

# Assessing pressure redistribution & usability

Auralis® Plus mattress replacement system

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## Introduction & clinical context

Worldwide obesity has risen dramatically over the last few decades<sup>1</sup>. In 2016 the World Health Organisation reported that there were more than 1.9 billion adults who were overweight. Of those over 650 million were obese, representing approximately 13% of the world's adult population<sup>2</sup>. This rise in obesity rates is a substantial and increasing challenge for today's healthcare providers. The increasing population of larger patients is likely to place considerable pressure on available resources and the need to meet the unique needs of this patient population.

Individuals with obesity are at an increased risk of developing a pressure injury as a result of many factors including reduced mobility, increased shear and friction, heat and moisture trapping between the body and the support surface and difficulties in redistributing pressure<sup>3</sup>.

In addition to injury over bony prominences, pressure injuries can also occur in a typical locations such as large and deep skin folds due to maceration, inflammation and skin and tissue necrosis<sup>3</sup>. A fragile vascular and lymphatic network along with additional load on dependant tissues is also responsible for skin and tissue complications<sup>3</sup>.

An adjustable support surface that is sympathetic to the needs of plus size patients and which offers appropriate pressure redistribution in combination with microclimate management, can play a significant role in increasing patient comfort and pressure injury prevention.

In order to evaluate the performance of the Auralis Plus mattress replacement system, rigorous in-house bench testing was undertaken to assess the pressure redistribution characteristics of the system under clinically relevant conditions. In addition to this usability testing with plus size healthy volunteers was also undertaken. This paper reports on the testing conducted with the Auralis Plus system pre-launch to help inform clinical decision making during support surface selection.

## Auralis Plus bariatric mattress replacement system

The Auralis Plus bariatric mattress replacement system is a new width adjustable and 'intelligent' dual therapy system for plus size patients, which when combined with the Citadel® Plus bedframe supports a seamless bariatric care environment, to Help facilitate efficient management of the plus size patient weighing up to 454 kg/1000 lbs.



Auralis Plus mattress replacement system & Citadel Plus

The Auralis Plus is designed for high acuity patients with limited mobility and compromised skin integrity. The system includes active (alternating) and reactive (constant low pressure) modes, and self-adjusting technology to minimise the risk and burden of pressure injuries. With the option to add the Skin IQ® 1000 Microclimate Manager into the Auralis pump, it makes microclimate simple, helping to address not only the risks associated with prolonged pressure, but also those risks associated with temperature and moisture between the skin and the support surface.

### Measuring mattress performance

Two primary methods were used: Pressure Relief Index (PRI) to assess the active alternating mode and Pressure Area Index (PAI) to assess the reactive constant low pressure mode of the Auralis Plus system. Both methods were used to measure the pressure redistribution characteristics of the support surface for plus size weight distributions.

### Pressure Relief Index

An active alternating support surface is designed to limit the degree of immersion and envelopment into the surface, in order to support the patient clear of the deflating cell (Figure 1a). The mechanism of off-loading varies by design. Key performance characteristics such as cycle time, cycle duration, amplitude and rate of change can be measured and compared using standard methodology<sup>4</sup>.

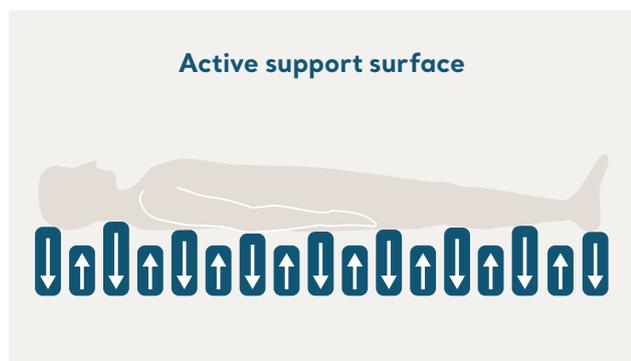


Figure 1a: Active Pressure Redistribution

Although it is impossible to determine an absolute threshold in the clinical setting, the goal is to achieve pressures as low as possible for as long as possible below standard thresholds of 30 mmHg, 20 mmHg and 10 mmHg.

### Pressure area index:

Reactive pressure redistribution surfaces (Figure 1b) provide an alternative, yet equally efficient method of pressure redistribution. As opposed to the periodic inflation and deflation of air cells the entire surface of a reactive mattress yields to the patient's weight, allowing the body to immerse into and be enveloped by the supporting medium air (powered or non-powered), foam or gel.

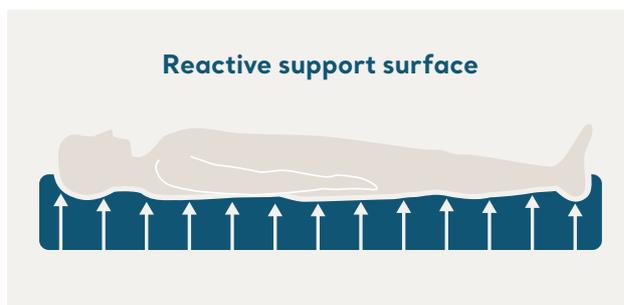


Figure 1b: Reactive Pressure Redistribution

By increasing the surface area in contact with the body, pressure is widely distributed and lowered. The benefits can be visualised using specialised pressure mapping which visually assess the degree of immersion provided by different support surfaces. The higher the percentage of PAI the better the pressure redistributing properties of the surface.

### Test methodology

Interface pressure measurements were collected using a 175 kg/385 lbs bariatric mannequin (Ruth-Lee). Additional 25 kg/55 lbs weighted sandbags were positioned on top of the Ruth-Lee mannequin to represent different anatomical somatypes. For the purpose of performance testing, Somatypes were grouped into two distinct categories:

- **Category 1:** The proportional apple - made to represent the proportional and apple somatypes (Figure 2a)



Figure 2a: Category 1 representation of the proportional apple

- **Category 2:** The bulbous pear - made to represent the pear and bulbous gluteal somatypes (Figure 2b)

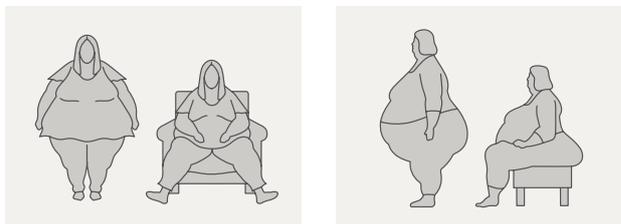


Figure 2b: Category 2 representation of the bulbous Pear

PAI was measured using an Xsensor 3.0 pressure measurement mat (Xsensor Technology Ltd), Calvary, Canada). PRI was measured using a Tekscan Sensor (Tekscan Inc, USA).

Analysis involved creating a Pressure Relief Index (PRI) calculating the time interface pressures were below clinically relevant thresholds below 30 mmHg, 20 mmHg and 10 mmHg. PRI is checked for 30 minutes in the alternating mode.

## Results: PRI performance



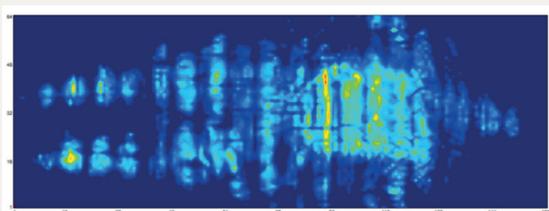
### Interpretation

- The alternating performance of the Auralis Plus is consistent across a weight range from 175 kg/386 lbs - 454 kg/1000 lbs
- At least 40% time will be spent off-loading in the alternating mode
- With the addition of the power-down straps in the heel zone of the mattress, offloading time at the heel is as high as 40% of the cycle time
- Testing demonstrated consistent performance regardless of somatypes tested. The Auralis Plus is likely to be effective at managing different body shapes and weight distribution

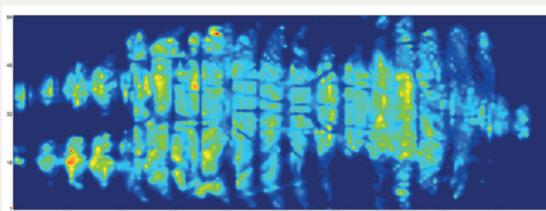
**Clinical relevance of PRI testing:** By sustaining a high PRI performance active pressure redistribution surfaces will ensure blood vessel diameters remain as large as possible for as long as possible. The potential advantage

of holding pressure 'lower for longer' has been reported in both healthy subjects<sup>5,6</sup> and those with impaired neurovascular response<sup>7</sup>.

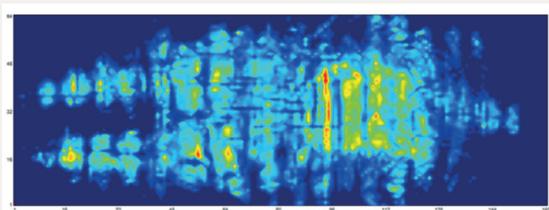
## Results: PAI performance



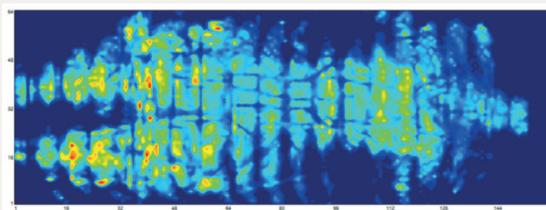
360 kg/793 lbs - Apple Shape - Flat Bed



360 kg/793 lbs - Apple Shape - 45° Fowler



454 kg/1000 lbs - Pear Shape - Flat Bed



454 kg/1000 lbs - Pear Shape - 45° Fowler

### Interpretation

- The constant low pressure mode of the Auralis Plus demonstrates consistency in performance in supine and Fowlers position across a variety of weight ranges (175 kg/385 lbs - 454 kg/1000 lbs)
- The PAI performance between the 2 somatypes was equivalent
- The pressure map images above show even distribution of interface pressure over the mannequin - no high spots or clustered pressure points were observed during the testing

**Clinical relevance of PAI testing:** With greater pressure redistribution comes an increasing likelihood that tissue distortion and vessel occlusion will be reduced.

The degree of pressure redistribution is dependent upon the surfaces ability to immerse and envelop the load.

## Assessing usability: generating user feedback

In addition to assessing the pressure redistribution properties of the Auralis Plus mattress replacement system, a usability assessment was also performed in order to generate user feedback. The specific aims of this phase were to:

- Assess and validate design features of the Auralis plus with plus-sized individuals
- Gather user feedback based on mattress stability & comfort in each therapy mode and at varying levels of comfort control adjustment
- Assess the addition of the Skin IQ 1000 microclimate coverlet onto the Auralis plus in terms of comfort and acceptability

### Assessment method:

Healthy plus size subjects were asked to evaluate 2 support surfaces - an Auralis 200 mattress replacement system as the bench mark product and the new Auralis Plus mattress replacement system (Figure 3). The full configuration of comfort mode settings (low, medium, high) was assessed for each of the subjects that took part in the usability evaluation in both active (alternating) and reactive (constant low pressure) modes. At each comfort level setting the bed frame was articulated from a flat supine position to 30°, then 45° and finally 60° head of bed elevation position.



Figure 3: Usability testing with plus size healthy volunteers

At each comfort setting and profiled position, subjects were given a 10 minute settling period before feedback was obtained from the participants.

Blinding of the subjects to the 2 mattress replacement systems was not possible for this testing.

Data obtained was focussed predominantly on mattress size (width), perceived comfort levels with the variety of comfort mode settings, mattress length, therapy modes and feedback on the addition of the Skin IQ 1000 Microclimate coverlet.

### Results & subject feedback:

Two healthy plus size subjects took part in this evaluation - 1 male and 1 female. The female subject weighed 155 kg/ 341 lbs and represented a 'Gluteal Pear' shape somatype. The male subject weighed 160 kg/352 lbs and represented a 'Proportional Apple' shape somatype.

Both subjects said they felt better on the Auralis Plus mattress replacement than the Auralis 200 system. For the female subject, this was mainly down to the support and the extra width provided by the inflatable width extension bolsters. For the male subject, he felt the cell pressure in the Auralis Plus was more appropriate for his weight and size and this led to him feeling more evenly supported by the new mattress.

Subjects agreed that the wider range of comfort adjustability available on the Auralis Plus system enabled them to find a pressure that was comfortable for them. Neither of the subjects had a problem with the introduction of the Skin IQ 1000 coverlet in terms of comfort. There was no tissue trapping or mattress cell separation observed during any phase of the usability testing.

### Conclusion & clinical impact

A global rise in obesity rates is likely to increase the requirement for equipment solutions which meet the unique needs of the plus size patient population. From a pressure injury perspective and given that prolonged or unrelieved pressure is the primary causative factor for pressure injury development, the most appropriate interventions must be those designed to mitigate risk by reducing the exposure to the degree and duration of pressure. In this respect, the provision of a support surface which provides effective pressure redistribution characteristics combined with microclimate management capabilities, are an essential component in the pressure injury prevention care pathway.

The Auralis Plus mattress replacement system provides good pressure redistribution properties in both active (alternating) and reactive (constant low pressure) therapy

modes. Testing demonstrated consistent performance regardless of anatomical somatype and across a broad range of mechanical loading scenarios. With the addition of the powered down heel zone, offloading time is as high as 40% of the alternating cycle in the vulnerable heel area.

From a usability perspective, healthy plus size volunteers found the system to be both comfortable and practical with the availability of the adjustable width extension side bolsters.

The data obtained from this study can help to highlight important support surface performance characteristics and help to inform clinical practice and subsequent surface selection for the plus size patient

## References

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