ning, 11 significant thickening, and 45 no significant change (in any medial subregion) compared with healthy knees. Only few parameters (WOMAC stiffness, JSW, knee alignment, ThC, and sCTX) predicted significant cartilage thinning versus no thinning (= thickening or no change); a low ThC of cmf was the strongest predictor of cartilage thinning. Significant cartilage thickening versus no change was predicted by higher WOMAC function scores and a smaller standard deviation of T2. No significant differences between groups were found for age, BMI, pain, meniscus pathology and other biochemical biomarkers.

Conclusions: Only few parameters predicted significant cartilage thickening, the strongest being baseline cartilage thickness in the medial femur (AUC=0.81). Participants with significant cartilage thickening (but also with significant thinning) were identified by increase WOMAC function scores and a smaller SD of T2 compared with OA knees with no change.

408 DEVELOPMENT OF A FULLY AUTOMATED SYSTEM FOR THE QUANTIFICATION OF HUMAN KNEE OSTEOARTHRITIC SYNOVIAL FLUID USING MAGNETIC RESONANCE IMAGES

W. Li1, F. Abram1, J.-P. Pelletier2, J.-P. Raynauld2, M. Dorais3, M.-A. D'Anjou4, J. Martel-Pelletier2
1ArthroVision Inc., Montreal, QC, Canada; 2Osteoarthritis Res. Unit, Notre-Dame Hosp., CRCHUM, Montreal, QC, Canada; 3Pharmacoepidemiology and Pharmacoeconomics Res. Group, Univ. of Montreal Hosp. Res. Ctr. (CRCHUM), Montreal, QC, Canada; 4Dept. of Clinical Sci., Faculty of Vet. Med., Univ. of Montreal, Saint-Hyacinthe, QC, Canada

Purpose: Joint effusion is frequently associated with osteoarthritis (OA) flare-up and is an important marker for therapeutic response. The aim of the study was to develop a fully automated system based on magnetic resonance imaging (MRI) for the quantification of synovial fluid in knee osteoarthritic (OA) patients.

Methods: Imaging was performed using a 1.5T and a knee coil. The MRI exam for joint fluid volume consists of two axial sequences: a T2-weighted true fast imaging with steady-state precession and a T1-weighted gradient-echo. The measurement process worked at sub-voxel resolution. Two MRI validation protocols were performed: 1) by using calibrated phantoms, 2) by comparing the volume obtained with the automatic versus the manual computation in 25 OA knees. In addition, the joint fluid volume assessed with the automatic MRI system was contrasted with the direct aspiration on ten knee OA patients.

Results: Volume assessment of calibrated phantoms containing 14.1 ml of liquid performed on different MR apparatus at four clinical sites with the developed automated MRI system showed excellent results; the calculated mean volume for 200 phantoms clinical sites with the developed automated MRI system showed 14.1 ml of liquid performed on different MR apparatus at four knee MR images was also excellent; r=0.98, p<0.0001. Moreover, comparison between volumes obtained by arthrocentesis and those calculated by the developed MRI automated system on ten knee OA patients showed that although the latter volume was higher, the Pearson correlation coefficient was also very good (r=0.88, p=0.0008).

Conclusions: This newly developed fully automated MRI joint fluid quantification system for knee OA patients was shown to produce highly reproducible results and demonstrated an excellent correlation with direct joint aspiration.

409 DIFFERENCES IN QUANTITATIVE MR IMAGING OF CARTILAGE MORPHOLOGY BETWEEN SAGITTAL VERSUS CORONAL ACQUISITIONS OF THE FEMOROTIBIAL JOINT

S. Maschek1,2, W. Wirth1,2, B. Wyman3, M.-P. Helliou Le Gravrand3, F. Eckstein for the A9001140 investigators1,2
1Chondrometrics GmbH, Ainring, Germany; 2Inst. of Anatomy, PMU, Salzburg, Austria; 3Pfizer Global Res. and Development, New London, CT

Purpose: Magnetic resonance imaging (MRI) is a powerful tool for the assessment of cartilage morphology (volume, thickness, surface areas) and can be used to evaluate disease progression (cartilage loss) in OA. Sagittal 1.5mm SPGR/FLASH sequences are a common standard in knee cartilage imaging and have the advantage that all cartilage plates in the femorotetarlar and femorotibial compartment are covered by the images, including the posterior aspects of the femoral condyles. Coronal acquisitions with thinner slices (1.0mm) have been advocated for better delineation of the cartilage in the weight-bearing femorotibial compartment, because of the smaller partial volume effects, particularly in the internal and external aspects of the tibia and femoral condyles. The objective of this study therefore was to directly compare the rate and sensitivity to change in cartilage thickness between 1.0 mm coronal vs. 1.5 mm sagittal acquisitions (FLASHwe acquired at 3 Tesla) in a 2 year longitudinal study in knees with radiographic OA.

Methods: A subsample of 55 participants with definite medial radiographic OA (29 KLG2, 26 KLG3) was analyzed from a larger study including 269 healthy reference subjects (A9001140). 1.0mm coronal and 1.5mm sagittal 3 Tesla FLASHwe MR images were acquired at 7 imaging centres, at baseline and at 24 months. The images were processed by 7 experienced readers. Segmentation of the medial (MT) and lateral tibial (LT), and the medial (cMF) and lateral weight-bearing femoral condyle (cLF) was performed in the coronal and sagittal images pairs, with blinding to the order of acquisition. Coronal and sagittal pairs were processed by the same reader, and segmentations were quality controlled by one person (F.E.). Cartilage thickness over the entire subchondral bone area (ThCtAB) was computed in 5 subregions of the medial and lateral tibia, and in 3 subregions of the medial and lateral weight-bearing femur, respectively, using custom software (Chondrometrics GmbH, Ainring, Germany).

Results: Results for the medial FT compartment are shown in Table 1: In MT, the mean change (MC%) and standardized response mean (SRM = MC/SD of change) were similar between coronal and sagittal images, but in cmf it was higher for the sagittal scans, also in internal and external subregions (ecMF, icMF). Only in the internal subregion of MT, the SRM for coronal (-0.24) was greater than for sagittal images (-0.10). The longitudinal changes were moderately correlated between coronal and sagittal scans, with the highest agreement in the external MT and the central aspect of cMF. The pattern of cartilage loss (relationship between cartilage morphology and bone area) was similar in MT and LT, but the cartilage morphology was different in cMF and cLF. The cartilage morphology in cMF had a higher rate of thinning in MT compared with LT, whereas in cLF it was higher in MT compared with LT.

Conclusions: The results of this study indicate that sagittal and coronal imaging provide comparable results for the assessment of cartilage thickness, but the cartilage morphology is different in the medial and lateral compartments. Sagittal imaging may be preferred for the assessment of cartilage morphology in the weight-bearing compartments, whereas coronal imaging may be preferred for the assessment of cartilage morphology in the non-weight-bearing compartments.
subregions) was similar for coronal and sagittal scans. Only small changes were observed in the lateral femorotibial compartment (data not shown).

**Conclusions:** Surprisingly, the 1.5mm sagittal images displayed a similar rate and sensitivity to change in cartilage thickness over 2 years in the medial tibia, and a greater rate and sensitivity in weight-bearing medial femur than 1.0mm coronal images. Although partial volume effects are stronger in internal and external subregions in sagittal (and in anterior and posterior subregions in coronal) scans, the spatial pattern of cartilage loss was similar between both orientations.

**410**

**FAT-SUPPRESSED INTERMEDIATE WEIGHTED FAST SPIN ECHO AND DUAL ECHO STEADY STATE SEQUENCES FOR SEMIQUANTITATIVE ASSESSMENT OF FOCAL CARTILAGE DAMAGE AT 3 T MRI**

F.W. Roemer, C.K. Kwoh, M. Hannon, M.D. Crema, C.E. Moore, J.M. Jakicic, S.M. Green, A. Guermazi

1Boston Univ. Sch. of Med., Boston, MA; 2Klinikum Augsburg, Augsburg, Germany; 3Univ. of Pittsburgh Sch. of Med., Pittsburgh, PA; 4VA Pittsburgh Hlth.care System, Pittsburgh, PA; 5Texas Woman’s Univ., Houston, TX

**Purpose:** Modern MRI systems offer a multitude of cartilage-dedicated sequences as possible options for quantitative assessment of cartilage morphometry in research and clinical settings. It is unknown, however, if there are differences among these dedicated sequences in their utility for semi-quantitative scoring of focal cartilage defects. The aim of the study was to compare semi-quantitative assessment of focal cartilage damage using the 3D dual echo in steady state (DESS) and intermediate-weighted (IW) 2D turbo spin echo (TSE) fat suppressed (FS) sequences at 3 Tesla (T) MRI.

**Methods:** The Joints on Glucosamine (JOG) study included 177 subjects aged 35-65 (95 men and 82 women) with frequent knee pain. 3 T MRI of both knees was performed at baseline on a Siemens Trio system using the same pulse sequence protocol as in the Osteoarthritis Initiative (OAI): sagittal IW 2D TSE FS, sagittal 3D DESS with water excitation (WE), axial multiplanar reformation (MPR) of sagittal 3D DESS WE, coronal MPR of sagittal 3D DESS WE, coronal IW 2D TSE. Cartilage status was scored on a scale from 0-6 according to the Whole Organ Magnetic Resonance Imaging Score (WORMS) by one experienced musculoskeletal radiologist (FWR) taking into account all five sequences. A total of 245 superficial (WORMS 2.0 lesions) or full-thickness defects (WORMS 2.5 lesions) were detected. In an additional consensus reading by two MSK radiologists (FWR, AG), the lesions were evaluated side-by-side using only the sagittal 3D DESS WE - and sagittal IW 2D TSE FS -sequences. Lesion conspicuity was graded from 0-3, hyper-and hypointensity signal changes adjacent to the defect were recorded as present or absent and the sequence that depicted the lesion with larger maximum diameter was recorded for each cartilage defect. Wilcoxon statistics were applied to determine differences between the sequences.

**Results:** 37 (17.5%) of the scorable lesions were located in the medial femorotibial (TF), 47 (22.8%) in the lateral TF and 126 (59.7%) in the patello-femoral compartment. 82.5% were superficial and 17.5% full-thickness defects. Conspicuity was superior for the IW-sequence (p<0.001), whereas the DESS-sequence revealed more associated signal changes (p<0.001). Comparing the DESS directly with the IW sequence, in 37 (17.5%) cases the DESS sequence showed the lesions as being larger; in 103 (48.8%) cases the IW showed the lesion as being larger; and in 71 cases (33.6%), both sequences depicted lesions as the same size (p<0.001).

**Conclusions:** The cartilage-dedicated DESS-sequence was inferior to the IW sequence in depicting the number and size of focal cartilage defects. More adjacent intrachondral signal changes were observed with the DESS, but the significance of this finding is unclear.

To increase detection of focal cartilage defects semi quantitative assessment of should not only be performed on cartilage-dedicated sequences but also on conventional fat suppressed fast spin echo sequences. These findings might be especially relevant for future assessment of OAI image data as the sequence protocol and MRI system used in the JOG study was comparable to that used in the OAI.

**411**

**INTRA- AND PERIARTICULAR CYSTIC LESIONS IN KNEES WITH AND WITHOUT RADIOGRAPHIC OSTEOARTHRITIS AND LONGITUDINAL ASSESSMENT OVER SIX MONTHS USING 3 T MRI**


1Boston Univ. Sch. of Med., Boston, MA; 2Klinikum Augsburg, Augsburg, Germany; 3Univ. of Pittsburgh, Pittsburgh, PA; 4VA Pittsburgh Hlthcare System, Pittsburgh, PA; 5Texas Woman’s Univ., Houston, TX

**Purpose:** Cystic lesions around the knee comprise a diverse group of entities, and are frequently encountered during routine magnetic resonance imaging (MRI) of the knee. These lesions are commonly found in osteoarthritic knees. MRI is the technique of choice in characterizing lesions around the knee, and is very useful to confirm the cystic nature of the lesion, to evaluate the anatomical relationship to the joint and surrounding tissues, and to identify associated intra-articular disorders.