Project Title

Prevention and management of pressure injuries using advanced manufacturing of personalised wheelchair cushions.

Research Team

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Project Description

Aim:

This project aimed to develop personalised 3D printed wheelchair cushions optimised to the needs of an individual in terms of pressure management and postural support.

Key Findings

A variable softness foam consisting of an elastic material 3D printed into an open-cell lattice structure (gyroid) was developed to provide optimal cushioning properties for personalised wheelchair cushions. The 3D printed foam improves on currently available materials because it can be finely tuned to provide a combination of soft, pressure distributing regions adjacent to the skin and supportive regions in the sides and base of a cushions design.

The 3D printed foam was tested to characterise its cushioning properties, durability, and resistance to heat and humidity. Results showed that the 3D printed material performed equivalently to foams currently used to manufacture custom wheelchair cushions at the Rehabilitation Engineering Centre, Metro North Hospital and Health Service (Qld Australia).

Full-sized wheelchair cushions were 3D printed with a typical raw material cost of $72 AUD per cushion, indicating that a cost saving is likely compared to the current method of manually cutting and gluing foams together to produce custom cushions.

Two consumer engagement sessions and one session with allied health professional were held to provide input into the needs of prescribers and end users with respect to the design and use of the 3D printed cushions. An overwhelming positive response was received from the engagement sessions, with common themes to focus on including cushion weight minimisation, cleanability, low profile, repeatability for replacement cushion, and the option to include sensors and ‘smart’ features into the design.

Conclusion

This project has developed 3D printed wheelchair cushions that can be precisely tailored to meet the needs of an individual. Laboratory tests have showed that the 3D printed cushions are approaching levels of performance, safety, and quality necessary for user testing. Cushion design and manufacturing is automatic, practical, and cost effective compared to the established manual method of production. The future of this work is to undertake user testing with a clinical trial.