No Sweat? A Study Into The Microclimate Characteristics Of PVC And Polyurethane Coated Seating Fabrics

Presented at the Tissue Viability Society (TVS) Conference May 2019
Authors: Dawn Chilvers, Richard Haxby, Katie Pearce, Claire Williams

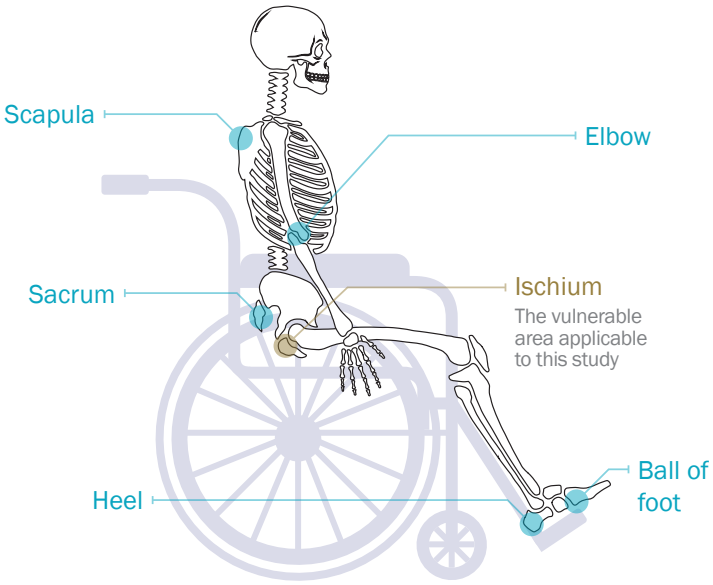
Outline

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[i]. Relative humidity 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[ii].

Following on from a previous study undertaken in 2016[iii], this paper aims to further investigate the differences in temperature and humidity of polyurethane coated (PU) fabrics over PVC.

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' are the ones we are interested in as part of this study.



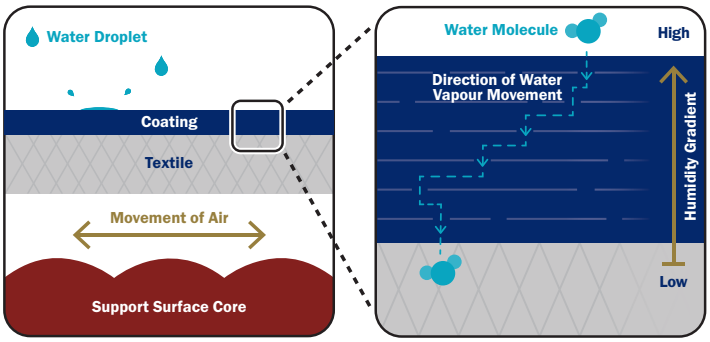
WHY FABRIC CHOICE IS IMPORTANT WHEN CONSIDERING MEDICAL SEATING

To help keep a patient's skin cool and dry, it is important to consider the Mositure 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:

Explaining Moisture Vapour Transfer

The polyurethane coating of a support surface is a **waterproof barrier...**

...but is also **water vapour permeable** because moisture vapour moves from areas of high humidity to lower humidity



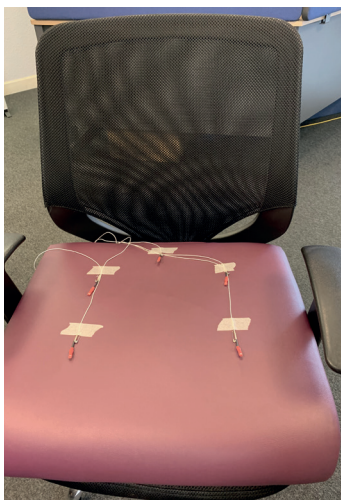
Method

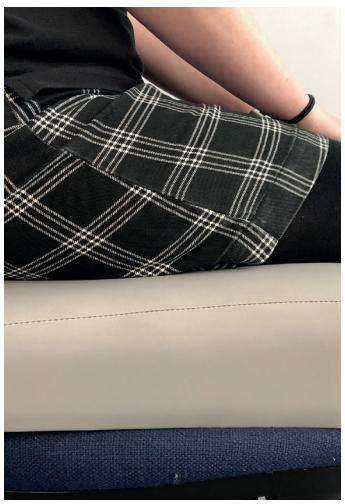
Two standard hospital chair cushions with a foam core were covered in a polyurethane-coated faux leather, and a PVC based vinyl fabric. These fabrics were chosen as PVC is still a popular choice for side of bed seating in hospitals, and polyurethane-coated faux leather is a logical alternative to this.

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

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

Each cushion was tested 4 times and the readings were averaged.





Results

LAB TESTING OF FABRIC SAMPLES

In a laboratory setting, the PU-coated faux leather was demonstrably more breathable than the PVC fabric.

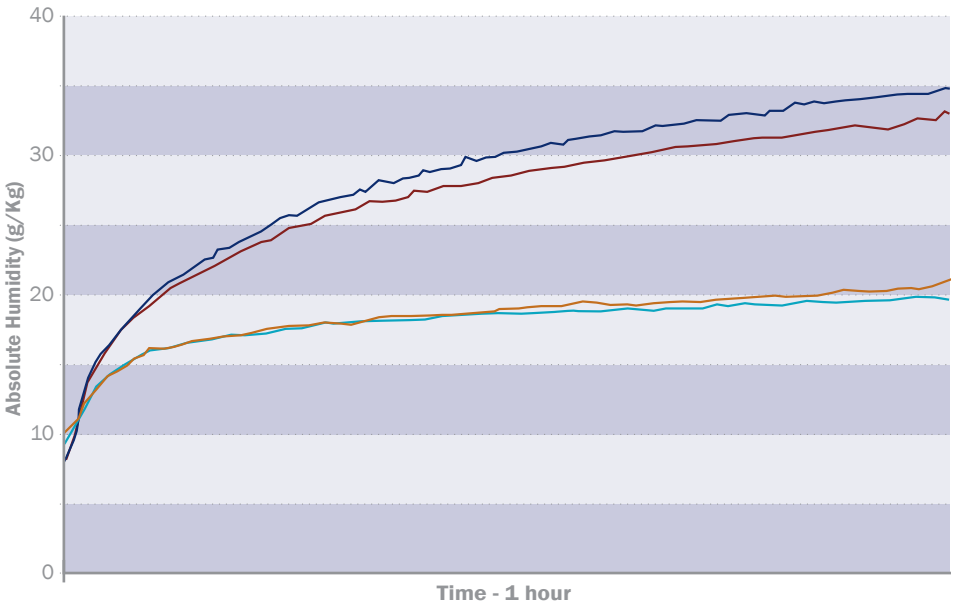
Test Method	PAYNE CUP ASTM D1653	ASTM E96 Method B	ASTM E96 Method BW
Unit	g/m²/24hours	g/m²/24hours	g/m²/24hours
PU-coated faux leather (LEA)	275	60	110
PVC	57	25	33

GRAPH 1 – ABSOLUTE HUMIDITY

As the test progressed, the humidity, recorded by the sensors on top of the cushion, was consistently higher for the PVC-coated cover than PU-coated artificial leather cover.

In regards to the sensors placed underneath the cover fabrics, the results were very similar for both the PVC and PU-coated faux leather.

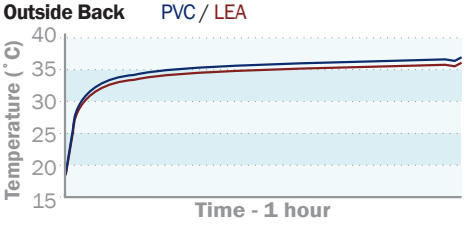
Top & Under (Averaged) PVC TOP / LEA TOP / PVC UNDER / LEA UNDER



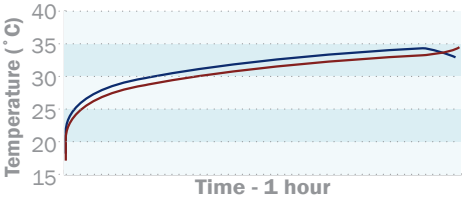
GRAPH 2 – TEMPERATURE

The temparature was slighly elevated on the PVC cushion in all three positions.

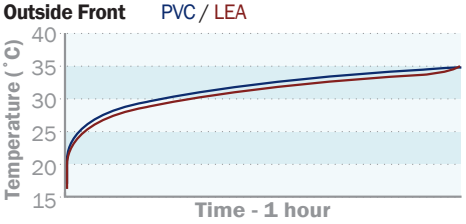
Outside Back PVC / LEA



Outside Middle PVC / LEA



Outside Front PVC / LEA



Conclusion

The humidity measured at the interface between support surface and test subject was consistently lower with the PU-coated leather cover than the PVC-coated cover.

This demonstrates that the PU-coated leather cover is better at dissipating the moisture, moving it away from the skin.

The authors expected that the humidity measured underneath the cover would have been significantly higher for the PU-coated artificial leather than the PVC coated cover as the material has a much higher MVTR. Whilst a slight difference was measured, it is not large enough to explain the difference seen above the cover.

The results suggest that the foam used in the seat may a limiting factor in the amount of moisture that can pass through the cover fabric and that there are mechanisms other than diffusion through the cover that allow some fabrics to effectively dissipate moisture.

Whilst the difference in temperature between the PVC and the PU leather was not massive, it was consistent. Keeping vulnerable skin cooler for longer could help reduce the occurrence of pressure ulcers.

It was clear that the PVC heated up faster than the PU-coated faux leather. This could make it more uncomfortable for the patient to sit on over a longer period of time. Furthermore, as vulnerable skin heats up it is more susceptible to damage in the ischial tuberosities, and could put the patient at greater risk of developing a pressure ulcer.

It is very important that the support surface cover and core work in harmony together to ensure optimum breathability, and allow the cover to work as it should in allowing moisture to escape from the skin / support surface interface.

This was an isolated study comparing a medical fabric against PVC, so further research is required to see if the results are repeatable. It would be interesting to see if the results differ if the seat core is changed to a different material and to identify the alternative routes for moisture dissipation. Further valuable information could be obtained by undertaking clinical trials with real patients over a longer period of time.

where skin meets fabric
dartex

Acton Close, Long Eaton, Nottingham
NG10 1FZ, UK
dartexsales@trelleborg.com
+44 (0)115 983 7676

www.trelleborg.com/engineered-coated-fabrics

WITH THANKS TO:

Teal Health Care for the provision of cushions **www.teal.co.uk**

Inside Climate GmbH for the provision of temperature & humidity testing equipment

REFERENCES:

i. Fisher SV, Szymke TE, Apte SY, Kosiak M. Wheelchair cushion effect on skin temperature. Arch Phys Med Rehabil 1978; 59(2): 68-72. | ii. Brienza DM, Geyer MJ. Using support surfaces to manage tissue integrity. Adv Skin Wound Care 2005; 18: 151-57. | iii. Haxby R, Pearce K, Scott I, Williams C. Seating and Microclimate 2016; Presented at European Seating Symposium conference, Dublin 2016.