Introduction The loss of glycosaminoglycans (GAGs) and breakdown of collagen are typical characteristics of early osteoarthritis (OA) (1). T1rho mapping has been shown to be sensitive to changes in cartilage proteoglycan loss (2). Previous studies have demonstrated that cartilage T1rho values are elevated in OA patients compared to corresponding healthy subjects (3, 4). Recent work has reported (5, 6) that T1rho values of the meniscus and the adjacent cartilage varies in healthy subjects and OA patients. The aim of this study was to assess and compare the compartment-wise T1rho values of menisci and cartilage with doubtful (Kellgren-Lawrence (KL) grade 1) to severe (KL4) OA at 3T.

Methods 30 subjects with varying degrees of OA (KL1-4, 13 females, 17 males, mean age ± SD = 63.9 ± 13.1 years) were recruited (7, 8). Approval for this study was obtained from the local institutional review board (IRB), and informed consent was obtained from all the subjects. All the MRI experiments were performed on a 3.0T clinical scanner utilizing an 8-channel phased array knee coil (transmit-receive). 3D T1rho-weighted images with parallel imaging (AF = 2) were acquired with TR/TE = 175/2.04 ms, spin-lock frequency = 300Hz, number of slices = 30, time of spin-lock (TSL) = 2/10/20/30 ms, slice thickness = 3 mm, matrix = 256X128, FOV = 15 cm, bandwidth = 260 Hz using the GRE sequence based on the spin-lock techniques (9). Mean cartilage T1rho values were evaluated in twelve compartments (LFa, LFc, LFp, LTa, LTc, LTp, MFa, MFc, MFp, MTa, MTc, MTp). Mean meniscus T1rho values were evaluated in six regions (lateral anterior, lateral central, lateral posterior, medial anterior, medial central, medial posterior). The Student’s t-test was used to determine whether there were any statistically significant differences in T1rho relaxation times between the femoral-tibial cartilage and the corresponding adjacent meniscus (anterior, central, and posterior) in the lateral and medial compartments.

Results and Discussion Fig.1 showed representative T1rho maps of cartilage in the lateral (a) and medial (b) compartments, and T1rho maps of menisci in the lateral (c, d) and medial (e, f) compartments, respectively, obtained from a doubtful-minimal OA patient. The color bars on the right show the T1rho values ranges, respectively. Table 1 listed the T1rho values (ms) of cartilage (mean ± SD) based on KL and WORMS grading. Likewise, Table 2 listed the T1rho values (ms) of meniscus (mean ± SD) based on KL and WORMS grading. Statistically significant differences (P < 0.05) were identified between cartilage T1rho values of moderate-severe OA subjects in the lateral femoral anterior sub-compartment and doubtful-minimal OA subjects in the lateral and medial compartments. There were statistically significant differences in meniscus T1rho values of the medial posterior sub-region of subjects with moderate-severe OA and all sub-regions in the lateral and medial compartments of subjects with doubtful-minimal OA. When evaluated based on WORMS, statistically significant differences were identified in cartilage T1rho values between cartilage with WORMS0-1 in the lateral tibial central and medial femoral central sub-compartments and cartilage with WORMS5-6 in the lateral and medial compartments.

Conclusion The preliminary results suggest that there are significant differences in T1rho relaxation times of the lateral femoral anterior cartilage in subjects with moderate-severe OA (KL3-4) versus all the other cartilage sub-compartments with moderate-severe OA and all sub-regions in the lateral and medial compartments of subjects with doubtful-minimal OA. When evaluated based on WORMS, statistically significant differences were identified in cartilage T1rho values between cartilage with WORMS5-6 in the lateral and medial compartments.