Can the use of dressing materials actually prevent pressure ulcers: presenting the evidence

In part one of this two-part series, the authors discussed the aetiology of pressure damage and how it develops. It was noted that despite widespread research into the field, pressure damage is still commonplace and the incidence and costs incurred can place a significant burden on healthcare resources. The authors questioned if a different approach should be investigated. In part two they examine the scientific evidence that supports the use of dressing materials in the prevention of pressure damage and conclude that there may already be tools available to facilitate this shift in preventative healthcare strategies.

Martyn Butcher, Geoffrey Thompson

KEY WORDS
Pressure
Shear
Research
Dressings
Evidence-based practice

Many different approaches to wound care have been adopted to prevent the development of pressure ulcers, and yet these wounds remain one of the most significant issues in healthcare today. One approach that has been largely overlooked is the potential benefit of wound dressings not to treat pressure damage, but to help prevent it in the first place.

In this article, the second in a two-part series investigating the aetiology, incidence and treatment of pressure ulcers, the authors undertook a literature search to identify if there are any published articles that refer to pressure ulcer prevention using wound dressings, and whether it can be used as an effective preventative treatment.

Martyn Butcher is an Independent Non-medical Prescriber and Independent Tissue Viability and Wound Care Consultant; Geoffrey Thompson is an Infection Prevention/Control Audit and Research Nurse, Worcestershire Acute Hospitals Trust NHS and an Independent Tissue Viability Nurse, Trustee member, Wound Care Alliance UK

Methodology

Electronic searches of bibliographic databases and internet sites (*Table 1*) were supplemented with manual searches of conference proceedings and journals relevant to wound management. This was not intended to be a systematic review — its role was to provide an overview of the evidence.

Pressure ulcer risk assessment and prevention programmes need to be introduced as a priority, as there is evidence to show that these can reduce the institutional incidence of pressure ulcers by as much as 60% (Bergstrom et al, 1995).

Pressure ulcers pose a serious risk to patients and represent a significant burden on the NHS. As such, they need to be considered in patient treatment regimens. Pressure ulcer risk assessment and prevention programmes need to be introduced as a priority, as there is evidence to show that these can reduce the institutional incidence of pressure ulcers by as much as 60% (Bergstrom et al, 1995).

A significant amount of research has been undertaken into pressure ulcer risk assessment and prevention, however, it is not the purpose of this article to review or critique this work. There has, though, recently been a focus on using advanced wound dressings to prevent the formation of pressure ulcers. A number of studies have looked at new and existing dressings in both the laboratory and clinical environment.

The evidence

In exploring the available evidence for dressing use in pressure ulcer prevention, it is important to differentiate between evidence that emanates from laboratory studies (*in vitro* – literally meaning 'in glass') and that which is derived from studies on human or animal subjects (*in vivo*, or 'in a living organism').

In vitro studies have the advantage of enabling the researcher to control the study environment and conditions, something difficult to achieve in the clinical setting. For example, dressing materials can be objectively tested for their mechanical properties without risk to study subjects, however, it is argued that such studies do not reflect the complex environment and conditions that occur within the clinical

setting. *In vitro* studies should, therefore, be seen as precursors to subsequent *in vivo* research.

The search revealed relatively few results that showed the use of dressings to prevent pressure damage. While comments on dressing use in pressure ulcer prevention were found (both with positive and negative results), the majority were subjective, unsubstantiated comments. Only those that presented results of research are presented. These invariably had positive outcomes.

Experimental evidence

In the laboratory, a variety of dressing materials have been evaluated for the prevention or minimisation of shear force and friction, all of which are major causes of pressure ulceration.

Ohura et al (2005) published a study that looked at the ability of various commonly available adhesive dressing materials to prevent shear forces. The products selected were a hydropolymer (Tielle™, Systagenix) a hydrofoam (Allevyn Adhesive™, Smith & Nephew) and a hydrocolloid (Duoderm CGF™, ConvaTec). A number of standardised tests were carried out on product samples to measure three causes of shear force — static friction, adhesion and shear transmissibility. The study demonstrated that the coefficients of static friction (the drag resistance between patients' clothing and the outer surface of the dressing) were 1.01, 0.72 and 0.48 for the hydropolymer, hydrofoam and hydrocolloid respectively.

Products were evaluated for adhesion using an industry-standard test in both dry and wet formats. The hydropolymer was withdrawn from this test as it displayed no adhesive qualities. The hydrofoam and hydrocolloid showed identical adhesive qualities when dry, but the hydrocolloid failed when wet (Ohura et al, 2005).

Transmissibility of shear testing was undertaken by measuring the ability of the dressing to deform when under force. The samples were compared with a control (a non-stretch tape). Due to its composition it was impossible to test the hydropolymer dressing in this experiment. When a 2 Newton pulling force was applied to the dressings, the hydrofoam demonstrated a 1 Newton reading compared with 2 Newtons for both the hydrocolloid and the control. This demonstrates that the hydrofoam was able to deform, preventing the transmission of force to the underlying structure (Ohura et al, 2005).

These laboratory results are backed up with clinical observations, although in the paper there are few indications as to how these were achieved. In clinical practice, Ohura et al (2005) identified that the hydrocolloid worked well in dry conditions, its low friction coefficient improving its overall performance. However, when the hydrocolloid was wet, adhesion was lost — this resulted in adhesion to undergarments and bedding, leakage of exudate, and faecal ingress. The hydropolymer did not perform well, with rucking and twisting of its central area. In addition, it had the highest friction coefficient and rapidly lost adhesion when wet. The hydrofoam, however, performed very well, demonstrating adhesion when both wet and dry, as well as good absorbency and low shear transmissibility.

In a more recent experimental study also headed by Ohura et al (2008), the researchers used a porcine skin model to measure the impact of external shear force and pressure on the superficial skin and subcutaneous layers covering an underlying bony prominence. The evaluation also aimed to verify how the influence of these external forces can be reduced after dressings are applied. Within the study, five dressing products in three groups were evaluated against a control (nil product). These were:

- Group 1: a hydrocellular foam (Allevyn Adhesive), and a hydropolymer (Tielle)
- Group 2: two polyurethane film products (Tegaderm™ [3M Health Care] and Opsite™ [Smith & Nephew])
- Group 3: a hydrocolloid (Duoderm CGF).

Table 1
Electronic data sources

Bibliographic databases:
MEDLINE (National Library of Medicine, Bethesda, USA)
EMBASE (Elsevier BV, Amsterdam, Netherlands)
CINAHL
Internet sites:
Cochrane Library
Wounds International

Measurements of pressure in the subcutaneous tissues and shear in the superficial and subcutaneous tissues were taken. The results showed that although all the dressing materials proved to be effective in reducing pressure and shear in the subcutaneous layer compared with the control, film dressings and hydrocolloid dressings were more effective than hydropolymer and hydrocellular dressings. It was also possible to demonstrate how shear is transmitted to the subcutaneous tissues. The authors concluded that reducing shear force and pressure would be clinically important when looking to reduce pressure ulcer formation (Ohura et al, 2008).

An experimental study by Ashford et al (2001) reported on the pressure-relieving properties of four wound dressings. This preliminary study was undertaken to assess the products' suitability to provide pressure relief in the management of foot ulcers.

In a laboratory, samples of Allevyn, Biatain™ (Coloplast), Lyofoam™ (Mölnlycke) and Tielle were subjected to dry and wet compression tests, shearing tests and a cyclical test. In the dry compression test, samples of all four dressings were subjected to a downward force (pressure) of known magnitude. The wet test involved undertaking the same process but with the dressings both saturated

and dampened with water. During the shear test, samples were exposed to measured lateral force until the dressing materials failed. In the cyclical test, each sample of dressing material was exposed to a maximum force of 500 Newtons, which was repeatedly applied and removed 1,000 times during the course of the test. The thickness of the materials was also compared before and after this 'stressing' (Ashford et al, 2001).

The results of the tests showed that all the dressings performed differently under different test conditions. Lyofoam was the dressing that deformed the most during compression testing, Allevyn and Tielle withstood the greatest shear deflection before failure, whereas Biatain withstood the greatest shear force. Overall, Allevyn was the most consistent performer. However, the authors pointed out that further *in vitro* studies need to be undertaken to substantiate these findings and, most importantly, that real-life clinical environments are very different from those found in a laboratory (Ashford et al, 2001).

Akimoto et al (2007) undertook an experimental study using a two-dimensional finite element mechanical analysis of a human model seated on a thin cushion pad with a range of hardness values (i.e. Young's modulus). The results showed that in all of the cushion pad models, the peak value of effective stress was less than that of the control model without a cushion pad.

Akimoto et al (2007) were also able to show that as cushion pad softness was increased, the measurements for stress distribution became more diffuse.

These results suggest that the use of a thin cushion pad is an effective way to prevent the development of pressure ulcers. Although not looking at dressings *per se*, these data could be applied to a similar effect for dressings of the same dimensions/structural components, particularly if combined with the findings of studies on adhesive products.

Anecdotal clinical evidence

For several years, the authors have observed nurses in various healthcare settings (e.g. acute, community hospitals, nursing homes, leg ulcer clinics) using proprietary film dressings to reduce friction in vulnerable areas, for example, over patients' external malleoli, hips or sacrum. Wound product manufacturers, and national or local healthcare institute wound formularies, i.e. *British National Formulary* (Royal Pharmaceutical Society of Great Britain and the BMJ Group, 2009), also include statements about the use of such dressings in attempting to reduce friction or shear. Nevertheless, such practices or formulary lists do not in themselves constitute a body of scientifically developed research and what little clinical 'evidence' exists should always be reviewed.

Miscellaneous pressure ulcer studies

Nasal bridge pressure ulcers can occur as a result of the use of nasal intermittent positive pressure ventilation (NIPPV), which can provide symptom control and improved quality of life for patients with acute and chronic respiratory failure. In a comparative clinical study undertaken by Callaghan and Trapp (1998), a control group (n=10) receiving NIPPV without protective dressings was compared to a group (n=10) using a hydrocolloid dressing (Granuflex™, ConvaTec), and another group (n=10) using a protective gel pad (Spenco Dermal™, Spenco).

The results demonstrated that 90% of the patients experienced skin deterioration when no protective dressing was used; 70% deteriorated when using the gel pad; but only 30% deterioration occurred with the hydrocolloid dressing. While the mechanisms of pressure damage associated with NIPPV use are more acute, the results do demonstrate the potential beneficial effects of short-term usage of dressings to prevent tissue damage (Callaghan and Trapp, 1998).

Heel pressure ulcer studies

Heel pressure ulcers have a high incidence and an increased risk of development when associated with various conditions, such as peripheral vascular disease and diabetes (Fowler et al, 2008).

Preventative measures, such as maintaining the patient in a semi-recumbent posture using a profiling bed with a knee gatch assembly, can reduce pressure on the heels. However, in most cases preventative measures are limited to simple pressure-relieving devices such as the Odstock Wedge (Invacare), which is placed behind the knees infilling the natural hollow in the popliteal space. This supports the underside of the thighs and calves, reducing the pressure under the heels without increasing pressure on the thighs and calves. Furthermore, by maintaining the patient in the semi-recumbent position, the support under the thighs reduces the tendency for the patient to slip down the bed, thereby reducing shearing forces on the sacrum.

The general consensus of opinion is that total heel off-loading, for example using pillows and specialist off-loading devices, is the only effective method of heel ulcer prevention (Cadue et al, 2008; Fowler et al, 2008).

However, the literature does indicate that dressings have been used to prevent heel pressure ulcers with a good deal of success. For example, Nakagami et al (2006) performed a clinical study on 30 elderly patients, which evaluated whether an ulcer-preventive dressing and a thin film dressing could reduce shear force on the heel. The results indicated that a dressing with a low-friction external surface could significantly reduce shear force ($P<.001$, Wilcoxon signed-rank test) (2.2 +/- 1.4 Newtons in the preventive dressing and 11.7 +/- 5.8 Newtons in the film dressing). However, results also suggested that these external dressings do not significantly reduce interface pressures and cannot be used as a substitute for heel elevation in an immobile patient (Nakagami et al, 2006).

More recently, the same investigators undertook an evaluation

of a semi-occlusive dressing containing ceramide 2 (one of the nine naturally occurring lipids found in the subcutaneous layer of the skin and marketed as the Remois Pad, Alcare Corp, Japan). The study featured 37 elderly patients at risk of pressure ulcer development. The findings demonstrated that no pressure ulcers occurred in either the intervention or control area (in the study, each bedridden patient had the product applied to one trochanteric region while the contralateral hip was used as the control). However, there was a significantly lower incidence of persistent erythema within the intervention area than the control area (P=0.007, RR 0.18 [95% CI: 0.05–0.73] and NNT 4.11 [2.50–11.63]). The authors concluded that this dressing was effective in preventing pressure ulcers in patients with highly prominent bones and dry skin (Nakagami et al, 2007).

In 2004, and following several years of investigations, Bots and Apotheker undertook a trial evaluating whether a self-adhesive hydropolymer dressing (Tielle, Systagenix) could reduce the incidence of heel damage. The study evaluated Tielle's effectiveness in preventing heel pressure ulcers in a wider surgical patient population (n=140). This demonstrated a reduction in heel pressure ulcer prevalence from 36.5–8.5% (a total reduction of 76.7%).

However, some technical problems were found with the dressing in this study (distortion and detachment), which necessitated the use of secondary cotton tubing. The authors considered it necessary to continue monitoring the effectiveness of the intervention (Bots and Apotheker, 2004).

A study carried out in an emergency department in eastern Australia (Sansom and Flynn, 2007) followed the progress of a group of patients (n=100) considered at risk of pressure ulcer development. Members of the group had a heel-shaped foam dressing (Allevyn Heel™, Smith & Nephew) applied prophylactically. A random selection of these patients (n=20) were followed-up two weeks later and none had gone on to develop pressure damage. Although uncontrolled, this study did indicate that the dressing has potential in pressure ulcer prevention and that clinicians are considering dressing products as a preventative intervention.

Another heel-shaped dressing study featuring Allevyn Heel was conducted in Spain (Torra i Bou et al, 2002). In this randomised controlled trial, 130 patients were assigned either to a standard care or preventative dressing group. Altogether, 111 patients completed the study, which demonstrated that 44% of patients in the control group exhibited pressure damage compared to 3.3% of patients in the intervention arm. This was considered highly significant (P=<0.001) and was said to prove that the use of this product was effective in reducing the incidence of pressure ulcers when compared with traditional prevention methods.

An early clinical study looked at the use of a film dressing (OpSite™) to prevent pressure ulcer formation in elderly orthopaedic patients (Hall, 1983). At first the results looked promising — in the test group, which was comprised of 18 patients on one ward, the film dressing was applied to all pressure points and resulted in a pressure ulcer incidence of 5.5%. In the control group, which comprised 16 patients on another ward, a higher number of patients (43.7%) developed pressure ulcers. However, closer evaluation of the data indicated that there were discrepancies between treatment regimens and quality of care between the two groups, which in all probability made significant contributions to the variations in pressure ulcer incidence (Hall, 1983).

Sacral pressure ulcer studies

In a recent clinical case study series, the use of an absorbent soft silicone self-adherent bordered foam dressing was evaluated for its ability to decrease sacral pressure ulcers in a surgical trauma intensive care unit (ICU) (Brindle et al, 2009). The baseline incidence of pressure ulcers in the ICU was stated as between

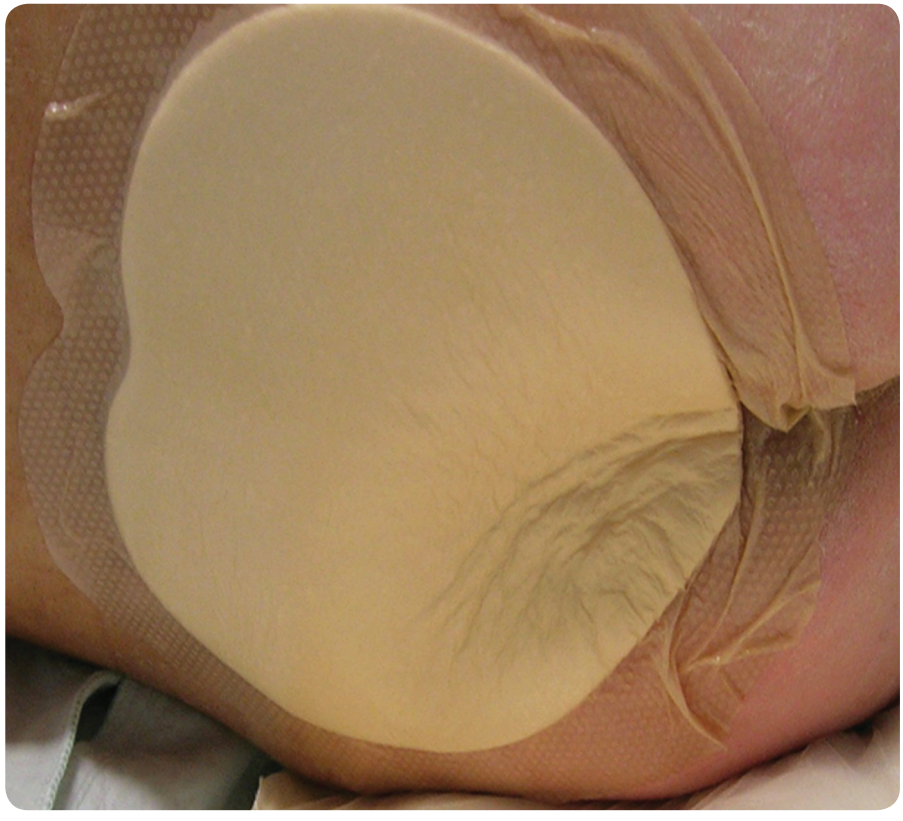

Figure 1. Mepilex sacrum dressing in place.

5–24%. In one three-month period, 93 patients were admitted to the ICU and of these 41 were identified as 'high risk' using a customised tool. The patients were then treated with the soft silicone prophylactic dressing (Mepilex® Border Sacrum [Mölnlycke Health Care]). The ultimate outcome of the study was a zero incidence of sacral pressure ulcers in those using this dressing (*Figure 1*).

Brindle et al (2009) stated that the dressing had qualities that were beneficial in the prevention of sacral pressure ulcers, for example:

- Excellent absorption capabilities
- Atraumatic adhesion technology
- An occlusive outer covering
- Shape that covers the sacrum and separates the gluteal folds.

In addition, it was postulated that the dressing may reduce friction, shear and moisture by (Brindle et al, 2009):

- Preventing friction between the gluteal skin folds
- Absorbing moisture collection on the intact skin
- Providing a barrier between the bed surface and the skin for patient positioning
- Allowing for routine skin assessments and removal without skin trauma because of the silicone technology
- Resisting minor faecal incontinence due to the occlusive outer layer.

Discussion

Both in the laboratory and in the clinical environment, there appears to be growing evidence that topical dressings can help to prevent the development of pressure ulceration. This could have serious implications for treatment. Up until now, the majority of resources have been spent on training staff to recognise those at risk of pressure damage and providing expensive pressure-relieving devices. However, the provision of these hi-tech support surfaces has limitations, particularly availability, ease of use and cost to healthcare providers. Also, despite the use of these devices, the incidence of pressure damage continues to be an issue (Brindle, 2009).

In a health environment where cost is increasingly an issue, clinicians are forced to explore new ways to deliver effective, evidence-based care. Without doubt, education of clinicians is vital and hi-tech support surfaces have a significant role to play, but are they enough? If dressing products can provide an additional tier of preventative care to those at risk and additional benefits when used as an adjunct to support surfaces, then surely their efficacy is worth exploring further.

However, if a dressing-based approach to pressure ulcer prevention is to be beneficial and cost-effective, what are the key elements (in terms of product functionality) that clinicians require?

Both in the laboratory and in the clinical environment, there appears to be growing evidence that topical dressings can help to prevent the development of pressure ulceration. This could have serious implications for treatment.

Heel ulceration

Pressure ulcers on and around the heel are the second most common pressure ulcers seen in healthcare (Clark et al, 2004), and their impact can be enormous. The absence of deeper soft tissue and the proximity of bone to the skin's surface mean that when ulceration occurs it is likely to be severe. This may lead to osteomyelitis and even limb amputation (Black, 2004).

Pressure damage can also have a catastrophic effect on patients' mobilisation and rehabilitation due to the difficulty in wearing footwear, pain and the need to prevent deterioration by off-loading. However, the frequent occurrence of pressure ulcers on the heel implies that successful clinical prevention strategies are not being widely employed. Even where research projects are implemented, the lack of standardised heel-based protocols and management support can lead to failure (McElhinny and Hooper, 2008).

Sustained pressure to the heel occurs as a result of limb immobility, either through a lack of motor activity or pressure and pain sensation (e.g. following neurological injury or anaesthesia). While the plantar surface of the foot is anatomically adapted to cope with high levels of pressure (Cichowitz et al, 2009), the heel does not have the same structure and is more vulnerable (Donnelly, 2001). Friction and shear are particularly prevalent in the heel and Jay (1995) argued that these account for the occurrence of tissue damage, even when support surfaces deliver interface pressures below capillary closing pressure.

Friction and shear forces impact on the heel as a result of patients moving themselves, movement of the patient by the nurse or movement by the position or action of the bed (Read, 2001). This may explain the phenomenon seen by the authors where patients undergoing lower limb orthopaedic procedures can develop heel damage on the contralateral limb.

While the provision of pressure-relieving equipment for patients who have to remain in bed is commonplace, and there are a wide number of seating products available, preventative interventions for chair-bound patients are rare (Gebhardt and Bliss, 1994).

A cost-effective conforming dressing with a low friction coefficient (thereby reducing shear force), which could also contour around the surface anatomy to minimise high pressure over the bony prominences of the calcaneum and malleolus, would be a successful adjunct to current care practices.

Sacral/natal cleft damage

Pressure damage most commonly occurs in the sacral and pelvic area (Vanderwee et al, 2007; Barrois et al, 2008). The sacral, and especially the natal cleft area, are particularly difficult areas to treat once pressure

damage occurs (Beldon, 2008). Dressing fixation and retention is problematic, off-loading is difficult while maintaining normal activities, and the close proximity of the anus means faecal contamination is likely, particularly when incontinence is an issue. This makes secondary infection a significant risk. Anatomically, this area of the body is prone to high levels of shear, especially when sitting or lying in a semi-recumbent position and when transferring between bed and chair (Russell, 1998). The mobility of the buttocks, particularly when muscle tension is lost, creates intense stretching forces, which can severely compromise tissue perfusion.

Preventing this damage is of the greatest importance (Reddy et al, 2006). The fundamental tenants of preventative management need to be employed, including the use of appropriate support devices, patient positioning, moisture reduction with barrier creams, urinary catheters, faecal incontinence collectors, and nutrition (Exton-Smith and Sherwin, 1961; Vanderwee et al, 2005). However, action needs to be taken to reduce friction and minimise shear, as well as relieving prolonged pressure to these vulnerable areas. The use of an appropriately designed low-friction preventative dressing would be a significant benefit.

Elbows

Damage to the tissues around the elbows can occur both while resting in bed and also while leaning on hard surfaces, such as bed-tables and armrests. Like the heel, this area has little soft tissue protection over the bony prominences and once damage occurs bone and joint infection can result. The development of a simple dressing to reduce friction and shear forces, dissipate high points of pressure and protect the structure of the elbow would help prevention in this area.

The future

If there is evidence to support the use of dressing materials in pressure ulcer prevention, then why has this not been widely adopted? One answer of course is that it already has. While the positive effects of modern wound care products are well documented, it is impossible to say how much of this benefit is due to their ability to maintain a positive wound environment and how much is owed to their action on pressure, shear and friction at the wound and peri-wound area.

In addition, many clinicians already use wound care products preventatively by applying foam-based heel dressings or film dressings to vulnerable areas. This is supported by company literature and national and local wound product formularies or pressure ulcer prevention protocols, although how successful this approach is when non-specialised products are employed is difficult to ascertain.

While the positive effects of modern wound care products are well documented, it is impossible to say how much of this benefit is due to their ability to maintain a positive wound environment and how much is owed to their action on pressure, shear and friction at the wound and peri-wound area.

To be successful in clinical practice, any dressing material employed preventatively would need to possess a number of key characteristics, including:

- A low surface friction coefficient: the dressing would need to reduce friction forces on the skin, therefore reducing the risk of desquamation, exposure of the fragile germinative layers and transmission of shear forces to underlying structures
- An adhesive interface that has a high tack but which can be removed atraumatically: the dressing would need to ensure correct placement and product retention even when under stress, to stabilise any fragile epidermis and prevent secondary epidermal stripping on removal
- A high moisture vapour transmission rate and absorbent capability: the dressing would need to take-up excess moisture and prevent epidermal maceration
- A conforming 'memory core': this should mould around bony prominences but not flatten-out following repeated exposure to perpendicular stress. It should also be robust enough to prevent material failure under significant shear forces
- Ease of single-handed application: the product would be easy for one carer to apply, e.g. by the patient themselves or their informal carer
- Availability in a range of shapes: the dressing would need to fit a variety of anatomical 'at-risk' areas
- Cost-effective: this would make it an affordable option for widespread adoption
- Robust *in vivo* and *in vitro* research data: the dressing would need to support clinical use and convince clinicians of its effectiveness, therefore speeding its adoption as an appropriate pressure ulcer prevention strategy.

Conclusion

Over the past 30 years, clinicians have sought hi-tech solutions to the problem of pressure ulcer prevention, and manufacturers have developed a range of equipment designed to reduce the causative mechanisms of pressure damage at the patient/support surface interface. Although this approach has had some success, it comes at a price and there are still a significant number of patients for whom access to equipment is difficult.

The results of the studies above indicate that there is a role for dressing materials in pressure ulcer prevention, although further targeted research is needed to support this. Certainly, the clinical experience of the authors of this two-article series, the damning published data on pressure ulcer occurrence, the

financial costs to healthcare providers, and the amount of patient suffering, indicate that there is a need to consider an alternative approach to pressure ulcer prevention. Ideally, this would involve both existing wound care products that can reduce friction and shear as well as next generation dressings, which have been specifically developed for this purpose. WUK

This work has been made possible through an educational grant from Mölnlycke Health Care Ltd.

References

Akimoto M, Oka T, Oki K, Hyakusoku H (2007) Finite element analysis of effect of softness of cushion pads on stress concentration due to an oblique load on pressure sores. *J Nippon Med Sch* **74(3)**: 230

Ashford RL, Freear ND, Shippen JM (2001) An in-vitro study of the pressure-relieving properties of four wound dressings for foot ulcers. *J Wound Care* **10(2)**: 34–8

Barrois B, Labalette C, Rousseau P, Corbin A, Colin D, Allaert F, Saumet JL (2008) A national prevalence study of pressure ulcers in French hospital inpatients. *J Wound Care* **17(9)**: 373–9

Beldon P (2008) Problems encountered managing pressure ulceration of the sacrum. *J Comm Nursing* **13(12)**: S6–12

Bergstrom N, Braden B, Boynton P, Bruch S (1995) Using a research-based assessment scale in clinical practice. *Nurs Clin North Am* **30(3)**: 539–51

Black J (2004) Preventing heel pressure ulcers. *Nursing* **34(11)**: 17

Bots TC, Apotheker BF (2004) The prevention of heel pressure ulcers using a hydropolymer dressing in surgical patients. *J Wound Care* **13(9)**: 375–8

Brindle C (2009) Review of pressure ulcer etiology and prevention: Can prophylactic dressing application decrease pressure ulcer incidence? *J Wound Ostomy Continence Nurs* (in press)

Cadue JF, Karolewicz S, Tardy C, Barrault C, Robert R, Pourrat O (2008) Prevention of heel pressure sores with a foam body-support device. A randomized controlled trial in a medical intensive care unit. *Presse Med* **37(1)**: 30–6

Callaghan S, Trapp M (1998) Evaluating two dressings for the prevention of nasal bridge pressure sores. *Prof Nurse* **13(6)**: 361–4

Cichowitz A, Pan WR, Ashton M (2009) The heel: anatomy, blood supply, and the pathophysiology of pressure ulcers. *Ann Plast Surg* **62(4)**: 423–9

Clark M, Defloor T, Bours G (2004) A pilot study of the prevalence of pressure ulcers in European hospitals. In: Clark M (ed). *Pressure Ulcers: Recent advances in tissue viability*. Quay Books, London: 8–22

Donnelly J (2001) Hospital-acquired heel ulcers: a common but neglected problem. *J Wound Care* 10(4): 131–6

Exton-Smith AN, Sherwin RW (1961) The prevention of pressure sores. Significance of spontaneous bodily movements. *Lancet* **18(2)**: 1124–6

Fowler E, Scott-Williams S, McGuire JB (2008) Practice recommendations for preventing heel pressure ulcers. *Ostomy Wound Management* **54(10)**: 42–57

Gebhardt K, Bliss M (1994) Preventing pressure sores in orthopaedic patients — is prolonged chair nursing detrimental? *J Tissue Viability* **4(2)**: 51–4

Hall (1983) Prophylactic use of op-site on pressure areas. *Nurs Focus* **1**: 148

Jay E (1995) How different constant low pressure support surfaces address pressure and shear forces. *J Tissue Viability* **5(4)**: 118–23

McElhinny ML, Hooper C (2008) Reducing hospital-acquired heel ulcer rates in an acute care facility: an evaluation of a nurse-driven performance improvement project. *J Wound Ostomy Continence Nurs* **35(1)**: 79–83

Nakagami G, Sanada H, Konya C, Kitagawa A, Tadaka E, Tabata K (2006) Comparison of two pressure ulcer preventive dressings for reducing shear force on the heel. *J Wound Ostomy Continence Nurs* **33(3)**: 267–72

Nakagami G, Sanada H, Konya C, Kitagawa A, Tadaka E, Matsuyama Y (2007) Evaluation of a new pressure ulcer preventive dressing containing ceramide 2 with low frictional outer layer. *J Adv Nurs* **59(5)**: 520–9

Ohura N, Ichioka S, Nakatsuka T, Shibata M (2005) Evaluating dressing materials for the prevention of shear force in the treatment of pressure ulcers. *J Wound Care* **14(9)**: 401–4

Ohura T, Takahashi M, Ohura N Jr (2008) Influence of external forces (pressure and shear force) on superficial layer and subcutis of porcine skin and effects of dressing materials: are dressing materials beneficial for reducing pressure and shear force in tissues? *Wound Rep Regen* **16(1)**: 102–7

Key points

- Wound dressings have been used to help prevent pressure damage.
- Authors have regularly indicated the use of dressings from anecdotal experience.
- There is a body of evidence to support the use of dressings to prevent pressure damage.
- There are a number of clinical situations where dressing-based pressure ulcer prevention may be appropriate.

Read S (2001) Treatment of a heel blister caused by pressure and friction. *Br J Nurs* **10(1)**: 10–19

Reddy M, Gill SS, Rochon PA (2006) Preventing pressure ulcers: a systematic review. *J Am Med Assoc* **296(8)**: 974–84

Royal Pharmaceutical Society of Great Britain and the BMJ Group (2009) *British National Formulary: wound management products*. RPS/BMJ, London

Russell L (1998) Physiology of the skin and prevention of pressure sores. *Br J Nurs* **7(18)**: 1084–96

Sansom W, Flynn K (2007) Risk assessment and anatomical foam heel dressings in emergency department to contribute to reduced development of pressure ulcers. *Aust J Wound Manage* **15(3)**: 114–7

Torra i Bou JE, Rueda López J, Camañes G, Herrero Narváez E, Blanco Blanco J, Martínez-Esparza EH, Aneas Alcántara J, Verdú Soriano J (2002) Heel pressure ulcers. Comparative study between heel protective bandage and hydrocellular dressing with special form for the heel. *Rev Enferm* **25(5)**: 50–6

Vanderwee K, Clark M, Dealey C, Gunningberg L, Defloor T (2007) Pressure ulcer prevalence in Europe: a pilot study. *J Eval Clin Pract* **13(2)**: 227–35

Vanderwee K, Grypdonck MH, DeFloor T (2005) Effectiveness of an alternating pressure air mattress for the prevention of pressure ulcers. *Age Ageing* **34**: 261