The Effect of Model Design and Cushion Construction on Pressure Measurement and Envelopment

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BACKGROUND AND PURPOSE: Wheelchair cushions are designed to protect skin by reducing and distributing pressure. Pressure sensors and buttock models are used in standardized testing of wheelchair cushions. The purpose of this study was to explore how the presence of a thin pressure measurement mat, cushion construction, and buttock model design affect interface pressure (IP), envelopment, and immersion. Aspects reported here are the effect of model design on IP and envelopment and the interaction between model design and cushion construction.

METHODS: Testing was performed with two indenters and seven cushions. One model was rigid, and one was made of gel with imbedded cylinders to represent the ischial tuberosities. Pressure data was captured using ten FSA sensors. Analysis was performed on magnitude and envelopment, as measured by pressure equality across sites.

RESULTS: Magnitude was significantly higher with the gel model; however two cushions exhibited significantly lower pressure with the gel model. Envelopment was significantly better with the gel model. A significant interaction between model and cushion was also found.

DISCUSSION AND CONCLUSION: Wheelchair cushions deform in response to a loaded indenter. With the rigid model, the cushion must conform to its fixed shape. However, with the gel model, both the cushion and the model deform. The result is a change in the shape of the indenter-cushion interface, which may not be consistent across loading trials. This is influenced by cushion stiffness and the unloaded shape of the cushion. The data suggests that model design influences the pressure redistribution properties of cushions. Therefore, development of standardized tests should consider the interaction between models and cushions.

References from Presentation: