

## Inter-scanner variability of MRI-based tibial cartilage volumetric parameters at 1.5T and 3T.

A. Horng<sup>1</sup>, S. Weckbach<sup>1</sup>, M. Notohamiprodjo<sup>1</sup>, C. Muenkel<sup>1</sup>, J. Weber<sup>1</sup>, M. F. Reiser<sup>1</sup>, and C. Glaser<sup>1</sup>

<sup>1</sup>Department of Clinical Radiology, University Hospital Munich, Campus Großhadern, Munich, Bavaria, Germany

**Purpose:** Cartilage loss over time is slow with reported values varying between 0 and 5% per year. Therefore, in view of multicentre studies, knowledge on inter-scanner variability is mandatory. As it is still unclear whether different scanner types of one manufacturer produce comparable results, inter-scanner variability of MRI-based cartilage volumetric parameters were evaluated.

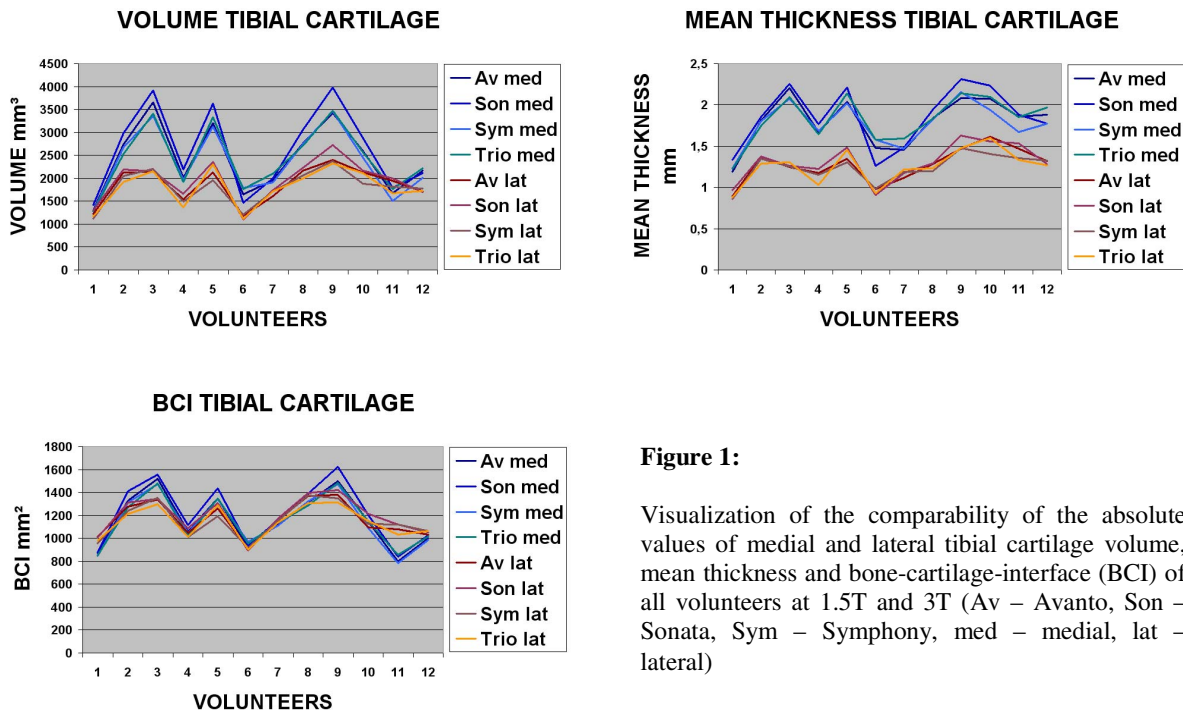
**Materials and Methods:** Coronal tibial 3D-T1-w FLASH WE (20ms/8ms/25°/0.3²x1.5mm³(1.5T);0.3²x1.2mm³(3T)) datasets of the right knees of 12 healthy volunteers (21-30y, 7f) were acquired with three different 1.5T and one 3T MRI scanners (Avanto, Sonata, Symphony, Trio, Siemens Medical Solutions, Erlangen) in one imaging session using a commercial circular polarized knee coil. All sequence parameters were identical at 1.5T, TR/TE/FA were adapted for optimized image contrast at 3T. After segmentation of the tibial cartilage plates, cartilage volume (voxel count), mean cartilage thickness (Euclidean distance) and the size of the bone-cartilage-interface (BCI) were calculated. Mean values and % differences were calculated for the different scanners and inter-scanner interclass correlation coefficient (ICC) was determined.

**Results:** Absolute values of tibial cartilage volume, mean thickness and BCI for each volunteer acquired from each scanner are depicted in Figure 1. ICC for volume was 0.924 (95%-confidence interval (CI) 0.832-0.974), for mean thickness 0.906 (95%-CI 0.797-0.968) and for CBI 0.947 (95%-CI 0.881-0.982). Absolute/relative average difference (1.5T only; 1.5T-3T) for cartilage volume was 0.17mm³/7.6%; 0.15mm³/6.8%, for mean thickness 0.09mm/5.7%; 0.08mm/5.5% and for BCI 0.04mm²/3.7%; 0.04mm²/3.6%. The highest difference was observed for the parameter cartilage volume between two 1.5T scanners (0.3mm³/12.6%).

**Conclusion:** ICC indicates good inter-scanner agreement at 1.5T and - despite slightly different resolution - between 1.5T and 3T for all 3 volumetric parameters. In average, differences of 5% have to be taken into account when comparing data from different scanners of one manufacturer. These compare favorably to reported inter-company scanner differences[1,2] as well as reported differences between scanners of different magnetic field strength in brain volumetric analyses [3], presumably due to the higher resolution used in the cartilage dedicated sequences. The data may contribute to calculate sample size in multicentric studies.

### References:

1. Westwood MA, Anderson LJ, Firmin DN, et al. Interscanner reproducibility of cardiovascular magnetic resonance T2\* measurements of tissue iron in thalassemia. J Magn Reson Imaging. 2003 Nov;18(5):616-20.
2. Filippi M, Rocca MA, Gasperini C, et al. Interscanner variation in brain MR lesion load measurements in multiple sclerosis using conventional spin-echo, rapid relaxation-enhanced, and fast-FLAIR sequences. AJNR Am J Neuroradiol. 1999 Jan;20(1):133-7.
3. Briellmann RS, Syngienotis A, Jackson GD. Comparison of hippocampal volumetry at 1.5T and at 3T. Epilepsia. 2001 Aug;42(8):1021-4.



**Figure 1:**

Visualization of the comparability of the absolute values of medial and lateral tibial cartilage volume, mean thickness and bone-cartilage-interface (BCI) of all volunteers at 1.5T and 3T (Av – Avanto, Son – Sonata, Sym – Symphony, med – medial, lat – lateral)