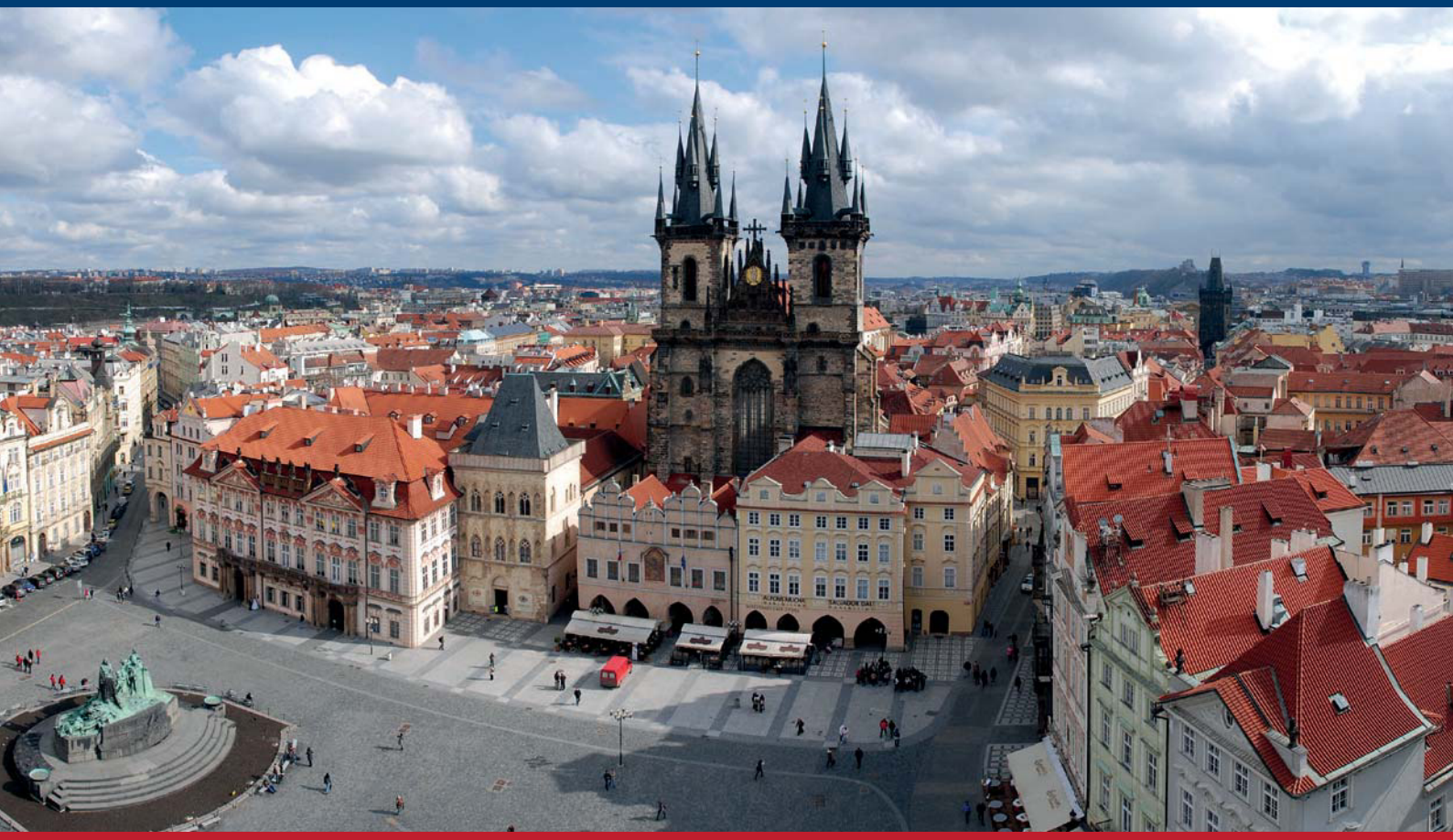
EPUAP 2022

The 22nd Annual Meeting of the
European Pressure Ulcer Advisory Panel

14 – 16 September 2022, Prague, Czech Republic

www.epuap2022.org



ABSTRACT BOOK

Partnerships: Masaryk University, Faculty of Medicine, Brno; Institute of Health Information and Statistics; Czech Wound Management Association; Ministry of Health of the Czech Republic

EUROPEAN PRESSURE ULCER ADVISORY PANEL

MUNI MED

ÚZIS

ČSLR Česká společnost pro léčbu rány

MINISTERSTVO ZDRAVOTNICTVÍ ČESKÉ REPUBLIKY

11.1

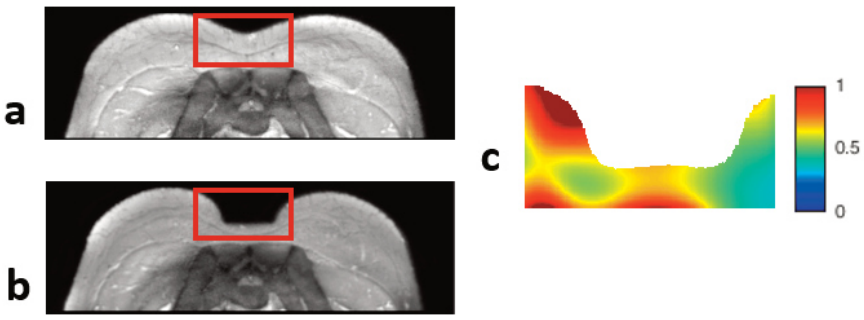
Contribution of the out-of-plane component in the assessment of sacral soft tissue deformations under compressive loading - Preliminary study on one subject.

Ekaterina Mukhina[1 2], *Pierre-Yves Rohan*[2], *Nathanael Connesson*[1], *Yohan Payan*[1]

1 *Univ. Grenoble Alpes, CNRS, Grenoble INP, TIMC-IMAG, La Tronche, France*
2 *Institut de Biomécanique Humaine Georges Charpak, Arts et Métiers ParisTech, Paris, France*

Introduction: Internal mechanical damage of the soft tissues was previously associated with the personalized risk of pressure ulcer development 1. 3D MRI is considered to be a golden standard of medical imaging for observing internal tissue deformations. 2D Ultrasound (US) images have been investigated 2 to find a more accessible alternative to MRI. However, a possible downside of using such a 2D modality is disregarding the out-of-plane tissue movements. The objective of this work was to assess the contribution of the out-of-plane component of soft tissue displacements under compressive loadings.

Methods: One healthy male volunteer (34 y.o., BMI=27.8 kg/m^2) was enrolled in the study (MAP-VS protocol N°ID RCB 2012-A00340-43). An MRI-compatible custom-made experimental setup, allowing the application of a vertical controlled load to the sacrum via an indenter, was used with different weights (0-1200 g) in a 3T MRI machine. Four load cases corresponding to the applied weight of 1200 g, 800 g, 600 g, and 400 g respectively were investigated. To evaluate the displacement fields, 3D image registrations (Elastix library) between the unloaded (Figure 1a) and loaded (Figure 1b) MRI configurations were performed. For each voxel of the vertical loading plane, the ratio of the out of plane displacement to combined in-plane displacement was evaluated (Figure 1c).



Results: The voxel-wise ratios of the out-of-plane displacement to in-plane displacement were higher than 0.5 for more than half of the voxels in the region of indentation for all investigated load cases. This ratio was also equal to or higher than 1.0 for almost half of the voxels in the region for load cases 2-4.

Conclusions: The preliminary results observed on one healthy volunteer suggest that the out-of-plane tissue displacements under compressive loads cannot be ignored. Possible next step is to investigate 3D B-mode US imaging as a way to combine the accessibility of the US technology and the advantage of three-dimension modality.

Acknowledgements: This project has received funding from the European Union's Horizon 2020 research and innovation programme under the STINTS Marie Skłodowska-Curie grant agreement No. 811965.

References

1. *Ceelen KK, Stekelenburg A, Loerakker S, et al. Compression-induced damage and internal tissue strains are related. J Biomech. 2008;41(16):3399-3404. doi:10.1016/j.jbiomech.2008.09.016*
2. *Akins JS, Vallely JJ, Karg PE, et al. Feasibility of freehand ultrasound to measure anatomical features associated with deep tissue injury risk. Med Eng Phys. 2016;38(9):839-844. doi:10.1016/j.medengphy.2016.04.026*