**A fat saturated proton density-weighted 3D-TSE-sequence for MRI of the knee at 3T – first clinical results**

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**Introduction:**

3D-TSE-sequences allow covering a whole organ of interest with an isotropic slab, facilitating interactive 3D-visualization. The high isotropic resolution reduces partial volume effects and enables free 3D-multiplanar-reformatting (MPR) without loss of image quality in the three major anatomical planes and along structures of interest. The purpose of this study was to technically and clinically evaluate knee-MRI at 3T with an isotropic fat-saturated(FS) proton-density-weighted(PDw) 3D-TSE-sequence.

**Materials and Methods:**

For technical evaluation the dominant knee of 10 healthy volunteers was examined with the sagittally orientated PD-FS 3D-TSE-sequence SPACE (TR 1200ms/TE 30ms/voxel-size 0.5³mm³/acquisition-time 10:35min) on a 3T-scanner (Magnetom TRIO). 0.5, 1 and 2mm thick multiplanar-reconstructions (MPRs) were performed in the three major anatomic planes. SNR, CNR, SNR-efficiency and anatomical-detail-visualization (5-point-scale) were compared to high-resolution state-of-the-art 2D-TSE-sequences in 3 orthogonal planes (TR 3200ms/TE 30ms/voxel-size 0.36x0.36x3mm/total acquisition-time 12:34min). Sixty patients with cartilage and meniscus pathologies were examined with the same techniques. Patient 3D-datasets were assessed using 1mm-thick MPRs. Detection of abnormalities and diagnostic confidence were assessed by 2 radiologists independently. Arthroscopy correlation was available for 18 patients. Statistical analysis was performed using 95%-confidence intervals, Wilcoxon-signed-rank-tests and Weighted-κ.

**Results:**

SNR-efficiency of SPACE was four to five times higher than for 2D-TSE-sequences. SNR and CNR of 1mm-thick SPACE-reconstructions were comparable to 2D-TSE-sequences (Figure 1) and provided superior visualization of small structures such as meniscal root ligaments.

Correlation with arthroscopy did not show significant differences between 2D- and 3D-sequences. One reader detected significantly more cartilage abnormalities (Figure 2) with the 2D-TSE-sequence (131 vs. 151, p=0.04). Diagnostic confidence was significantly higher for meniscus abnormalities (Figure 3) for SPACE for one reader.

Intersequence-correlation was excellent (κ=0.82 to 0.92).

Interreader-correlation was good to excellent (κ=0.71 to 0.80), intrareader-correlation was excellent (κ=0.90 to 0.92).

**Conclusions:**

3T enables time-efficient 3D-TSE-imaging of the knee at adequate SNR and CNR. Detection and visualization of meniscus- and cartilage-pathologies is at least comparable to state-of-the-art 2D-TSE-sequences. 3D-TSE-sequences with consecutive MPR may become a valuable component of future knee-MRI protocols.

**References:**

1. Lichy et al.; MRI of the body trunk using a single-slab, 3D-T2w TSE-sequence with high sampling efficiency (SPACE) for high spatial resolution imaging: initial clinical experiences. Invest Radiol,2005. 40(12): p.754-60.1