

THE EFFECT OF HEAT AND MOISTURE ON SKIN ULCER FORMATION

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Abstract

High interface pressures and extended sitting times have been identified as the principle contributing factors that contribute to skin ulcer formation. Recent testing and a review of research show that skin temperature and relative humidity at the buttocks/cushion interface may be equally as important. This workshop will review the causes of skin ulcers and examine the role of heat and moisture in skin ulcer development.

History

Skin ulcers at sitting support surfaces remain a continuing and consistent problem for many wheelchair users. Historically, high interface pressures at the cushion/buttocks contact surface and extended sitting times have been identified as the two principle contributing factors in skin ulcer development for wheelchair riders. As a result, cushion designs have traditionally been focused on managing the overall and peak pressures during sitting. It is a long held belief that there is an increased risk of skin ulcer formation in the presence of heat or moisture but there has been little research that has direct correlation to wheelchair cushion use.

Temperature and Metabolism

The fact that increasing skin temperature results in a corresponding increase in metabolic rate is well documented. Depending on the particular study that is cited, metabolic increase is in the neighborhood of 10% for each one-degree (C) increase in tissue temperature ¹.

Kokate ² demonstrated the link between temperature and pressure rather conclusively with the study where a series of temperature controlled 51mm diameter discs were used to apply a constant force of 100 mmHg to the backs of swine for a period of 5 hours.

The disc temperatures were controlled at 25°C, 35°C, 40°C, and 45°C. Tests were conducted on 64 sites per temperature (264 total sites). After 7 days, it was found that there was no ulcer formation at any site for the 25°C temperature, while the sites at 35°C showed significant deep tissue damage. The sites at 40°C and 45°C developed even more pronounced levels of damage including both deep and superficial involvement. This information is extremely relevant due to the fact that skin interface temperatures on most wheelchair cushions will increase to 35° - 37° C in two hours or less on sitting. While this would lead some to believe that controlling temperature alone can control the ulcers, it is more likely that it is a combination of temperature and pressure that must be controlled

Human Subject Testing

Using this work as a guide, a pilot study was conducted to explore the possibility of measuring temperature and humidity at the skin surface on several wheelchair cushions. In the study, six adults were fitted with temperature and humidity sensors and placed on wheelchair cushions for a period of one to two hours. Cushions with substantially different construction and materials were selected. Results of the study indicated that it was possible to measure skin interface temperature and humidity and to determine how cushion materials and construction methods affect heat and moisture.

Summary

Temperature and moisture have a significant impact on the development of skin ulcers. Methods to control or manage the increase in skin temperature in seated individuals should be considered as part of the evaluation and provision of equipment for persons at risk of tissue trauma development.

References

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