

## T1rho MRI of Menisci and Cartilage in mild Osteoarthritis Patients at 3T

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**Introduction** Early osteoarthritis (OA) is characterized by the loss of glycosaminoglycans (GAG) and collagen disruption (1). T1rho mapping has been shown to be indicative of changes in cartilage proteoglycan loss (2). Prior studies have demonstrated that cartilage T1rho values are elevated in OA patients compared to corresponding healthy subjects (3, 4). Recently, it has been reported (5, 6) that T1rho values of the meniscus and the adjacent cartilage varies in healthy subjects and OA patients. The objective of this study was to compare T1rho values of cartilage with that of the meniscus in subjects with mild osteoarthritis at 3T.

**Methods** Mild OA subjects were recruited (K-L Score = 2, n = 15, 5 females, 10 males, mean age = 61 years  $\pm$  7.6, age range = 52 - 64 years) (7). 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 (8). Mean cartilage T1rho values were evaluated in four compartments (LF, LT, MF, MT). 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** Two representative T1rho maps of cartilage in the lateral and medial compartments obtained from a mild OA patient are shown in Fig. 1 (a, b), respectively. Similarly, Fig. 1 (c, d) shows two representative T1rho maps of the meniscus in the lateral and medial compartments from the same subject, respectively. As is shown in Table. 1, the mean T1rho values of femoral and tibial cartilage in the lateral compartment in mild OA patients were  $51 \pm 6$  ms and  $46 \pm 4$  ms, respectively. The mean T1rho values of femoral and tibial cartilage in the medial compartment in mild OA patients were  $50 \pm 7$  ms and  $49 \pm 5$  ms, respectively. On the other hand, the mean T1rho values of the anterior, central, and posterior meniscus in the lateral compartment in mild OA patients were  $28 \pm 6$  ms,  $27 \pm 3$  ms, and  $29 \pm 7$  ms, respectively. The mean T1rho values of anterior, central, and posterior meniscus in the medial compartment in mild OA patients were  $31 \pm 16$  ms,  $31 \pm 7$  ms, and  $35 \pm 9$  ms, respectively. The differences in T1rho relaxation times between cartilage (femoral, tibial) and the meniscus (anterior, central, and posterior) in both lateral and medial compartments were statistically significant ( $P < 0.001$ ). There was also a statistically significant difference ( $P = 0.033$ ) identified when T1rho relaxation time of the central meniscus in the medial compartment ( $31 \pm 7$ ) was compared with that in the lateral compartment ( $27 \pm 3$ ). Finally, there was no statistically significant difference identified when T1rho relaxation times of cartilage in the lateral compartment were compared with cartilage of the medial compartment ( $P > 0.05$ ).

**Conclusion** The preliminary results suggest that there are significant differences in T1rho relaxation times between the femoral-tibial cartilage and the meniscus in lateral and medial compartments ( $P < 0.05$ ). There is also a statistically significant increase in the T1rho relaxation time in the central meniscus in the medial compartment when compared to the lateral compartment ( $P < 0.05$ ). This may be due to the propensity for osteoarthritis to involve the medial compartment to a greater degree than the lateral compartment. These preliminary data could serve as reference standards for future studies and suggest that T1rho might detect meniscal abnormalities in subjects with osteoarthritis.

**References** 1) Mlynarik V et al, J Magn Reson Imaging. 1999; 10: 497-502. 2) Akella SV et al, Magn Reson Med. 2001; 46: 419-423. 3) Li X et al, Osteoarthritis Cartilage 2007; 15: 789-797. 4) Blumenkrantz G et al, Eur Cell Mater. 2007; 13: 76-86. 5) Bolbos RI et al, Osteoarthritis Cartilage 2009; 17: 12-18. 6) Rauscher I et al, Radiology. 2008; 249: 591-600. 7) Kellgren J et al, Ann Rheum Dis 1957; 16: 494-501. 8) Pakin SK et al, Magn Reson Med. 2006; 56: 563-571.

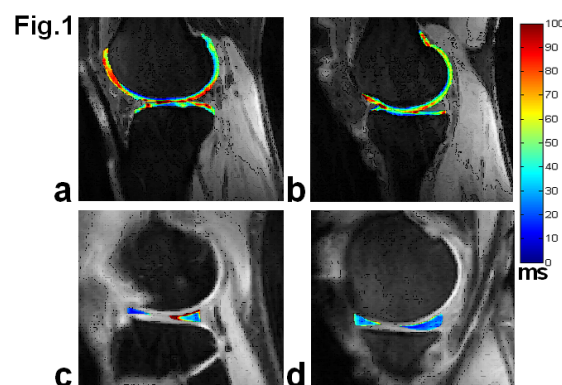


Table.1		Mean $\pm$ SD (ms)
Femoral Cartilage	Lateral	$51 \pm 6$
	Medial	$50 \pm 7$
Tibial Cartilage	Lateral	$46 \pm 4$
	Medial	$49 \pm 5$
Anterior Meniscus	Lateral	$28 \pm 6$
	Medial	$31 \pm 16$
	Central	$27 \pm 3$
Posterior Meniscus	Medial	$31 \pm 7$
	Lateral	$29 \pm 7$
	Medial	$35 \pm 9$