Development and validation of a new methodology for the fast generation of patient-specific FE models of the buttock for pressure ulcer prevention.

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Ischial pressure sores are painful, slow healing wounds that develop during prolonged sitting. Its formation is associated with the high internal strains induced by the compression of the soft tissues under the ischium [1]. Although, many 3D Finite Element (FE) models have been developed to predict the mechanical response of the subdermal soft tissues, they are always constructed from segmentation of MRI or CT-Scan acquisitions limiting the studies to only one individual and overlooking the inter-individual variability. In this contribution, we present a new methodology for a fast 3D FE model generation of the buttock for PU prevention. The 3D subject-specific FE model was generated from the combination of bi-planar Radiography, ultrasound imaging and optical scanner and is composed of the pelvis (rigid body) and 3 homogeneous layers representing the muscle tissue, fat and skin. The adipose tissue and the muscle layer were modelled as an Ogden quasi-incompressible hyperelastic material and the material properties were calibrated to fit the experimental data. The validation of the model was performed from external pressure measurement on a population of 6 healthy subjects. The mean difference of the median pressure was 0.32kPa (std 0.8kPa), showing good agreement between the experiments and FE models and representing 2% of the mean value. The low generation time of this model compared to existing methodologies will allow to investigate the influence of pelvis and buttock geometry on the biomechanical response of the subdermal soft tissues under the ischium during sitting (Figure 1).

[1] L. MacGregor, "Pressure , Shear , Friction and Microclimate in Context: a Consensus Document," *Wounds Int.*, pp. 1–25, 2010.

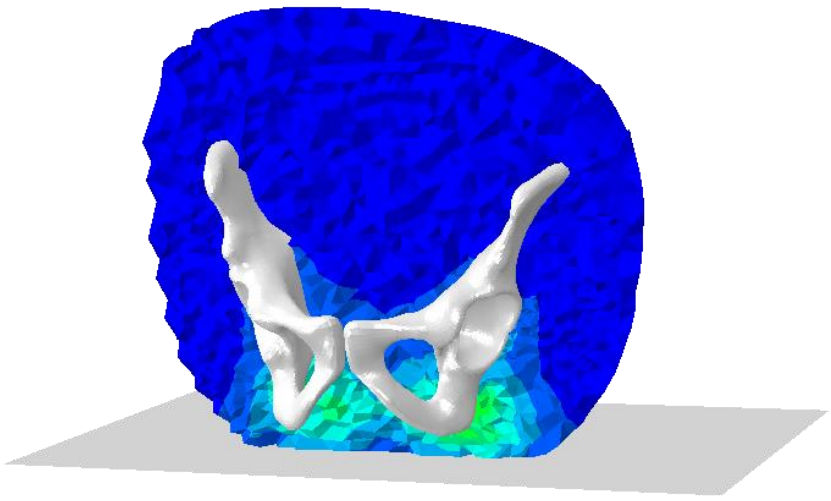

Figure 1 : Finite Element model of the buttock region during sitting

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