

Title: FACTORS ASSOCIATED WITH RADIOGRAPHIC OSTEOARTHRITIS IN PEOPLE WITH KNEE PAIN, SYMPTOMS OR FUNCTIONAL LIMITATIONS AFTER ANTERIOR CRUCIATE LIGAMENT RECONSTRUCTION

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Purpose

The high rates of early-onset knee osteoarthritis (OA) after anterior cruciate ligament reconstruction (ACLR) are alarming considering the young, active population in which ACLR is most prevalent. The relevance and impact of the presence or absence of radiographic OA in people with knee pain, symptoms or functional limitations after ACLR is poorly understood. The purpose of this study was to compare (i) participant characteristics; (ii) QOL and psychological factors, and (iii) physical and activity-related factors, in ACL-reconstructed individuals with knee difficulties with or without radiographic tibiofemoral and/or patellofemoral OA.

Methods

Knee radiographs were obtained from 81 individuals recruited from a larger cross-sectional study of 162 people with knee difficulties 5 to 20 years following ACLR. Knee difficulties were defined as reporting a less than optimal score for at least 50% of items in any two Knee Injury and Osteoarthritis Outcome Score (KOOS) subscales (pain, symptoms, ADL, sport/rec, QOL). Three radiograph views were requested: weight bearing postero-anterior (PA) erect in 15 degrees knee flexion, weight-bearing lateral in 30 degrees knee flexion, and non-weight bearing skyline in 45 degrees knee flexion. All radiographs were graded by an experienced radiologist using the Kellgren & Lawrence criteria and a score of \geq grade 2 for the tibiofemoral or patellofemoral joint was used to define the presence of radiographic OA. All exploratory factors (described in Figure 2) were selected based on literature review and clinical reasoning and were collected by questionnaire at a median 8

(IQR 7 to 12) years after ACLR. Direct acyclic graphs were used to minimise conditional associations and bias in multivariable analyses. Binary logistic regression was utilised to investigate the relationship between exploratory factors and the presence or absence of radiographic OA. Results are reported as odds ratios (ORs) and 95% confidence intervals (CIs), with adjustment for potential confounders (BMI, age, time since ACLR, additional knee surgery).

Results

Knee radiographs were undertaken at a median 9 (IQR 8 to 11) months after questionnaire completion. Of the 50 people (62%) with radiographic OA, 38% had OA in one compartment, 34% had OA in 2 compartments and 28% had radiographic OA in all 3 knee compartments (Figure 1). Participant characteristics and patient-reported outcomes for people with and without radiographic OA are described in Figure 2. A delay from injury to ACLR > 6 months was associated with a 6.9 times greater odds of having OA, compared to a delay of < 6 months (OR 6.9, 95% CI 1.5 to 18.8). Having at least one additional knee surgery since ACLR was associated with a 5.1 fold increased odds of having knee OA (OR 5.1, 95% CI 1.7 to 15.4). Reporting a contact mechanism of ACL injury reduced the odds of having OA by 29% compared to reporting a non-contact mechanism of injury (OR 0.29, 95% CI 0.1 to 0.9). A 1 point increase in ACL-QOL (better score on a 0-100 scale) corresponded to a 3% decrease in the odds of having OA (Figure 2B). Participants who reported a moderate to significant impact of their knee on their QOL had 8.9 times greater odds of having knee OA, compared to participants reporting no or slight impact on QOL (OR 8.9, 95% CI 2.3 to 35.1). Dissatisfaction with knee function was associated with 6.9 times greater odds of having OA, compared to satisfaction with knee function (OR 6.9, 95% CI 1.4 to 32.7). Wide CIs were observed for all analyses, likely related to the small sample size. Time since ACLR, sex, anxiety and depression, pain, symptoms, work limitations and return to sport status were not associated with the odds of having radiographic OA (Figure 2).

Conclusions

Five key factors were strongly related to increased odds of radiographic OA in individuals with knee difficulties at a median 8 years following ACLR. Reporting more knee-related QOL impairment or dissatisfaction with knee function was associated with increased odds of having radiographic OA. Receiving one or more additional knee surgeries since ACLR, reporting a non-contact mechanism of ACL injury and a delay longer than six months from injury to ACLR were associated with a heightened risk of radiographic OA. Considering pain and symptoms were not related to OA in this sample, there may be other factors contributing to dissatisfaction and impaired QOL in people with OA and knee difficulties after ACLR.

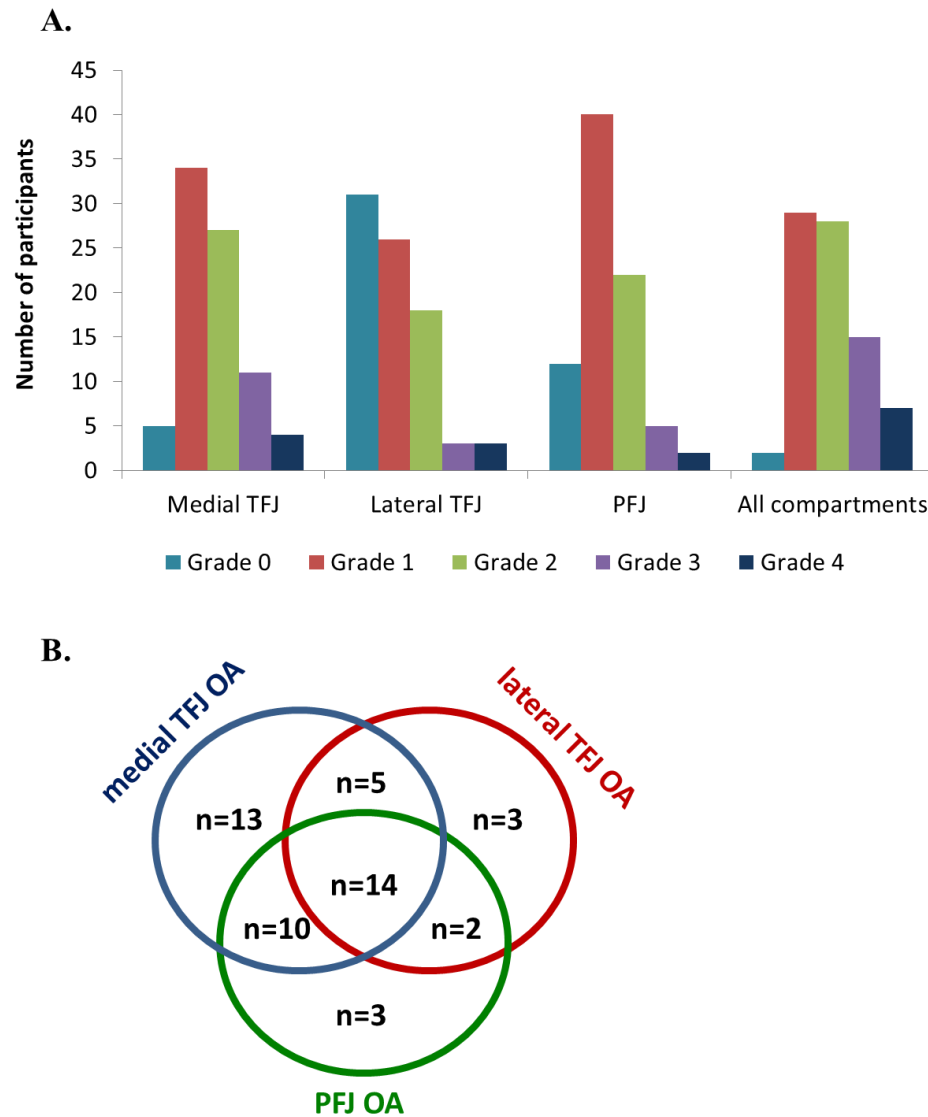


Figure 1. Knee osteoarthritis prevalence by severity and compartment

Figure 1A: n=81; Figure 1B: n=50; TFJ: tibiofemoral joint; PFJ: patellofemoral joint; All compartments: presents the highest grade of osteoarthritis from any compartment for each participant; Grade 0-4: Graded using the Kellgren and Lawrence score.

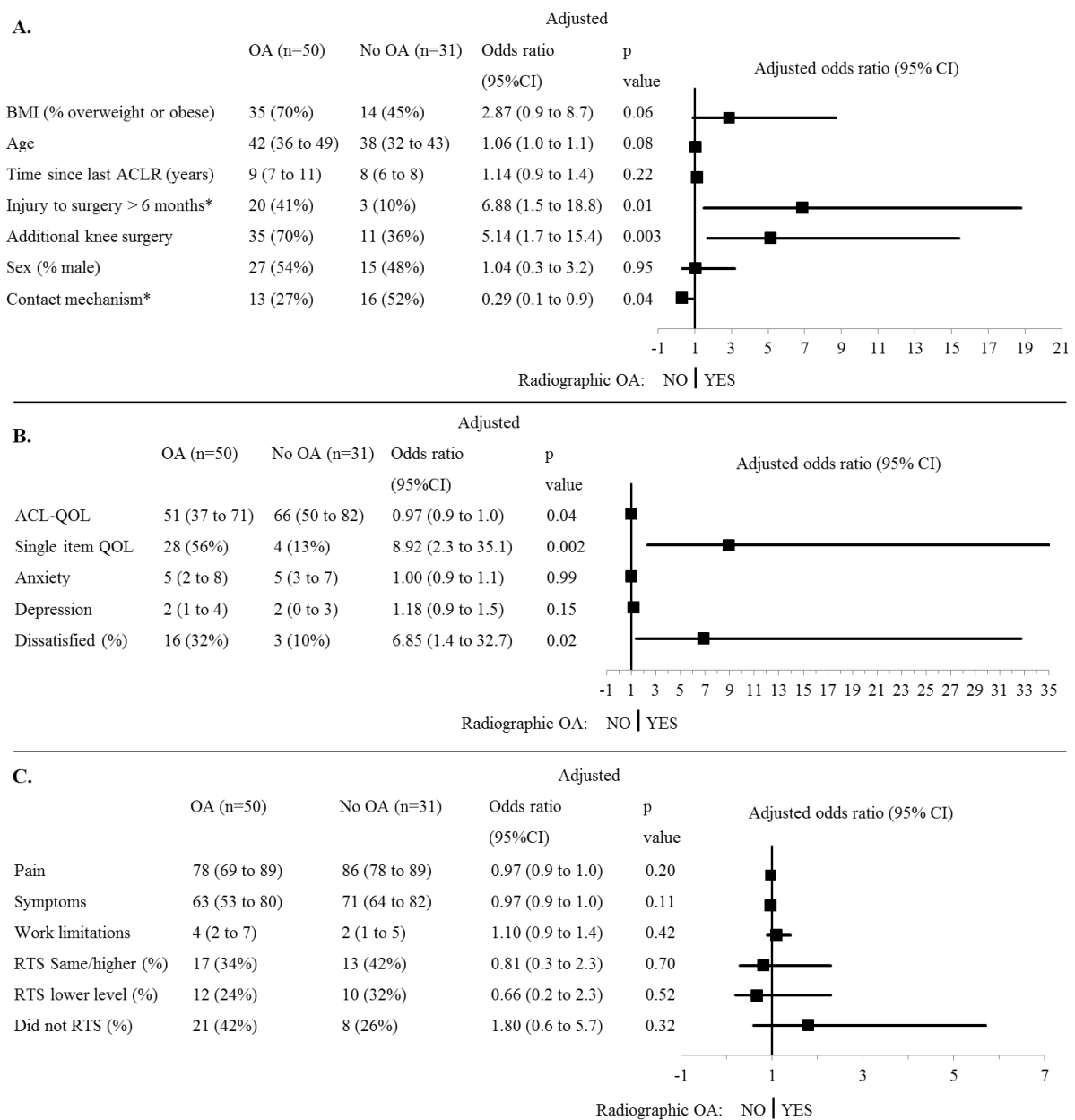


Figure 2. Participant characteristics (A), quality of life and psychological factors (B) and physical and activity-related factors (C) and comparisons between individuals with and without radiographic patellofemoral and/or tibiofemoral osteoarthritis

All values are reported as median (IQR) for continuous variables or frequency (percent) for binary data; Adjusted: Adjusted for age, BMI, time since ACLR surgery and additional knee surgery; BMI: number of participants with a BMI classified as overweight or obese (≥ 25.0 kg/m²) as opposed to

normal weight range (18.9–24.9 kg/m²); Injury to surgery: compared to <6 month delay; Additional knee surgery: any subsequent knee surgery to the ACL-reconstructed knee; Contact mechanism: compared to a non-contact mechanism of injury; Single-item QOL: number of participants reporting a moderate or significant impact of their knee on their quality of life (as opposed to no or slight impact); Anxiety and depression: measured with the Hospital Anxiety and Depression Scale (scored 0 best, 21 worst); ACL-QOL, pain (KOOS-pain), symptoms (KOOS-symptoms): scored 0 (worst) to 100 (best); Dissatisfied: % dissatisfied with current knee function (compared with % satisfied); Work limitations: assessed with the Workplace Activity Limitations Survey (scored 7 (best) to 28 (worst)); RTS: self-reported return to sport (RTS) at the same or higher level than before ACL injury ('RTS Same/higher'), at a lower level than before ACL injury ('RTS lower level') or non-return to competitive sport after ACLR ('Did not RTS'); * unsure responses were removed resulting in one missing response for 'injury to surgery' and two missing responses for 'contact mechanism'