Simulation and Discussion of the Microclimate in Heel Protector Boots

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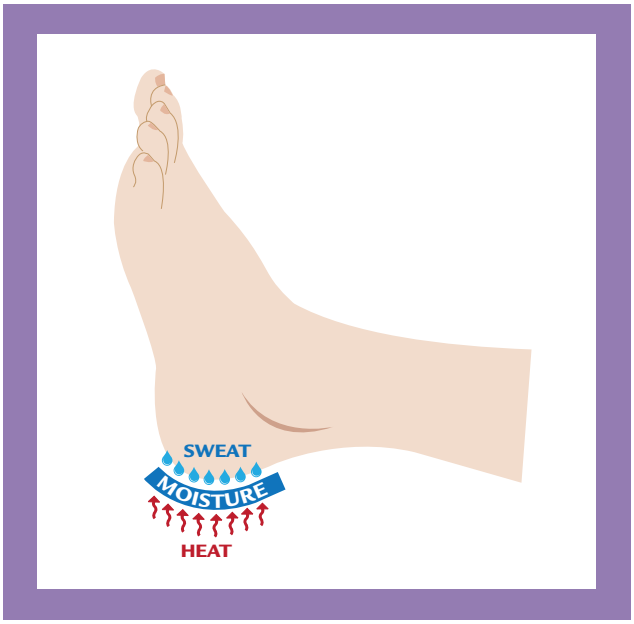
Background

Heel protector boots protect the integrity of the at-risk heel tissue by redistributing pressure and reducing friction and shear; however, tissue integrity is greatly influenced by the microclimate at the tissue-protector boot interface. Because elevated skin temperature is associated with increased metabolic demand of 6% to 13% per degree Celsius, it is reasonable to conclude that tissue susceptibility to injury is increased, particularly when both nutrient supply and metabolite removal are reduced by loading.[1]

- High temperatures stress tissues by increasing metabolic demand and induce sweating response, leading to an accumulation of moisture.

- Moisture trapped at the skin increases friction and lowers the breaking strength of skin.

In addition to pressure, friction, and shear reduction, the temperature and moisture permeability of these devices should be considered when choosing an appropriate heel protector boot in the clinical setting.



Purpose

The purpose of this experiment was to simulate, measure, and compare the microclimate at the boot-patient interface by applying a heated indenter, modified to release water vapor, to the internal surface of six commercially available heel protector boots.

Open-Celled Foam

Air Bladder

Pillow

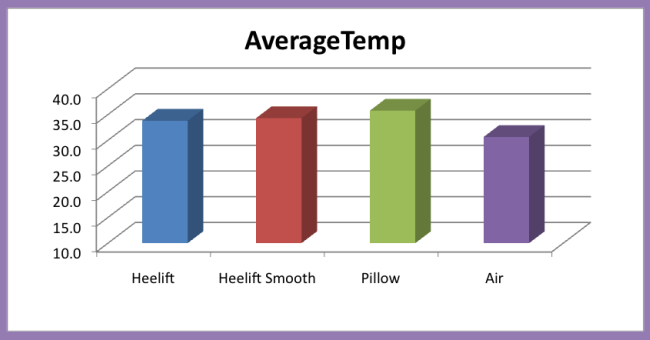
Two samples of three different styles of boot construction were tested: open-celled ventilated foam, air bladder, and pillow. The microclimate was continuously monitored via temperature and humidity sensors.

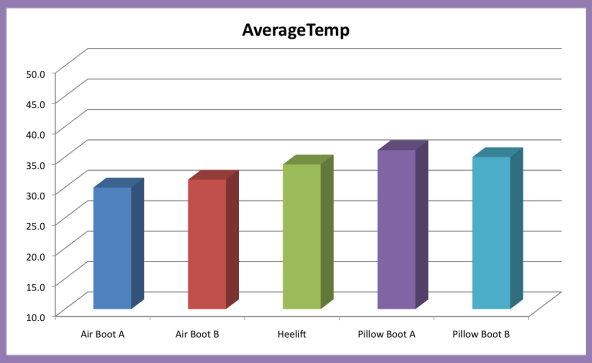
1 Lachenbruch C. Skin cooling surfaces: estimating the importance of limiting skin temperature. Ostomy Wound Management 2005; 51(2):70-9

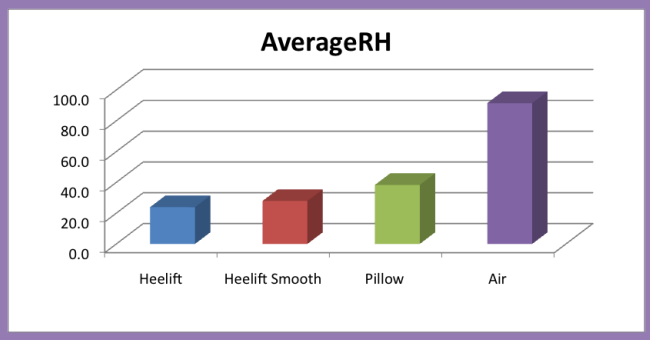
Results

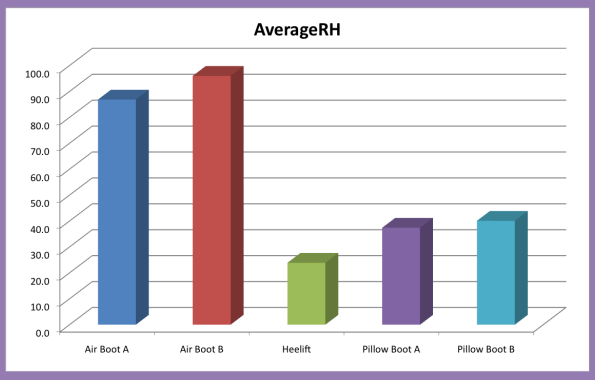
As described by Gefen[12], a support surface's permeability to humidity and perspiration has a much greater effect on tissue integrity than skin temperature. Although the air bladder boots were the coolest, the open-celled foam boots were more permeable to moisture, demonstrating that the microclimate inside these boots is better suited for protecting tissue integrity than less moisture permeable constructions.

2 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



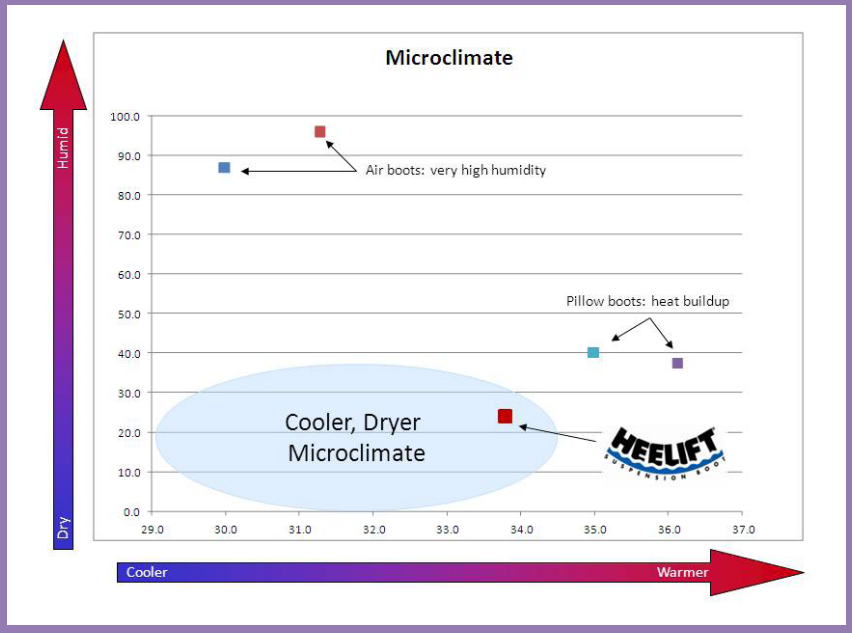






Conclusion

The air bladder style boots remained cooler than the pillow and open-celled foam constructions by approximately 4-6°C and 2-3°C, respectively. The open-celled foam trapped less humidity (was more permeable) than the air bladder and pillow constructions by approximately 50% RH and 10% RH, respectively.



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