Methods: Patients: 26 meniscectomized patients (18 men, 46.2±5.3 yrs, 174.8±7.0 cm, BMI 25.2±3.9) operated for a symptomatic non-traumatic medial meniscal posterior horn tear. Exclusion criteria: miss-classified by the surgical code system, previous cruciate ligament injury, severe cartilage changes defined as deep clefts or visible bone at meniscectomy or self-reported co-morbidity factors limiting participation in the study. 26 population-based controls (16 men, 45.8±6.1 yrs, 175.0±8.1 cm, BMI 25.6±4.7) identified through the Danish social security system. Exclusion criteria; previous cruciate ligament injury, other knee surgery or self-reported co-morbidity factors limiting participation in the study.
Stair descent test: Knee ROM was assessed using a flexible electrogoniometer crossing the knee joint, GRF using force plate analysis and medial vs. lateral muscle activity and co-activation using electromyography (EMG) (vastus lateralis: VL, vastus medialis: VM, biceps femoris: BF, semitendinosus: ST) during the transition step between stair descent and level walking.
Self-reported outcomes: Pain was assessed using the Knee injury and Osteoarthritis Outcome Score (KOOS).
Statistical analysis: A mixed linear model with 'subject' as random effect and 'leg' (i.e. operated, non-operated and control legs) as fixed effect tested the main effect of 'leg'. The Mann-Whitney test was used to assess differences in pain between patients and controls.
Results: Patients reported more pain than controls ($p \leq .001$). No differences were observed between patients and population-based controls for any other variables (i.e. movement speed, GRF or EMG) including knee ROM (operated leg: 43.0°, non-operated leg: 44.3°, controls: 43.4°, respectively, p=.45). Reduced peak ground reaction forces (GRF_{peak}; 161.7 vs. 169.3%BW) were observed for the meniscectomized leg vs. the non-operated leg in patients along with decreased VM vs. VL ($p \leq .05$) muscle activity at GRF_{peak} and reduced overall medial vs. lateral thigh muscle activity ($p \leq .05$) in the meniscectomized leg compared with the non-operated leg.
Conclusions: The hypothesized differences between patients and controls could not be confirmed. However, meniscectomized legs showed reduced GRF_{peak} along with attenuated medial leg muscle activity relative to the non-operated contralateral leg. This finding supports the hypothesis that meniscectomized patients have altered neuromuscular motor patterns to reduce knee joint loading and/or minimize knee joint pain, which may reflect an initial state in the progression of knee OA.

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MECHANICAL LOADING IS RELATED TO CARTILAGE DEFECTS IN MEDIAL TIBIOFEMORAL OSTEOARTHRITIS

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Purpose: Focal loss of articular cartilage is a characteristic feature of medial tibiofemoral osteoarthritis (OA). Specifically, loss of medial tibial cartilage volume and medial tibiofemoral cartilage defects are observed with increasing disease severity. One factor thought to contribute to the loss of articular cartilage is increased mechanical load, although in vivo evidence of this relationship is lacking. The external knee adduction moment (KAM) measured during walking gait is a validated proxy for medial compartment knee load. The purpose of this study was to evaluate the relationship between medial cartilage volume and defects and the KAM in individuals with medial tibiofemoral OA.
Methods: 180 (103 F, 77 M) participants with mild-moderate medial tibiofemoral OA were recruited. A Vicon motion analysis system was used to measure the external KAM as participants walked at their usual pace for 5 trials. The variables of interest were the overall peak KAM (Nm/BW*HT%) and the positive KAM angular impulse (Nm.s/BW*HT%) which is equivalent to the positive area under the adduction moment-time graph. Medial tibial cartilage volume and medial tibiofemoral cartilage defects were measured from knee MRI taken in the sagittal plane on one of two 1.5-T whole body MRI units. Medial tibial cartilage volume and bone area were assessed using validated methods by trained observers. Cartilage defects in the medial tibial and femoral cartilage were scored on a scale from 0 (normal cartilage) to 4 (full thickness cartilage wear with exposure of subchondral bone). Tibial and femoral scores were summed, for a total score ranging from 0-8. Static knee alignment was measured from a standing semiflexed posteroanterior knee xray and converted to mechanical axis. Multivariate linear regression models were constructed with cartilage volume or defect score as the dependant variable and peak KAM or KAM impulse as the predictor variable. Covariates included age, gender, body mass index, MR unit, medial tibial bone area, static knee alignment and walking speed. Analyses of tibial cartilage volume also included K-L grade as a covariate; analyses of tibiofemoral cartilage defects also included tibial cartilage volume as a covariate.
Results: Peak KAM and KAM impulse were positively associated with medial tibiofemoral cartilage defect score in univariate analysis and after adjustment. In univariate analysis and after adjusting for the confounders, neither peak KAM nor KAM impulse were associated with medial tibial cartilage volume (Table 1).

Table 1. Relationship between cartilage volume, defects and mechanical loading indices

Variable	Medial tibial cartilage volume		Medial tibiofemoral cartilage defects	
	Regression coefficient (95% CI)	P value	Regression coefficient (95% CI)	P value
Peak KAM (Nm/BW*HT%)	32.6 (-38.7, 103.8)	0.37	0.49 (0.09, 0.90)	0.02
Peak KAM (Nm/BW*HT%)*	57.6 (-17.1, 132.3)	0.13	0.41 (0.05, 0.78)	0.03
KAM impulse (Nm·s/BW∗HT%)	-25.3 (-204.6, 153.9)	0.78	3.06 (2.13, 4.00)	<0.001
KAM impulse (Nm·s/BW∗HT%)*	130.7 (-58.5, 319.9)	0.17	1.66 (0.77, 2.56)	<0.001

*Indicates adjusted for relevant covariates.

Conclusions: This study demonstrates that peak KAM and KAM impulse are associated with cartilage defects in patients with medial knee OA, suggesting that increased mechanical loading may play a role in the pathological changes in articular cartilage that occur with medial knee OA. The absence of a relationship between our KAM measures and medial tibial cartilage volume indicates that cartilage defects may be a more sensitive indicator of cartilage change in response to mechanical loading. Future longitudinal studies are needed to corroborate our findings and investigate the temporal relationship between mechanical loading and knee structure changes.

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TEST-RETEST RELIABILITY OF MAXIMAL LEG MUSCLE POWER AND FUNCTIONAL PERFORMANCE MEASURES IN PATIENTS WITH SEVERE OSTEOARTHRITIS (OA)

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Background & Purpose: Muscle power, taking both strength and velocity into account, is a more functional measure of lower extremity muscle activity compared with the traditionally used isometric and/or isokinetic muscle strength. More functional measures are preferred to determine muscle function and as outcomes in exercise studies in patients with OA.
Purpose: To evaluate the reliability of single-joint and multi-joint maximal leg muscle power as well as functional performance measures in patients with severe OA.
Methods: Subjects: 20 patients diagnosed with severe OA and scheduled for unilateral total hip or knee replacement (mean age: 68.7±7.24), 11 knee patients (6 female) and 9 hip patients (4 female), volunteered to participate.
Subjects underwent a test battery on two occasions separated by approximately one week (range 7 to 11 days). Muscle power was measured using a linear encoder (MuscleLab Power, Ergotest Technology, Langesund, Norway) during unilateral isolated single-joint knee extension and flexion and unilateral isolated single-joint hip extension and abduction. Muscle power of unilateral multi-joint knee and hip extension was obtained with a leg extension press (Nottingham Power Rig, Nottingham University, Nottingham, UK). Three functional performance measures (20 m walk, 5 times chair stands, maximal number of knee bends/30sec) were also evaluated. Pain was measured on a VAS scale prior to and after conducting the entire test battery.
Statistics: Bland & Altman plots were used to evaluate systematic differences and potential outliers. Outliers were defined as more than 3 SD of the mean. Reliability was assessed by within subject coefficients of variations (CV_{WS}). Paired t-tests were performed to reveal systematic difference indicating a learning effect.