Frugal Innovations: Reliability of construction of a locally-sourced pressure relieving wheelchair cushion for low-resourced settings

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Background

- Approximately 65 million people worldwide need a wheelchair[1]
- An estimated 20 million do not have access to adequate seating[1]
- In developing countries, 80% of people with spinal cord injuries die from pressure ulcer complications[2]
- Appropriately prescribed and constructed wheelchair cushions reduce the occurrence of pressure ulcers[1]
- Pressure reducing cushions i.e. ROHO) are expensive and often not available in less resourced settings[3]

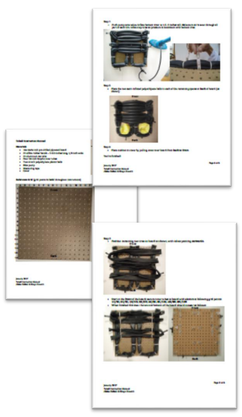
Objectives

The purpose of this study is to assess the reliability of pressure-reducing properties across multiple Tuball cushions when independently constructed by different individuals, given equivalent materials and instructions.

1) To investigate the variability in dispersion index (DI), peak pressure index (PPI), contact-area quartile (CQ), and seat pressure index (SPI) measurements across Tuball cushions constructed by different individuals
2) To evaluate the subjective experience of workload demands while constructing a Tuball cushion, using the NASA Task Load Index (NASA-TLX).[5]

The Tuball cushion, constructed using inexpensive and locally-sourced materials, has been shown to have similar pressure-reducing properties as the ROHO cushion.[4] However, the validity of these findings depends on the consistency of its construction, which until now has yet to be explored.

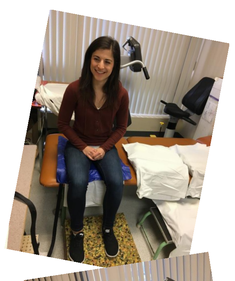
Methods



Phase 1: Cushion Construction

Six occupational therapy student participants each constructed a Tuball cushion from equivalent materials and written instructions, resulting in a total of xix constructed cushions (C1-C6)

Following construction, each participant completed the NASA Task Load Index (TLX) as a measure of task demand.



Phase 2: Interface Pressure Measurement

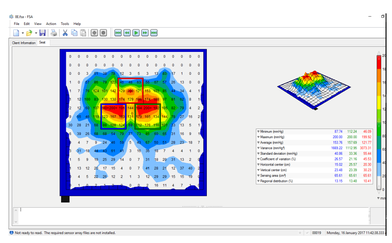
Five occupational therapy student participants (P1-P5) sat on each of the six cushions using a Force Sensing Array (FSA - BodiTrak) pressure mapping system to determine interface pressures.

Participants were instructed to sit on a height adjustable plinth, with their ankles, knees, and hips at 90 degrees of flexion, in an upright position with their hands in their lap. Interface pressures were recorded every 20 seconds beginning six minutes after the first recording. Recordings from 6, 8, and 10, and 12 minutes were exported for analyses.

Analyses

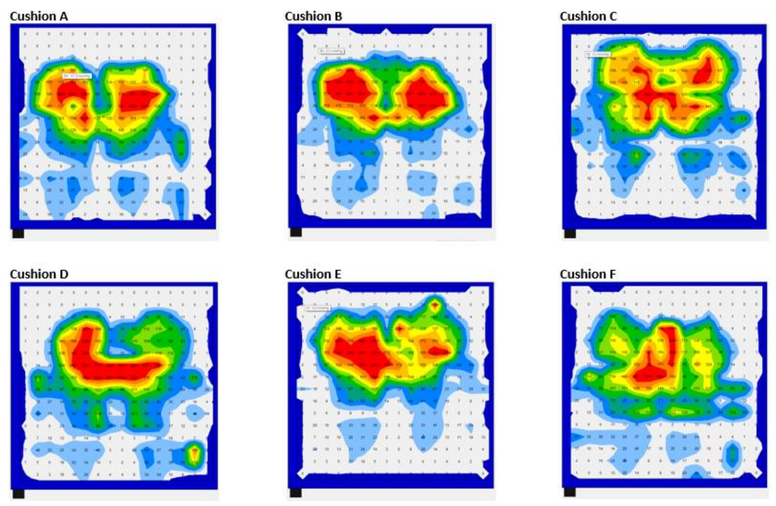
Dispersion index (DI), peak pressure index (PPI), contact-area quartile (CQ), and seat pressure index (SPI) were calculated for each of the exported frames, and averaged to determine a single value per participant-cushion pairing (i.e. P1-C1 through P5-C6). Intraclass correlation coefficients (ICC 2,4) were calculated to determine reliability of each of the four outcomes across the six cushions.

NASA-TLX scores for each of the six cushion constructors were calculated to determine adjusted scores for each of the seven task load domains.



Results

Outcome Measure	ICC	95% CI	Interpretation
Dispersion index	0.745	0.103-0.970	Good-moderate
Peak Pressure Index	0.879	0.573-0.986	Excellent
Contact-area Quartile	0.951	0.829-0.994	Excellent
Seat Pressure Index	0.920	0.717-0.991	Excellent



Discussion and Conclusions

- The Tuball cushion can be constructed reliably across multiple individuals, given the same materials and instructions
- The use of different materials will likely impact the benefits associated with the cushion
- Regardless of reliability of cushion construction, fitting remains critical to ensuring correct application of a pressure relief cushion
- The provision of a reduced-cost, locally sourced wheelchair cushion has the potential to address a critical health care gap for wheelchair users in developing countries
- Further research is warranted to explore the pressure-reducing qualities of the Tuball cushion when constructed using non-standard materials in a low resourced environment prior to clinical use

References

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