Both sequences showed similar results for reproducibility related to volunteers and raters (CV) and averaged reproducibility (RMSA) with slightly, but not significantly, better results for the 3D-TrueFISP sequence (p = 0.05).

For cartilage thickness measurements, both morphological sequences showed comparable good results with RMSA of 7.1% to 8.5%. Regarding quantitative T2 values measured at the same location RMSA ranged with excellent results from 3.2% to 4.7%.

Conclusions: In our study, defined regions within the thin and, in terms of MRI, technically demanding cartilage of the talocrural joint were analyzed and a combined assessment of cartilage thickness and T2 relaxation times was performed in a clinically acceptable scan time. The obtained results show a good reproducibility of high-resolution isotropic 3D-TrueFISP, PD FS TSE and quantitative T2 cartilage imaging. Reproducibility of less than 10% in a challenging joint with cartilage thickness of around 1 mm provides an excellent basis for diagnosis, grading and follow-up of pathological conditions of the ankle cartilage layers.

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SIMULTANEOUS ACQUISITION OF MORPHOLOGICAL IMAGES AND FUNCTIONAL T2 VALUES: A FEASIBILITY STUDY IN PATIENTS AFTER CARTILAGE REPAIR IN THE KNEE USING A DOUBLE ECHO STEADY STATE (DESS) APPROACH AT 3 TESLA

G.H. Welsch1, T. Mamisch2, S. Marlovits1, S. Domayer1, T. Hughes3, M. Deimling3, S. Trattnig1
1Medical University of Vienna, Vienna, Austria; 2University of Berne, Berne, Switzerland; 3Siemens Medical Solutions, Erlangen, Germany

Purpose: Different MRI techniques have been proposed for probing the structure and the molecular composition of cartilage. In osteoarthritis diagnosis of early stages of cartilage softening is still challenging. Furthermore cartilage repair procedures demand for advanced MR sequences. A fast Double Echo Steady State (DESS) sequence permits accurate and precise analysis of cartilage morphology in the knee joint at 3T. However to improve therapy monitoring especially after cartilage repair procedure, in addition to morphological imaging, quantitative mapping techniques, such as T2 mapping, seem to be useful.

Based on the simultaneous acquisition of two signals with clearly different contrasts within the DESS sequence, it allows the formation of two MR images. In principle T2 values can be calculated from the combination of the first and second images.

In this study we used those combined possibilities of the DESS sequence and compared it to a standard T2 multi-echo spin echo (SE) sequence in healthy volunteers, patients with arthroscopically diagnosed areas of cartilage softening, patients after cartilage repair procedure using microfracture technique (MFX) and after matrix-associated autologous chondrocyte transplantation (MACT).

Methods: Four groups (I-IV) were enrolled in this study: (I)15 healthy volunteers with no clinical symptoms or history of knee pain. (II)8 patients with arthroscopic diagnosis of cartilage softening. (III)10 patients after MFX therapy. (IV)10 patients after MACT. Ethical approval was provided.

MR imaging was performed on a 3 T MR scanner. The protocol for all groups was identical and consisted of a SE sequence using 6 echoes for the standard T2 mapping and the alternative DESS-T2 approach. A region of interest analysis was undertaken covering the full thickness of the cartilage site in all groups. For correlation between SE-T2 and DESS-T2 values, a correlation using the Pearson coefficient was achieved.

Results: Quantitative T2 assessment of native hyaline cartilage in healthy controls showed mean T2 values (ms) of 55.4 ± 6.2 using the classical SE-T2 approach and 54.7 ± 6.7 using the new DESS-T2 method. Correlation between both measurements was highly significant (p < 0.001). In all other groups, SE-T2 values and DESS-T2 values also showed significant correlation (p < 0.05). Whereas in cartilage softening and after MFX T2 values were significantly lower than in healthy volunteers (p < 0.05), in patients after MACT T2 values stayed stable (p > 0.05). Figure 1 shows a DESS-T2(left) and SE-T2(right) map after MFX with low (blue) T2 values within the area of cartilage repair(arrows).

Figure 1

Conclusions: In conclusion, T2 mapping based on a high resolution 3D-DESS sequence correlates good with standard SE T2 mapping. Hence the presented DESS option gives the opportunity to combine morphological and functional imaging in one sequence to assess healthy or softened cartilage and cartilage repair tissue. Implicating this correlation, biochemical imaging can be added to a routine morphological protocol to further elucidate cartilage changes and follow-up nonsurgical and surgical therapy options.

Future studies are needed to investigate this clinical impact and the accuracy for a longitudinal change of cartilage morphology and biochemistry. Furthermore to optimize signal-to-noise for the assessment of spatial variation within articular cartilage.

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MAGNETIC RESONANCE IMAGING (MRI) ALLOWS FOR PRECISE AND RELIABLE ASSESSMENT OF SYNOVIAL MEMBRANE THICKNESS IN KNEE OA PATIENTS

J-P. Pelletier1, F. Abram2, J. Martel-Pelletier1
1Osteoarthritis Research Unit, University of Montreal Hospital Centre, Notre-Dame Hospital, Montreal, PQ, Canada; 2ArthroVision Inc., Montreal, PQ, Canada

Purpose: The assessment of joint structural damage and changes over time is becoming essential for monitoring the progression of osteoarthritis (OA) and evaluating therapeutic response. Synovitis in knee OA patients has been demonstrated to be a significant risk factor for disease progression, thus assessment of the severity of synovitis and its progression over time are of primary importance. A number of methods to assess the severity have been described but are invasive. The aim of this study was to develop a new MRI acquisition sequence which will allow reliable and sensitive assessment of the severity of synovitis in knee OA patients without the use of a contrast agent.

Methods: Imaging was performed using a 1.5 T scanner with a transmit-receive knee coil. Measurements of synovial membrane thickness were performed on four regions of interest (ROIs) and...