ASSESSMENT OF MENISCUS WITH QUANTITATIVE MRI: ADIABATIC T_{1P} AND T_{2P} IN ASYMPTOMATIC SUBJECTS AND PATIENTS WITH EARLY OSTEOARTHRITIS

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OBJECTIVE: To evaluate meniscal degeneration in asymptomatic subjects and patients with early osteoarthritis (OA) using adiabatic $T_{1\rho}$ (Ad $T_{1\rho}$) and $T_{2\rho}$ (Ad $T_{2\rho}$).
METHODS: Quantitative assessment of meniscus was performed with $AdT_{1\rho}$ and $AdT_{2\rho}$ mapping [1] on sagittal knee images acquired using a 3 T clinical MRI system in 17 asymptomatic volunteers and 17 patients with early radiographic OA (KL = 1,2). The cohorts were matched for sex and age. MR images of all the subjects were separately assessed by an experienced radiologist and scored using MRI OA Knee Score (MOAKS) [2]. $AdT_{1\rho}$ and $AdT_{2\rho}$ values were calculated in four different regions of interests (ROIs) of meniscus: anterior horn medial (AHMED), posterior horn medial (PHMED), anterior horn lateral (AHLAT), and posterior horn lateral (PHLAT) (Fig.1). Then the calculated data was used to assess (i) meniscal degeneration in volunteers and patients and (ii) meniscus lesion in subjects based on MOAKS independent of their symptoms and KL.

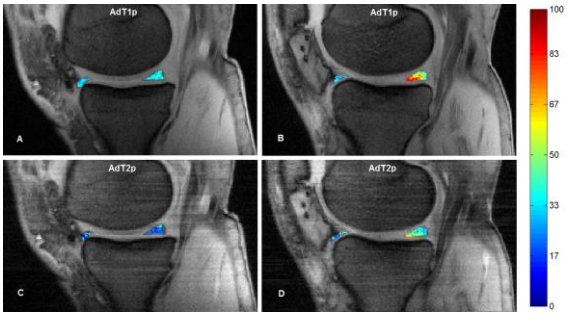

Figure 1:MR images of medial meniscus. ROIs show AHMED and PHMED in asymptomatic volunteers (A, C) and patients (B, D). The color bar indicates the respective relaxation times in [ms].

RESULTS: Both $AdT_{1\rho}$ and $AdT_{2\rho}$ in PHMED of patients were significantly longer than their respective asymptomatic compartments ($p = 0.007$ for $AdT_{1\rho}$, $p = 0.005$ for $AdT_{2\rho}$). Similarly, both $AdT_{1\rho}$ and $AdT_{2\rho}$ of PHMED with lesion were significantly longer than their relevant compartments with no lesion ($p < 0.001$ for $AdT_{1\rho}$, $p = 0.011$ for $AdT_{2\rho}$). The longer values of $AdT_{1\rho}$ and $AdT_{2\rho}$ for patients and subjects with lesion indicate the severity of meniscal degeneration in PHMED, which is consistent with the findings of previous studies [3]. Our findings also indicate that $AdT_{1\rho}$ and $AdT_{2\rho}$ measurements could not only distinguish meniscal degeneration in subjects with clinical symptoms but could also distinguish the lesion in subjects clinically assessed by radiologists.
CONCLUSIONS: This study reports that $AdT_{1\rho}$ and $AdT_{2\rho}$ relaxation measurements can provide a non-invasive means of detecting and monitoring the degenerative changes in the meniscus, which are associated with progression of OA.

[1] S. Michaeli et al., Magnetic Resonance in Medicine 53, 4 (2005).
[2] D.J. Hunter et al., Osteoarthritis and Cartilage 19, 8(2011).
[3] Z.A. Zarins et al., Osteoarthritis and Cartilage 18, 11 (2010).