**Study of relative velocity at the knee joint surface based on MRI data**

**Motivation & Objectives**

In order to study the initiation and development of knee osteoarthritis, it may be useful to examine the knee kinematics at the joint surface. For this task, MR technology appears to be a very useful non-intrusive in vivo technique. The objective of this project is to present a MRI-based technique that allows us to study the relative tibiofemoral movement at the knee joint surface. The study is done for a cohort of ten (n = 10) healthy subjects and provides a biomechanical description of the human, loaded living knee. This project shows the feasibility and reproducibility of this technique, providing a quantifiable description of the rolling and sliding that occurs between the cartilage of the tibia and the femur.

**Methods**

**Relative surface displacement vector plot**

For 6 tibiofemoral angles, the relative displacement at the cartilage surfaces of the femur and the tibia was plotted. These plots are an example of the observed displacement between tibiofemoral angles 7°, 14°, 18.5°, 23°, 26° and 30°. The vectors are plotted according to a colour gradient such that the closest points of the tibia to the femur appear in red and the furthest points to the femur model appear in yellow.

**Discussion**

From the static MR scans, the relative displacement between both cartilage surfaces in contact was assessed. This highlighted graphically the posterior translation of the tibial plateau. The surface relative motion has a sliding and rolling component, which were measured in this study.

**Study of subchondral contact point location**

For 6 tibiofemoral angles, the subchondral contact point was tracked on both the tibial plateau and the femur condyles. The 6 contact points are plotted according to a colour gradient such that the contact point of the first position is in light blue and the last one (sixth) is in pink. This shows the sliding of the femur condyles on the tibial plateau, as the contact point on the femur translates and the tibia almost doesn't.

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