

All Day Slings

Pressure Mapping and Microclimate testing

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 tissues³.

Given that prolonged or unrelieved pressure is the primary causative factor³, the most appropriate interventions must be those designed to mitigate risk by reducing the exposure to the degree and duration of pressure. Interventions, such as assisted repositioning regimens, help to reduce risk and are most effective when used in combination with pressure redistributing support surfaces.

Support surface technologies reduce the interface pressure between the body and support surface. The International pressure injury prevention and treatment guideline views support surfaces as an important component in pressure injury prevention and treatment protocols, since they can help prevent the effects of damaging tissue deformation and provide an environment that enhances perfusion of at risk or injured tissues.⁴ They further recommend that the key characteristics to consider when selecting a support surface are those features that affect **pressure redistribution, friction, shear force management and microclimate**⁴.

These key characteristics however will vary substantially between the different support surface technologies available, and this can often make appropriate surface selection in the clinical setting challenging. Standard test methods that quantify performance characteristics have been developed with the aim of matching users' needs to support surface capabilities⁵.

All Arjo support surfaces undergo rigorous bench testing to ensure they deliver the desired pressure redistribution under clinically relevant conditions. Our surfaces are also tested in independent laboratories to the US national standard for support surfaces: ANSI/RESNA SS-1:2019⁶. This whitepaper aims to demonstrate the compatibility of Arjo All Day Slings with the Pentaflex seat cushion, using the principles of the S3i testing standards designed for support surfaces⁷. Although the current S3i test standards focus on full body support surfaces rather than seat cushions, this approach has been taken because patients are often transferred from a support surface to a bedside chair and back. Therefore to provide a consistent means of comparison between the performance of the All Day Slings and other patient handling devices left underneath the patient in bed, the support surface standard was used.

Clinical relevance of testing the support surface in combination with Arjo All Day Slings

Arjo All Day Slings are used to reposition and transfer patients in combination with a passive floor or ceiling lift. The patient often remains on the sling following transfer to a chair, to reduce the amount of manual handling by caregivers and improve working efficiencies.

The international pressure injury prevention and treatment guideline⁴ recommends not leaving patient handling devices underneath the patient unless specifically designed to do so. It is therefore important to ensure that leaving the All Day Slings in place underneath the patient does not adversely impact the performance of the Pentaflex[®] Cushion.

This document will provide a summary of the results of the tests performed (performed to the ANSI/RESNA SS-1:2014 and :2019 standard) on the Pentaflex Cushion with and without the addition of the All Day Slings.

Surface tested:

The surface selected for testing is an example of a relatively widely used seat cushion, typically seen in acute and long term care and prescribed for immobile patients or patients with microclimate issues.



Pentaflex Cushion



General Purpose Clip Sling All Day (MAA2040M)



Mesh Sling All Day (MAA2070M)

Pressure mapping

Test overview: This test is performed to measure the interface pressure of a support surface to aid in the evaluation of the ability of a surface to redistribute pressure applied by a human subject.

Method: An Xsensor pressure mapping system was employed for conducting this evaluation. Three subjects were used according to the following weight ranges: 120-140 lbs, 160-180 lbs and 190-210 lbs.

Subjects were placed in a seated position in each of the All Day Slings, on the Pentaflex Cushion and asked to keep reasonably still for the duration of the 30 minute test especially below their chest region. In addition, the subjects' hips, knees and ankles were positioned to approximate 90° angles. Scans were obtained at 5 minutes and 30 minutes. Pressure Area Index (PAI) values were calculated on the complete set of pressure mapping data.

Clinical Relevance: Pressure redistribution plays an important role in preventing pressure injuries on patients while bed-ridden or in transport. Redistributing pressure around pressure points on the human body is an important factor to preventing or reducing the risk of pressure injuries. Pressure mapping can be an effective tool in determining the ability of a surface to redistribute pressure applied by a human subject.

Results: The results of the pressure mapping tests showed no impact of the All Day Slings on the pressure distribution when applied under a person who was seated on a Pentaflex Cushion for up to 30 minutes. The percentage of pressure Area Index (PAI) below 40 mmHg and 30 mmHg is reasonable with variation between test subjects which may be due to variability of subjects' size. The test variability of pressure mapping is +/-15%, mainly depending on the live test subject.

Pentaflex Cushion – Subject 2 (175 lbs)

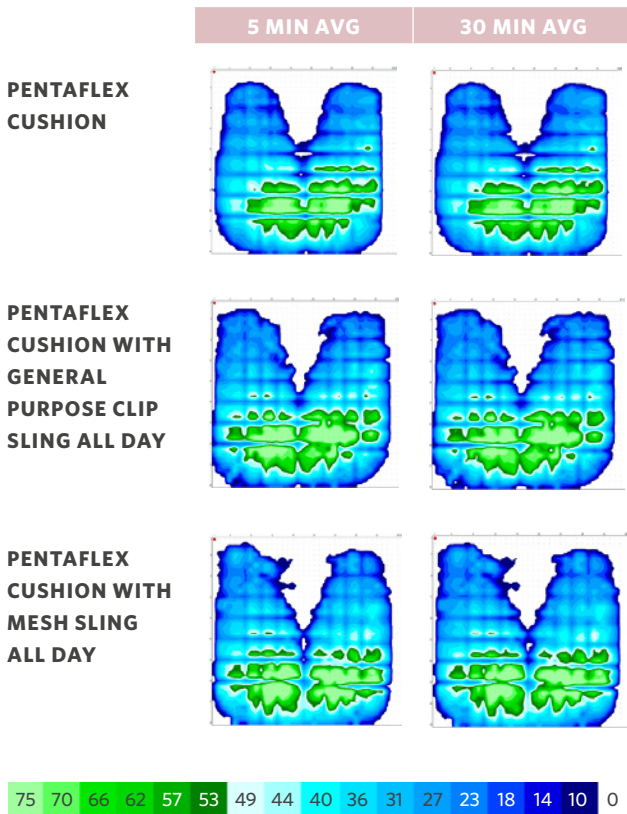


Figure 1. Pressure Mapping for Pentaflex Cushion with and without All Day Slings

Interpretation

There is no relevant change of the interface pressure with the addition of the slings to the Pentaflex Cushion. Due to the small subject sample (n=3) it is not possible to draw any statistical significance from the testing.

Microclimate management

An increasing body of evidence suggests that microclimate between the skin and the support surface plays a role in the development of pressure injuries. The term microclimate refers to the temperature, humidity and airflow next to the skin. Managing microclimate helps improve tissue tolerance to pressure, friction and shear.

Heat & water dissipation characteristics for support surfaces

Sweating guarded hot plate (SGHP) method: SS-1 (2019): Section 4⁶

Test overview: The purpose of this test is to identify the ability of the support surface to remove heat and moisture from the patient interface.

Method: A heated moist indenter measures the flow of heat and humidity through a support surface (Pentaflex Cushion) simulating the interface between the skin and the support surface.

Clinical relevance: There is a growing appreciation of the role of microclimate management in helping to improve tissue tolerance to aid in pressure injury prevention and management, particularly in the presence of excessive moisture and elevated temperature at the skin surface interface. Any surface that is in contact with the skin has the potential to affect the microclimate. The overall effect is dependent upon the nature of the support surface and the cover material.

Results: Differences in test results from SGHP are within test variability according to the test lab and therefore not relevant. The evaporative capacity of the Pentaflex Cushion with and without the addition of the All Day Slings is shown in figure 2.

Evaporative capacity

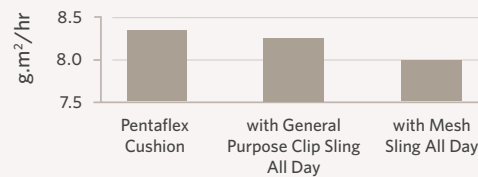


Figure 2. The evaporative capacity of the support surface with and without the addition of the All Day Slings

Interpretation

The sweating guarded hot plate test results showed that the addition of the All Day Slings on top of the Pentaflex Cushion did not have any significant impact on the heat and humidity dissipation as the test results were all within the test variability.

Body analog method: SS-1 (2019): Section 3⁶

Test overview: This test method measures the heat and moisture dissipation properties of the support surface by creating a comparable environment to the human body lying on a mattress. This test also includes a simulated repositioning event (shown at time = 180 minutes in figures 3 and 4) to assess the ability of a surface to return to its original state prior to loading.

Method: A Thermodynamic Rigid Cushion Loading Indenter (TRCL) is used to generate, control and measure the environmental conditions of temperature and relative humidity (% RH) at the patient interface.

Clinical Relevance: Humidity can have an adverse effect on tissue viability and often results in moisture being condensed and trapped under the patient's body. Products that provide less resistance to heat flow and more breathability will have RH closer to 50% with lower temperature.

Results: The Body Analog test results show there is no discernible difference when adding the All Day Slings on top of the Pentaflex Cushion.

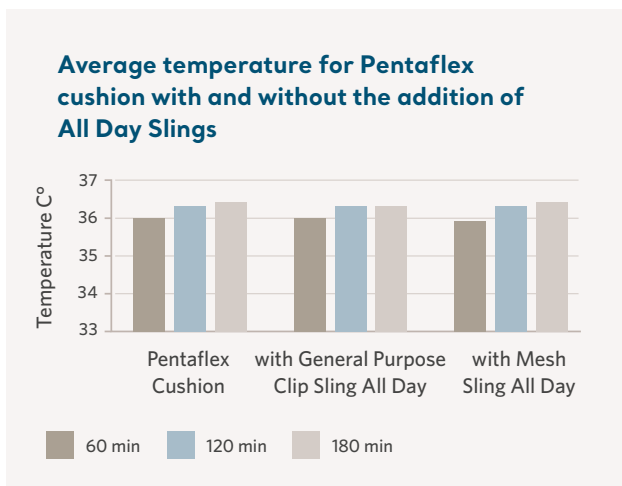


Figure 3. Average temperature for Pentaflex Cushion with and without the addition of All Day Slings

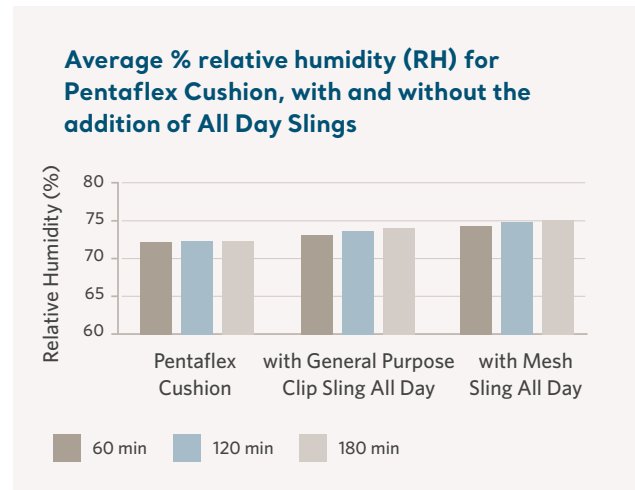


Figure 4. Average % relative humidity (RH) for Pentaflex Cushion, with and without the addition of All Day Slings

Interpretation

The Body Analog test results showed that the addition of the All Day Slings on top of the Pentaflex Cushion did not have any significant impact on its heat and humidity dissipation properties.

Conclusion

These tests are designed to demonstrate the impact on the Pentaflex Cushion performance characteristics (when leaving the All Day Slings in place underneath the patient) - not the impact of this directly on individual patients. This can support clinical decision making when assessing the risk of leaving the All Day Slings underneath patients for a period of time between transfers. However, the test results only form part of an individual patient risk assessment, which should be carried out by the responsible clinician when considering leaving an All Day Sling underneath a patient for a period of time between transfers. This should include consideration of the following factors:

- Individual clinical conditions and needs of the patient
- The efficacy of the surface they are positioned on
- Repositioning and patient handling practices
- Other factors influencing the risk of pressure injury development e.g. temperature and microclimate related needs. Ongoing monitoring of the patient is essential when deciding to leave the All Day Sling in place on the support surface, underneath the patient.

References

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3. 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/PPPIA, 2019. Section 8: Introduction to Repositioning and Early Mobilisation. Page 115.
4. 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/PPPIA, 2019.
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6. RESNA SS-1:2019 Requirements and Test Methods for Full Body Support Surfaces.
7. Arjo data on File, ref 100122546 and 100122547.
8. Arjo test data on file.

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