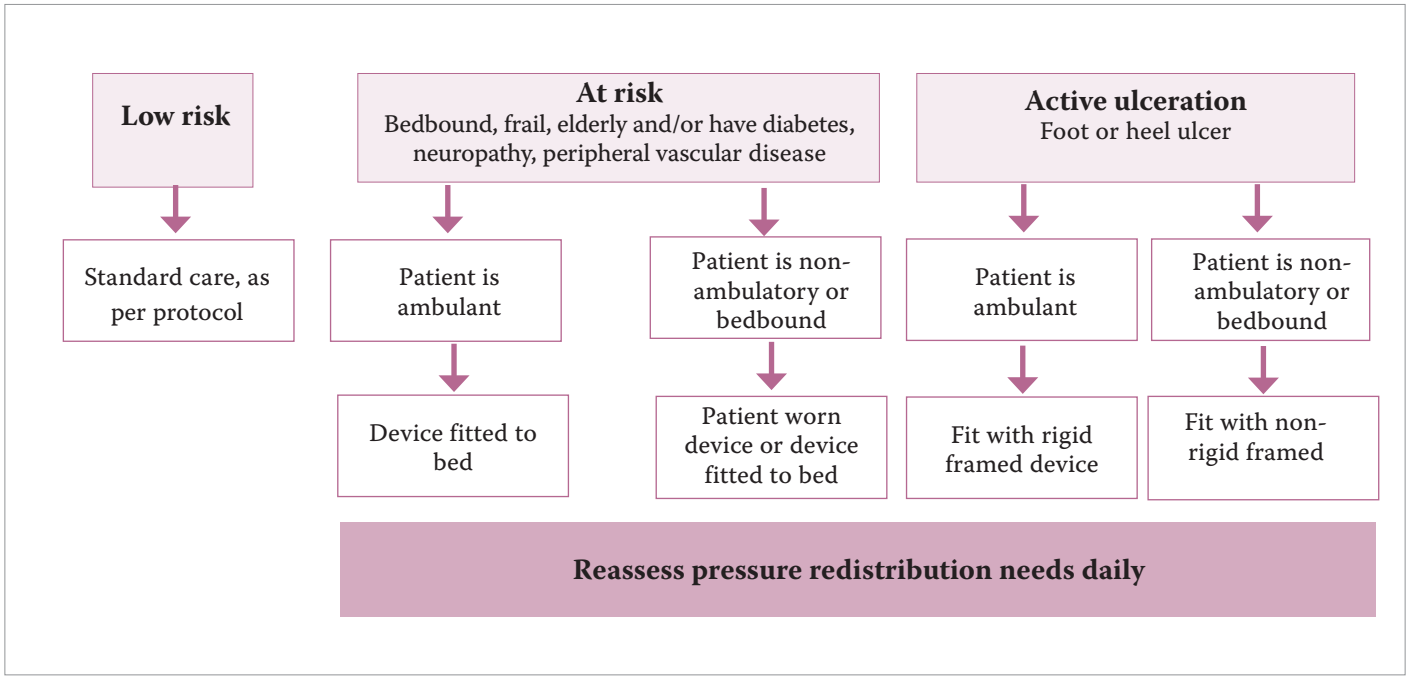
For patients with an active ulcer, the use of the FootSafe protection boot can be considered for non-ambulatory patients. A rigid frame device (e.g. Ambulatory Pressure Relief Boot, Talarmade) is more suitable for ambulatory patients.

Simplicity by design

All products incorporate simple design features including:

- Pressure limitation valve to ensure correct amount of inflation (20mmHg)
- High radiofrequency welded seams for improved infection control and strength
- Inflatable core cell and all straps and button fastenings manufactured in antimicrobial-impregnated polyurethane, allowing the products to

Figure 1. Algorithm for selecting he most appropriate pressure redistribution device according to whether the patient is at risk or has an active ulcer and taking into account whether they are ambulatory or non-ambulatory.



be cleaned and used for multiple patients

- Straps and button fastenings are adjustable for secure fixation. Straps can be replaced if worn
- Replaceable covers are made from Dartex Care 420 — a highly durable, fourway stretch material that can withstand hospital cleaning and disinfection.

Evidence for use

Independent testing of the HeelSafe and SoleSafe products has shown effective reduction in heel and plantar pressures at all body weights tested. The optimum inflation pressure was 20 mmHg across all body weights, meaning that weight does not need to be considered prior to inflating the product and placing under the patient. In addition, there were no adverse effects on skin microclimate (temperature and humidity at the skin-support surface interface), with heat and water vapour transfer rates within expected norms (Medicare Innovations, data on file).

USING THE PROVELO RANGE IN PRACTICE

The Prolevo range was introduced for heel PU prevention and treatment as part of the CPR campaign in two hospitals in Scotland. This has facilitated decision-making by clinicians for the selection of appropriate devices based on individual patient needs using a simple algorithm (*Figure 1*).

Impact on PU prevention

Standardising product selection and highlighting the importance of PU prevention strategies at a ward level, has encouraged the use of the pressure redistributing devices and reduced confusion about which product to select and when.

All products can be easily stored, reducing the time to reach the patient, and cleaned/disinfected using local decontamination protocols for single or multiple-patient use. Training of clinicians in the use of the Prolevo range has been assisted by the manufacturer through a ward-based educational programme for heel PU prevention. When the roll-out of CPR is complete, the aim is to undertake a re-audit to evaluate the effectiveness of this campaign.

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