UNIVERSITY OF BRESCIA

PhD Program
in
TECHNOLOGY FOR HEALTH

An integrated methodological and experimental framework addressing the relationship between functionality and structure of the knee osteochondral system throughout osteoarthritis

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Background

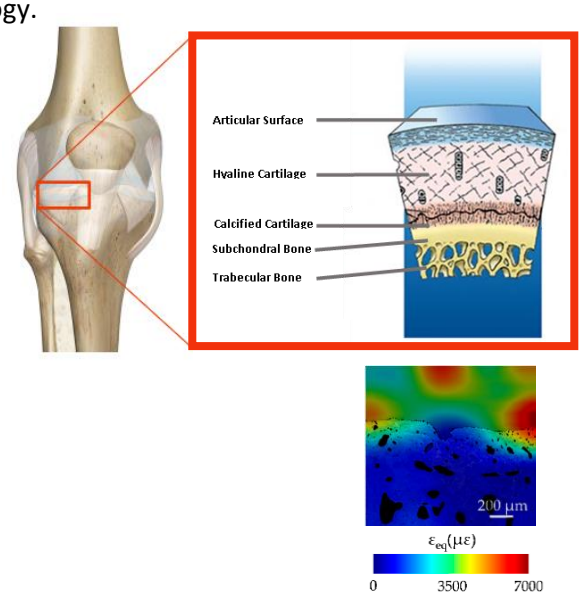
Evaluating the functionalities of the tissues constituting the osteochondral unit of the human load-bearing joints, e.g. the knee, is crucial to properly define therapeutic approaches responding to degenerative diseases of the locomotion system, e.g. osteoarthritis (OA). Such assessments are generally achieved *ex-vivo* through single-layer approaches affecting the behavior of tissues which are no longer subjected to their *in vivo* conditions. Overcoming this issue, optical techniques could represent a solution in obtaining a full-field measurement of strain gradients the whole osteochondral unit undergo *in vivo.*

Objectives

The main objective of this project is to develop a novel and sound optical-based procedure to assess the comprehensive functionality of the biological tissues constituting the knee osteochondral unit. The acquired information will be used to attempt a relationship between structure, composition and osteochondral tissues response, firstly to evidence how the existing relationship changes throughout the progression of OA and, secondly, to improve the current clinical imaging-based grading of such a pathology.

Methodologies

Optical-based technologies will investigate displacement and strain fields acting on the osteochondral unit. The developed procedure will be applied to healthy and pathological, i.e. OA affected, tissues. Moreover, the information achieved through single-layer methodologies will be also achieved, thus to improve the tissue functionalities assessment. Finally, the tissues will be subjected to clinic imaging, thus to evaluate their pathophysiological status.



Expected Results and Impact

The exploitation of an integrated framework able to elucidate the deep and dynamic relation existing between functionality and structure of the tissues which constitute the human knee osteochondral compartment will contribute in refining the assessment of the early stages of degenerative pathologies but will be also in evaluating the efficacy of treatments and tissue-engineering solutions responding to diseases of the locomotion system.