

greater in healthy women (1.82 ± 1.03 mm) than in healthy men ($1.19 \text{ mm} \pm 1.26$ mm; $p < 0.01$).

Conclusions: The ratio between meniscus surface area and (ipsi-compartmental) tibial bone area may provide a useful measure for comparing meniscus size across different cohorts with mixed sexes, for instance when testing whether knees with OA display meniscus hypertrophy. Although tibial plateau coverage by the meniscus is similar in healthy men and women, medial meniscus extrusion was greater in women, which may provide potential clues as to why women are at greater risk of symptomatic knee OA than men.

422 AUTOMATIC SEGMENTATION OF BONE AND CARTILAGE FROM KNEE MRI

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Purpose: Osteoarthritis involves changes in bone shape and structure, articular cartilage shape and structure, meniscus, synovium, and ligaments. Magnetic resonance imaging (MRI) allows more comprehensive inspection of bone and cartilage in multiple compartments compared to traditional radiography. For MRI to be available for large clinical trials with thousand(s) participants and several visits, automation of the scoring seems desirable. Even if low-field MRI offers slightly lower resolution and/or signal-to-noise ratio, the lower cost associated with installation and maintenance may make low-field MRI cost-effective for clinical trials. We evaluated a method for fully automatic segmentation of bone and cartilage from knee MRI in terms of segmentation precision and accuracy.

Methods: MRIs were acquired using a Turbo 3D T1 sequence from a 0.18T Esaote scanner (40° FA, TR 50 ms, TE 16 ms, scan time 10 minutes, resolution 0.7 mm x 0.7 mm x 0.8 mm). The sequence was optimized for cartilage visualization. Radiographs were acquired in a load-bearing semiflexed position using the SynaFlex and graded by an experienced radiologist on the Kellgren and Lawrence grade (KLG).

The study included 145 knees (51 with KLG 0, rest evenly KLG 1-3) from 22-79 years old subjects with 59% female. 31 representative knees were rescanned a week later to allow inter-scan precision validation.

The Tibia bone and the medial tibial and femoral cartilages were segmented automatically using a computer-based voxel classification framework. The method was trained on 25 knees and evaluated on the rest. All scans were manually segmented by a radiologist by slice-wise outlining.

Results: All scans were successfully segmented and included in the statistics below. An example is seen in the figure. A 3D visualization of the automatically segmented Tibia, medial tibial cartilage, and medial femoral cartilage are shown together with a sagittal scan slice located in the lateral compartment.



Precision was measured as inter-scan coefficient of variation (CV). For the three compartments, CV on volume quantifications were 5.3%, 6.3%, and 10.0% for Tibia, tibial cartilage (MT.VC), and femoral cartilage (MF.VC), respectively.

Segmentation accuracy was measured as the Dice volume overlap. Dice were 97%, 81%, and 79%, for Tibia, tibial cartilage, and femoral cartilage, respectively.

For comparison, repeated manual radiologist segmentations gave precision of CV 7.3% and 6.8% and accuracy of Dice 86% and 86%, for tibial and femoral cartilages respectively.

Conclusions: The results demonstrate the feasibility of performing automatic segmentation of bone and cartilage in knee MRI with a performance close to manual segmentation by a trained radiologist.

423 EVALUATION OF THE ARTICULAR CARTILAGE OF OSTEOARTHROTIC KNEE IN T2 MAPPING LOADING MRI

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Purpose: The purpose of this study was to evaluate the articular cartilage of the knee and to detect the osteoarthritis of the knee using magnetic resonance imaging with axial loading device which can simulate the physiological standing state at 3.0 Tesla.

Methods: Between September 2008 and December 2010, twenty two patients, twenty three knees (nine males, fourteen females) who had the pain in their knee joints were included in this study. Informed consent was obtained from all patients after the content of the examinations had been explained. These patients were divided into four groups according to Kellgren-Lawrence classification, grade I 3 knees, grade II 10 knees, grade III 8 knees and grade IV 2 knees. At the time of the evaluation with loading MRI, the patient's mean age was 68.8 years old (ranged from 55-76). Mean femoro-tibial angle (FTA) was 177.8 degrees (ranged from 175-185) and range of motion of affected knee joint was -6.5 (ranged from -25 to 6) / 131.8 (ranged from 105-145) degrees. These data was compared with those who has no knee pain and had never undergone knee surgery as a control group (seven knees, the mean age was 34.0 years old).

T2 mappings of the medial and lateral compartment of the knee joint were taken using 3.0 Tesla MRI system. After taking the conventional T2 map imaging, T2 mapping under loading condition were taken using axial compression device which applied compression force of 25% of body weight.

Results: By loading axial compression, T2 indices of the articular cartilage were decreased at the medial and lateral compartment in control group. On the other hand, those were unchanging or increased at the medial compartment, those were unchanging or slightly decreased at the lateral compartment in osteoarthritis group ($p < 0.05$).

Conclusions: These results indicate that T2 mapping with axial loading system could be used for detecting the knee osteoarthrotic change of the articular cartilage, and could have a great value in diagnosis of the knee osteoarthritis.

Inflammation and Immunity

424 RELATIONSHIP BETWEEN SYNOVIAL FLUID CYTOKINES, MMP'S & TIMP'S AND JOINT SPACE WIDTH NARROWING ONE YEAR POST-ACL RECONSTRUCTION

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Purpose: Much of what is known about the inflammatory response in clinical models of osteoarthritis is derived from studies evaluating primary OA during the latter stages of the disease. Limited information is available regarding the role of inflammation in early-onset post-traumatic osteoarthritis (PTOA), especially during the onset and/or earliest stages of the disease process. The purpose of this investigation was to evaluate concentrations of numerous cellular mediators found in the synovial fluid of the ACL-reconstructed (ACL-R) knees that display joint space width (JSW) narrowing one-year post-ACL reconstruction. With this information we hope to better characterize the inflammatory cytokine milieu present in synovial fluid, as well as the production/regulation of type-II collagen degradative enzymes matrix metalloproteinases (MMPs) and tissue inhibitors of MMPs (TIMPs).

Methods: A prospective cohort with nested case-control analysis study design was used for this investigation of post-traumatic OA following ACL injury and subsequent surgical reconstruction. Inclusion criteria included: Age at the time of ACL-R = 14-55yrs; BMI = 18.5-30, Tegner