

Assessment of Cartilage T_{1rho} Values in Osteoarthritic Patients with and without Meniscal Tears at 3T

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Introduction Prestructural characteristics of early osteoarthritis (OA) are the loss of glycosaminoglycans (GAG) and collagen breakdown (1). T_{1rho} mapping has been shown to be sensitive to changes in cartilage proteoglycan loss (2). Previous studies have demonstrated that the T_{1rho} values are elevated in OA patients when compared with corresponding healthy subjects (3, 4). Recently, it has been reported (5, 6) that the T_{1rho} varied between meniscus and the corresponding adjacent cartilages of healthy subjects and OA patients. The main purpose of current work was to determine cartilage T_{1rho} changes in OA patients with and without meniscal tears.

Methods Two groups of OA subjects were recruited (n = 5 without meniscal tears, 4 females, 1 male, mean age = 60 years ± 8.4, age range = 50 - 62 years, and n = 5 with meniscal tears, 2 females, 3 males, mean age = 65 years ± 6.8, age range = 60 - 65 years). Approval for this study was obtained from 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 T_{1rho}-weighted images with parallel imaging (AF = 2) were acquired with TR/TE = 175/2.04 ms, spin-lock frequency = 300Hz, number of slices = 25, time of spin-lock (TSL) = 2/10/20/30 ms, slice thickness = 3 mm, matrix = 256X128, FOV = 15 cm, flip angle = 25°, bandwidth = 260 Hz using the GRE sequence based on the spin-lock techniques (7). Mean cartilage T_{1rho} values were evaluated on six different regions of interest in these two groups. The Student's t-test was used to determine whether there were any statistically significant differences in T_{1rho} relaxation times between the two groups, separately in the lateral and medial compartments.

Results and Discussion Representative T_{1rho} maps of cartilage obtained from an OA patient without meniscal tears are shown in Fig. 1 (a, b). Similarly, Fig. 1 (c, d) shows representative T_{1rho} maps of cartilage from an OA patient with meniscal tears. As is shown in Fig. 2, the average T_{1rho} values of femoral, tibial, and patellar cartilage in the lateral compartment in OA patients without meniscal tears were 56.64 ± 4.74 ms, 43.71 ± 7.94 ms, and 54.03 ± 6.49 ms, respectively. The average T_{1rho} values of femoral, tibial, and patella cartilage in the medial compartment in OA patients without meniscal tears were 62.61 ± 5.34 ms, 51.49 ± 5.25 ms, and 54.77 ± 7.27 ms, respectively. On the other hand, the average T_{1rho} values of femoral, tibial, and patella cartilage in the lateral compartment in OA patients with meniscal tears were 67.10 ± 6.51 ms, 64.71 ± 7.82 ms, and 67.45 ± 7.42 ms, respectively. The average T_{1rho} values of femoral, tibial, and patella cartilage in the medial compartment in OA patients with meniscal tears were 67.13 ± 2.05 ms, 58.94 ± 8.63 ms, and 65.68 ± 9.59 ms, respectively. There are significant difference in cartilage T_{1rho} relaxation times between the two groups within the lateral compartment (P < 0.05 for T_{1rho} values of femoral, tibial, and patella cartilages, respectively). However, there are no significant differences in cartilage T_{1rho} relaxation times between the two groups within the medial compartment (P > 0.05 for T_{1rho} values of femoral, tibial, and patella cartilage, respectively).

Conclusion The preliminary results suggest that there are significant differences in T_{1rho} relaxation times in patients with meniscal tears, only in the lateral compartment (P<0.05) but not in the medial compartment (P>0.05). Therefore degeneration following meniscal tears appears to be compartment specific.

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