

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 \pm 8.4, age range = 50 - 62 years, and n = 5 with meniscal tears, 2 females, 3 males, mean age = 65 years \pm 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 \pm 4.74 ms, 43.71 \pm 7.94 ms, and 54.03 \pm 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 \pm 5.34 ms, 51.49 \pm 5.25 ms, and 54.77 \pm 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 \pm 6.51 ms, 64.71 \pm 7.82 ms, and 67.45 \pm 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 \pm 2.05 ms, 58.94 \pm 8.63 ms, and 65.68 \pm 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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