Interface Pressure Testing

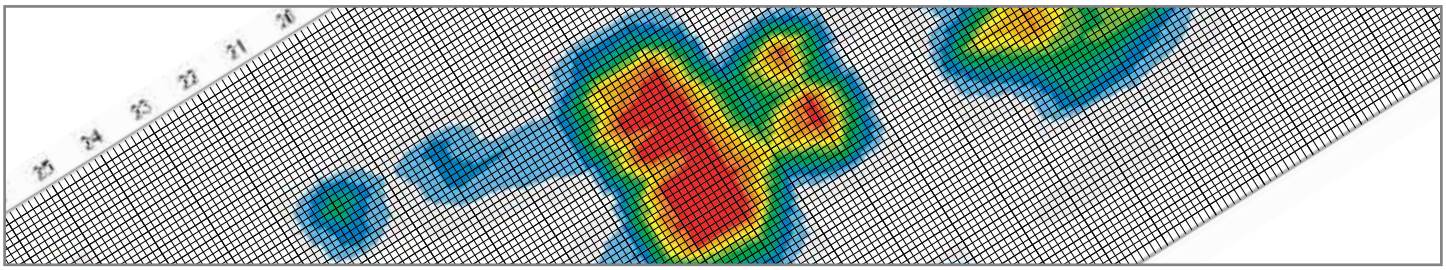
CairMax Foam Air Pressure Surface

Introduction

Pressure injuries are common and costly, posing a serious health concern impacting cost of care, reimbursement and quality of life, while affecting patients, healthcare workers and healthcare authorities alike.[1,7]

In the United States, annual estimates show 1.7 million patients develop pressure injuries with associated healthcare costs of $8.5 billion. In some European countries it has been reported that the cost of pressure injury prevention and treatment accounts for more than 1% of the total healthcare budget. This is the third largest cost incurred by healthcare providers after cancer and cardiovascular diseases.[2-4]

The reporting of pressure injury prevalence and incidence throughout the UK, Europe and USA is far from comprehensive, however, one point that continually stands out when looking at the figures reported over the last ten years is that there has been little change in the percentage of patients developing or presented with these wounds.



With the size of the problem posed by pressure injuries remaining apparently unchanged and the associated treatment costs continuing to rise, it is important to ensure that products aimed at the marketplace for prevention and treatment provide appropriate levels of pressure redistribution and relieve to patients.

While it is widely accepted that clinical outcomes represent the best method of proving clinical efficacy for a medical device, laboratory measurements still play an important role when assessing pressure care equipment.

Such measurements typically take the form of Interface Pressure tests. While such testing is ideally undertaken by an independent body, these tests are extremely costly and very time consuming – and as a result, the majority of manufacturers undertake these measurements in-house using highly specialised pressure mapping equipment.

The results of such tests can be used by Tissue Viability Nurses (TVNs) and their colleagues to help identify which products are likely to provide their patients with the appropriate levels of pressure redistribution and relief for pressure injury prevention and treatment.

What is pressure mapping?

A pressure map is a computerised clinical tool for assessing pressure distribution. To use it, you place a thin sensor mat on a mattress surface or seating area. When your patient lies on the mat, a computer screen displays a map of pressures, using colours, numbers and a graphic image of the patient. Typically, the hotter colours (the reds and oranges) indicate areas of higher pressures and the cooler colours (the blues and greens) indicate areas of lower pressures. The display usually has several options including a three-dimensional display of peak pressures and a statistical analysis.

Pressure mapping does have some drawbacks, including inconsistencies in the way manufacturers report and display the pressures, differences in measurable peak pressures among manufacturers and sensor accuracy and drift. Still, these visual displays provide key data that can augment nursing assessment of the areas of potential tissue damage.

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Pressure mapping accuracy – the facts

The historical definition for a 'pressure reducing' or 'pressure relieving' support surface was one that yielded pressure readings of 32mmHg or lower on most bony prominences most of the time. This 'gold standard' for optimal pressure (32mmHg), however, is not realistically possible. The number 32mmHg is capillary pressure at heart level. The capillary pressure is much greater than this down by the feet and research shows that 60mmHg is probably a much better number to use as capillary pressure.

In the early 1990's, many organisations important to wound care, such as the Wound Ostomy Continence Nurses Association (WOCN) and the National Pressure Ulcer Advisory Panel (NPUAP) defined pressure reduction as "reduction of interface pressure, not necessarily below the level required to close capillaries, ie capillary closing pressure."5 Pressure relief was defined as "reduction of interface pressure below capillary closing pressure".

It is important to note:

1. 32mmHg has been discredited as too general, and is a gross misrepresentation of work by Landis in 1930. WOCN, NPUAP and many other wound care organisations have worked for years to educate clinicians and consumers that this number is erroneous.
2. In clinical practice, the capillary closing pressure for many people is well below 32mmHg.
3. The capillary closing pressure for an individual can only be determined through invasive techniques.
4. The only non-invasive and objective tool a manufacturer has to approximate meeting this definition is interface pressure mapping. It is erroneous to believe that interface pressures are equivalent to capillary closing pressure. Interface pressures are read between the support surface and the patient's skin, while capillary closing pressure is read at the microscopic level.
5. When pressure mapping is used, one subject may yield interface pressures below 32mmHg, while another subject on that same mattress will record interface pressures above 32mmHg. This can be due to prominent bony prominences, body weight distribution, body weight in relation to height, and many other factors. The definitions are impossible to apply when subjects vary so widely in their pressure readings. This applies to nearly all support surface products on the market.
6. Pressure mapping systems only measure uniaxial pressure (vertical or straight down) and do not measure shear forces at all.
7. Pressure alone is not a reliable indicator of risk for skin breakdown. Pressure is not the only factor in pressure injury development. Heat, moisture from perspiration or urine, poor nutrition, sensory loss, age-related connective tissue changes, friction or shear and poor circulation all contribute to pressure injuries.

Novis Healthcare Limited recommends that laboratory test results form only a part of the decision making process in regard to pressure care equipment, which should also take into account clinical judgement and evaluation, or use of the product in a clinical setting with real patient outcomes. The approach of combining laboratory measurements with the experiences and views of respected clinical staff provides a more holistic view in assessing product acceptability and performance in a clinical setting.

This report details Interface Pressure measurements taken on a dynamic patient support surface – the CairMax Foam-Air Pressure Surface – using a healthy volunteer. Data is reported as maximum and minimum pressures.

Aim

The aim of this project was to examine the interface pressures of a subject resting supine on the CairMax Foam-Air Pressure Surface.

Methodology

All Interface Pressure measurements were taken using the Xsensor X3 from Xsensor Technology Corporation. The Xsensor X3 is composed of a large bed sized pressure mapping mat with a grid of 160x64 individual pressure sensors. Pressure range was 0-60mmHg and interface pressure maps were saved at intervals of 0.5 seconds.

The CairMax Foam-Air Pressure Surface was set up according to the manufacturer's instructions on a standard hospital bed frame with a bed base. The mattress replacement and X3 mat were placed directly onto the bed base and the system left to operate for a minimum of 60 minutes at maximum pressure before testing commenced.

A single healthy volunteer subject was used to test the support surface. The test subject was a 38 year old male, weight 84 kg, height 168 cm and Body Mass index (BMI) of 29.8.

All tests took place with the subject placed in a standardised supine position (lying flat on their back, legs shoulder width apart, arms resting by their side, head resting on static head cells).

Data was analysed to report maximum and minimum pressure measurements and also the percentage of immersion area at or below interface pressure thresholds of 10, 20, 30, 40 and 50 mmHg.

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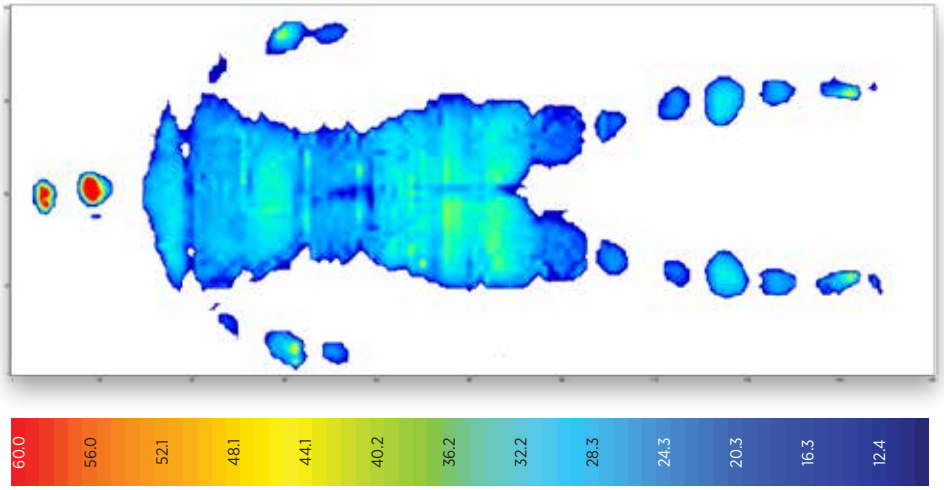
A reactive (constant low pressure) support surface moulds to the patient's shape (immersion and envelopment) in order to redistribute body weight over a larger contact area. The interface pressure remains constant while the patient remains in the one position, but is redistributed over a wider surface area. The research in this field suggests that high specification foam mattresses are most effective in reducing risk of PIs, compared to standard foam mattresses and overlays[6].

Pressure Mapping Result



Interface Pressures

Maximum Interface Pressure	44.1 mmHg
Minimum Interface Pressure	0 mmHg
Average Interface Pressure across contact interface	22.3mmHg
Maximum contact area (immersion)	4617.74cm^2
Percentage of surface area between 40-50mmHg of pressure	2%
Percentage of surface area between 30-40mmHg of pressure	24%
Percentage of surface area between 20-30mmHg of pressure	25%
Percentage of surface area between 10-20mmHg of pressure	49%
Percentage of surface area between 0-10mmHg of pressure	< 2%

Please Note: For patients with poor local and/or systemic oxygenation and perfusion and in patients who cannot reposition adequately every 20 – 30 minutes when awake or asleep for medical reasons, should be nursed on an alternating pressure support surface that optimises pressure offloading[8].

References

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