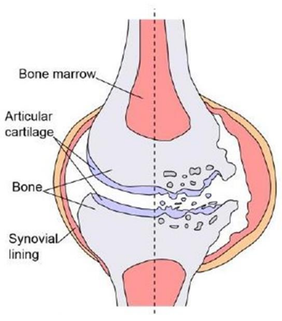
OActive

Advanced personalised, multi-scale computer models preventing OsteoArthritis

Background

Osteoarthritis (OA) is a degenerative disease of the articular cartilage and the most common form of arthritis that causes joint pain, mobility limitation and, thus, reduces independence and overall quality of life. Although the usual population associated with the condition is the elderly (65 years old ranges from 12- 30%), who are mostly inactive, athletes and younger individuals are also susceptible. Whilst the available data have implicated the role of the various modifiable or nonmodifiable risk factors in the development and progression of OA, no study has conclusively explored the interaction and integration of other information sets in a patient-specific manner.



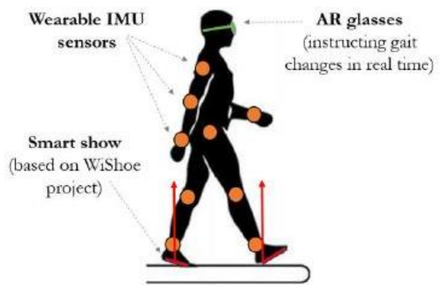
Knee joint degeneration in OA

OActive Overall Objective

The OACTIVE scientific and technological objectives focus on the development of patient-specific computer models and simulation in order to develop appropriate OA prevention interventions or treatments. The main focus of the OACTIVE will be on knee OA (KOA) because this is the joint where OA symptoms most frequently cause significant loss of function and mobility.

The project objectives include:

- **Mechanistic modelling framework of the musculoskeletal system**
- **Systemic health and inflammation modelling framework**
- **Behaviour, social, environmental modelling framework**
- **Hypermodelling framework empowered by big data**
- **Ontology-based framework for data /models reusability and sharing**

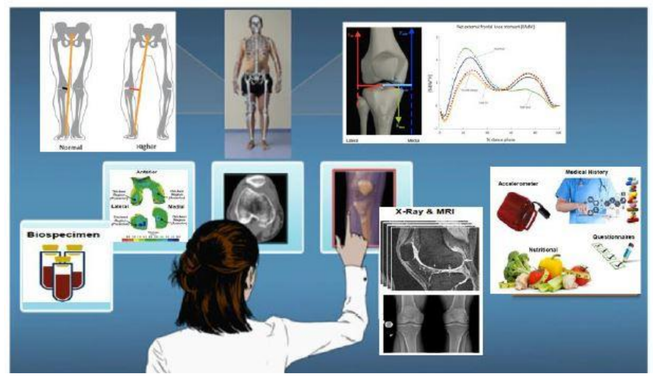


Augmented Reality based gait re-training system

- **Personalised interventions using Augmented Reality (AR)**
- **Technology Validation**

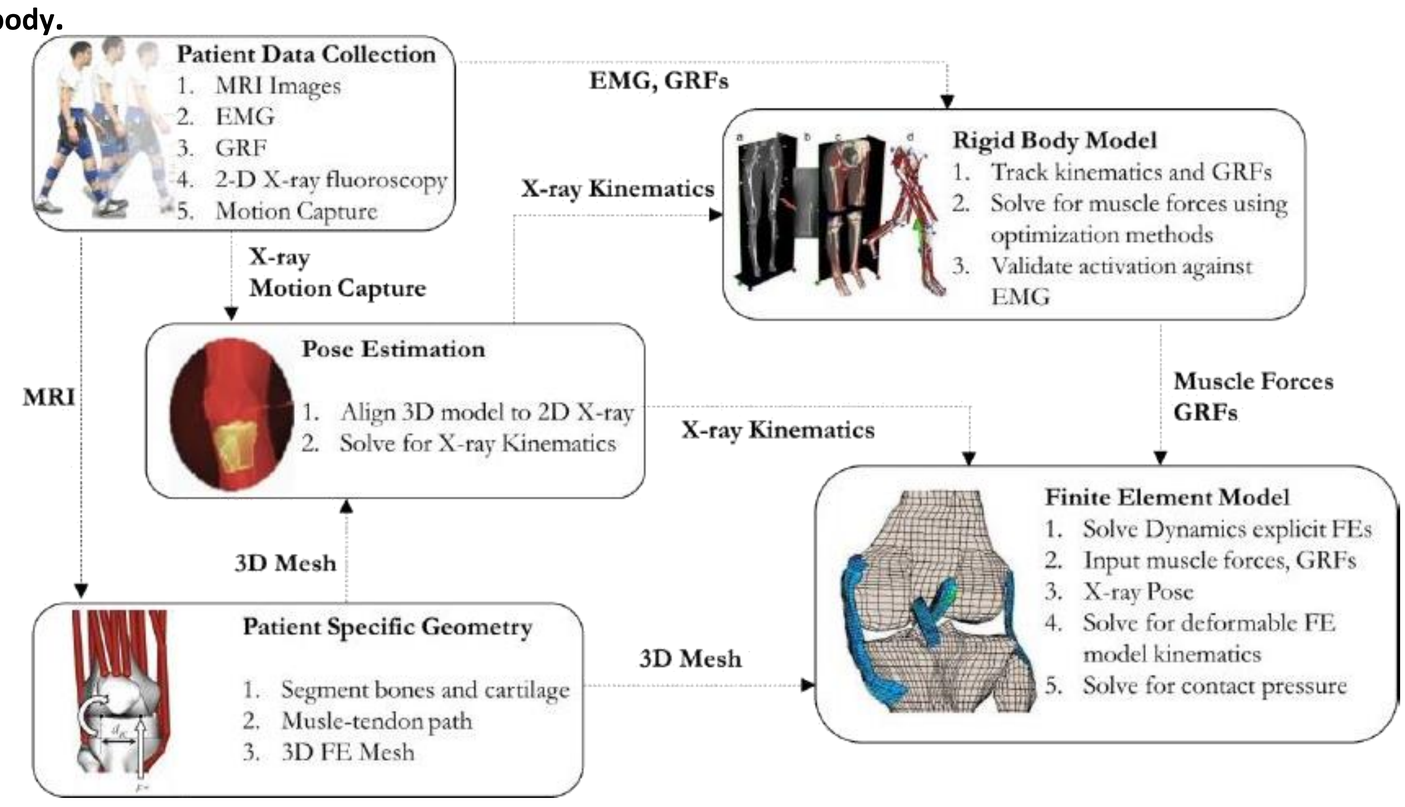
The Concept

The overall aim of OACTIVE is to join up the European research effort in knee OA, to thus provide a step- change in the understanding and non-pharmacological management of the disease through early identification and personalized interventions. The OACTIVE project aims to develop computer modelling and simulations able to aggregate various information sets (e.g. biomechanical, molecular, biochemical, medical imaging, social, lifestyle, economic, occupational, microbiome, environmental, developmental, psychological) to generate robust OA predictors for resilience to challenges and recovery. The models will process and apply individual/patient-specific information in a multi-scale approach for integrating information from the molecular level to the whole body.



Multimodal data of Knee OA

The OActive project has a proposed duration of 36 months (3 years) and is divided into four phases which include the following activities: R&D activities (WP2-6), Validation activities (DEMO) (WP7-9), Dissemination and Exploitation Activities (DEC) (WP10), Project management activities (PM) (WP1).



Biomechanical Modelling Framework for estimation of articular loading

Phase 1: Technology generation and experimentation

This phase of the project includes all the R&D activities for the development of the OActive personalised models implemented at various scales along with the design / development of the intervention module. The phase is finalised when all the developed models have been designed and tested in the laboratory and are ready for integration (WP2-5).

Phase 2: Integration of the developments from Phase 1 using big data

This phase involves the integration of all the developed technologies of Phase 1 (including mechanistic/phenomenological models, output information sets from various scales such as biological, social and behavioural). Big data and deep learning technologies will play a key role being the integrator of the various information sets as developed in Phase 1. Each model will be fine-tuned with the rest, and minor modifications are expected in order to optimise all the submodules to operate as a single integrated multi-scale hyper-model. In order to achieve this, the integration process runs in parallel with Phase1 giving constant feedback for modification for each sub-model.

Phase 3: Validation of the OActive system

The aim of this phase is to validate the integrated OActive system in both clinical studies/trials and big data registries. Clinical studies will also offer vital input to make any necessary adjustments before deploying the system in humans. Big data registries will be used to verify the efficiency of OActive in a large human population. The accumulated results will give feedback to Phase 2 in order to monitor the required actions and perform an evaluation of the KPIs.

Phase 4: Project Management and Dissemination, Exploitation, and Communication Activities

This Phase runs the whole duration of the project in order to keep track of all the involved activities (R&D, DEMO) and take action when is required. This will ensure the smooth progress of all the R&D and demonstration activities as well as efficient planning for dissemination of the results throughout the duration of each phase

Project Partners

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