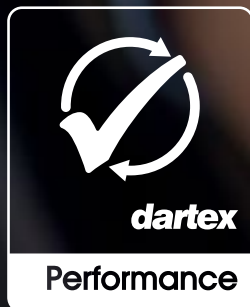




Are you sitting comfortably?

A study of how different types of Dartex[®] polyurethane-coated seat cushion covers compare against vinyl (PVC) when subjected to temperature and humidity testing



Aim

To demonstrate how the moisture vapour permeability of a seating fabric can influence the microclimate between the patient and support surface and show why this is important for patient comfort and outcomes.

BACKGROUND

It is well documented that managing skin temperature and moisture levels is important for maintaining skin integrity; for example, a 1°C increase in skin temperature leads to a 13% increase in metabolic demand.¹ Relative humidity² also affects the strength of the stratum corneum: at a relative humidity of 100% the stratum corneum is 25 times weaker than at 50% relative humidity.

Following on from a previous study undertaken in 2016³, this paper aims to further investigate the differences in temperature and humidity at the patient / support surface interface in seating, where the support surface is covered in a range of polyurethane (PU) and vinyl coated fabrics.

Clinical Relevance

MICROCLIMATE CHARACTERISTICS

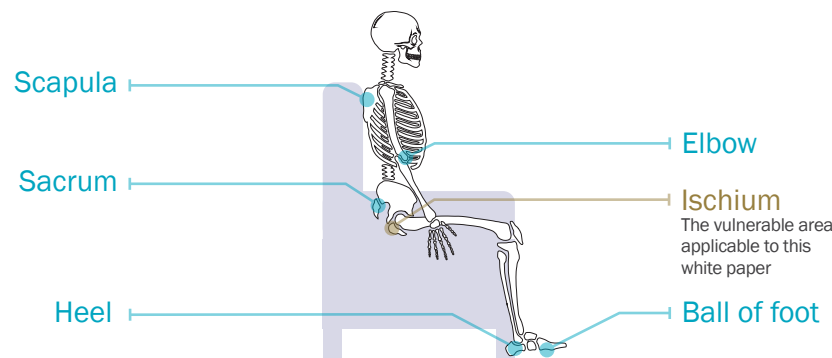
Demonstrating how different fabrics can influence the level of humidity in the area between skin and fabric.



WHERE PRESSURE ULCERS CAN FORM ON A SEATED PATIENT

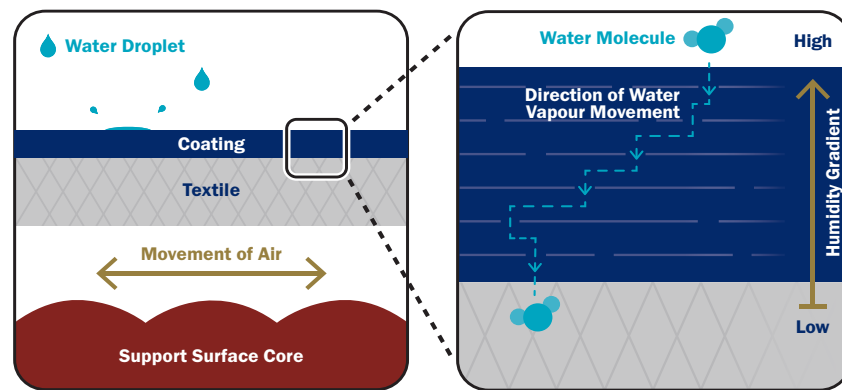
There are a number of areas where a seated patient could develop an avoidable pressure ulcer.

The ischial tuberosities, known informally as the 'sit bones' is the relevant area for this white paper.



WHY FABRIC CHOICE IS IMPORTANT WHEN CONSIDERING MEDICAL SEATING

To help keep a patient's skin cool and dry, it is important to consider the Moisture Vapour Permeability (MVP) or 'breathability' of the fabric. How much it 'breathes' is determined by the Moisture Vapour Transfer Rate (MVTR), which essentially means how quickly moisture vapour travels through the fabric and away from the patient's skin.



WHAT IS ABSOLUTE HUMIDITY?


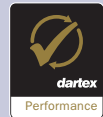
"Humidity is the amount of water present in a gas. Absolute humidity is the mass of water vapour that a given volume of gas can carry at a set temperature.

When a gas is at its maximum capacity, it is said to be fully saturated." Khan and O'Driscoll, 2004)⁴

Method

Four studies were undertaken in a laboratory and in a clinical setting to demonstrate the breathability of Dartex[®] fabrics in different conditions, with different cushion cores.

The fabrics were first tested in the laboratory to establish their levels of breathability:

TEST METHOD	PAYNE CUP ASTM D1653	PAYNE CUP ASTM D1653	ASTM E96 METHOD BW
UNIT	g/m ² /24 Hours	g/m ² /24 Hours	g/m ² /24 Hours
	850	275	500
	550	120	130
VINYL	57	25	33

- Dartex[®] Microclimate is demonstrably more breathable in laboratory conditions.
- Vinyl has the lowest levels of breathability.

STUDY 1

Laboratory testing to demonstrate breathability of different Dartex[®] fabrics compared to vinyl when covering a standard foam chair cushion, manufactured by Teal[®].

STUDY 2

Laboratory testing to demonstrate breathability of Dartex[®] Microclimate compared to vinyl when used with innovative Airospring[™] spacer core cushion.

STUDY 3 & STUDY 4

Clinical testing of Dartex[®] fabrics when used on specialist Seating Matters[®] chair by in-patients at a hospital in Ireland.

ANTICIPATED RESULTS

It is expected that the Dartex[®] Microclimate fabric would demonstrate lower levels of absolute humidity between patient and support surface due to its higher levels of breathability.

Study 1 – Standard foam core cushion

RATIONALE

Laboratory testing to demonstrate breathability of different Dartex® fabrics compared to vinyl when covering a standard Teal® healthcare foam core hospital chair cushion.



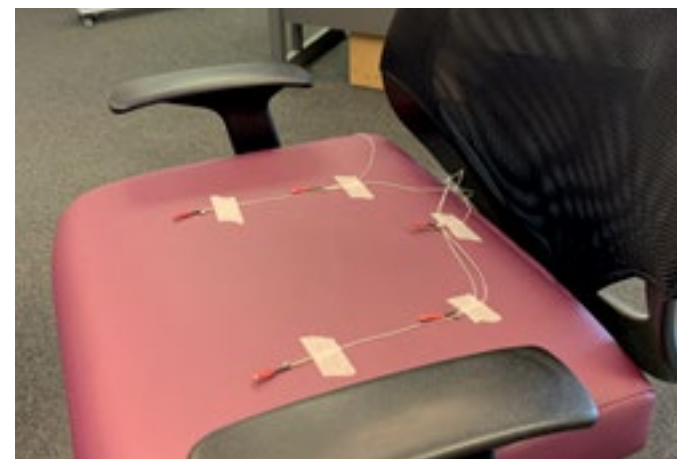
Method

Dartex® Performance (PER200), Dartex® Microclimate (MIC200) and standard healthcare vinyl fabric covers were made for a standard Teal® hospital side-of-bed patient chair cushion.

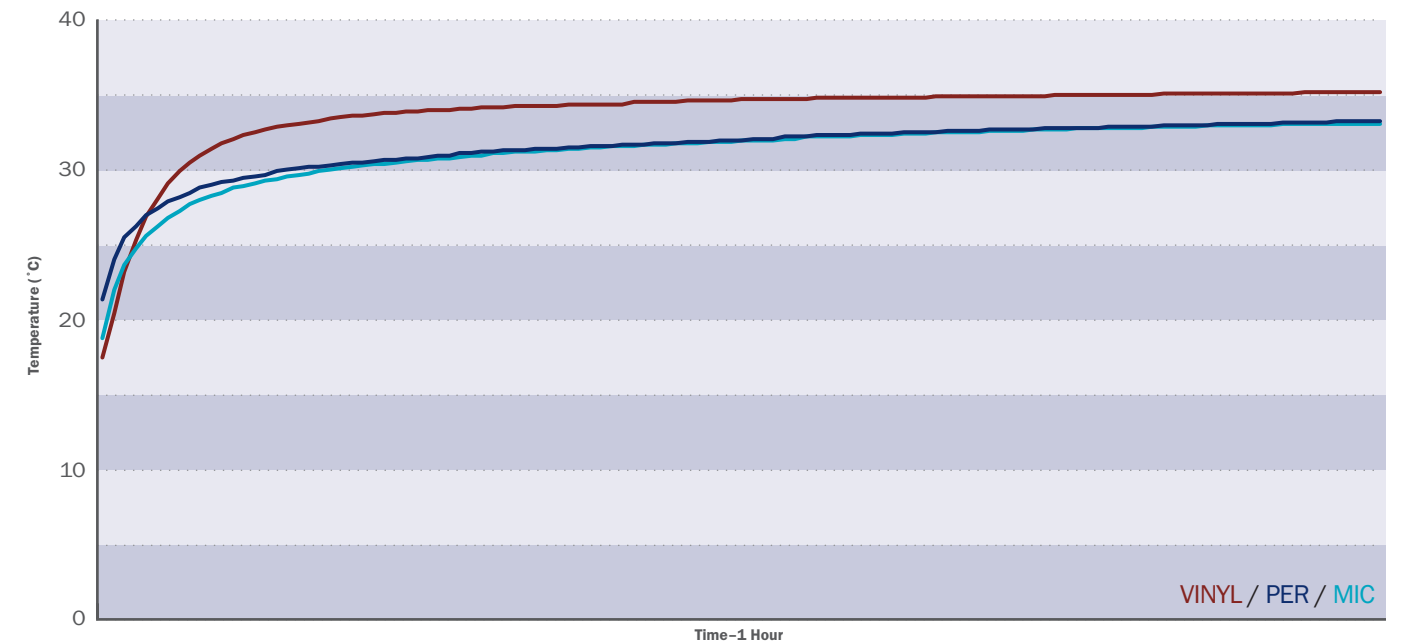
A seated volunteer weighing 60kg sat on each cushion for 1 hour.

Each cover was tested 4 times and readings were averaged, between each trial. Three measurements were taken each time and the average recorded.

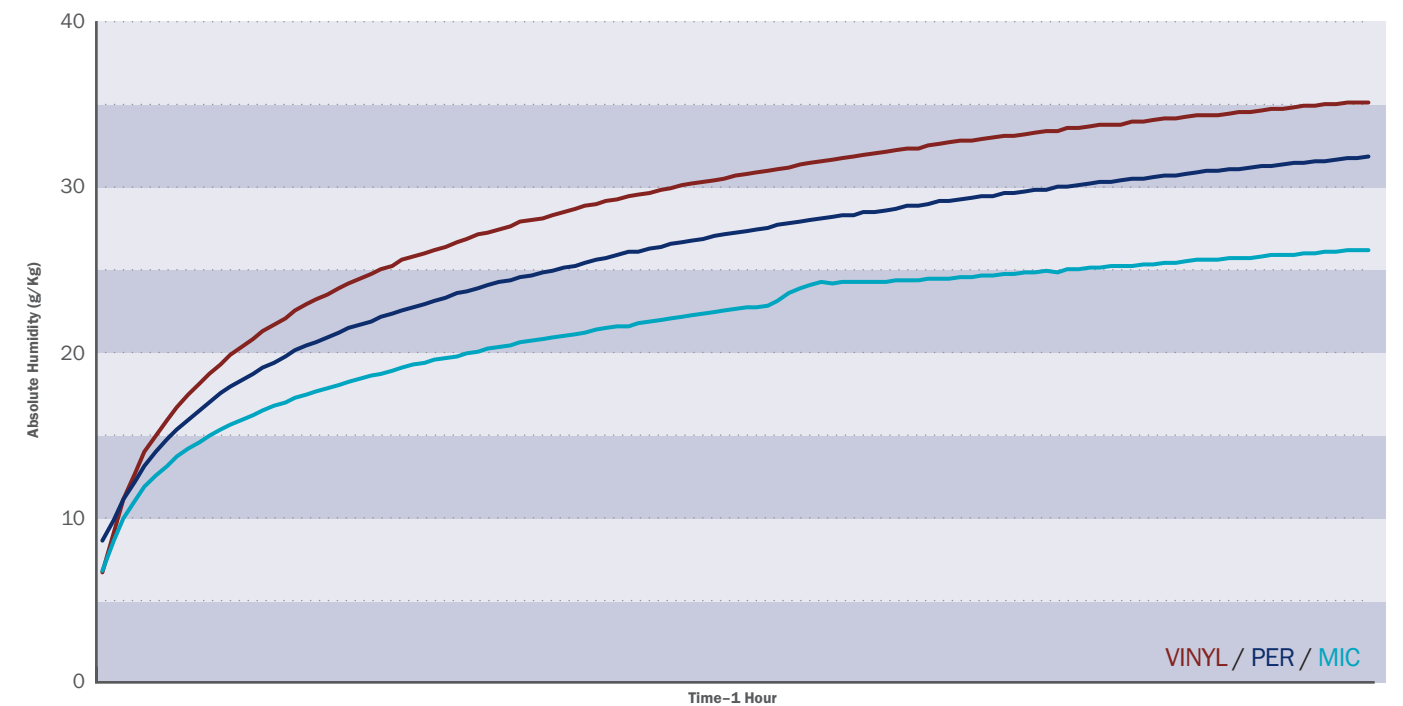
Temperature and humidity sensors were placed at the front, middle and back of each cushion, above and below the cover for each test.



TEMPERATURE – AVERAGE TOP



ABSOLUTE HUMIDITY – AVERAGE



Results

TEMPERATURE – BACK:

- The Dartex® MIC200 fabric performed the best, taking the longest time to equilibrate with body temperature.
- The vinyl cover temperature curve flattened out more quickly than the other fabrics, and settled at a higher temperature,
- It could be inferred from this that vinyl would be hotter and more uncomfortable to sit on for a longer period of time compared to the Dartex® fabrics tested.

ABSOLUTE HUMIDITY:

As expected, Dartex® Microclimate fabric performed the best, with lower levels of absolute humidity between the patient and the support surface than the other fabrics.

Study 2 – Spacer core cushion

RATIONALE

Laboratory testing to demonstrate breathability of Dartex® Microclimate compared to vinyl when used with innovative Airospring™ spacer core cushion.

Method

An Airospring™ spacer core pressure redistribution cushion was covered half in Vinyl and half in Dartex® Microclimate (MIC200) fabric.

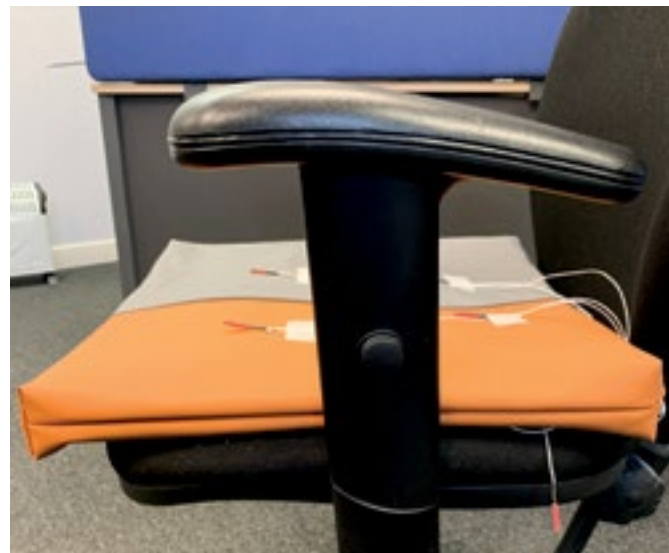
Temperature and humidity sensors were placed at two locations on each layer; above the cover, below the cover and underneath the spacer.



©Airospring

A seated volunteer weighing 60kg sat on the cushion for 1 hour.

The cushion was tested once and readings were averaged.



Results

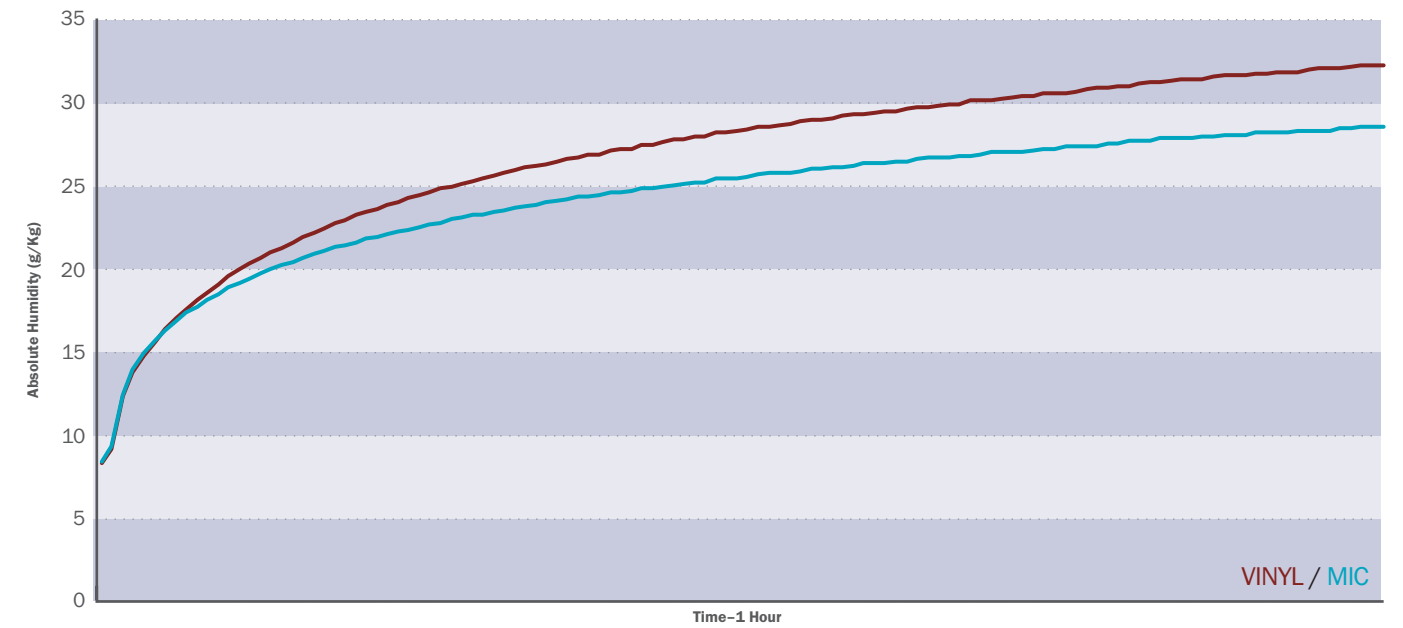
TEMPERATURE:

There was no significant difference reported between the two different sides of the cushion. This is not surprising as both sides of the cushion are in thermal contact.

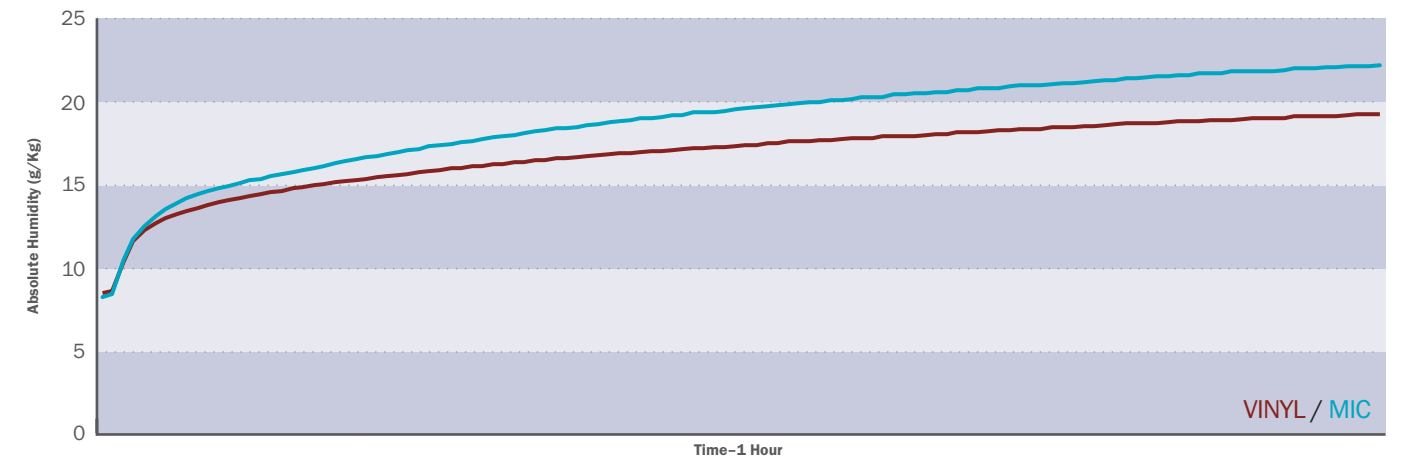
ABSOLUTE HUMIDITY:

- As expected, Dartex® MIC200 fabric performed the best, with lower levels of absolute humidity between the support surface and patient than the vinyl
- The vinyl side of the cushion demonstrated a more rapid increase in moisture
- The increase in humidity under the cover demonstrates that the Dartex® MIC200 cover allowed moisture through the cover away from the patient.

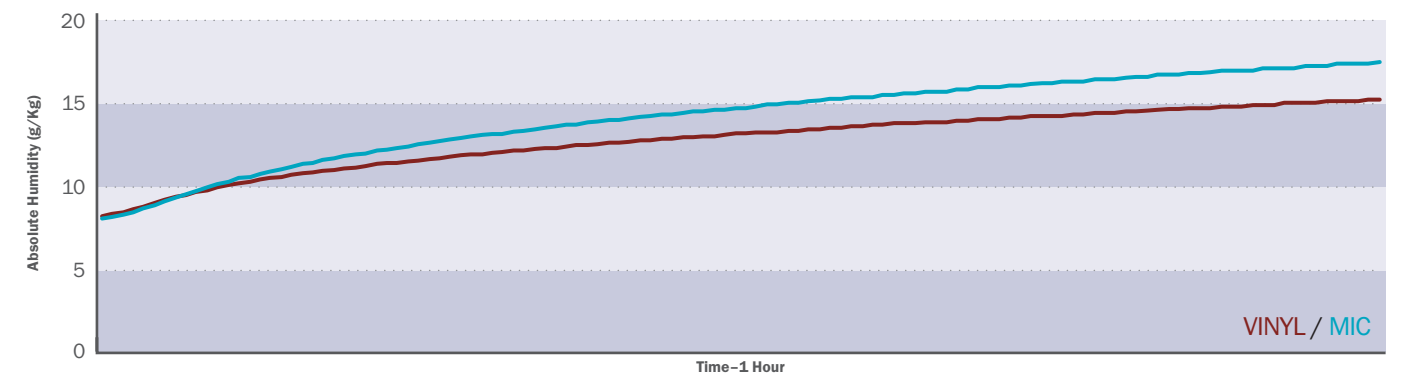
ABSOLUTE HUMIDITY – AVERAGE TOP



ABSOLUTE HUMIDITY – AVERAGE UNDER



ABSOLUTE HUMIDITY – AVERAGE BOTTOM



Study 3 – Clinical Evaluation: Specialist recliner chair

RATIONALE

Clinical testing of a specialist Seating Matters® Phoenix™ chair by an in-patient (Patient A) at a hospital in the Republic of Ireland.



Method

A Seating Matters® Phoenix™ chair was specially designed for this trial. One half of the cushion was upholstered with Dartex® Microclimate (MIC200) fabric and the other half with Dartex® Performance (PER200) fabric.

The T-Back of the chair was also upholstered to match the cushion.

Temperature and humidity sensors were placed at the front, middle and back of the cushion, above the cover. They were also placed on the T-Back of the chair.

Patient A sat in the chair for 1 hour and readings were averaged.

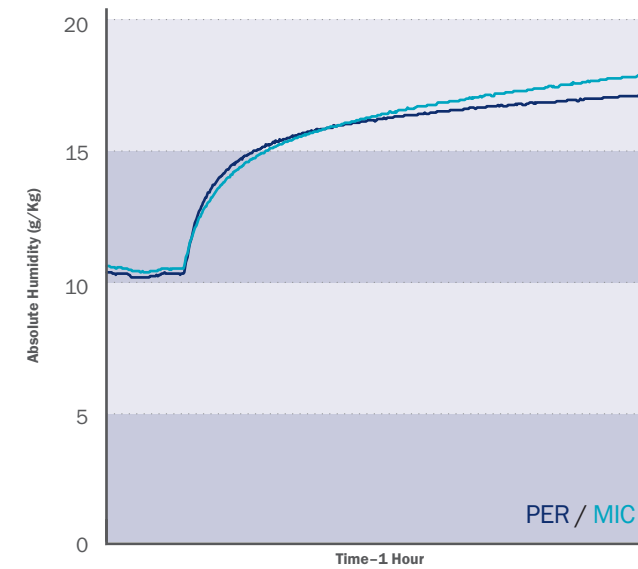


Results

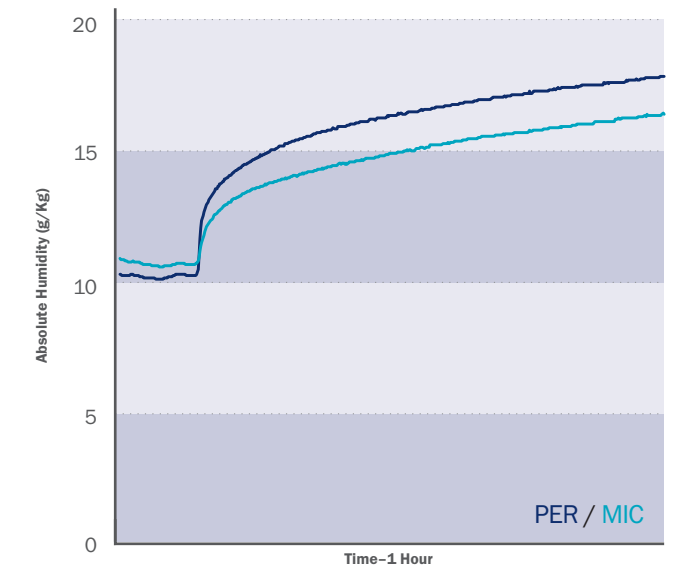
PATIENT A: TEMPERATURE

There was no significant difference reported between the two different sides of the cushion and T-back.

ABSOLUTE HUMIDITY – PATIENT A – BACK OF CHAIR AVERAGED



ABSOLUTE HUMIDITY – PATIENT A – SEAT CUSHION AVERAGED



ABSOLUTE HUMIDITY:

- The posture of the patient made interpretation of the results from the sensors on the seat back difficult as some of them were not fully covered. The Performance and Microclimate fabrics showed similar results.
- On the seat cushion, however, the Microclimate fabric demonstrated reduced humidity between patient and seat.

Study 4 – Clinical Evaluation: Specialist recliner chair

RATIONALE

Clinical testing of a specialist Seating Matters® Sorrento™ chair by in-patients (Patient B and Patient C) at a hospital in the Republic of Ireland.

Method

A Seating Matters® Sorrento™ chair was specially designed for this trial. One half of the cushion was upholstered with Dartex® Microclimate (MIC200) fabric and the other half with Dartex® Performance (PER200) fabric.

Temperature and humidity sensors were placed at the front, middle and back of the cushion, above and below the cover.

Patient B and Patient C each sat in the chair for 1 hour and readings were averaged.

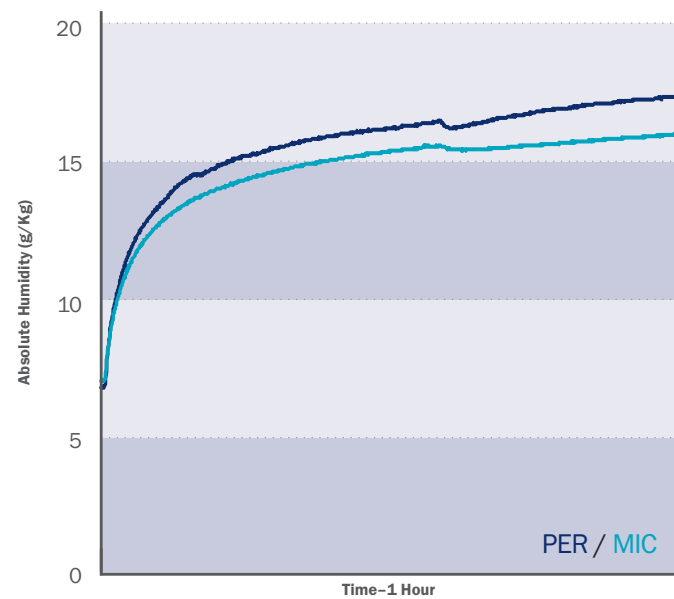


Results

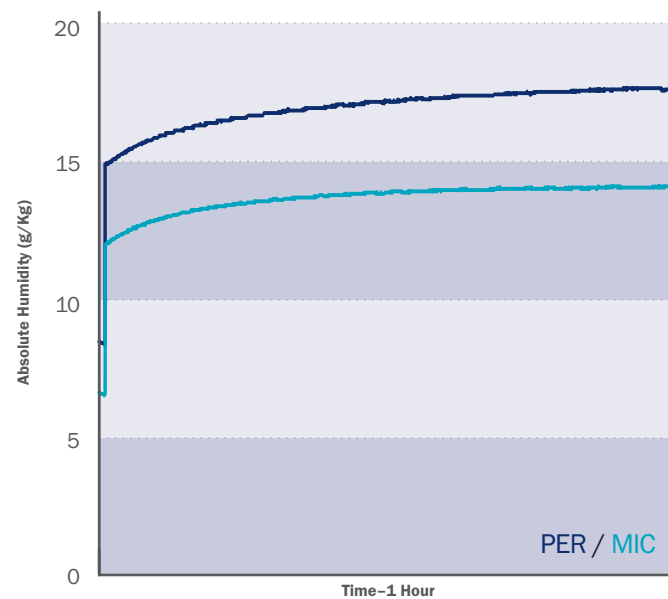
TEMPERATURE:

There was no significant difference reported between the two different sides of the cushion and T-back.

ABSOLUTE HUMIDITY – PATIENT B – SENSORS ABOVE THE FABRIC AVERAGED



ABSOLUTE HUMIDITY – PATIENT C – SENSORS ABOVE THE FABRIC AVERAGED



ABSOLUTE HUMIDITY:

As expected, Dartex® MIC200 demonstrated lower levels of absolute humidity between the patient and the seat cushion

than Dartex® PER200. Both Patient B and Patient C gave similar results.

Conclusions

- Laboratory testing demonstrated that Dartex® polyurethane fabrics are significantly more breathable than vinyl, with the Microclimate fabrics showing the highest breathability.
- In all trials involving vinyl, there was a higher concentration of moisture between the skin and the support surface on the vinyl than the polyurethane. As well as being uncomfortable for the user, as vulnerable skin heats up it becomes more susceptible to damage.
- The best results occur when cover and core work together to move moisture through the support surface.
- Further testing in a clinical setting is required to get first-hand experience from patients as to how they are experiencing the support surface in a real life situation.

THE STUDIES IN THIS PAPER WERE CARRIED OUT IN COLLABORATION WITH:

 Teal Healthcare® www.teal.co.uk/brands/teal-healthcare	 Airospring™ www.airospring.co.uk	 Seating Matters™ www.seatingmatters.com
---	--	---

References:

- Fisher SV, Szymke TE, Apte SY, Kosiak M. Wheelchair cushion effect on skin temperature. Arch Phys Med Rehabil 1978; 59(2): 68-72.
- Brienza DM, Geyer MJ. Using support surfaces to manage tissue integrity. Adv Skin Wound Care 2005; 18: 151-57.
- Haxby R, Pearce K, Scott I, Williams C. Seating and Microclimate 2016; Presented at European Seating Symposium conference, Dublin 2016.
- Khan, S.Y. & O'Driscoll, B.R. (2004) Is nebulized saline a placebo in COPD? BMC Pulmonary Medicine, 30 (4), 9.

© 2019 Trelleborg Group. At time of publication the information contained in this literature is believed to be correct and accurate.

Trelleborg is a world leader in engineered polymer solutions that seal, damp and protect critical applications in demanding environments. Its innovative engineered solutions accelerate performance for customers in a sustainable way. The Trelleborg Group has local presence in over 40 countries around the world.



twitter.com/TrelleborgHM
youtube.com/Trelleborg
linkedin.com/company/trelleborgecf
www.dartexcoatings.com