Hybrid support surfaces made easy

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Introduction

The number of people at risk from pressure ulcers is increasing due to an ageing population and a rising prevalence of long-term conditions globally. Since most pressure ulcers are preventable, greater demands are being placed on practitioners to implement strategies for prevention. The variety of support surfaces available for pressure ulcer care, however, often makes selection difficult and delays implementation. This Made Easy focuses on a new, yet established, category known as hybrid support surfaces. These are becoming increasingly important as alternatives to high-quality foam or alternating mattresses. With a wide range of hybrid systems available, it is important to understand how they work, the type of therapy different systems deliver and their suitability to prevent or treat various risk levels.

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Role of support surfaces in pressure ulcer prevention

Pressure ulcers are wounds caused by continuous occlusion of blood vessels that supply oxygen and glucose to the tissues due to excessive pressure, shear or a combination of the two[1]. The most effective preventive strategy is the use of devices that reduce such external forces. Patients with mobility impairments, due not only to advanced age, but also to spinal cord injury or critical illness, are commonly placed on a pressure redistributing support surface as part of a pressure ulcer prevention programme.

Support surfaces are defined as 'specialised devices for pressure redistribution designed for the management of tissue loads, microclimate, and/or other therapeutic functions'[2]. Of the available support surfaces, alternating pressure air mattresses that intermittently remove pressure from some areas of the body, while maintaining pressure on others, have been shown to be effective[3].

The latest international collaborative practice guideline published by the European Pressure Ulcer Advisory Panel and US National Pressure Ulcer Advisory Panel, together with the Pan Pacific Pressure Injury Alliance, clearly recommends the use of support surfaces that match the changing needs of individual patients, with strong evidence for their use[4].

Understanding support surfaces

Standard hospital mattresses are composed of a block of foam and are the simplest approach to pressure redistribution — however, they do not react to patient movement or adjust to significant pressure increases in high-risk areas (e.g. sacrum and heels). For patients at risk of pressure ulcers, higher-specification support surfaces should be used as part of a prevention strategy[5].

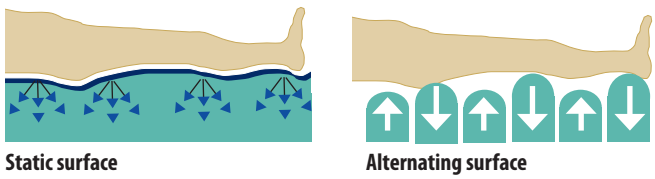
However, the variety of support surfaces being marketed is confusing, even for the most experienced clinicians. This market is still lacking standard, objective means for quantifying the efficacy of support surfaces in protecting tissue integrity and viability.

Types of support surface

There are two main approaches to preventing pressure ulcers using support surfaces. These are referred to as:

- **Static surfaces:** A 'reactive' mattress that works on the principle of distributing the patient's weight (force) over a maximum body surface area. It does this by conforming to the patient's body contours to increase the area in contact with the support surface. It provides a constant low-pressure profile whereby the pressure at every contact point is reduced. This alleviates localised internal tissue loads to help prevent the development of a pressure ulcer[6]. Static systems may comprise foam, foam and air, gel or layers of different foam densities. Some air-filled support surfaces allow air to escape through small holes and require a continuous pumped air supply. These are called low-air loss systems. Others, known as air-fluidised systems, contain sand-like particles, such as silica beads, through which air is forced. As the air is forced through the particles, they take on the properties of a liquid.
- **Alternating surfaces:** An 'active' mattress that requires a power supply to mechanically vary the pressure beneath patients, with cyclical inflation and deflation of sections of the support surface. This allows pressure to be transferred from parts of the patient and then reapplied, reducing the duration of pressure (Figure 1). Repositioning of patients is as important on alternating support surfaces as on static surfaces[1].

Figure 1 Static and alternating surface mechanisms



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Selecting and putting into place equipment for patients at risk of pressure ulcers can be both complex and time-consuming, with many organisations having a wide range of products available to choose from. In addition, many patients will require their pressure ulcer care to be stepped up or stepped down as their condition changes.

What is a hybrid support surface?

Hybrid support surfaces combine foam and air to maximise the benefits offered by both static and alternating surfaces. They simplify choice, as one piece of equipment is suitable across a much broader range of patients. However, there is a lack of clarity about what these products are, how they work and which patients they are suitable for.

Broadly speaking, there are two types of hybrid support surfaces: non-powered and powered. Available systems are designed to be suitable for a range of pressure ulcer risk levels and categories of pressure damage.

It is essential to check the information provided by the manufacturer to ensure that the correct mattress is used up to the appropriate risk level and category of pressure ulcer for individual patients (Tables 1 and 2).

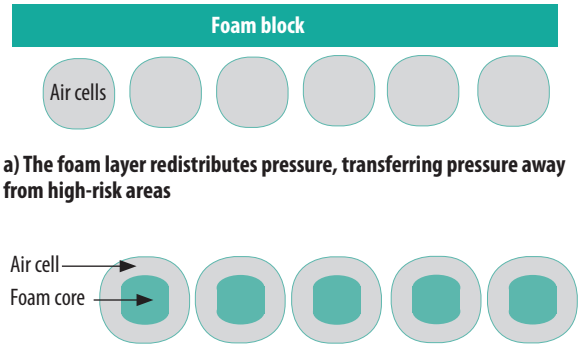
Non-powered hybrids

Non-powered hybrids work on the principle of air displacement. When a person repositions his or her weight, air moves within the mattress to surrounding cells for optimum pressure redistribution. This allows the mattress to conform to the shape of the person's body as he or she moves, increasing the surface area in contact with the mattress and reducing the patient/support surface interface pressures. This minimises the potential for cell and tissue breakdown[6].

Non-powered hybrids are typically configured with a layer of foam at the patient interface and a series of air cells beneath the foam (Figure 2a). Some systems effectively place a layer of air cells at the patient interface — for example, The Dyna-Form™ Static Air HZ has foam inserts within a layer of air cells so that the patient can be supported firstly by the air cells and not the foam (Figure 2b).

The non-powered hybrids are primarily competing with the high-specification foams as a good quality replacement mattress, but with additional pressure redistribution. It is important to check the product literature for specific guidance and level of evidence supplied.

Figure 2 Non-powered hybrid mattress construction



a) The foam layer redistributes pressure, transferring pressure away from high-risk areas

b) The foam core acts as a pump to redistribute air, transferring pressure away from high-risk areas

Table 1 Non-powered hybrids

Mattress name	Manufacturer	Risk level and/or pressure ulcer category	Description (based on product literature)	Maximum weight
AtmosAir™	ArjoHuntleigh	Up to Category II	4 longitudinally positioned air cylinders with an open-pressurised Self-Adjusting Technology™ system. Comprises independent dynamic air chambers, intake and regulator valves, and covered with foam	227kg
Acclaim flow	Sidhil	High risk	Self-regulating air displacement and intake system using an intelligent Air Flow Technology with zoned castellated foam overlay	230kg
CuroCell® Area Zone	Care of Sweden	Up to Category II	Contains 9 air cells that are divided into zones, which adapt automatically to the user, and multiple layers of high quality foam	230kg
Dyna-Form™ Mercury Static Air HZ	Direct Healthcare Services	Up to Category III	Incorporating 14 air and foam filled cells and a patented valve system (Reactive Airflow System [RAS]) that allows air to displace and adjust to the patient's body weight and movement	254kg
Transair Static Air	Karomed	High/Very high risk	4 longitudinal polyurethane cells encased below a surface of single castellations of high-density foam. Head and heel sections are contoured closer to the body area to reduce surface area	254kg

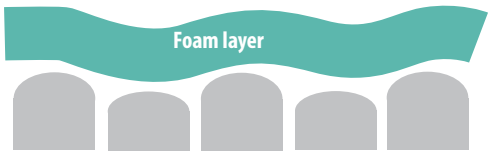
Powered hybrids

Powered hybrids also consist of foam and air cells, most typically configured as a layer of foam (this may be simple or castellated foam) at the patient interface, with a series of air cells beneath (Figure 3a). The Dyna-Form™ Mercury Advance mattress has powered air cells around the foam inserts, which effectively provide a layer of alternating air cells above the foam (Figure 3b).

All of the powered hybrids in the non-powered mode function much like the non-powered products. However, the attachment of a powered pump can inflate and deflate alternate air cells at regular intervals. Depending on where the air cells are in relation to the patient interface, this can offer increased pressure redistribution or even intermittent offloading of pressure (Table 2).

When selecting a powered hybrid system, it is important to consider whether it offers both pressure redistribution in the static mode and pressure relief in the alternating mode. Hybrid systems where there is a layer of foam above the air cells provide active redistribution at a constant low pressure. Where the foam is positioned inside the air cells (e.g. Dyna-Form Mercury Advance) the system functions as an alternating pressure system, providing additional pressure relief in the powered mode. The presence of the foam core within the air cells means that air movement is not restricted by a top layer of foam and less air is required to inflate the cells, allowing the pump to be smaller and more efficient.

Figure 3 Powered hybrid construction



a) Where the foam is on top of the air cells, the mattress provides a constant lower pressure

b) Where the foam is encased within the air cell, the mattress is able to provide alternating pressure relief in the powered mode

Table 2 Powered hybrids

Mattress name	Manufacturer	Risk level and/or pressure ulcer category	Description (based on product literature)	Primary mechanism	Maximum weight
CuroCell Cirrus®	Care of Sweden	Up to Category IV (0–180kg) and Category II (181–230kg)	Combines air with a soft foam surface	Active redistribution/ foam over air	230kg (depending on extent of pressure damage)
Dyna-Form™ Mercury Advance	Direct Healthcare Services	Very high risk and up to Category IV	A foam head cell and series of 14 transverse air cells, each containing a foam-profiled insert. These are held within a foam U core (see page 5). In static mode the mattress attains the pressure-relieving properties of the Dyna-Form Mercury Static Air HZ mattress. In the alternating mode the mattress is able to offer similar properties to an alternating system	Alternating pressure relief 1:2 cycle	254kg
P.R.O.® Matt	Joerns	Up to Category II in non-powered (static mode) and up to uncomplicated Category III or IV using powered mode	Air and foam cells with a visco-elastic foam topper. Non-powered mattress replacement system with Pressure Redistribution Optimization (P.R.O.) technology. Optional control unit provides powered immersion or alternating pressure therapy	Active redistribution/ foam over air	227kg
Quattro® Fusion	Talley	All risk levels and existing pressure ulcer (Category not stated)	Visco-elastic foam inside 14 air cells. Choice of either 1-in-4 active alternating air pressure cycle or continuous low-pressure therapy	Alternating pressure relief 1:4 cycle	250kg
Softform® Premier Active 2	Invacare	Very high risk and up to Category III	Air cells covered by a castellated foam topper. A static pressure-reducing support mattress for patients at high risk with option to add digital pump to introduce effective alternating pressure	Active redistribution/ foam over air	250kg
Transform Active	Karomed	High/very high risk	Air cells covered with a foam topper	Active redistribution/ foam over air	260kg

CASE STUDY 1: USING A HYBRID SYSTEM AS AN ALTERNATIVE TREATMENT OPTION IN A PATIENT WITH A CATEGORY IV PRESSURE ULCER (adapted from[7])

Background

A 62-year-old man with type 2 diabetes, peripheral vascular disease and a below-knee amputation was admitted to a community hospital (from acute care) with a Category IV sacral pressure ulcer. The wound was12cm x 6cm x 4cm central depth with 3cm undermining in all areas. The wound bed comprised 70% slough and 30% granulation.

On admission he was placed on an alternating replacement mattress. However, he said he could not sleep as it was noisy and the motion of the mattress made him feel nauseous; he also reported that he could not pull himself over. The option of using the Dyna-Form Mercury Advance mattress was discussed with the patient and his relatives, which he agreed to try.

Treatment with Dyna-Form Mercury Advance

- After 48 hours the patient stated that he was sleeping better and could reposition himself in bed.
- Within 9 days the wound size had reduced by 3cm length and 2cm width; the depth had reduced to 1cm undermining in all areas. It comprised 50% slough and 50% granulating tissue.
- At Week 4 the wound had reduced by half again and the patient was now able to get out of bed to start mobilising.
- By 8 weeks, the patient's wound was 10% slough and 90% granulation tissue. The patient was very positive about his progress and was looking forward to going home.
- 12 weeks after admission the patient was discharged home. His wound was 2cm x 2cm with100% granulation tissue.

Summary

This case study records the positive clinical impact of the Dyna-Form Mercury Advance hybrid mattress when used as part of a holistic approach to patient care. As well as healing of his Category IV pressure ulcer, the patient benefitted from improved sleep, better mobility and an uplift in wellbeing. This case demonstrates that a powered hybrid mattress can provide a good option for those patients who would not normally tolerate active systems.

Acknowledgement: Sue Mason, Clinical Lead Tissue Viability, Staffordshire and Stoke-on-Trent Partnership NHS Trust, UK

Benefits of using powered hybrid support surfaces

The powered hybrids offer real benefits in terms of their ability to step up or step down care simply by adding or removing an external power source. Patients do not have to wait for a new piece of equipment to arrive, nor do they have to be transferred to another mattress at a time when their condition has deteriorated and they may be experiencing pain or discomfort.

As the mattress is designed to function in a non-powered mode, in the event of a power failure (e.g. in the home care setting), the patient remains on a high-quality foam support surface and the potential for any pressure damage is reduced. In comparison, many of the replacement stand-alone alternating mattresses have only a very thin piece of foam in the bottom, so the patient may end up lying on the wires and bed base with very little to protect him/her from further pressure damage. In a cardiac arrest situation, the foam support of a hybrid system can hold the patient much more firmly than a deflated alternating mattress.

Powered hybrids can reduce reliance on alternating pressure mattresses, which usually need to be leased or purchased separately by hospitals for use on an as-required basis. This has the potential to reduce costs and space needed for storage. Most hybrid mattresses are also designed to be cleaned on the ward in the same way as a standard foam mattress, greatly reducing decontamination costs.

The majority of the powered mattresses can also be used with a matching cushion for a complete support solution, with the same pump being used for both mattress and cushion. This reduces the amount of equipment required in what is frequently a limited space, while providing 24-hour pressure reduction.

Developing a rationale for using a powered hybrid support surface

Hybrid support surfaces are safe to use in various care settings including hospitals, nursing homes or in the patient's own home. They are ideal for patients with long-term conditions, who can deteriorate at any time, offering minimal delays to patients when their needs change, along with minimal disturbance. When selecting a hybrid system, base your decision on data relevant to the care setting involved and focused on the impact on resources and outcomes. The following benefits were reported using the Dyna-Form Mercury Advance hybrid system.

Minimising delays

The increased requirement for higher-specification pressure redistribution systems in patients at very high risk of pressure ulceration can lead to delays in provision of equipment with the additional requirement to transfer the patient to a replacement mattress[8].

A recent audit of a UK hospital highlighted significant delays in the provision of high-specification equipment in high-risk patients[9]. Where alternating mattresses were used, these were found to be labour-intensive for nurses to place under the patient and disruptive for patients. The hybrid system used afforded rapid intervention, reducing the time taken to get a patient onto a powered mattress from over 7 hours (typical alternating mattress) to zero as the nurse simply attached and switched on the pump at the end of the bed (Figure 4).

Improving patient experience

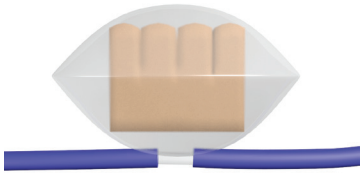
The introduction of a hybrid system also highlighted a number of patient benefits[8]. Patients reported improved levels of

Product focus: Using the Dyna-Form Mercury Advance

The Dyna-Form™ Mercury Advance (Direct Healthcare Services) comprises a high-specification foam mattress made from castellated foam (see below). The pump can be used to activate the alternating pressure-relieving function of the mattress via a series of connected foam and air cells within the mattress.

The mattress consists of a foam head cell and series of 14 air cells, each containing a foam insert, all held within a solid foam frame known as the U Core, which is designed to give stability to patients when transferring into or out of the bed.

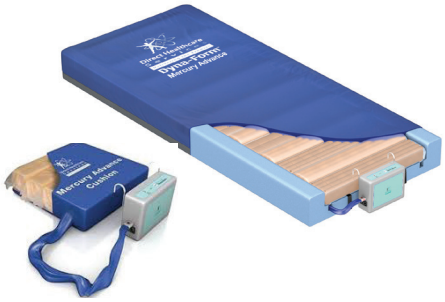
The air cells are joined together by a tubing system that allows the air to move from cell to cell (see below).



When the patient sits or lies on the mattress, the foam responds to the distribution of the patient's weight and moves air around to where it is most needed. In the static mode, the mattress is suitable for use in patients up to high risk who still are able to move around in the bed.

Should the patient's condition deteriorate (and particularly if mobility is reduced) the pump enables the mattress to become a dynamic system. The air cells are arranged into alternate pairs of A and B cells, which are filled and emptied in sequence.

A digital power unit controls the pump, allowing air to flow into or out of the air cells as required according to the operating mode selected. In the powered mode, the mattress can be operated on either low or high pressure. The low-pressure setting is recommended for patients who may be very frail or experienced discomfort on traditional alternating systems. The high-pressure setting should be used for any patient with existing pressure damage or at very high risk.



The Dyna-Pad Mercury Advance Alternating Cushion uses the same technology for patients at very high risk.

comfort, ability to sleep better (the system was quieter), and they were more able to reposition and move independently in bed compared to previous active replacement mattresses used (see Case 1, p4). Improved comfort and tolerablity has also been associated with improved quality of life (see Case 2, p6) and better outcomes[7].

Reducing pressure ulcer incidence and costs

The Dyna-Form Mercury Advance mattress was found to be associated with a 39% reduction in incidence of pressure ulcers (Figure 5), with a concommitant reduction in severity[10].

Powered hybrid systems have been shown to promote healing of pressure ulcers[11], while the Dyna-Form Mercury Advance has been effective in the treatment of a Category IV pressure ulcer[7].

Significant cost savings were also associated with the use of this system in Category II–IV pressure ulcers (Figure 6).

Figure 4 How long does it take to replace a mattress? Adapted from[7-9]

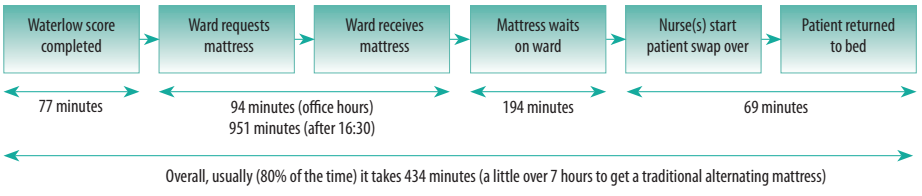


Figure 5 Incidence of pressure ulcers. Adapted from[7-9]

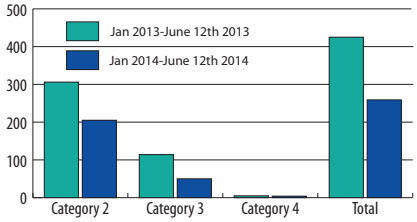
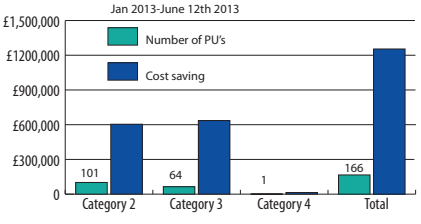


Figure 6 Cost savings. Adapted from[7-9]



Releasing resources

By reducing the need for alternating mattresses, it may be possible to release nursing time back to care with a hybrid system, helping to improve safety and the patient experience[12]. Potential cost savings identified using the Dyna-Form Mercury Advance include[10]:

- **minimal set-up time and easy to operate (step up and down care as required)**
- **less patient moving and handling (reducing risk of further skin injury)**

CASE STUDY 2: USING A HYBRID SYSTEM TO IMPROVE PRESSURE ULCER HEALING IN A PATIENT WITH AN ACQUIRED BRAIN INJURY

Background

The patient (50s) has an acquired brain injury as a result of several strokes more than 20 years ago. Following this, the patient was reliant on a wheelchair for mobility and support staff to assist with all care needs. The patient had moved to a nursing home within the last few years as a greater level of care support was now necessary.

The patient had developed a Category IV pressure injury on the sacrum approximately 12 months previously. This caused constant pain and discomfort. At this point in time, the patient would spend the majority of time in bed — in the morning sitting in an upright position to read/drink/eat and in the afternoons, lying in a side-position in an attempt to reduce the pressure and discomfort.

Treatment with Dyna-Form Mercury Advance

It was decided to trial the Dyna-Form Mercury Advance mattress as it offered additional support and comfort and to assist in the healing of the current pressure injury. The mattress was trialled for several weeks, during which time pressure mapping was undertaken when the patient was in an upright seated position and supine; both positions showed minimum pressure to the sacral area. Overall, there was a good level of pressure relief to all areas of the body that were in contact with the mattress.

The patient continues to use the mattress. The pressure ulcer has shown significant progress: the patient's comfort level has improved and is now spending 5 days a week out of bed for up to10 hours at a time. This has had a positive impact on general health and wellbeing.

We have also trialled the Dyna-Pad Mercury Advance alternating cushion for the powered wheelchair. This has given additional comfort and pressure relief. The patient is also confident that this will provide the same comfort level in the wheelchair as in bed, allowing more time to be spent in the wheelchair. The patient is able to access the local community, spending time away from the nursing home and is increasingly independent. The nursing staff are currently looking at how they can link the cushion to the PWC battery supply, ensuring constant air flow pressure relief at all times.

Acknowledgement: Morag Irvine, Community Liaison Person (CLP) / Senior OT, Mount Lawley, Western Australia

mattresses can be cleaned on the ward, reducing decontamination costs[13].

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Summary

When selecting a hybrid support surface, clinicians should be clear about the mechanism of action claimed, how the benefit is delivered to the patient and the level of evidence for use to ensure that the right mattress is used at the right time for individual patients. The term 'hybrid' is often used because the mattress comprises more than one material in its construction. Ideally, a hybrid mattress should deliver two different therapies. A powered hybrid matttress that delivers both pressure distribution and pressure relief in the alternating mode may offer an effective intervention in patients at very high risk of pressure ulceration and in those with existing damage up to a Category IV pressure ulcer.