PRESSURE ULCER PREVENTION AND MANAGEMENT:

Using Mattresses and Cushions

In order to prevent pressure ulceration in patients in primary or secondary care, staff must assess the patient’s risk of pressure damage and match them with the appropriate pressure-relieving equipment to meet their needs. All patients within a secondary care hospital setting will require a bed, mattress and a cushion/chair appropriate to their needs as identified using risk assessment and local guidelines.

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It is indisputable that pressure ulcers cause pain and suffering to patients and cost the NHS thousands of pounds to treat. Over the past 25 years, considerable finance and attention have been directed towards the prevention of pressure ulceration (Clark, 2001), with the premise that prevention is better than cure. However, the provision of pressure-relieving equipment to a large acute hospital or a widespread primary care trust may be problematic.

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Figure 1. Patients with pressure ulceration require pressure relieving mattresses and regular repositioning to avoid pressure damage at vulnerable sites (marked in red).

Anywhere the leg touches the bed, but especially the heels

Ankles

Perineum

Anterior knee

Hips (trochanter and ischium)

Elbows

Spine

Side of head, ears

Shoulder

Elbows

Back of head, shoulder blades

Medial knee (between the knees)

Hip bones or (iliac crest)

Ankles

Perineum

Anterior knee

Hips (trochanter and ischium)

Elbows

Spine

Back of head, shoulder blades

Medial knee (between the knees)

Hip bones or (iliac crest)
Issues that need to be addressed include:

- The type of equipment required
- Whether all pressure-relieving equipment should be dynamic (i.e. driven by an electrical pump) or a mixture of static and dynamic
- The morbidities of the patients
- The ability of staff to use the equipment appropriately.

The cost of pressure-relieving equipment will be a major deciding factor for the tissue viability nurse or whoever has the responsibility of selecting equipment; everyone working within the NHS is aware of budget control and the necessity of being clinically and cost-effective.

**Guidelines**

Guidelines issued by the National Institute for Health and Clinical Excellence (NICE, 2005) and NHS Quality Improvement in Scotland (2005) state that, as a minimum, no patient at risk from pressure ulceration should be nursed on anything less than a high-density foam mattress, and that the type of pressure-relieving equipment, whether mattress, bedframe or cushion, should be dependent upon the healthcare professional’s assessment of the patient. However, all healthcare professionals, especially nurses and therapists (physiotherapists and occupational therapists), should be aware that pressure-relieving equipment alone is insufficient to prevent pressure damage. The patient must also be regularly repositioned (Figure 1), with the frequency of repositioning being consistent with the overall aim of care and being well documented (European Pressure Ulcer Advisory Panel [EPUAP], 1998); it is particularly important to assess the ability of patients to reposition themselves (NICE, 2005). Some dynamic pressure-relieving equipment may disable a patient; however, if placed on a static mattress the patient may be able to reposition him/herself independently (Beldon, 2006).

Guidance is required for staff working in either primary care (community) or secondary care (acute hospital setting) to enable them to assess patients’ risk of pressure damage and match patients with the appropriate pressure-relieving equipment to meet their needs. Without appropriate guidance, there is a danger that pressure-relieving equipment may be chosen according to staff preference, without rationale or financial basis (James, 2004).

**Education**

To ensure that staff use pressure-relieving equipment appropriately, extensive and thorough training is required. Any trust embarking on a new lease for equipment would be prudent to ensure that training in its use is completed by all staff; anything else will leave the patient vulnerable and staff frustrated in their inability to use the equipment.

It is also vital to ensure that staff use an appropriate risk assessment tool, such as Waterlow (1985), to identify those patients vulnerable to pressure damage and to match the patient with the appropriate equipment. Continued use of pressure ulcer risk assessment ensures that each patient’s increased or decreased risk is identified, and equipment is changed as appropriate; this is called the ‘step-up’, step-down’ process (Thompson, 2006).

**Properties of pressure-relieving/reducing equipment**

A pressure ulcer is defined as a localised area of soft-tissue damage caused by impairment of the local vascular and lymphatic supply by pressure, shear or friction, or a combination of all three (EPUAP, 1998). The main focus of any pressure-relieving or pressure-reducing equipment is to reduce or relieve pressure, shear and friction, allowing the vascular and lymphatic circulation to continue supplying tissues unhindered.

Mattresses as support surfaces have two main functions: the redistribution of pressure to prevent pressure damage; and the provision of a comfortable surface for the patient to lie upon.
upon (Rithalia and Kenney, 2000). The various factors associated with patient comfort include: skin temperature, weight distribution and vapour exchange between the patient’s skin and the mattress cover. Measuring comfort is extremely difficult as it is subjective (Grindley and Acres, 1996), and consequently a huge range of patient response is possible from the evaluation of a single mattress.

It is important to understand the difference between mattresses that reduce pressure and those that relieve pressure. To differentiate between the two, manufacturers may claim, ‘low interface pressure’ so it is important that this term is understood.

Interface pressure is the pressure required from an external source, such as a mattress, to close the capillaries in the tissue. If the interface pressure is increased and the capillaries close, the surrounding tissue will die. In the independently mobile, healthy individual this does not represent a threat since the pressure when applied causes discomfort and we move as a consequence of that stimulus. However in the elderly, immobile, possibly undernourished, ill patient who does not move spontaneously this will represent a significant threat, possibly leading to pressure damage.

The interface pressure required to close capillaries varies from one person to another, and even within each individual as a reflection of his/her blood pressure. As a consequence, the nurse needs to consider the pressure ulcer risk assessment of the individual when selecting either pressure-reducing or pressure-relieving equipment.

Pressure-reducing mattresses
Pressure-reducing equipment redistributes pressure by spreading the weight over a large surface area. The support surface moulds to the contours of the patient’s body so that a greater surface area is in contact with the support surface, rather than the pressure being concentrated over areas of bony prominence, thereby reducing the effects of pressure and thus the risk of damage. Protection of the bony prominence is vital since there is often less natural padding available such as muscle, e.g. the heel. Although constant, the interface pressure is of low value and the tissue remains viable as capillaries remain open (Hampton, 2000).

While most static mattresses refer to a foam or visco-elastic foam mattress, this group also includes the most technically advanced equipment. Static, non-electrical mattresses may be formed from cut or layered foam, such as Pentaflex™ (Huntleigh Healthcare), visco-elastic foam, such as Transfoam Visco™ (Karomed Limited) (Figure 2), or air-filled mattresses, such as Repose™ mattress overlay (Frontier Therapeutics), which comes packed inside a unique and easy-to-use pump.

All of these mattresses function by redistributing or spreading the load of the patient’s weight on a static surface, thus reducing the interface pressure at the vulnerable bony pressure points of the body (Figure 3). How much the interface pressure is reduced

![Figure 3. Static, non-electrical mattresses function by redistributing or spreading the load of the patient's weight on the mattress, thus reducing the interface pressure at the vulnerable bony pressure points of the body.](image-url)
varies from patient to patient, depending on the individual’s blood pressure and volume of adipose tissue (Bennet et al, 1981; Rithalia, 1996).

The successful use of static foam/air equipment relies upon either the patient being able to reposition him/herself or the patient being repositioned regularly by others, in order to periodically reduce the interface pressure.

If the patient is not repositioned there is increased risk of pressure damage despite the use of pressure-reducing equipment. There is no equipment, as yet, which is a substitution for movement.

The patient may be in a hospital or home setting, which must also be considered before selecting equipment. Pressure-reducing mattresses that are driven by an electrical pump, such as air-fluidised mattresses or low air-loss mattresses, are almost always used in secondary care; the size and complicated function of such mattresses precludes their use in primary care.

Low air-loss mattresses are constructed of cells into which air is constantly pumped and then slowly lost through the vapour-permeable surround when weight is applied. The effect is slight deflation of some cells, enabling the system to conform to and support the body (Arblaster, 1999). Low air-loss mattresses are indicated for the treatment of severely injured patients, those at high risk of developing pressure ulcers or patients who have grade 3 or 4 pressure ulcers (EPUAP, 1998). Low air-loss mattresses, such as Breeze™ (Huntleigh Healthcare), are particularly useful for those patients who are unable to tolerate a moving surface.

Air-fluidised mattresses are bulky and usually only required in a critical care setting or a burns/plastic surgery unit. Air-fluidised equipment comprises of a mattress which contains thousands of silicone-coated, tiny beads. Air is pumped into the mattress, which then supports the patients with minimal pressure.

The mattress covers are air permeable and the air is warmed as it passes into the mattress. If the patient has a large wet wound this aids drying of the wound. These mattresses, due to their bulk and weight, are supported by a specialist frame and are very heavy. They are highly specialised and used more for their ability to manage large volumes of bodily fluid, such as wound exudate, burns, incontinence, and so on.

Pressure-relieving mattresses
Pressure-relieving mattresses include the alternating-pressure air mattresses or dynamic mattresses, which are driven by an electrical pump and have air-filled cushions or cells that are connected in groups to the pump. These alternately inflate or deflate over a set time period, thus removing the supporting pressure from the patient’s body. Dynamic mattresses function by changing the interface pressure by periodically deflating the air cells under the body, which redistributes the pressure on the soft tissues and encourages the reperfusion of previously supported areas (Rithalia and Kenney, 2000).

Before selecting a pressure-relieving mattress, patient comfort must also be considered. Not all patients enjoy being nursed on dynamic mattresses as some complain of motion sickness and others complain that the electrical pumps are noisy, especially at night; it is not unknown for a patient to refuse to use such a mattress.

As technology advances, equipment is now being produced that has the dual capability of a static and dynamic mode of action. Mattresses that ‘sandwich’ a set of alternating air cells in between a foam base and a foam insert, such as Softform Premier Active mattress™, (Invacare), enable a patient to be nursed on either a static mattress or a dynamic system without changing the mattress. This gives an obvious advantage to both patient and nurse, as it removes the need to replace the mattress when the patient’s risk assessment indicates the need to ‘step-up’ or ‘step-down’ equipment (Thompson, 2006).

The Deep Cell Prime™ mattress, (Talley Medical), is classed as an alternating-cell, dynamic mattress that has a one-in-four cell cycle; this allows 75% of the body to be supported
while 25% of the body receives pressure relief. In addition, this mattress has a low air-loss facility, which lowers the humidity that may cause moisture on the skin, leading to maceration (Gray, 2002). Thus the mattress combines the benefits of both pressure-reducing and pressure-relieving abilities.

### Cushions

Any patient considered at risk from pressure damage additionally requires a cushion to reduce or relieve pressure. Certainly, any patient who is using a pressure-relieving mattress should also be using a pressure-relieving cushion when sitting out of bed (Gray, 2002). Pressure ulcers are associated equally with poor seating as they are with an inadequate mattress (Cowan, 1997). Generally speaking, if a patient is using a foam mattress successfully then a foam or gel cushion is appropriate; however, if a dynamic mattress is being used then a dynamic cushion should be used as well.

### Table 1

Examples of pressure-reducing and pressure-relieving cushions

<table>
<thead>
<tr>
<th>Examples of static cushions</th>
<th>Examples of dynamic cushions</th>
<th>Suitable for primary care</th>
<th>Suitable for secondary care</th>
<th>Pressure ulcer risk level</th>
<th>Maximum weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pulsair® alternating cell (Tailey Medical)</td>
<td>No — no back-up battery</td>
<td>Yes</td>
<td>Yes</td>
<td>High</td>
<td></td>
</tr>
<tr>
<td>B.A.S.E® sequential one-in-four cell cycle (Pegasus)</td>
<td>Yes* — either mains-operated pump or with Mobile™ battery (20 hours)</td>
<td>Yes</td>
<td>Yes</td>
<td>High</td>
<td></td>
</tr>
<tr>
<td>Suprema®</td>
<td></td>
<td>Yes</td>
<td>Yes</td>
<td>Low-medium</td>
<td></td>
</tr>
<tr>
<td>Visco-elastic foam (Huntleigh Healthcare)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pentaflex® cut foam (Huntleigh Healthcare)</td>
<td>Yes</td>
<td>Yes</td>
<td>Low</td>
<td>90 kg</td>
<td></td>
</tr>
<tr>
<td>Repose® (Frontier Therapeutics)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thermo-Contour® (Hill-Rom Ltd)</td>
<td>Yes</td>
<td>Yes</td>
<td>Low-medium</td>
<td>Not specified</td>
<td></td>
</tr>
<tr>
<td>Alto® alternating-cell cushion (Hill-Rom Ltd)</td>
<td>No, powered only by mains electricity</td>
<td>Yes</td>
<td>Low-medium</td>
<td>140 kg</td>
<td></td>
</tr>
<tr>
<td>Primo® dynamic low-pressure system (Hill-Rom Ltd)</td>
<td>No, powered only by mains electricity</td>
<td>Yes, shares pump with mattress</td>
<td>High</td>
<td>140 kg</td>
<td></td>
</tr>
<tr>
<td>Transvisco® (Karomed Ltd)</td>
<td>Yes</td>
<td>Yes</td>
<td>Medium-high</td>
<td>120 kg</td>
<td></td>
</tr>
<tr>
<td>Transair 250® dynamic alternating-cell cushion (Karomed Ltd)</td>
<td>No, powered only by mains electricity</td>
<td>Yes</td>
<td>High</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transflo® (Karomed Ltd)</td>
<td>Yes</td>
<td>Yes</td>
<td>High</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Serenade® dynamic alternating-cell cushion (Sidhil Ltd)</td>
<td>Yes</td>
<td>Yes</td>
<td>High</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Provided the patient is capable of managing equipment or has supervision
It must also be remembered that a patient’s seating needs may change as a result of weight gain or loss, progression of disease, muscular ability to sit erect or spinal deformity. In other words, the body’s contours and soft-tissue padding change; a cushion that was suitable initially may not be so two years later (Rappl and Jones, 2001).

Many patients in secondary care spend long hours sitting out of bed in chairs. Patients become exhausted and are unable to maintain their posture in the chair, leading to a slumped position and unnatural pressure being applied to the bony prominences (Gebhardt and Bliss, 1994); even the use of an appropriate cushion does not prevent exhaustion.

To seat a patient safely the cushion will need to:
- Maintain a symmetrical and well-balanced position
- Reduce friction and shear forces by stabilising the ischial tuberosities and supporting the thighs
- Maintain hip flexion at 90°
- Maximise functional ability
- Enhance the ability to transfer independently or with assistance

How to select appropriate equipment
Selecting the appropriate pressure-relieving or redistributing equipment for an individual patient is not easy. It relies upon several factors:
- The healthcare provider, whether nurse or therapist, having a good working knowledge of the equipment available and their patient’s ability to comply with using the equipment. Just because the nurse/therapist feels that a particular equipment is appropriate, does not mean the patient agrees or will use it
- The patient’s pressure ulcer risk assessment score.
- Increase comfort, which is the patient’s priority
- Assist energy management by stabilising the pelvis, so that less energy is spent trying to sit upright (Collins, 2001).

Static cushions of varying composition can be used for patients at low to high risk of pressure damage. Visco-elastic cushions mould and conform to the individual body shape; air-filled cushions and cut-foam cushions similarly redistribute pressure.

Dynamic cushions are generally used for patients at high risk of pressure ulcer development, or for those who already have a pressure ulcer, in which case sitting should be minimised even when using a high-risk cushion.

Table 1 gives examples of some pressure-reducing and pressure-relieving cushions and their suitability for use in primary and secondary care.

However, it should always be remembered that any risk assessment tool does not replace clinical judgment
- The healthcare setting, i.e. hospital vs home. Dimensions of different equipment may exclude their use, i.e. does the equipment fit through the doorway of the patient’s home? In addition, the patient may need to share the bed with a partner
- Acceptability to the patient — is the equipment deemed clean to the patient/family? Is it quiet/noisy, bulky or an offensive colour? It must be remembered that in patients’ homes they control what happens; if the equipment does not meet their expectations they may not use it
- Ability of family/carers to use equipment and act if a problem arises. Sufficient training to ensure safe, appropriate use of the equipment is critical to ensure the safety of the patient
- The size/weight of the patient. Obese patients may
require bariatric equipment; conversely, if patients are debilitated or short then paediatric equipment may be more appropriate (adapted from Alexander, 2004).

There is a danger that the nurse/therapist may select equipment based upon his/her own familiarity and on a ‘worst case scenario’ (Miers, 1990), such as the patient developing a pressure ulcer. Ideally, a joint decision made by the patient/carer with the nurse/therapist’s advice is more likely to result in equipment being used to the patient’s best advantage.

It should be remembered that to the patient his/her comfort is likely to come first. It is also important to remember that, in addition to documenting the choice of pressure-relieving equipment, the rationale must be included (Pennels, 2001); otherwise, other healthcare professionals may change the equipment without realising the professionals may change the choice of pressure-relieving equipment, the rationale must be included (Pennels, 2001); otherwise, other healthcare professionals may change the equipment without realising the importance of pressure-reducing equipment. The Prevention and Treatment of Pressure Ulcers. In: Morison E, ed. The Prevention and Treatment of Pressure Ulcers: Harcourt Brace, Edinburgh


NHS Quality Improvement Scotland (2005) Best Practice Statement: The Treatment/Management of Pressure Ulcers. NHS QIS, Scotland


Conclusion
As there is a plethora of pressure-relieving equipment available, it is pragmatic for a specific range of equipment to be identified according to each patient’s needs and whether the healthcare setting is in primary or secondary care. All patients within a secondary care hospital setting will require a bed, mattress and a cushion/chair appropriate to their needs, as identified using risk assessment and local guidelines. There is evidence to suggest that if fundamental equipment possesses basic pressure-reducing properties the risk to the patient will be minimised (Maylor, 2001). WE