

## Meeting stability and other seating goals on wheelchair cushions: an evidence-based approach

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### Summary

There is lack of an existing standardised testing methodology to objectively evaluate stability measures of seating surfaces for wheelchairs in a repeatable way. This presentation explains the development of a testing procedure to measure stability characteristics on wheelchair cushions, and compares test results with regard to other seating goals.

### Aims & Objectives

Provide an understanding of seating goals and how product categories can meet those goals.  
Deliver insights for the stability test methodology.  
Provide an overview of the results for products groups (foam, gel, air, etc.)  
Test results of the performance of individual products will be blinded since a peer-reviewed publication on this project is pending.

### Background

There is a wide variety of support surfaces available on the market. Every product is built with a specific design and material to optimise outcomes for users and to support them with their daily challenges. The uniqueness of the user's body and their specific needs and limitations make it a real challenge to create a standardised product that meets the four seating goals:

Positioning – we position our body to enable function and to be able to execute activities  
Stability – to secure our functional level and to create a safe environment  
Health – to prevent secondary complications, and more particularly pressure ulcers  
Comfort – to preserve our functionality and well-being over time

Meeting these four objectives for wheelchair users requires a combination of insights into the physiological process behind the diagnosis and into how materials and design of seating surfaces can influence the delivery of those goals. There are specific standardised methods available to evaluate the performance of products in some of those goals, like pressure mapping to evaluate and optimise pressure redistribution characteristics necessary to prevent pressure ulcers, or questionnaires to evaluate comfort.

Stability as a seating goal cannot be compromised to deliver on seating goals. User safety and performance are key to be able to provide users with a solution that can support them for a significant amount of time. Cushions with low resilience, or that otherwise react in a way that prioritises accommodation of changes in load distribution over supportive reactive forces to maintain position and posture, may reduce a user's ability to perform leaning manoeuvres or other activities. The evaluation of stability characteristics is very subjective due to the lack of standardised testing procedures that limit the number of variables and are merely based on the impressions of users, healthcare workers and/or wheelchair providers.

The University of Pittsburgh have developed a test to evaluate how a wheelchair cushion resists an off-centre load in the lateral and antero-posterior direction. Two measurements are made to quantify the cushion's response:

1. The magnitude of tilt of the cushion indenter to characterise how the cushion deforms in response to the load

2. The pressure redistribution at the seat interface to quantify the nature of the reaction forces at the seat interface

A cushion response that would represent the least harmful yet most stable response to an off-centre shifting load would be a low magnitude tilt resulting in low peak pressure and/or large contact area.

The development of the test has four major objectives:

1. to perform stability testing (lateral and anterior load shift)
2. to perform pressure mapping
3. to compare stability results between cushions
4. to evaluate correlation between pressure distribution and stability

The text describing the test procedure, methodology, results and conclusions is submitted for peer-reviewed publication. Therefore, only blinded results per product category will be shared at the conference.

### **Discussion**

Product design and material selection are the two determinants for the performance in the area of stability and pressure redistribution. The test results on product categories show that the discussion cannot be reduced to materials only, since low and high performance is seen in all product categories. Contouring, off-loading, segmenting surfaces, layering, creation of compartments, or flow restricting mechanisms are some examples that can influence the pressure redistribution or stability characteristics of products. The primary scope of product selection for wheelchair users is to find a product that delivers on the four seating goals in line with their needs and that doesn't compromise one seating goal to deliver another.

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