modest reduction was observed in the LTP (p=0.047) and MTP (p<0.024) of the sham joints.

**Conclusions:** Clinical CT equipment permitted easy and non-invasive assessment of the BMD temporally (ACLT and sham) in an in vivo OA rabbit model.

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**AUTOMATIC KNEE CARTILAGE VOLUME QUANTIFICATION COMPARED TO JOINT SPACE WIDTH: BIOMARKERS OF LONGITUDINAL PROGRESSION?**

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**Purpose:** For clinical studies, diagnostic and prognostic biomarkers are needed to select a population at the target stage of osteoarthritis (OA) with a high risk of progression; and an efficacious biomarker is needed to quantify the treatment effect. Currently, diagnostic and prognostic markers are available, but the development of progression biomarkers has proved to be challenging. The aim of this study was to evaluate whether a fully automatic cartilage volume quantification method is suitable as a biomarker for quantification of longitudinal progression of knee OA. For perspective, the results are compared to joint space width (JSW) quantification.

**Methods:** A study population was prospectively selected with 159 subjects with age 21 to 81 years (mean 56), BMI 19 to 38 (mean 28), and 48% female. Radiographs were acquired in a load-bearing semi-flexed position using the SynaFlex. MRI scans with near-isotropic voxels were acquired from a Turbo 3D T1 sequence on a 0.18T Esaote scanner (40° FA, TR 50 ms, TE 16 ms, scan time 10 min, resolution 0.7 x 0.7 x 0.8 mm³). Radiographs and MRI were acquired for both left and right knees at baseline (BL), after one week for a subgroup of 31 knees, and at follow-up (FU) after 21 months. After exclusion of 25 knees used for training of the computer-based method, 288 knees were in the study at BL and 245 knees at FU. Kellgren and Lawrence (KL) score and JSW were evaluated from the radiographs in the medial tibio-femoral compartment and tibial and femoral cartilage volume was quantified in the medial compartments by a fully automatic framework. JSW and volume were normalized by the tibial plateau width.

At BL, the distribution of KL scores was (145,88,30,24,1) for KL 0-4. At FU, 25 knees had progressed from healthy to OA (KL>0) and 101 had remained healthy.

**Results:** At BL, the mean total cartilage volume was 6851 mm³ with a scan-rescan CV of 3.6% (since the method is fully automatic, the intra-scan CV was zero). The volume quantification allowed diagnostic separation at BL of healthy from OA (p<0.001) as well as from early OA (KL 1, p<0.01), see Figure 1. The BL volume predicted progression with borderline significance (p=0.08). Finally, the measured cartilage loss was higher for progressors than non-progressors (p<0.01), see Figure 2 (right). For comparison, JSW provided diagnostic separation of healthy from OA (p<0.001) and from early OA (p<0.01) - but allowed neither prognostic (p=0.3) nor progression separation (p=0.4, Figure 2 left).

**Conclusions:** Since JSW is an integral part of the KL score, the diagnostic ability was expected. However, the results indicated that the use of JSW as outcome measure in longitudinal studies is questionable. Cartilage volume was suitable as diagnostic marker and borderline suitable as prognostic. More importantly, the volume quantification showed increased cartilage loss for the OA progressors compared to the non-progressors (p<0.01). Thereby, the fully automatic computer-based method may be suitable for use as a treatment efficacy marker in longitudinal studies.

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**T2-STAR RELAXATION AS A MEANS TO DIFFERENTIATE CARTILAGE REPAIR TISSUE**

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**Purpose:** The capability of magnetic resonance imaging (MRI) to visualize morphological and biochemical changes of articular cartilage give it the potential to follow-up different therapy procedures. A possible non-invasive statement about the produced cartilage repair tissue remains challenging and founded the need for modern evaluation techniques such as quantitative T2 mapping. However its clinical use with sufficient signal to noise and high resolution is limited by relatively long scan time. Underlying reliable results, T2 star mapping with its possible short scan time seems to offer a potential alternative. In a recent study of our group the accuracy and efficiency of the used T2 Star fitting algorithm was validated and the use of T2 star maps, created in clinically acceptable time frames and with resolutions that allow a detailed analysis of the cartilage, was shown.

The goal of the presented feasibility study was to use T2 star mapping in the follow-up of two different cartilage repair procedures and to compare it to the established T2 mapping by a multi-echo spin-echo (SE) technique.

**Methods:** One group of 15 healthy volunteers and two patient