Table 1
Angular laxity and stiffness in meniscectomized patients (n=75) and controls (n=38)

	Unadjusted mean ± SE		P-value	Adjusted mean± SE		P-value
	Patients	Controls		Patients	Controls	
Angular laxity, degrees						
Varus	-9.8 ± 0.4	-8.0 ± 0.4	0.003	-10.0 ± 0.3	-7.8 ± 0.4	0.000
Valgus	6.9 ± 0.2	6.1 ± 0.3	0.019	7.0 ± 0.2	5.8 ± 0.3	0.000
Total	16.8 ± 0.6	14.1 ± 0.6	0.004	17.0 ± 0.5	13.7 ± 0.7	0.000
Stiffness, Nm/°						
Varus*	1.41 ± 0.05	1.55 ± 0.07	0.074	1.39 ± 0.05	1.58 ± 0.07	0.011
Valgus*	1.88 ± 0.06	1.98 ± 0.10	0.406	1.84 ± 2.05	2.05 ± 0.08	0.056
Midrange*	1.76 ± 0.07	2.21 ± 0.10	0.000	1.74 ± 0.06	2.26 ± 0.09	0.000

*These data were log-transformed for statistical analysis.
Adjusted model include age, sex, height and body mass as covariates.

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EFFECT OF A SIX-WEEK COMBINED HIP AND KNEE NEUROMUSCULAR EXERCISE PROGRAMME ON JOINT LOADING AND MUSCLE CO-CONTRACTION IN INDIVIDUALS WITH MEDIAL KNEE OSTEOARTHRITIS

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Purpose: Medial knee osteoarthritis (OA) is a mechanical condition affected by the amount of load on the knee joint. This load is determined by the magnitude of the external knee adduction moment (EKAM). Moreover, increased muscle co-contraction of the agonist and antagonist muscles around the knee joint have been reported to increase with knee OA with the possibility of a further increase in the loading at the joint. Exercises are a common treatment which have been shown to decrease pain, improves muscle strength and function. However, there is a paucity of literature on the effect of exercise regimens on both EKAM and muscle co-contraction and whether exercises increase or decrease loading on the joint. Previous studies strengthening either the quadriceps or hip adductors have found no significant change in EKAM which may be due to the type of exercises, the muscles exercises or method of progression. Therefore, the purpose of this study was to investigate the effectiveness of a neuromuscular training exercise programme of the hip and knee muscles on EKAM and the co-contraction of antagonist muscles in knee OA.
Methods: This study was a pilot pre-post design study comparing the effects of a six-week exercise programme. A convenience sample of 19 participants were recruited from the waiting lists at a local Hospital. 3-dimensional kinematic (Qualisys OQUS, Gothenburg, Sweden) and kinetic (AMTI, USA) analysis were collected whilst walking. Surface electromyography (EMG) data were collected using a Noraxon Telemyo system (Noraxon, USA) and average normalised activation was recorded with electrodes placed on vastus lateralis (VL), vastus medialis (VM), biceps femoris (BF), and semitendonosis (ST) muscles on the affected side. Using the Biodex system 3 isokinetic dynamometer (Biodex Medical Systems, Shirley, N.Y., USA), the average peak torque of the knee flexors and extensors were assessed concentrically at 60°/s and isometrically at 45°, whereas the hip abductors were assessed isometrically at 0°. Clinically, the pain subscale of the Knee injury and Osteoarthritis Outcome Score (KOOS) questionnaire. The participants were assessed at baseline and after the six-week exercise programme and patient's attendance to the treatment sessions was recorded. Paired t-tests were used to determine the effects of the exercise programme on all outcome measures before and after the pilot exercise programme.
Results: Fourteen participants (twelve women and two men, mean age 61.79±10.42 years) completed the exercise programme with good attendance rates (mean 5.36 (SD 0.84) sessions). The EKAM did not change significantly throughout the stance phase on the affected side though pain and muscle strength significantly improved ($p<0.05$). The mean difference (standard deviation) and p-values of EKAM during gait are as follows: in early-stance -0.01 (0.08), p= 0.57, in mid-stance -0.01 (0.05), p=0.70, and in late-stance -0.02 (0.06), p=0.21. Only muscle co-contraction between vastus-lateralis and biceps-femoris of the affected side significantly decreased in early and mid-stance (26.68 (34.84), p=0.01 and 12.68 (21.07), 0.04, respectively).
Conclusions: The current pilot exercise programme was developed in an attempt to decrease the load on the knee joint. However, it can be seen from this preliminary data that EKAM did not increase or decrease significantly but muscle co-contraction on the lateral side of the knee joint decreased which may have reduced total loading on the joint. The reduced co-contraction may be one way in which pain was decreased in this exercise programme along with the increased muscle strength. This should be confirmed in a larger and longer RCT, as if the EKAM can be maintained with an exercise programme with increased adherence, rate of progression could be delayed.

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INTERACTIONS OF JOINT KINEMATICS AND PHARMACOLOGIC TREATMENT FOR KNEE OSTEOARTHRITIS PAIN

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Purpose: To determine if symptomatic treatment of knee osteoarthritis is associated with changes in the primary and secondary motions of the knee during walking. While changes in knee joint loads have been associated with pain intervention, there is a paucity of information relating kinematic changes to pain modifications. Yet kinematic changes have been implicated in the pathway to knee OA. Specifically, it has been suggested changes in the secondary movements of the knee including anterior-posterior (AP) translation and internal-external (IE) rotation can contribute to cartilage changes. Therefore the following hypothesis was tested: Primary (flexion) and secondary movements (AP and IE) of the knee are significantly different for the two active drug (Oxycodone and Celecoxib) treatments compared to a double blind placebo treatment phase.
Methods: A single-blind washout, double blind treatment, double dummy cross-over pilot study using placebo, Oxycodone HCL and Celecoxib was used to test the hypothesis. Subjects were randomized to one of six active treatment sequences. Subjects (n=6) who met study eligibility requirements and completed the informed consent process underwent an initial physician, clinical lab, and radiographic screening. Eligible subjects had been taking a non-steroidal anti-inflammatory 15 of the 30 days prior to enrollment for index knee pain, OA of grade 2 or 3 as defined by the Kellgren and Lawrence grading system of the medial tibiofemoral joint and met the American College of Rheumatology clinical classification criteria. Subjects were tested in the gait laboratory at the beginning of each arm of the cross-over study design. Walking kinematics were collected using the Point Cluster technique marker-set at self-selected normal pace. External inter-segmental forces and moments were calculated for the lower limb with inverse dynamics. Repeated measures ANOVA were used to test for differences in the hip and knee flexion, adduction, internal external (IE) rotation and the knee anterior-posterior (AP) translation motions between the three active treatment phases. Simple linear regressions tested for association between changes in kinematics and kinetics.
Results: Significant differences between Placebo and Celecoxib arms were found for the mean IE knee rotation angle (Figure 1) while changes in flexion and AP translation did not reach significance. In a post-hoc analysis the change in knee IE rotation was correlated with the change

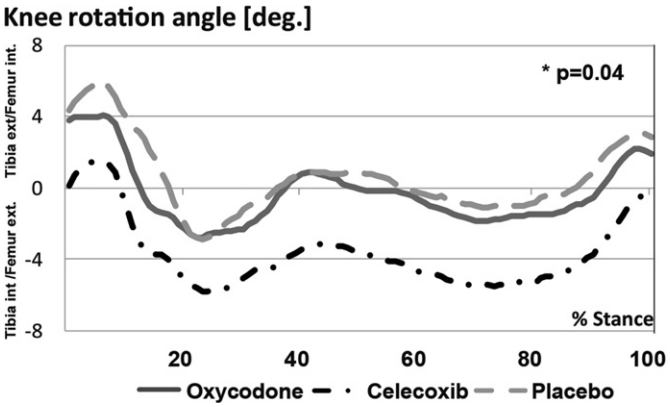

Figure 1. There is a shift in the mean stance phase knee rotation angle for the anti-inflammatory (Celecoxib) relative to the placebo and analgesic (Oxycodone) arms.

in IE rotation (r2=0.33) and total reaction moments (r2=0.66). There were no differences in walking speed or step-length for any treatment.
Conclusion: The shift towards greater tibia internal rotation and the association with external joint moments suggests that with treatment of Celecoxib there may be a lessening of bracing or co-contraction around the joint that results from pain and inflammation. A rotational shift in joint kinematics has previously been linked with patterns of cartilage thinning. The different kinematic response between the two treatment arms suggest potential differences in the impact of these drugs on ambulation and may have implications for different rates of disease progression that require further study.

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PRE-OPERATIVE SELF-EFFICACY AND PAIN CATASTROPHIZING ARE ASSOCIATED WITH KNEE BIOMECHANICS DURING GAIT POST-MENISCECTOMY

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Purpose: Meniscectomy is a risk factor for developing knee osteoarthritis (OA) and potentially leads to altered gait. Altered gait (e.g. reduced knee angle excursion and knee extensor moment and lower peak vertical ground reaction force) can change articular cartilage loading and contribute to the onset of OA. A variety of impairments could lead to altered gait, including abnormal psychosocial factors. Few studies have investigated the effect of psychosocial factors on gait, particularly in people with meniscectomy. From a clinical perspective, such research could help identify rehabilitation targets for the recovery of normal gait to possibly minimize the risk of knee OA. Therefore, the purpose of this study was to 1) examine gait biomechanics after meniscectomy, and 2) determine if pre-operative psychosocial factors are associated with post-meniscectomy knee biomechanics during gait.
Methods: Fifteen subjects with traumatic meniscal tear and meniscectomy were recruited (14 males; mean age: 20.1 ±2.9yrs; 10 lateral/5 medial meniscectomy). Questionnaires for psychosocial constructs were administered pre-operatively and included pain catastrophizing [Pain Catastrophizing Scale, PCS; range=0-52 points], fear of movement/re-injury [Tampa Scale for Kinesiophobia, TSK-11; range=11-44 points], and self-efficacy for knee activity [Knee Activity Self-Efficacy Scale, KASES; range=0-100 points]. Higher scores indicate higher levels of the given construct. Gait analysis was conducted after rehabilitation was complete (mean = 7.5 weeks post-operative). Retro-reflective markers were placed prior to five walking trials at a self-selected speed. Marker position was recorded with a motion capture system (Motion Analysis Corp), and ground reaction forces were recorded with two force platforms (Advanced Mechanical Technology Inc). Sagittal plane knee angle excursion, knee extensor moment and peak vertical ground reaction force (PVGRF) were analyzed bilaterally during weight acceptance. Gait biomechanical variables were compared between sides with paired t-tests. Pearson's Product Moment correlation determined the association between pre-operative questionnaire scores and post-operative gait biomechanical variables on the surgical side.
Results: Compared to the non-surgical side, the surgical side showed reduced sagittal plane knee angle excursion and knee extensor moment during weight acceptance (p=.001 and p=.002, respectively, Table). PVGRF was not significantly different between sides (p=.54, Table). Pre-operative KASES scores were positively associated with post-operative sagittal plane knee angle excursion on the surgical side (r=.689, p=.004). Pre-operative PCS scores were negatively associated with post-operative knee extensor moment on the surgical side (r=-.501, p=.057).
Conclusions: Sagittal plane knee excursion and knee extensor moment were reduced on the surgical side during gait post-meniscectomy. Higher self-efficacy for knee activity and lower pain catastrophizing pre-operatively were associated with better knee biomechanics during gait post-operatively. The findings indicate that even after rehabilitation, altered gait was present in subjects with meniscectomy. Self-efficacy for knee activity and pain catastrophizing should be addressed in rehabilitation to optimize gait recovery.

Gait biomechanical variables and questionnaire scores

Variable	Surgical side	Non-surgical side	Points
Knee angle excursion (°)	13.05 (4.51)	16.48(4.37)	
Knee extensor moment (N-m/kg)	0.07(0.17)	0.18(0.18)	
Peak vertical ground reaction force (N)	996.51(316.28)	1005.53(283.43)	
Pain Catastrophizing Scale (PCS)			10.93(8.32)
Tampa Scale of Kinesiophobia (TSK-11)			23.13(5.48)
Knee Activity Self-Efficacy Scale (KASES)			49.20(23.34)

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RELATION BETWEEN QUADRICEPS STRENGTH AND PHYSICAL ACTIVITY IN PEOPLE WITH KNEE OSTEOARTHRITIS

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Purpose: Physical inactivity is common in patients with knee osteoarthritis (KOA) and has been linked to serious comorbidities such as cardiovascular disease, obesity and diabetes. It is important to develop cost-effective strategies to increase physical activity (PA) in patients with KOA to improve overall health and decrease the economic burden that this patient population places on the healthcare system. Improving lower extremity strength may be important for increasing PA, yet the relation between strength and physical activity in patients with KOA is not well understood. The purpose of this study was to examine the correlation between strength and self-reported PA in KOA patients. Additionally, we sought to determine if there were differences in strength between our less active patients (low PA) and our more active patients (high PA), and if correlations between strength and PA with KOA.
Methods: Thirty-six patients (15 males, 21 females; age =59.9±11.6yrs; height = 171.2±9.2cm; mass = 84.3±18.9kg; body mass index (BMI)= 28.9±6.9;,Godin Leisure-Time questionnaire =32.5±25.01) with radiographically diagnosed tibiofemoral KOA participated. Maximal isometric knee extensor strength was assessed via a Biodex System II dynamometer with the knee in 90° of flexion. Knee extension torque values were normalized to body mass (NmŸkg-1). PA was evaluated using the Godin Leisure-Time questionnaire. A Godin-Leisure time score of 32.5, which was the mean score in our dataset, was used to divide low PA and high PA subgroups. Pearson Product Moment and Spearman rank correlations were used to analyze relations between normally and non-normally distributed variables, respectively. Independent t-tests were used to determine if differences in quadriceps strength existed between groups. An alpha level of 0.05 was used for all analyses.
Results: Quadriceps strength demonstrated a significant, positive correlation with PA (r=0 .44, r2=0.18, P=0.01) with all KOA patients included in the correlation analysis. PA was reported to be significantly lower in the low PA (15.61±10.68) group compared to the high PA group (56.27±19.20, P<.001). The high PA subgroup had greater quadriceps strength (n=15, 2.01±0 .84) compared to the low PA subgroup (n=21, 1.5±0.59, P=0.04). Quadriceps strength significantly correlated with PA in the high PA subgroup (ρ=0.53, P=0.04), but not in the low PA subgroup (ρ=-0.21, P=0.35).
Conclusion: Higher levels of PA modestly correlate with higher quadriceps strength in our entire KOA sample. Quadriceps strength predicted 18 % of the variance in PA. The relation between higher strength and increased PA is stronger in the high PA subgroup compared to the entire sample. Conversely, quadriceps strength does not significantly correlate with PA in the low PA subgroup. Additionally, the high PA subgroup demonstrated greater quadriceps strength compared to the subgroup of patients who reported less PA. These data may indicate the importance of lower extremity muscle function for maintaining PA, and may suggest that higher PA may maintain strength in patients with KOA. Further research should evaluate the effectiveness of a comprehensive rehabilitation strategy that develops lower extremity strength and increases PA for the purpose of improving overall health and decreasing the risk of inactivity related comorbidity in patients with KOA.