

Background

- Pressure ulcers are a leading secondary complication of spinal cord injury.
- Internal tissue deformation resulting from external interface pressure is believed to be the primary biomechanical factor responsible for pressure ulcer development.

Methods

Model

- Embedded molded pelvis and femurs (3B Scientific)
- Gel-based buttocks and thighs (Dragon Skin FX-Pro®, Smooth-On, Inc., Easton, PA)

Data Collection Protocol

- Siemens Trio 3T MRI scanner
- Coronal, T1 images, 4mm slice thickness
- 4 Loading conditions/surfaces pictured to the right: unloaded reference, HR45 foam, a Jay Extreme cushion, and a rigid surface
- 58.4 kg were applied on top of the buttocks and thighs to simulate a 70kg person

Analysis

- Mimics (Materialise, Inc.)
- Registered pelvis to unloaded reference
- Identified peak of the ischial tuberosity and tissue thickness below the ischial tuberosity.



Goals

In order to provide effective interventions to prevent PU development, we must:

- *Current Study:* Demonstrate that 3-dimensional measurements of a phantom buttocks tissue deformation could be collected from MRI data.
- *Long term:* Understand how individuals' buttocks tissue responds to loading when seated on different commercially available cushions.

Results: Tissue Thickness & Deformation at the Ischial Tuberosities

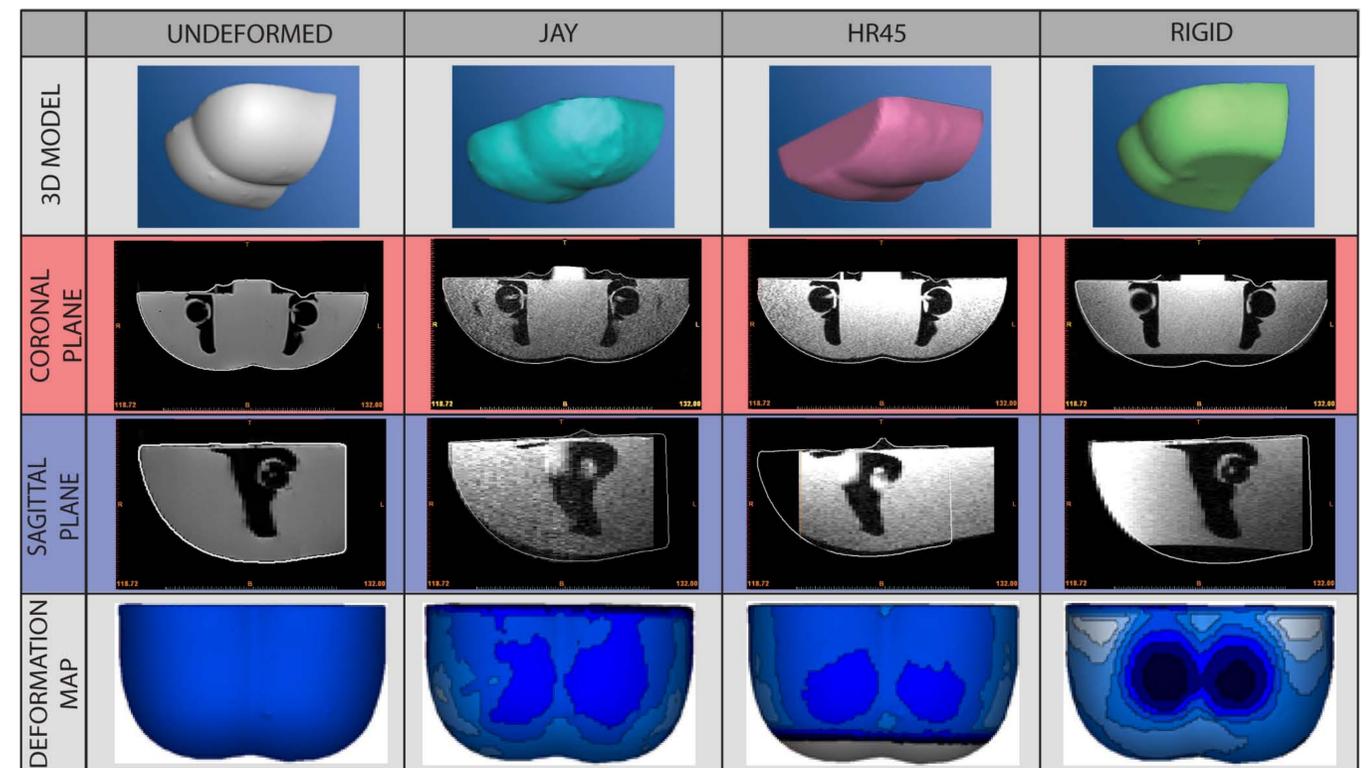
Cushion	Thickness (mm)	% Deformation
Unloaded	22.3	0%
Jay Extreme	21.2	5%
HR 45 Foam	17.7	21%
Rigid	6.0	73%

Results: 3D

Row 1: 3D rendering of model surface.

Rows 2-3: Contours of the unloaded buttocks compared with the MRI of the deformed buttocks.

Row 4: Deformation maps, where darker colors correspond with greater deformation. On the rigid surface there was a steeper gradient of deformation near the ischial tuberosities than on the Jay Extreme and HR45 foam.



Conclusions

- Differences do exist in the deformation of buttocks tissue across cushions, with greatest deformation on a rigid surface.
- MRI is a suitable methodology to analyze 3-dimensional buttocks deformation.
- More study is needed to determine how the differences in deformation will impact pressure ulcer development.

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