

and matrix-degrading enzymes in articular cartilage are significantly higher in Nfat1-deficient mice than WT mice.

**Conclusions:** Nfat1 deficiency promotes the initiation and progression of PTOA. The results from Nfat1<sup>+/-</sup> mice are particularly important as they reflect the effect of Nfat1 “gene dosage” on PTOA. This will direct us to explore if decreased NFAT1 expression in joint tissues is a risk factor for development of OA in humans.

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### LOWER HOP SCORES RELATED TO GAIT ASYMMETRIES AFTER ACL INJURY: IDENTIFYING ASSOCIATIONS RELATED TO THE DEVELOPMENT OF EARLY ONSET KNEE OA

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**Purpose:** The majority of young, active individuals with anterior cruciate ligament (ACL) injuries develop knee osteoarthritis (OA) within 10–15 years of injury. Joint biomechanics have been linked to the development of OA after ACL injury. Patients who develop knee OA within 5 years of ACL reconstruction (ACLR) demonstrate a relative joint unloading pattern early after injury and surgery. Lower single-legged hop scores early after injury are also associated with later radiographic signs of OA. Subtle changes in joint biomechanics related to the development of posttraumatic OA can be difficult to identify in a clinical setting. Therefore, the purpose of this study is to determine whether single-legged hop scores are related to underlying alterations in knee joint biomechanics early after ACL injury and reconstruction.

**Methods:** Athletes with acute, unilateral ACL injuries participating in cutting and pivoting sports prior to injury were included. Exclusion criteria were a repairable meniscus, full-thickness articular cartilage lesion >1 cm<sup>2</sup>, or symptomatic grade III injury to other knee ligaments. Testing was completed prior to ACLR after effusion, range of motion, pain, and obvious gait impairments were resolved (baseline) and 6 months after ACLR. Testing consisted of a single-legged single hop for distance (involved/uninvolved × 100%) and gait analysis with surface electromyography (EMG) during self-selected walking speed. Kinetic variables of interest included external peak knee flexion moment (PFKM) and peak knee adduction moment (PKAM) with loading differences between limbs calculated (involved-uninvolved).

A patient-specific EMG-driven Hill-type musculoskeletal model was used to estimate joint contact forces during walking. The variable of interest was peak medial compartment contact force (MCpk) during stance phase with loading differences again calculated.

Pearson correlations were used to evaluate the relationship of biomechanical variables with single hop scores. A prior significance level was set at  $p \leq 0.05$ .

**Results:** Twenty-two patients were available for analysis prior to ACLR (16 M, 6 F, age 31.6±10.6 years, BMI 26.9±3.5, time from injury to testing 8.5±8.2 weeks) and 31 patients at 6 months (19 M, 12 F, mean age 31.4±10.9, BMI 27.4±4.3, time from injury to ACLR 16.5±11.2 weeks). Prior to ACLR single hop scores (mean 79.5±14.9%) were significantly correlated to involved PKFM ( $p=0.026$ ,  $r=0.474$ , mean 0.33±0.17 Nm/kgm), involved PKAM ( $p=0.045$ ,  $r=0.431$ , mean 0.26±0.09 Nm/kgm), involved MCpk ( $p=0.031$ ,  $r=0.460$ , mean 2.55±0.51 BW), PKFM loading difference ( $p=0.035$ ,  $r=0.451$ , mean -0.14±0.18 Nm/kgm), MCpk loading difference ( $p=0.002$ ,  $r=0.629$ , mean -0.36±0.88 BW) and trending toward significance for PKAM loading difference (0.054,  $r=0.417$ , mean 0.00±0.13 Nm/kgm). Six months after ACLR single hop scores (mean 93.3±9.7%) were significantly correlated to involved PKFM ( $p=0.013$ ,  $r=0.440$ , mean 0.39±0.14 Nm/kgm), PKAM loading difference ( $p=0.006$ ,  $r=0.485$ , mean -0.01±0.07 Nm/kgm), and MCpk loading difference ( $p=0.002$ ,  $r=0.534$ , mean -0.11±0.58 BW) but not involved PKAM ( $p=0.391$ ,  $r=-0.160$ , mean 0.27±0.09 Nm/kgm), involved MCpk ( $p=0.268$ ,  $r=0.205$ , mean 2.75±0.64 BW) or PKFM loading difference ( $p=0.056$ ,  $r=0.346$ , mean -0.08±0.12 Nm/kgm). Hop scores were not correlated to any biomechanical measures on the uninvolved limb except MCpk prior to ACLR ( $p=0.026$ ,  $r=-0.473$ , mean 2.90±0.67 BW) and after ACLR ( $p<0.001$ ,  $r=0.598$ , mean 2.86±0.65 BW) and PKAM after ACLR ( $p=0.035$ ,  $r=-0.380$ , mean 0.28±0.10 Nm/kgm).

**Conclusions:** Single hop for distance scores were consistently correlated with knee moments and joint contact forces prior to ACLR. Lower hop scores are related to lower involved limb biomechanical measures and greater asymmetry between limbs. These relationships continued six months after ACLR despite a mean hop score greater than 93%. Lower hop scores may be representative of the joint unloading patterns previously

linked to the early development of OA after ACL injury. Hop tests provide a simple clinical measure which may help identify patients at greatest risk of joint degeneration. Further work is required to determine cut-off hop scores which represent clinically meaningful biomechanical asymmetries.

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### OCCUPATIONAL RISK FACTORS FOR HIP OSTEOARTHRITIS ARE ASSOCIATED WITH EARLY HIP STRUCTURAL ABNORMALITIES – A 3.0T MRI STUDY OF COMMUNITY-BASED ADULTS

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**Purpose:** Occupational exposure to heavy lifting and stair climbing are associated with radiographic hip osteoarthritis (OA). This study examined whether these activities are associated with early structural hip joint changes in a community-based population.

**Methods:** 198 community-based people with no history of hip disease, including OA, had 3.0T-MRI to assess hip cartilage volume, defects and bone marrow lesions (BMLs). Recall of occupational exposure to heavy lifting and stair climbing aged 18 to 30 years and in the previous 10 years were collected. A persistence score was defined as exposure at neither time point (0), at one time point (1) or at both time points (2).

**Results:** Exposure to heavy lifting when aged 18 to 30 years was associated with BMLs of the central superolateral femoroacetabular region (OR 3.8, 95% CI 1.5 – 9.2,  $p < 0.01$ ), with persistence score associated with cartilage defects in the central superolateral region of the femoral head (OR 1.6, 95% CI 1.0 – 2.5,  $p = 0.04$ ). Exposure to stair climbing aged 18 to 30 years and persistence score were associated with an increased risk of cartilage defects in the central superolateral femoral head and BMLs in the central superolateral and posterior femoroacetabular regions (OR range 2.1 to 3.2, all  $p \leq 0.03$ ).

**Conclusions:** Occupational exposure to heavy lifting and stair climbing are associated with hip structural abnormalities. If confirmed by longitudinal data, such associations may explain how occupational activities affect the hip joint and may identify new targets for the prevention of hip OA.

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### FACTORS RELATED TO QUALITY OF LIFE IN PEOPLE WITH KNEE PAIN, STIFFNESS OR ACTIVITY LIMITATIONS 5 TO 20 YEARS FOLLOWING ANTERIOR CRUCIATE LIGAMENT RECONSTRUCTION

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**Purpose:** Anterior cruciate ligament reconstruction (ACLR) can result in the early onset of osteoarthritis (OA), which may restrict activity participation and impair an individual's quality of life (QOL). However, longer-term QOL outcomes have not been examined in people with persistent knee symptoms consistent with early onset OA following ACLR. The aims of this study were to (i) describe QOL, anxiety, depression and sport-related impairments in people with knee symptoms 5–20 years following ACLR; and (ii) explore relationships between QOL, participant characteristics, psychosocial and sport-related factors.

**Methods:** We conducted a cross-sectional analysis of individuals with knee pain, stiffness or limitations in function following ACLR. Participants were recruited from orthopaedic surgeons and community advertisements. All patients aged 18–55 years who had undergone ACLR 5–20 years ago were invited to participate in the study. Modified Knee Injury and Osteoarthritis Outcome Score (KOOS) cut-off criteria were used to identify symptomatic individuals. Individuals with significant comorbidities or not fluent in English were excluded. Participants completed questionnaires including the KOOS QOL subscale (KOOS-QOL), ACL-QOL, Assessment of QOL 8D Utility Instrument (AQoL-8D), Hospital Anxiety and Depression Scale (HADS), participant characteristics and sport-related information. The KOOS and ACL-QOL scores range from 0 (worst) to 100 (best), and AQoL-8D utility values range from 0.00 (death) to 1.00 (full health). Pearson's correlation coefficients ( $r$ ) or Spearman's correlation coefficients ( $\rho$ ) (for categorical or ordinal data) were used to explore relationships between variables.

**Results:** A total of 162 participants aged 38±9 years (mean±SD) completed the questionnaires at an average 9±4 years following ACLR, 56% were overweight or obese, and 46% were women. Mean KOOS-QOL