medial tibiofemoral joint degeneration (as measured by medial WORMS score) and peak KAM (slope = 0.42 ± 0.20; P=.037) as well as KAM loading rate (slope = 12.3 ± 3.2; P=.0004). These relationships continued to be significant after adjusting for body weight (respective p-values of .019 and .0004). The relationship between medial WORMS score and KAM loading rate continued to be significant even after adjusting for peak KAM (P=.0001). However, the relationship between medial WORMS score and peak KAM was no longer significant after adjusting for KAM loading rate (P=.2). The relationship between medial WORMS score and KAM impulse was not statistically significant, even prior to adding covariates to the regression analysis (slope = 0.10 ± 0.10; P=.3).

Conclusions: These results provide insight into the dynamic loading characteristics associated with knee OA and support the hypothesis that KAM loading rate is strongly associated with the degree of medial tibiofemoral joint degeneration independent of KAM peak and impulse. This has potential implications for the development of treatments aimed at slowing the progression of knee OA. Further prospective designed studies could explore the potentially causal link between KAM loading rate and knee OA.

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HIP ABDUCTOR FUNCTION IN INDIVIDUALS WITH KNEE OSTEOARTHRITIS: IMPLICATIONS FOR MEDIAL COMPARTMENT LOADING DURING GAIT

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Purpose: Hip abductor muscles generate moments of force that control lower extremity coronal plane motion. Strengthening these muscles has been a recent trend in therapeutic intervention studies for knee osteoarthritis based on the theory that hip abductor strength influences knee joint loading. The current study investigated the relationship between hip abductor muscle function (strength and activation) and the net external knee adduction moment during gait in those with medial compartment knee osteoarthritis.

Methods: 54 individuals with moderate knee osteoarthritis walked at their self-selected velocity while gluteus medius electromyograms, lower extremity segment motions and ground reaction forces were recorded. The net external knee adduction moment (KAM) was calculated and amplitude normalized to body mass. Linear enveloped electromyographic profiles were generated and amplitude normalized to maximal voluntary isometric contraction amplitudes. Peak KAM was determined. Principal component analyses were applied to the KAM and electromyographic profiles. Hip abductor strength, subject anthropometrics and gait velocity were measured. Multiple regression models evaluated the relationship between anthropometric, velocity, strength and electromyographic variables and the KAM waveform characteristics. Statistical significance was determined at alpha = 0.05.

Results: A significant positive relationship was found between hip abductor strength and peak KAM (R2=16%, P=0.003). Walking velocity, early stance phase gluteus medius activity (PP2-scores) and height were positively associated with an increased difference between early and late stance KAM (PP2-scores)(R2=60%, P<0.001). Greater overall gluteus medius amplitudes were positively related to greater mid-stance net adduction moments (PP3-scores) (R2=16%, P=0.003).

Conclusions: Hip abduction muscle strength and gluteus medius activation characteristics explained significant variability in specific KAM variables during gait in individuals with moderate knee osteoarthritis. However; a large percentage of the variability was not explained by these variables, thus altering hip muscle function is only one small contributor to KAM characteristics.

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INTEGRATION OF DYNAMIC MECHANICAL ASSESSMENT IN THE MANAGEMENT OF KNEE OSTEOARTHRITIS PATIENTS

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Purpose: Dynamic local mechanical factors are known to be preponderant in the proximate progression of knee osteoarthritis (OA). However, it is difficult for physicians to address these factors in their clinical decision-making process due to the lack of easy-to-use measurement tools. A novel knee biomechanical assessment device (KneeKG™) validated for measuring 3D knee kinematics (flexion-extension; varus-valgus; internal-external tibial rotation) has shown utility for accurate measurement of knee function and objective quantification of the effect of conservative treatments. The purpose of this study was to determine if this assessment device can easily be integrated in a clinical setting and used by physicians to identify and address mechanical disorders involved in the development and progression of knee OA.

Table 1
Patient Characteristics

Number of patients	73
Female (%)	57 (78%)
Mean age (SD)	59.1 (11.1)
Mean Body mass index (SD) kg/m^2	29.1 (5.2)
Waist (SD) cm	99.8 (13.0)
Number of knee with Med Comp OA (Grade III-IV on KL scale)	97 (58)
Number of knee with Lat Comp OA (Grade III-IV on KL scale)	42 (14)
Number of knee with PF Comp OA (Grade III-IV on KL scale)	102 (25)
Total number of knees evaluated	109

Methods: 73 patients were recruited from a knee OA multidisciplinary program (Table 1). Weight bearing x-rays were used to grade the severity of OA according to the Kellgren-Lawrence (KL) classification. Local dynamic knee mechanical factors were assessed while the patient walked at comfortable speed on a treadmill with the KneeKG™ markers affixed to the knee. 3D kinematic data were automatically analyzed and a report generated highlighting known mechanical factors linked to the progression of knee OA. The patients were evaluated by 4 physicians in accordance with standard clinical protocols after which they were given a copy of the KneeKG™ report with the opportunity to comment and integrate the findings into their clinical decision-making process.

Results: The average duration of each evaluation was 20 minutes for one knee. Only 5 patients out of 73 (6%) could not perform the biomechanical assessment (3 due to inability to walk on a treadmill (mean age: 84 years old), 1 due to hyper-sensitivity of the skin, 1 due to attachment system not holding on the knee).

The initial clinical assessment of the remaining 68 patients indicated that static alignment was the main mechanical factor identified (fixed flexion in standing position, limb alignment). The physicians did not identify any dynamic mechanical deficits such as varus thrust or internal tibial rotation. After reviewing the KneeKG™ reports, the physicians concluded that 32 knees in 25 patients exhibited significant varus thrust (mean 3.3°, range 2.5° to 5.1°). The dynamic alignment (at initial contact, during loading or during stance) had a direct correlation to the affected knee compartment in 85% of the cases.

The clinical record of the 25 patients having a varus thrust showed modification of the initial treatment plan in order to address it, thereby indicating that the KneeKG™ report was interpreted and integrated by the physicians into their clinical decision-making process.

Conclusions: The assessment of local dynamic mechanical factors using the KneeKG™ allowed clinicians to address mechanical disorders that are involved in the proximate cause of knee OA and to enhance their therapeutic decision-making process in agreement with current clinical and scientific knowledge.

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REGAINING NORMAL AND SYMMETRICAL KNEE CONTACT FORCES AFTER ANTERIOR CRUCIATE LIGAMENT INJURY AND RECONSTRUCTION

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Purpose: To investigate longitudinal changes in knee contact forces after anterior cruciate ligament (ACL) reconstruction in order to better describe the time course of altered loading that may contribute to the development of osteoarthritis in these patients.

Methods: Six athletes (3 men, 3 women; age=33.6±10.4, BMI=25.6±2.0) with complete, unilateral ACL rupture were evaluated using motion analysis 6.3 (SD=4.9) weeks after injury (baseline) once initial impairments were resolved. Athletes underwent arthroscopic assisted ACL reconstruction an average of 13 (SD=8.4) weeks after injury and performed motion analysis 6, 12 and 24 months after ACL reconstruction. Motion analysis was used to obtain stance phase kinematics and kinetics at each testing session during natural cadence