Conclusions: Patellar tendon enthesis abnormalities are common in the elderly. The presence of cross-sectional but not longitudinal associations suggests they commonly co-exist with other knee structural abnormalities. This suggests they may not be a major player in symptom development or structural changes with the exception of tibial BMLs.

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COMPARISON VERIFICATION BETWEEN TEXTURE ANALYSIS BASED ON T2MAP MRI AND HISTOLOGICAL ANALYSIS OF THE MENISCAL DEGENERATION IN PATIENTS WITH KNEE OSTEOARTHRITIS

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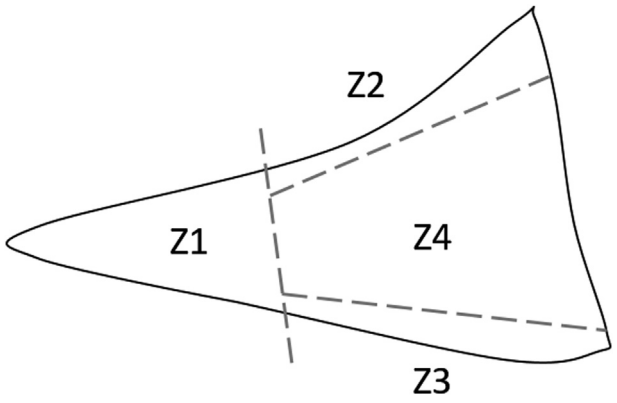
Purpose: Cartilage degeneration and maceration is the most important pathophysiology for both the onset and progression of knee osteoarthritis (OA). However, mechanisms for cartilage degeneration and maceration in knee OA are not fully understood. It has recently been suggested that meniscus plays a crucial role for the pathophysiology of not only advanced stage but also early stage of knee OA. Normal meniscus shows homogeneous with low signal intensity on MRI, while meniscal tears, mucoid degeneration or linear lesions show slightly high signal intensity. However, it is still unclear how the meniscal degeneration shows on MRI. The texture analysis is available for evaluating the characteristic of the tissue by analyzing the distribution of pixels with signal intensity and position with a mathematical technique. However, it has not been examined whether texture analysis can be available for evaluation of the degeneration of menisci in knee OA. The aim of this study was to verify the efficacy of texture analysis, in addition to T2map, for the evaluation of meniscal degeneration in knee OA patients.
Methods: Sixty meniscus samples (medial menisci, 26; lateral menisci, 34) were obtained from eleven patients with advanced- or end-stage knee OA [female, 9; 77.6 (SD 4.4) years old on average] who underwent either total knee arthroplasty (TKA) or unilateral knee arthroplasty (UKA). The knee joints of the patients were analyzed by the 3.0T MRI. Texture analysis of the menisci on T2map coronal plane was performed using Gray Level Co-occurrence Matrix (GLCM) method described by Haralick et al. (IEEE, 1973). Four textural features (contrast 0°, contrast 90°, variance, and entropy) and T2 were extracted for each regions of interest on each slice. Original positions of the removed menisci and the MR images were validated manually. Serial paraffin sections of the menisci were stained with hematoxylin and eosin for examining the cellularity and surface integrity and Safranin O for examining the proteoglycan content and collagen alignment. Meniscus was divided into four sections according to the method reported by Pauli et al (Figure). Histological assessment of the menisci was performed in these four regions. Degeneration of menisci in each region was graded as shown in Table, which was modified by the method reported previously (Paili et al., OAC 2011). Histological scoring was performed by two different readers (HK and TA) independently. A correlation analysis was conducted by Spearman's correlation coefficient. Texture analysis and statistical analysis were performed using MATLAB 2017a (MathWorks, Natick, MA, USA). A P value <0.05 was considered to be statistically significant.
Results: The T2 value of the menisci were not associated with the histological scores, including cellularity, surface integrity, proteoglycan content and collagen alignment, of the menisci of the patients. The texture analysis scores, including contrast 0°, contrast 90°, variance, and entropy, of the menisci were not associated with T2 valueof the menisci of the patients. Entropy and contrast 90° of the texture analysis scores were not associated with the histological scores of the menisci of the patients. Variance of the texture analysis scores was correlated with the collagen alignment of the histological scores of the patients ($R^2 = -0.30$, $P = 0.03$), while that was not correlated with other histological scores of the menisci. Similarly, content 0° of the texture analysis scores was correlated with the collagen alignment of the histological scores of the patients ($R^2 = -0.30$, $p = 0.03$), while that was not correlated with other histological scores of the menisci.
Conclusions: The texture analysis of the degeneration of menisci associated with knee OA was correlated with the histological analysis of the degeneration of menisci in patients with knee OA, while T2 value of the degeneration of menisci was not.

Histological assessment score

	Zone 1	Zone 2	Zone 3	Zone 4	Sub total
Surface	0–3	0–3	0–3		0–9
Cellularity	0–3			0–3	0–6
Collagen	0–3			0–3	0–6
Staining	0–3			0–3	0–6
Total score					0–27



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EDUCATIONAL PROGRAM IN SUBJECTS WITH KNEE OSTEOARTHRITIS IMPROVES ADHERENCE, AEROBIC AND FUNCTIONAL CAPACITY

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Purpose: The purpose of present study was to analyze the effects of an educational program emphasizing the regular practice of physical exercise on physical fitness, functional capacity and daily living physical activity levels in patients with knee osteoarthritis (OA).
Methods: Two hundred and thirty-nine patients (X male and Y female) under treatment for primary or secondary knee OA (degree I to IV in the Kelgreen and Lawrence scale) at the public health system were randomly allocated to educational (EDU; n = 112) or control (CON; n = 127) groups. All subjects of EDU and CON have their physical fitness (six minute walking test (6MWT) and seat-and-reach test), functional capacity (stair climbing test) and daily living physical activity (IPAQ short version) assessed at baseline (pre), and during 6,12 and 24 months of follow-up.
Results: EDU improved (P < 0,006) 6MWT at 6 months (10%), which were maintained at 12 months, and slightly reduced (5%) at 24 months. 6MWT also improved (P < 0,006) in CON at 6 months, but it was of lower magnitude (4,5%) and returned to baseline at 12 and 24 months. EDU and CON showed similar improvements ($P < 0.05$) in stair climbing at 6 months (EDU = 13%; CON = 12.3%), which were maintained at 12 and 24 months.EDU also showed an increased prevalence of “actives”

and “very actives” subjects, as well as a reduced prevalence of sedentary subjects during follow-up ($P < 0,05$). Although CON also showed an increased prevalence of "very actives" subjects during follow-up, it was lower than that observed in EDU. Flexibility did not change during follow-up in both groups.

Conclusions: The present results suggest that an educational program promoting the regular practice of physical exercise may be an effective tool for improving physical fitness, functional capacity and daily living physical activity in patients with knee OA.

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ASSOCIATION BETWEEN THE HYPERTROPHY AND THE EXTRUSION OF MEDIAL MENISCUS USING 3T MRI IN PATIENTS WITH KNEE OSTEOARTHRITIS

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Purpose: It still remains fully inconclusive for the developmental process of knee osteoarthritis (OA). However, recent development of the imaging technology for knee OA has advanced the developmental process of knee OA. Medial meniscal extrusion (MME) is associated with the cartilage damage and progression of knee OA. We have recently reported that medial tibial osteophyte evaluated by T2 mapping MRI is frequently observed in the patients with early-stage knee OA, showing close association with MME, and that MME is positively correlated with the meniscal degeneration (ART, 2017). It has been revealed that meniscal hypertrophy of the medial meniscus (MM) occurs frequently in knee OA patients. However, the clinical relevance of MME and meniscal hypertrophy and the cause and effect relationships between them remain unclear. The purpose of this study was to examine whether there was any association between MME and hypertrophy of MM in patients with knee OA using 3T MRI based analyses.

Methods: A total of 136 patients (63.1 years old on average) who visited our out-patient clinic for knee pain between May 2012 and September 2016 were enrolled in this study. The severity of knee OA was classified by Kellgren–Lawrence (K/L) grading scale based on standing extended-knee X-ray images. 3T MRI for the affected knee was also performed in all patients. Diagnosis of knee OA for the subjects with K/L 0 and 1 was conducted using 3T MRI according to the method previously reported (Hunter et al., Osteoarthritis Cartilage, 2009). Patients who showed less than 174° of femoro-tibial angle (FTA) were excluded from the study. MRI scan were performed using sagittal and coronal two dimensional (2D) fat suppressed and proton density weighted image fast spin-echo sequence (TR = 1800 ms, TE = 11 ms, Slice thickness = 3 mm). MME distance was defined as the distance from the outermost edge of the MM to a line connecting the femoral and tibial cortices. Mean meniscal area, height, and width were measured in the analysis of the shape of MM on coronal images at the mid-point of the medial femur and tibia (as the mean of the 3 surfaces). Inter-relationships between the distance of MME and shapes of MM were examined.

Results: Among 136 patients, 32 (23.5%), 37 (27.2%), 27 (19.9%) and 40 (29.4%) showed K/L grade 0&1, 2, 3 and 4, respectively. Fifty-eight of 136 patients (42.6%) were male, while remaining 78 patients (57.4%) were female. MME distance, meniscal height, meniscal width and meniscal area of MM of the patients were 6.0 mm (SD: 3.9), 6.7 mm (SD: 2.6), 7.0 mm (SD: 2.2) and 35.3 mm^2 (SD: 3.9) on average, respectively. Meniscal area ($r = 0.38$, $p < 0.001$) and meniscal height of MM ($r = 0.47$, $p < 0.001$) were associated with MME in patients with knee OA, while meniscal width of MM were not associated with MME ($r = 0.13$, $p = 0.14$). When the patients were divided into four grades according to the MME grades of the MRI Osteoarthritis Knee Score (MOAKS), no significant differences of the meniscal area and height of MM of the patients were observed between MOAKS grades 0, 1, and 2, respectively. In contrast, the grade 3 of meniscal area of MM of the patients (40.3 mm^2) was significantly greater in comparison to the grade 2 of meniscal area of MM (30.9 mm^2, $p < 0.001$). The grade 3 of meniscal height of MM of the patients (7.7 mm) was significantly higher in comparison to the grade 2 of meniscal height of MM (5.7 mm, $p < 0.001$).

Conclusions: These results suggest that meniscal hypertrophy could be involved in the degeneration of MM in patients with knee OA, although further study is needed. In conclusion, meniscal area and height were associated with MME in patients with knee OA.

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3D MENISCAL POSITION PREDICTS KNEE REPLACEMENT IN FAST PROGRESSING KNEE OSTEOARTHRITIS

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Purpose: Knee replacement (KR) represents an important clinical endpoint of knee osteoarthritis (KOA). Previous studies have shown that loss of cartilage thickness is associated with subsequent KR. The aim of the current study was to quantitatively assess the role of the meniscus in fast progression to KR, specifically whether a change in meniscal position and/or morphology predicts progression from early radiographic KOA to KR within two years compared with matched controls.

Methods: A nested case-control study was conducted among Osteoarthritis Initiative (OAI) participants: Cases (KRs) with baseline Kellgren-Lawrence grade (KLG) and KR between the 36 and 60 month (M) follow-up visits were matched one to one to controls without KR through 60M by age, sex and baseline KLG. Quantitative 3D measures of medial meniscal position and morphology were determined from manual segmentation of coronal 3T MR images acquired at the visit before KR (T_0) and two years before T_0 (T_{-2}) (Fig. 1). Cartilage thickness measures were available for the same period. Paired t-tests and conditional logistic regression (odds ratios [OR]) were applied to compare meniscal changes from T_{-2} to T_0 between KRs and controls.

Results: The 35 knees with KLG <=2 who received a KR were from 33 OAI participants [52%♀; age 65 ± 7; body mass index (BMI) 30 ± 4; KLG 0/1/2: 5/8/22] whereas the 35 control knees were from 35 participants [52%♀; age 64 ± 7; BMI 30 ± 5; KLG 0/1/2: 9/4/22]. At T_{-2} no significant differences in meniscal parameters or cartilage thickness were observed between the groups (data not shown). Between T_{-2} to T_0, knees with subsequent KR displayed a significant decrease in tibial plateau coverage by the meniscus and a significant increase in medial meniscal extrusion, whereas no change in positional measures was observed in controls (Table 1). Among morphological measures, reduction in meniscal width (but not in height or volume) was significantly greater in KRs than controls (Table 1). The odds for subsequent KR increased with decreasing tibial plateau coverage, increasing meniscal extrusion, decreasing meniscal width and with central medial femorotibial cartilage thickness loss, both with and without adjustment for pain and BMI (Table 1). Yet, the ORs for KRs vs. controls were observed to be greater for cartilage thickness change than for change in meniscal measures.

Conclusions: The tibial plateau coverage by the meniscus in the medial compartment decreased significantly, during the two years before KR, whereas no relevant change was observed in matched controls. This decrease was paralleled by an increase in meniscal extrusion, and by a reduction in meniscal width. The association of meniscal measures with KR appeared to be somewhat weaker than for