MS subjects from the 31 NS subjects. These variables were then used in a linear regression model to predict the KOOS other symptoms score of all analyzed subjects.

Results: 5 subjects were removed due to poor MESE segmentation. The T2 skewness at the trochlear cartilage (v1), the femoral bone T2 standard deviation at the trochlea (v2), the T2 differences at the bone cartilage interface (BCI) between the central medial and lateral femoral bone (v3), the standard deviation of T2 at the BCI of the lateral femoral cartilage (v4), and the T2 kurtosis differences between the central medial and lateral femoral bone (v5) best predicted the KOOS other symptoms with a sensitivity 0f 0.738, an AUROC of 0.733, and an R2 of 0.192, as seen in Table 1.

Conclusion: Automated, advanced image analysis coupled with advance bioinformatics tools is an effective way to develop T2 based image variables associated with OA related knee symptoms. Local variations in T2 values were the strongest predictors of the KOOS other symptoms score. Therefore, a large spread of T2 values may be an indicator of joint disease and patient discomfort.

Table 1. Prediction parameters for KOOS other symptoms. Symbols (*), (**) and (***) represent a p-value lower than 0.05, 0.01, and 0.001, respectively.

Parameters	Model				
Sensitivity	0.738 (0.677 - 0.806)				
Specificity	0.756 (0.705 - 0.795)				
Accuracy	0.75 (0.72 - 0.77)				
AUROC	0.733 *** (0.71 - 0.75)				
R^2	0.192 ***				
Pearson correlation	0.438 ***				
Feature	v1	v2	v3	v4	v5
Mean	0.1556	15.8091	17.8910	26.5820	1.9977
Standard Deviation	0.3139	4.4075	9.5647	8.2393	2.0483
t-value	-1.8240	-3.2750	1.5880	1.7370	-0.8620
p-value	0.0704	0.0013	0.1146	0.0846	0.3902

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IS MEDIAL KNEE OSTEOARTHRITIS ASSOCIATED WITH CHANGES AT THE ANKLES AND THE FEET?

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Purpose: Primary ankle osteoarthritis (OA) is considered to be uncommon, however, an association of radiographic ankle OA with symptomatic knee OA has recently been reported (McDaniel G, PMID 21310252) , and lateral ankle pain is common in patients with knee OA. We hypothesized that the the tibio-femoral malalignment and lateral shift observed in medial knee OA would be associated both with radiographic OA of the ankle and with altered center of pressure (COP) of the foot during the stance phase of gait.

Methods: 90 subjects with symptomatic medial knee OA (K-L grade 2-3, ambulatory pain >30 mm on a 100 mm VAS) were included. Full limb mechanical axis and AP X-rays of the ankles were obtained. Joint space width (JSW) of the medial and lateral tibiotalar joints were measured using a validated method (Goker B, PMID 19381746). Also, in addition to the knee alignment angle, the tibial lateral shift, defined as the distance between the center of the intercondylar notch of the femur and midpoint of the tibial plateau, was measured, using Image J software (US NIH, Bethesda, MD, http://rsbweb.nih.gov/ij/). In 10 randomly selected patients center of pressure were measured during the stance phase of the gait. Pearson's correlations were calculated to analyze the relationship between the ankle JSW and the other radiographic parameters. Spearman's correlation test was used to analyze the relationship between the tibial lateral shift and COP of the foot. p <0.05 was considered significant.

Results: The mean±SD tibial lateral shift was 5.18±2.45 mm, and was inversely related to the lateral ankle JSW (r=-0.27, p=0.01). In contrast, there was no relationship with the medial ankle JSW (r=-0.16, p=0.12). Also, the knee alignment angle (mechanical axis) was not associated either with medial or lateral ankle JSW (r=0.11, p=0.23 and r=0.16, p=0.12, respectively). There was a direct and significant relationship between tibial lateral shift and COP (rho 0,64, p=0.046).

Conclusions: Radiographic JSW is a measure of cartilage loss, and is directly related to strucutral OA progression. These findings of an association between the magnitude of lateral tibio-femoral shift in knee OA and narrowing of ankle JSW and COP suggest that the aberrant loading of the knee in OA has structural implications at the ankle and the feet, and may explain the previously described association between medial knee OA and radiographic ankle OA.

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BONE MARROW LESIONS IN THE KNEE DIAGNOSED IN MR IMAGES ARE ASSOCIATED WITH LOCALLY INCREASED BONE MINERAL DENSITY MEASURED ON CT IMAGES

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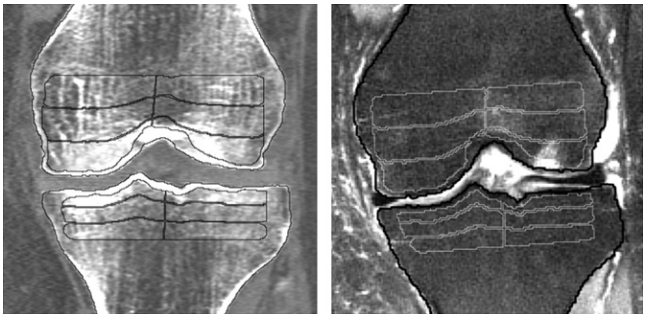
Purpose: While the correlation between bone marrow lesions (BML) and the progressive deterioration of hyaline cartilage is evident in patients with knee OA, the association with bone mineral density (BMD) is ambiguous. We used advanced 3D QCT imaging with a dedicated MIAF analysis software to measure BMD and CT-MR registration to correlate BML with BMD.

Methods: 3D CT images of the knee of 34 patients with knee OA (KL grade 2 or 3) were analyzed with MIAF-Knee starting with an automated 3D segmentation of the periosteal and endosteal surfaces of femur and tibia. Based on anatomic coordinate systems and segmented growth plates, three subchondral VOIs with increasing distance from the joint space were defined in tibia and femur (see left figure), which were first subdivided into medial and lateral and then further into anterior, central and posterior subVOIs, in which BMD was determined.

BMLs were diagnosed on coronal MR images (turbo spin echo sequence) in 17 patients (WORMS grade >= 1) in either femur or tibia (BML group). 17 patients without BMLs were used as control group. A 3D registration between CT and MR data was performed to transfer all CT subVOIs to the MR datasets (see right figure). Then, BMD differences between the VOI containing the BML and its direct neighboring VOIs were calculated. For large BMLs, the BMD of all VOIs covered by the BML were averaged. Neighbor VOIs were considered in 3 dimensions (medial-lateral, proximal-distal, anterior-posterior). Corresponding to each dataset of the BML group, the BMD difference was also calculated using the same VOIs in a randomly assigned dataset of the control group. This procedure was repeated five times. Therefore, for each patient of the BML group, the corresponding BMD differences in the control group were averages derived from 5 different control datasets.

Results: Despite different resolution in CT (voxel size 0.25 x 0.25 x 0.3 mm^3) and MR (voxel size 0.55 x 0.55 x 3.0 mm^3) acquisitions, the registrations showed very good overlap.



Due to the BMD gradient in the epiphysis, percentage BMD differences between VOIs containing lesions and their neighboring VOIs were significantly different from zero in both groups. However, differences between VOIs were significantly higher (t-test, p<0.01) in the BML group (43.0%± 40.0%) compared to the control group (11.7%±22.9%).

Conclusions: Despite the relative small sample size, we found in patients with knee OA that the presence of BMLs was strongly associated with