Assessing Mattress Performance Characteristics:

Comparison of the Interface Pressures of the new Auralis Pressure Redistribution System with the Auto Logic 200

Author: Professor Mike Clark, Welsh Wound Innovation Centre*, Cardiff, UK.

Clinical Context

A powered support surface, with the capability to change its load distribution properties, with or without applied load[1].

An active support surface most commonly redistributes pressure, by the alternate inflation and deflation of air cells. The principal design goal is to mimic the protective effect of spontaneous physiologic or assisted repositioning, by periodically reducing tissue contact with the support surface to a level that is as low as is practically achievable and for as long as possible. This is often the modality of choice for patients who cannot be regularly repositioned manually.[2]

Auralis Alternating Pressure Mattress System

Measuring Performance

Measurement of interface (contact) pressure is a long-established technique used to characterise one aspect of the performance of pressure redistributing support surfaces. For static surfaces, concepts of immersion and envelopment are commonly used to give context to interface pressure measurements[3]. However for active surfaces the performance of the surface depends not only on immersion and envelopment but refers more to the amplitude between maximum and minimum interface pressures, the rate of interface pressure increase as air cells inflate and the time between maximum inflation and maximum deflation. Recent work developed a test method for characterising active support surfaces[4] and this method was used to assess the performance characteristics of a new support surface, the Auralis Pressure Redistribution system when compared to an established product; the Auto Logic 200 mattress replacement system.

* The Welsh Wound Innovation Centre (WWIC) has recently launched its own support surface testing facility in South Wales. With the imminent release of international standards for mattress testing (ISO 20342) WWIC over time will seek accreditation for its test facility making this one of the first accreditated mattress test laboratories in Europe

Objectives:

1. To identify any differences in 'sacral' and 'heel' pressure measurements between two Arjo patient support surfaces – Auto Logic 200 (AL) and a prototype surface – Auralis (AU) both used in their alternating pressure mode.
2. To identify the effect of introducing a microclimate management surface (Skin IQ) upon both test mattresses with respect to changing interface pressures when used in alternating pressure mode.
3. To identify any differences between the interface pressures applied by the two test surfaces when used in constant low pressure mode.

Methodology

- Between June and July 2019 interface pressure measurements were performed within the Welsh Wound Innovation Centre (WWIC), Cardiff, Wales
- Interface pressure measurements were collected while a flat wooden surface representing the human body was positioned centrally upon the mattress surface with 80 kg weight applied in a set order to the areas corresponding to the 'head', 'trunk', 'pelvis' and 'feet' of the mannequin (Figure 1)
- Interface pressure was measured using a X-Sensor 3.0 pressure measurement mat (X-Sensor Technology Corporation, Calgary, Canada) with surface dimensions of 44 cm by 44 cm with a measurement range of 0 to 200 mmHg
- The pressure mat was calibrated in accordance to the manufacturer's instructions before measurements commenced
- The X-sensor pressure mat was used to gather data upon the maximum and minimum pressures applied to the sacrum and heel regions in six configurations: Auto Logic in alternating mode both with and without Skin IQ, Auralis in alternating mode with and without Skin IQ and finally Auralis and Auto Logic in constant low pressure mode both with and without Skin IQ
- In each alternating pressure mode test, approximately three full cycles of stable interface pressure measurements were used to characterise the effects of the test surfaces, while in constant low pressure mode interface pressures were measured for 30 minutes
- Analysis involved creating a Pressure Relief Index (PRI) calculating the percentage of time interface pressures were below 30 mmHg, below 20 mmHg and finally below 10 mmHg

Test Mannequin – shown for illustration purposes only.
Not actual test.

Tables 1 & 2 proportion of time the interface pressures measured at the sacrum & heel of the mannequin were below 30 mmHg

Key Results

- Equivalent PRI performance characteristics were noted between the 2 systems
- Slightly improved PRI performance was noted in the heel section of Auralis compared with Auto Logic
- The addition of Skin IQ to both support surface systems is unlikely to impact off-loading performance
- Both systems consistently exhibited interface pressures below 30mmHg in constant low pressure mode

Table 1 Sacral Data*

PERCENTAGE OF TIME	AUTO LOGIC SACRUM	AURALIS SACRUM	AUTO LOGIC SACRUM & SKIN IQ	AURALIS SACRUM & SKIN IQ
20–30 mmHg	6.3 %	7.0 %	6.2 %	7.2 %
10–20 mmHg	8.9 %	11.0 %	12.7 %	15.5 %
< 10 mmHg	31.9 %	21.2 %	28.3 %	13.9 %

*alternating pressure mode activated

Table 2 Heel Data*

PERCENTAGE OF TIME	AUTO LOGIC HEEL	AURALIS HEEL	AUTO LOGIC HEEL & SKIN IQ	AURALIS HEEL & SKIN IQ
20–30 mmHg	5.7 %	24.1 %	5.5 %	17.6 %
10–20 mmHg	7.5 %	12.1 %	11.0 %	14.5 %
< 10 mmHg	27.4 %	23.8 %	21.5 %	27.2 %

*alternating pressure mode activated

Note:

1. Pressure maps shows pressure redistribution across the body but the individual measurements can be inexact up to +/– 10%. While there may appear to be small differences in the pressures applied by the different surfaces, these fall within the margin of error of the pressure mat.
2. The heel PRI is different between the two systems, with Auralis providing a slightly improved performance, but sacral measurements appear very similar in terms of performance characteristics

Summary

- It is important to remember that pressure maps are often not precise +/– 10% error as standard. A large variance is needed for there to be significant differences between mattresses and their performance characteristics.
- Few clear differences emerged between the two mattresses (AL and AU) where no Skin IQ microclimate management system was placed over the mattress
    - Interface pressure performance characteristics were considered equal, with slight improvements noted in PRI in the heel section of the Auralis with the addition of the powered down heel straps
- When Skin IQ was added to the two mattresses, the microclimate management system tended to slightly reduce peak interface pressure at the sacrum and heels with limited effect on calculated PRI
    - These small changes in interface pressure measurements were not anticipated to impact performance of the two mattresses when used in combination with the Skin IQ microclimate system
- In constant low pressure mode, both mattresses provided interface pressures consistently below 30mmHg at both the sacrum and the heel of the mannequin

References

[1] European Pressure Ulcer Advisory Panel, National Pressure Injury Advisory Panel, Pan Pacific Pressure Injury Alliance. Prevention and Treatment of Pressure Ulcers/Injuries: The International Guideline 2019. Emily Haesler (Ed.). EPUAP/NPIAP/PPIA:2019

[2] National Pressure Ulcer Advisory Panel, European Pressure Ulcer Advisory Panel and Pan Pacific Pressure Injury Alliance. Prevention and Treatment of Pressure Ulcers: Clinical Practice Guideline. Emily Haesler (Ed.). Cambridge Media: Osbourne Park, Western Australia; 2014

[3] RESNA (2019). American National Standard for Support Surfaces – Volume 1: Requirements and Test Methods for Full Body Support Surfaces (ANSI/RESNA SS-1:2019). 2019; Available from https://www.resna.org/standards/support-surfaces/support- surfaces

[4] Clark M, Phillips L, Knibbe HJJ. Lifting and transfer devices: A bridge between safe patient handling and pressure ulcer prevention. American Journal of Safe Patient Handling and Movement. 2015; 5(4): 154-60

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