AtmosAir Velaris Adaptable Alternating Support Surface

Comparative Testing of Interface Pressure Performance of Seven Hybrid Surface Technologies Using a Weighted Mannequin

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Introduction & clinical context

Pressure injuries develop over time and are a consequence of a sequential and gradual deterioration of cell structures which are subjected to bodyweight or external forces[1,2]. Although the underlying cause and formation of pressure injuries is complex and multifaceted, generally they cannot form without loading, or pressure on the tissues[3].

In order to reduce the likelihood of pressure injury development, support surface design principles have long been focused upon the reduction of the magnitude and duration of skin and soft tissue loading. A wide range of Pressure Redistributing (PR) patient support surfaces, introduced into health care facilities over the past thirty years, have been used to achieve this. However, the effectiveness of these PR surfaces is often unclear[4]. In addition, key product performance characteristics can vary substantially between the different technologies available, which in turn can make appropriate surface selection in the clinical setting challenging.

Surface performance depends on many complex factors and hence a clear interpretation of performance data is needed to help inform clinical practice and to help guide clinical decision making and surface selection at the bedside. Surrogate non-invasive outcome measures of support surface effectiveness have been widely reported and mainly reflect the pressure exerted by the support surface upon the skin (for example Tissue Viability Society 2010[5]). Measurement of interface (contact) pressure is a long established technique used to characterise one aspect of the performance of pressure redistributing support surfaces.

This product performance evaluation compared heel and sacral contact pressures of a new adaptable alternating surface (AtmosAir Velaris) as well as six other configurations of pressure redistributing mattresses used for pressure injury prevention and management.

Testing objectives

Over September to November 2021, seven mattresses from various manufacturers were tested within the Welsh Wound Innovation Centre (WWIC) testing laboratory. The objectives of the study were to determine 'sacral' and 'heel' contact pressures measured upon a loaded mannequin positioned upon each of the pressure redistributing mattresses.

Arjo AtmosAir Velaris Adaptable Alternating Pressure Mattress

The Velaris adaptable alternating pressure mattress replacement represents the latest support surface innovation from Arjo. It combines foam and air to maximise the benefits offered by both a reactive and active alternating support surface. The Velaris pump offers fully adaptive technology to transform the surface into an alternating system with full off-loading capabilities designed to support a variety of patient risk profiles. Unique AltoVac® technology in the pump vacuums air out of the cells to provide a faster off-loading profile, whilst keeping interface pressure as low as possible for as long as possible.

Arjo AtmosAir Velaris Adaptable Alternating Pressure Mattress

Methodology

This study measured contact pressures at the 'sacral' and 'heel' region of a loaded mannequin (Figure 1) (80 kg plate weights on a rigid body flat wooden board mannequin with heel protrusions) positioned upon each tested mattress. The Velaris mattress was a production equivalent build without CE certification. All other mattresses were CE marked.

Figure 1: Pressure Redistribution 50th Percentile Mannequin Test Set Up. Shown for illustration purpose only – not actual test set up

The order of testing of the support surfaces was made using a pre-determined randomisation schedule. All work was performed according to the general requirements of ISO 20342 (Assistive products for tissue integrity when lying down — Part 1: General requirements), at the current time specific details of ISO 20342 mattress performance tests were not available and WWIC worked to the best available technologies for characterizing support surface performance.

Contact pressure measurements

- Contact pressure measurements were collected while a 50-percentile mannequin representing the human body was positioned centrally upon the mattress surface.
- Contact pressures were measured using a TekScan Evolution Handle (TekScan Inc., Boston, USA) with a type 4201 sensor with a measurement range of 0 to 400 mmHg. This device was used to gather continuous data upon the pressure applied to the sacrum and heel regions over the course of either four full alternating therapy cycles (40 minutes) or thirty minutes while mattresses acted in reactive (static) mode for each product. The type 4201 sensor (dimensions 50 mm x 24 mm) contains 264 measurement points with each recorded once-a- second during pressure measurement.
- The sensor cable was attached using medical tape to the underside of the mannequin at a distance of approximately 8cm from the sensor head to allow the sensor to be free-floating at both the apex of the heel and sacral region. Where possible the heel and sacrum were positioned above the apex of an air cell within the mattress although the configuration of some mattresses precluded this step as the air cells were difficult to identify through overlying foam.
- Prior to each pressure measurement session, a calibration file specific to the sensor was loaded into the software recording pressure measurements. Each pressure measurement session was recorded as a video file with measured pressures also stored as data files.

Data handling

- The data files from each mattress, anatomical site and mattress mode of action (static or active) were processed using an Excel spreadsheet provided by Arjo to reduce the 264 measures per second to a single pressure measurement associated with each second of mattress testing.
- Maximum and minimum contact pressures were recorded for each mattress from the first stable alternating cycle considered to occur between minutes 20 and 30 of each active mattress test. A Pressure Relief Index was also calculated for each active mattress from the period 20 to 30 minutes.
- After pressure measurements began; this index reported the percentage of measurements below 30, 20, 10 and 1 mmHg.
- No formal statistical testing of differences between measured contact pressures was undertaken as there were no natural groups (for example age, gender, Body Mass Index) to allow comparisons to be made.

Key Results

Pressure Redistribution Performance Characteristics in Reactive Mode

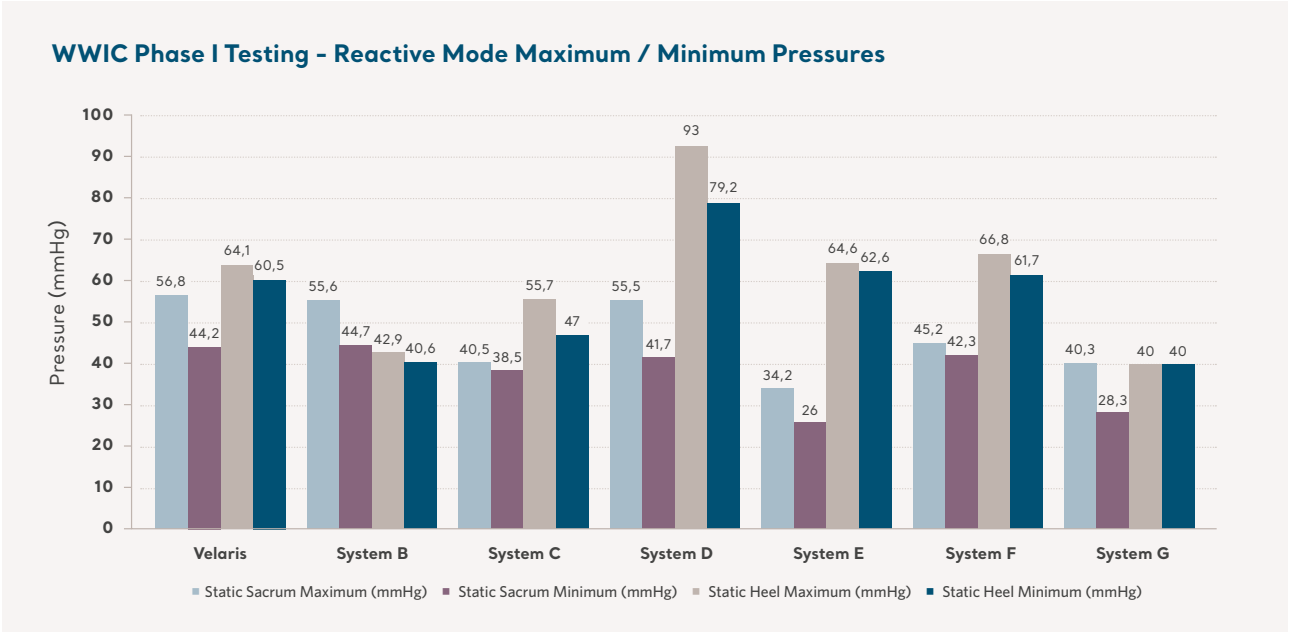

Figure 2 Static Pressure Performance

Figure 2 shows reactive pressure performance for each of the mattresses tested in both the sacral and heel region.

- Contact pressures for all systems tested were generally higher in the heel than sacral pressures.
- Pressure performance at both the sacrum and heel demonstrated few differences between the products when in reactive mode

Pressure Redistribution Index (PRI) Results – Alternating Mode – Sacrum

Figures 3a and 3b show pressure redistribution performance for each mattress in active alternating mode at the sacral region.

- PRI values show Velaris has the highest percentage of time below the standard thresholds of 30 mmHg, 20 mmHg & 10 mmHg
- Only 2 products tested achieved off-loading (below 1 mmHg) at the sacral region
- Velaris spent the most amount of time off-loading (59.5%) during the alternating cycle

The Velaris most often applied sacral contact pressures below 1 mmHg

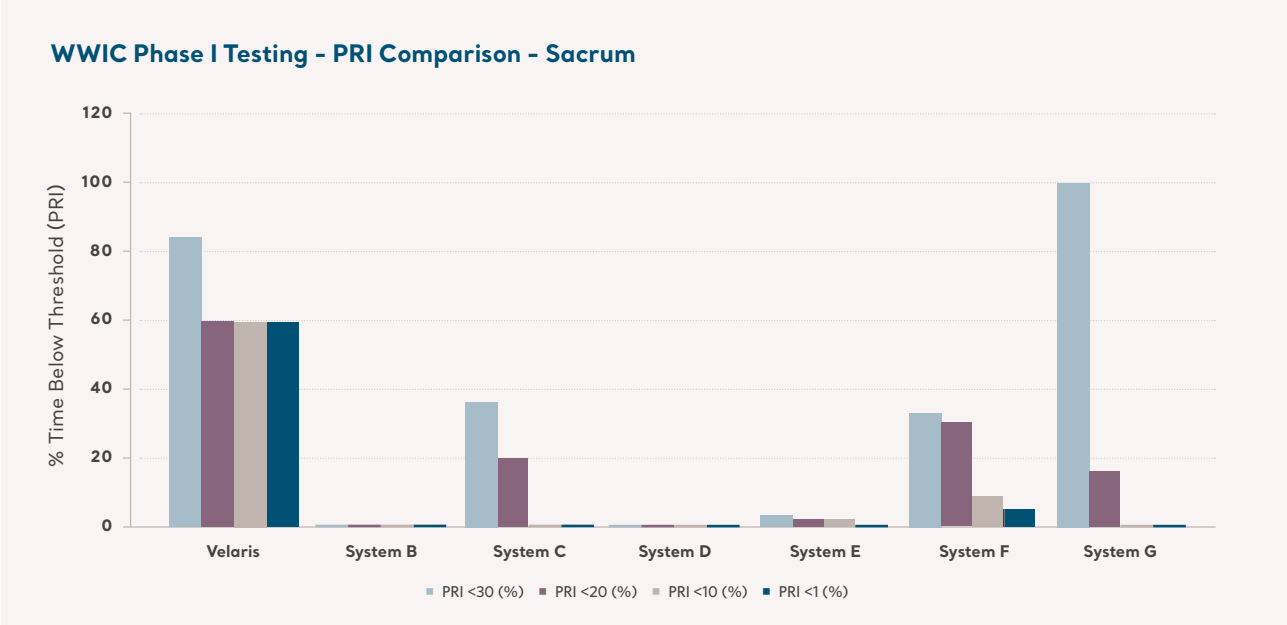

Figure 3a Pressure Redistribution Index Performance Comparison in active alternating mode – Sacral region

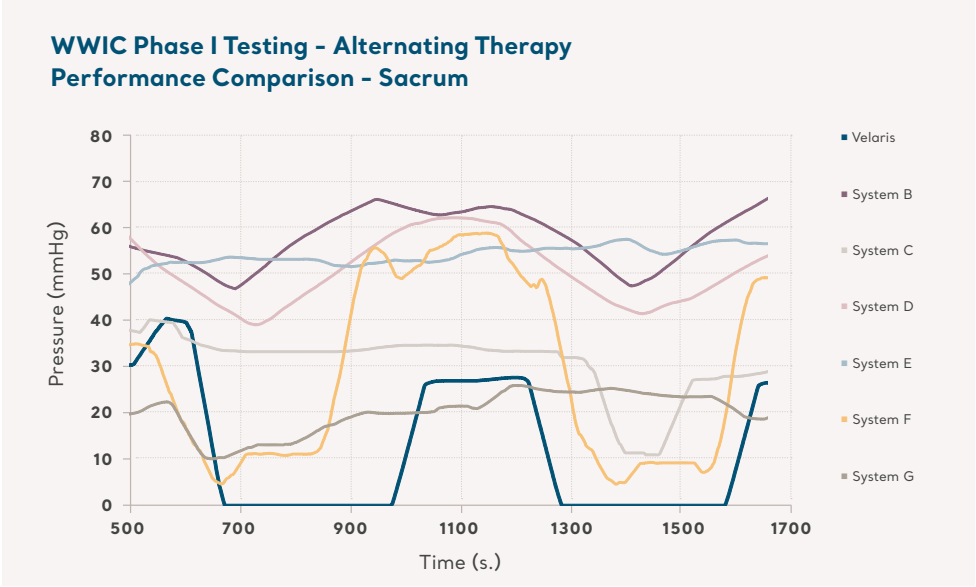

Figure 3b Pressure Redistribution Index Performance Comparison in active alternating mode – Sacral region

Pressure Redistribution Index (PRI) Results - Alternating Mode - Heel

Figures 4a and 4b show pressure redistribution performance for each mattress tested in active alternating mode at the heel region

- PRI values at the heel show Velaris has the highest percentage of time below the standard thresholds of 30 mmHg, 20 mmHg & 10 mmHg
- Velaris was the only product tested to achieve full off-loading at the heel region
- Velaris spent 44.0% of the cycle time achieving pressure off-loading

Only the Velaris mattress applied minimum heel contact pressures of 0 mmHg at the heel section

WWIC Phase I Testing - PRI Comparison - Heel

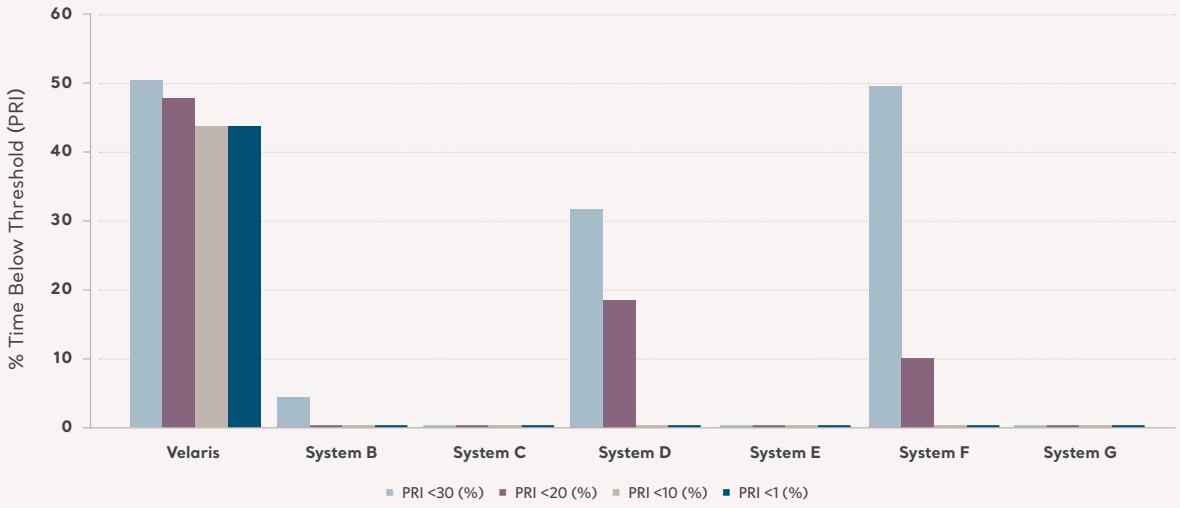

Figure 4a Pressure Redistribution Index Performance Comparison in active alternating mode – Heel region

WWIC Phase I Testing - Alternating Therapy Performance Comparison - Heel

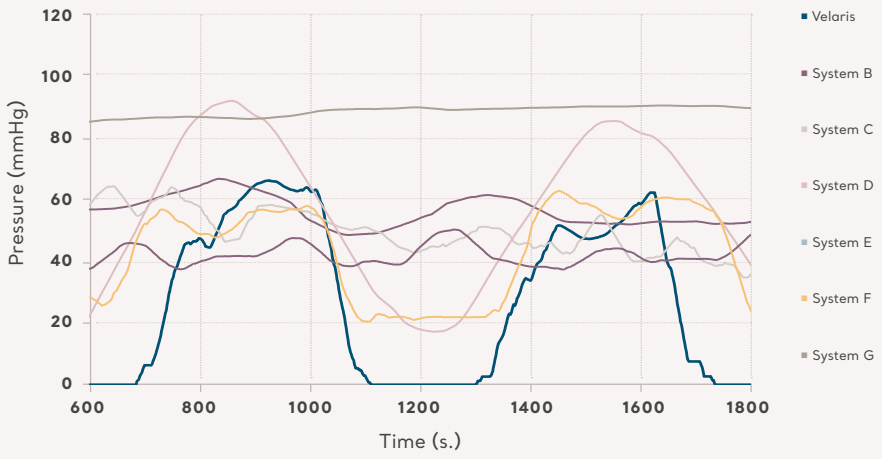

Figure 4b Pressure Redistribution Index Performance Comparison in active alternating mode – Heel region

Summary

The results of the current study suggest that the tested mattresses generally apply over 30 mmHg to both the sacrum and heels when in reactive mode and few differences between the surfaces when in reactive mode could be observed.

There were clear differences in product performance between the tested mattresses **when in active mode, two of the surfaces applied minimum sacral contact pressures of 0 mmHg (Velaris and System F) with the Velaris mattress most often applying sacral contact pressures below 1 mmHg**.

When considering the heel region of the mannequin when mattresses were **in active mode only the Velaris mattress applied minimum heel contact pressures of 0 mmHg with 44.0% of heel pressures below 1 mmHg**.

The results of these laboratory tests show clear differences between the performance of the different mattresses in terms of pressure redistribution. The promising results from the study require verification among human volunteers and then most importantly in patients to fully characterise the performance of the AtmosAir Velaris mattress.

References

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