Validation of FE models for Bone from the Organ to the Tissue Level

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Abstract

Osteoporotic fractures of the central skeleton represent a major health problem. Computed tomography (CT) based, subject specific multi-scale finite element (FE) models represent an interesting approach to investigate bone strength non-invasively. However, every model before a translation to clinical applications needs to be carefully validated *in vitro* with reliable experiments to quantify to what extent they can predict what they were designed for. This seminar will focus on the validation of FE models of bone at two different dimensional scales. Quantitative Computed Tomography based FE models of the proximal femur and thoracolumbar vertebral body were compared with experiments and standard clinical tools to evaluate the predictive ability of such models at the organ level. Moreover, a combination of high resolution scanning, stepwise loading and deformable image registration was used to validate microCT based FE models of cortical and trabecular bone samples at the tissue level. In particular, the accuracy and precision of the experimental procedure used to investigate the local strains at this dimensional scale were investigated in details.

BioSketch

Enrico Dall'Ara has a Mechanical Engineering Degree from the University of Bologna and a PhD in Biomechanics from the Vienna University of Technology. His main research interests are related to characterization of mechanical properties of biological tissues (in particular bone) using multi-scale imaging and experimental approaches and the development of validation and calibration studies for CT based Finite Element models. He published 26 papers in international peer reviewed journals in experimental, computational and orthopaedic biomechanics. In 2013 he won an Intra-European Marie Curie Fellowship for two years postdoc in Sheffield at the Department of Mechanical Engineering and INSIGNEO Institute for *in silico* medicine.