

## Why use Alternating Pressure for pressure ulcer management?

Pressure ulcers are defined as localised damage to the skin and the underlying tissue, caused by a combination of pressure, shear, and friction<sup>1</sup> and continue to present a major health problem.

- Up to 1 in 5 patients in Europe are incurring tissue damage in acute care<sup>2</sup>
- In the United Kingdom, up to 4% of the healthcare budget is spent on pressure ulcer management<sup>3</sup>
- Pressure ulcers pose a significant threat for patient comfort and morbidity with associated factors such as pain, loss of mobility and loss of self-esteem having a negative impact on patient wellbeing
- Pressure ulcers pose a significant burden to the healthcare provider; increased cost of care, length of stay, nursing time and litigation.

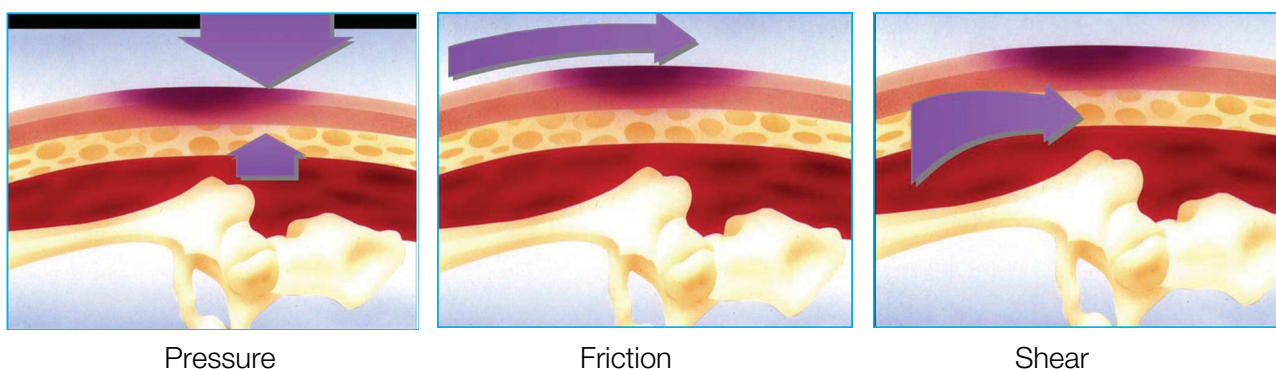
Pressure ulcers are considered preventable and correct management can reduce the risk of occurrence.



Pressure ulcer avoidance is a main concern for clinicians and healthcare providers alike.

### FORMATION OF A PRESSURE ULCER:

A pressure ulcer can be described as an ulceration resulting from the combined effects of **PRESSURE**, **SHEAR AND FRICTION**.



The formation of pressure ulcers is complex and not fully understood, however the basic process involves the constriction of small blood and lymph vessels, as a result of external compression and distortion of the soft tissues. This causes an insufficient supply of essential nutrients and oxygen, together with a build up of waste products from cell metabolism.

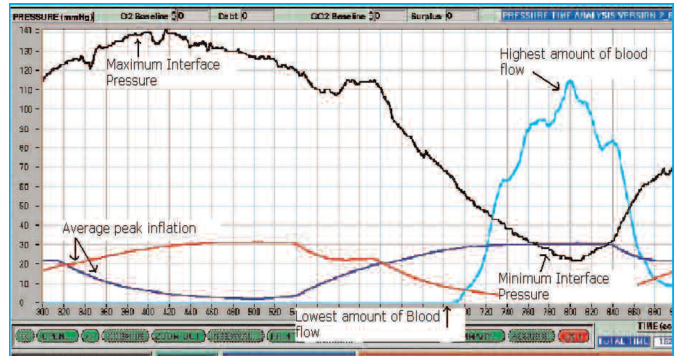
These forces can cause a significant reduction in blood flow as vessels stretch, kink or tear<sup>4</sup> resulting in reduced blood flow, ischemia and vessel occlusion, which can lead to pressure damage.

## PATHOPHYSIOLOGY OF PRESSURE ULCERS:

Traditionally, average capillary closing pressures have been used to predict the pressures beyond which tissue damage may occur: **32 mmHg in the arterioles**, 20 mmHg in the capillary bed and 12 mmHg in the venules<sup>5</sup>.

However, studies that are more recent suggest that the average ‘functional’ operating pressure in the capillary bed is **17 mmHg ... NOT 32 mmHg<sup>6</sup>** and may be as low as 6 mmHg in the venous end of the capillary.

Fortunately, evolution has equipped the body with a natural ability to manage high pressures for short periods of time, by initiating normal spontaneous movement which stimulates reactive hyperaemia: a process that restores the blood flow to the tissues<sup>7</sup>.

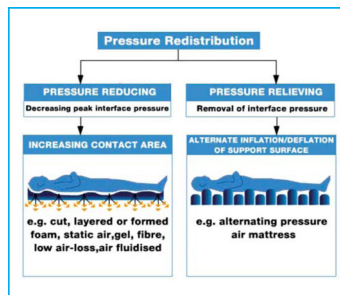
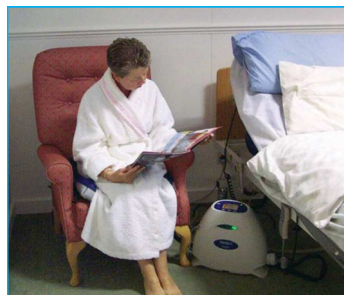


## WHO IS AT RISK?

- Patient groups, such as the elderly<sup>8</sup> and paraplegics<sup>9</sup> move less frequently and have related tissue structure that predisposes them to pressure ulcers.
- Those under the influence of sedatives or strong analgesics.
- Patients with neurological disorders, leading to impairment of sensation.
- Patients with microvascular disease – e.g. diabetes, arteriopathy etc.
- Incontinent patients – moisture macerates the skin increasing the risk of pressure ulcers.
- Age, not an independent risk factor alone but associated with high risk co-morbidities.

## HOLISTIC WAYS TO HELP PREVENT PRESSURE ULCERS DEVELOPING:

Traditionally a care plan is devised following a risk assessment of the patient – measures should include:



A 24 hour, individualised, repositioning regime<sup>10</sup>, which includes; early mobilisation, good nutrition, management of incontinence, restricted time spent seated, the provision of a pressure redistributing support surface for both bed and chair *and* daily skin inspection.

## ALTERNATING PRESSURE: THE NATURAL METHOD OF RELIEVING PRESSURE

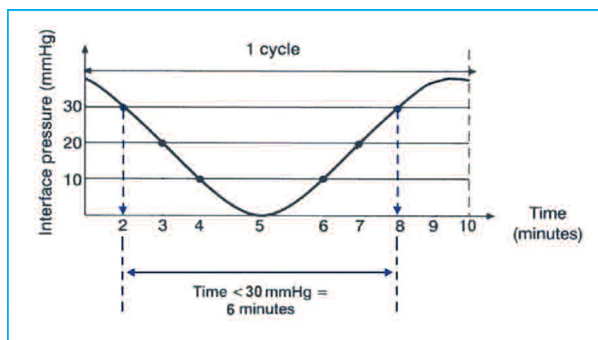
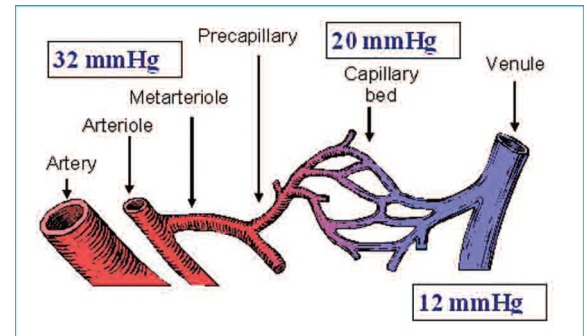
### *Alternating pressure air mattress (APAM), alternating overlay, dynamic, active mattress.*

Alternating Pressure systems, the only truly dynamic or active systems, typically consist of rows of horizontal cells that alternate; with the 1:2 cycle offering the greatest degree of pressure off-loading.

The ideal movement pattern is one which resembles that of healthy individuals - approximately one movement every five minutes<sup>11</sup>. This facilitates restorative blood flow to the tissues, which is usually accompanied by a measurable hyperaemic response.

The loading cycle needs to be of **sufficient amplitude and duration** to both mimic normal movement and to 'lift' the body clear of the deflating cell long enough to allow reperfusion. Systems that have a low amplitude cycle may be unable to stimulate blood flow and, if pressure relief is ineffective, may have an adverse effect on clinical outcome.

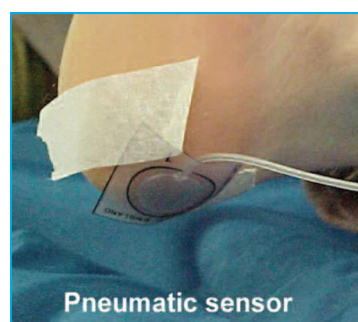
The ability of an APAM to *relieve* pressure *below* clinically relevant thresholds is measured by calculating the **Pressure Relief Index (PRI)**. Choosing thresholds close to arteriolar, capillary and venule operating pressures (30, 20 and 10 mmHg) indicate an APAM's performance. Clearly, the greater the time spent under each threshold... the better! In particular, the 20 and 10 mmHg thresholds<sup>12,13</sup> are clinically more important.



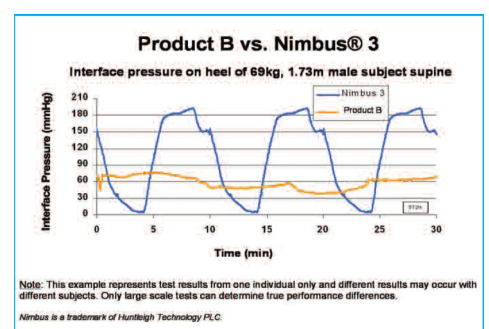
Time below 30mmHg = 6 minutes = 60%  
 Time below 20mmHg = 4 minutes = 40%  
 Time below 10mmHg = 2 minutes = 20%

Pressure Relief Index can be used to measure and compare the performance of alternating surfaces such as mattresses and cushions. Interface pressure (the pressure existing between the support surface and the test subject) is recorded using a single sensor such as an Oxford Pressure Monitor then digitally analysed and expressed as a graph. Other outcome measures such as blood flow can also be measured and can clearly illustrate the relationship between off-loading and blood flow.

The graph illustrates a typical interface (contact) pressure/time tracing (PRI) for a correctly inflated APAM.



The sensors are placed over bony prominences, typically the sacrum, heel and trochanter, and tests can be performed in the supine, side lying or sitting positions to produce a comparative graph (shown to the right).



The graph shows *Nimbus@ 3* system (*DFS@ 3* system, USA) 1-in-2 cycle over 10 minutes against a competitor product, claiming to perform in the same manner. As can be seen, *Nimbus 3/DFS* systems clearly alternates while the competitor product does not mimic normal movement or truly alternate and therefore may not elicit a normal hyperaemic response.

**SYSTEMS MAY LOOK SIMILAR BUT DO NOT NECESSARILY DO THE SAME JOB**

## OPTIMISING CLINICAL OUTCOMES USING ALTERNATING PRESSURE:

The function of an effective APAM is to hold **contact** pressures as **low** as possible for as **long** as possible, particularly under the most vulnerable areas such as the heel.

- Ensure staff know how to correctly set up the device and adjust cell pressures accordingly for nonautomatic systems – use fully automatic systems where possible to avoid the risk of error.
- Minimise the use of tightly fitted sheets and padding in order to optimise the beneficial effects of pressure off-loading but, at the same time, actively manage incontinence.
- Take particular care when moving and handling the patient to avoid friction and shear.
- Ensure effective pressure management continues when the patient is seated in a chair.
- Use mattress replacements rather than an overlay on top of a base foam mattress where; the patient is at the upper weight limit for an overlay, the base mattress is of questionable quality, or where side rail height is an issue.
- Alternating mattress replacements have been found to be **the most cost-effective** way to manage prevention in the highest risk patient and for the treatment of grade 3 or 4 pressure ulcers<sup>14</sup>.

### References:

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