A Comparison of Temperature Regulating Wheelchair Cushions

Megan Matthews, North Wales Posture and Mobility Service

Summary

This research project aims to determine the effectiveness of wheelchair seat cushion technologies that are marketed as being effective at regulating temperature. A method of measuring temperature at the user-seat contact surface was developed and applied to cushions prescribed by the North Wales Posture and Mobility Service (PAMS), in order to understand how useful these technologies are.

Aims and Objectives

The aim of this study was to evaluate and compare technologies used within commercially available and custom wheelchair cushions to regulate temperature at the user-seat interface.

To achieve this, the following objectives were set:

- Develop and define a method to measure temperature at the cushion/user interface.
- Apply this method to commercially available seat cushions that are commonly prescribed within PAMS and marketed as being temperature regulating.
- Apply this method to custom contoured foam carve cushions, manufactured to service standard and modified to improve temperature regulation.

Background, Method, and Results

Overheating is often prevalent among wheelchair users with neurological conditions, and can have a number of adverse effects (WheelAir, no date b). In particular, a 1°C increase in sacral skin temperature contributes approximately 14 times as much to the risk of developing a pressure ulcer as a 1mmHg increase of pressure (Zeevi, Levy and Gefen, 2017). Whilst other interventions, such as antibiotics, skin creams, and frequent clothing changes, may be used to regulate temperature, microclimate control at the seating surface should be considered when prescribing a cushion (WheelAir, no date *a*, WheelAir, no date *c*). The main driver for this project is that whilst many wheelchair cushion manufacturers claim that their products regulate the microclimate at the user contact surface effectively, the cushions currently prescribed at PAMS have not historically been quantitatively compared.

Five commercially available wheelchair cushions were tested and compared. These included the Jay Balance Cryo Fluid with microclimate cover, the Jay Climazone with CoolOver cover, the Recare Supracor Stimulite Classic with standard cover, and the Vicair Adjuster O2 with standard cover. The aforementioned cushions are all marketed as having temperature-regulating properties (Helping Hand Pressure Care, no date; Invacare, no date; Recare, no date; Sunrise Medical, no date). The JAY LowZone+, which is not marketed as having an effect on user-seat interface temperature, was also tested as a comparator cushion. Two custom contoured foam carve seat cushions were tested. One of these custom cushions was manufactured to service standard, and another was modified with the aim of increasing airflow.

Two temperature probes were used to measure the skin temperature at left ischial tuberosity (IT) and left mid-thigh of one healthy 24-year-old female volunteer. The

participant sat on each test cushion, set up as per manufacturer's guidance on the same Rea Azalea wheelchair base, for a total sitting period of 2 hours. Skin temperature was measured and recorded at both anatomical landmarks every 5 minutes. Paired t-tests were conducted to compare the final temperature, total change in temperature, and the time to 50% total temperature change at mid-thigh and IT. Logarithmic regression was used to fit models to the time series data gathered from each sensor on each cushion.

A statistically significant difference was discovered between the maximum temperature measured at the IT and mid-thigh, as well as between the time to 50% temperature change at the IT and mid-thigh. This was across all cushions. Due to study size, it was not possible to determine the statistical significance of the differences in maximum temperature across the commercially available cushions. Despite this, a difference of 3.1°C and 1.9°C in maximum temperature, at the IT and mid-thigh respectively, was measured across the different commercially available cushions. This could be clinically relevant when considering an increase in pressure ulcer risk. An air ventilation channel in the modified custom contoured seat appeared to increase the skin temperature at the IT, although this difference was minimal.

Discussion

The temperature measured at the mid-thigh was consistently higher than that at the IT across all cushions. Whilst some manufacturers place cooling material beneath users' ITs, this finding suggests that a cushion designed to lower skin temperature at the mid-thigh may be beneficial. This study also found that an air ventilation channel may not be an effective method of limiting temperature build-up in custom contoured seating. In future work, the differences in skin temperature at the user-seat interface of different commercially available cushions should be further explored. Such work should include enough participants so that statistical significance may be determined.

References

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Email: megan.matthews@wales.nhs.uk