Studies Correlating Microclimate to the Materials and Design of Heel Offloading Boots

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Background

Previously, clinicians attempting to reduce heel pressure ulcer prevalence considered only three factors: pressure, shear and friction. However, an additional factor receiving attention in recent years is **microclimate**.

Purpose

When a new factor is identified in the development of pressure ulcers, the way products used for prevention and treatment are evaluated must evolve. Cindy Kiely, writing for WOCN in the July/August 2012 issue, noted, **"We also found that skin and wound products were in need of extensive review. Products selection was based upon cost rather than evidence-based practice."**[5] Not only is it important to evaluate heel offloading products and other skin and wound products based on clinical studies, those studies must be updated to accommodate new information. In the wake of this new focus on microclimate, two recent studies have been conducted to determine how professional heel offloading materials and devices performed.

What is microclimate?

In relation to pressure ulcer development, microclimate is a term used to describe two aspects of the interface between the skin and a support surface — temperature (of the skin or the soft tissues) and humidity or skin surface moisture at the interface between the skin and the support surface.[1,2,3]

Why is microclimate important?

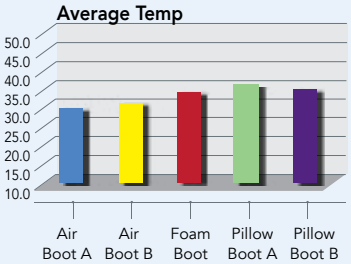
In a recent study, Gefen wrote, **"There is increasing evidence that thermodynamic conditions within and around skin tissue strongly influence the susceptibility of skin to SPUs (Superficial Pressure Ulcers)..."**[4] Successful pressure ulcer prevention depends upon a complex balance between two sets of parameters — the external loads applied to the skin and soft tissues, and the intrinsic ability of the skin and soft tissues to withstand prolonged or excessive loading. If the intrinsic resilience of the skin and soft tissues deteriorates, pressure damage is more likely to occur. Hence, a full understanding of a patient's conditions, and immediate environment, including anything that may cause the patient's skin to increase in temperature or moisture should be considered.

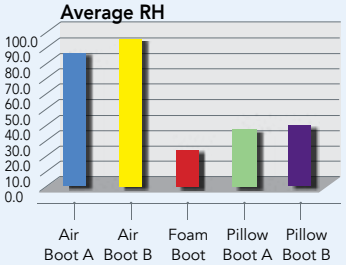
Results

1 Simulation and Discussion of the Microclimate in Heel Protector Boots[6]

Weber State University and E. Call, C. Oberg, B. Bill, C. Mclean

As described by Gefen, a support suface's permeability to humidity and perspiration has a much greater effect on tissue integrity than skin temperature. Although the air bladder boots were the coolest, the open-celled foam boots were more permeable to moisture, demonstrating that the microclimate inside these boots is better suited for protecting tissue integrity than less moisture permeable constructions.

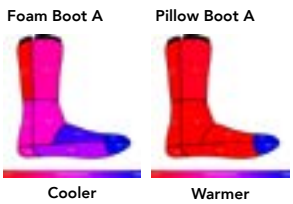


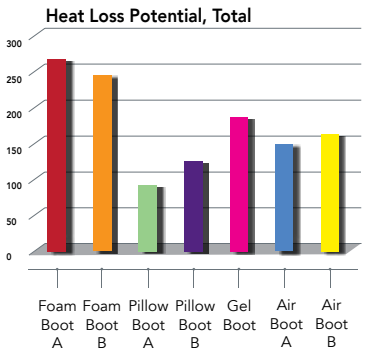


2 Thermal and Evaporative Heat Transfer Properties of Seven Pressure Relieving Heel Protector Boot Products[7]

Textile Protection and Comfort Center College of Textiles North Carolina State University

Seven pressure relieving heel protector boot systems were submitted to the Textile Protection and Comfort Center (T-PACC) in the College of Textiles at North Carolina State University.





Conclusion

While extensive further testing is needed, especially clinical testing that takes into account factors outside the laboratory environment, it is clear that the materials had varied responses to heat and moisture. That these results were correlated by material type (e.g. the pillow-style boots performed more like each other than like the air boots or foam boots) suggests that the material used in constructing a heel offloading device is at least as important as the design of the boot itself as concerns microclimate. When heat and moisture are considered together, the foam boots arguably performed best.

1

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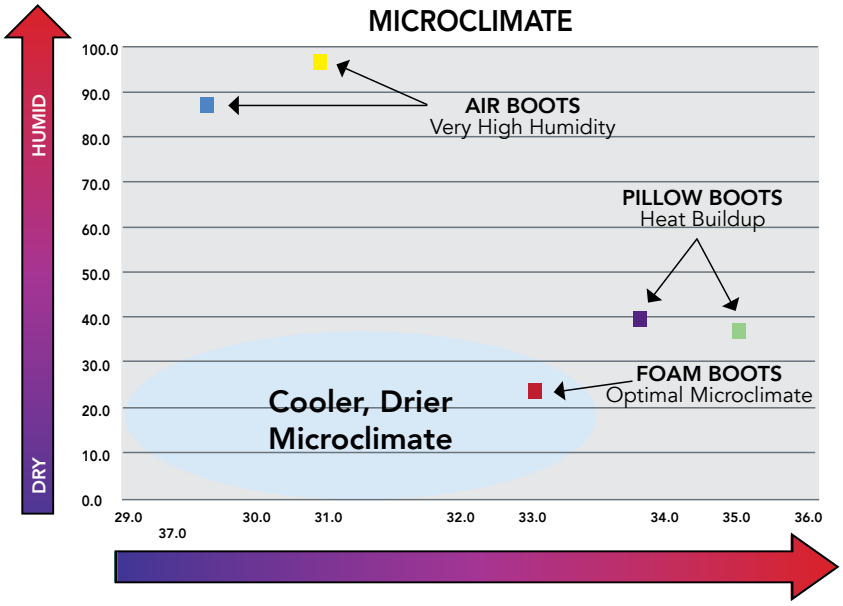

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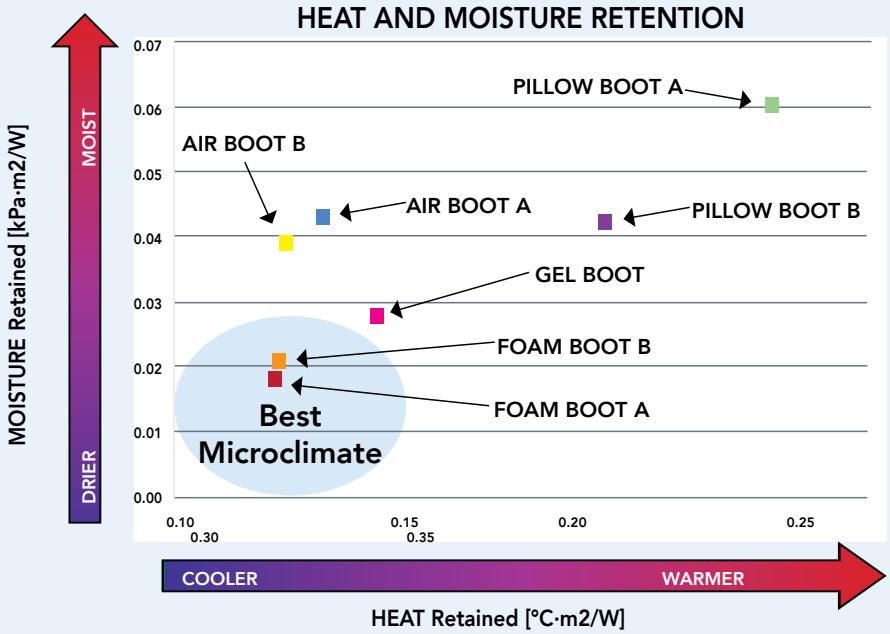

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1 Clark M, Black J Skin IQTM Microclimate Made Easy. Wounds International 2011;2(2). Available from http://www.woundsinternational.com
2 National Pressure Ulcer Advisory Panel (NPUAP). Support Surface Standards Initiative. NPUAP 2007. Available at: http://www.npuap.org/NPUAP_S3I_TD.pdf.
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4 Gefen, A. How do microclimate factors affect the risk for superficial pressure ulcers: A mathematical modeling study. Journal of Tissue Viability 2011; 20:81-88.
5 Kiely, Cindy, "Cultural Transformation in Pressure Ulcer Prevention and Care." Journal of WOCN. July/August 2012, p.444.
6 Call, Evan, Craig Oberg, Brian Bill, Chad Mclean: Weber State University, "Simulation and Discussion of the Microclimate in Heel Protector Boots." September, 2013.
7 Textile Protection and Comfort Center, College of Textiles: North Carolina State University, "Thermal and Evaporative Heat Transfer Properties of Seven Pressure Relieving Heel Protector Boot Products." March 2014.