

Fear as a Missing Link: The Relationship Between Knee Pain and Physical Activity in Athletes with Patellofemoral Pain

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INTRODUCTION: Patellofemoral pain, pain in/around the anterior knee intensified with activities that load the knee joint, is one of the most common causes of knee pain in the United States, affecting about one quarter of the population across the lifespan. When not treated effectively, PFP can lead to chronic pain, psychological distress, reduction or cessation of physical activity, and decreased overall health and quality of life. Up to 74% of individuals will reduce, alter, or stop their athletic activities due to the experience patellofemoral pain but the mechanisms of this process are not clear. The fear avoidance model proposes that pain can lead to injury-related fear (i.e., fear of pain, painful movement, and/or reinjury), causing avoidance behaviors such as a reduction in physical activity. Individuals with patellofemoral pain experience higher levels of injury-related fear than those without knee pain but it is not clear whether injury-related fear influences physical activity. Therefore, the purpose of this study was to test the relationships between anterior knee pain, injury-related fear, and physical activity in athletes with patellofemoral pain. We hypothesized that injury-related fear would be a statistically significant mediator of the relationship between knee pain and physical activity.

METHODS: Adults (≥ 18 years), including both males and females, who reported any type/level of sport participation and anterior knee pain during joint loading activities were included in the study. Eligible participants completed online questionnaires including a demographics survey, the Anterior Knee Pain Scale (AKPS) to measure knee pain (0 to 100 points), the Tampa Scale of Kinesiophobia-11 (TSK-11) to measure injury-related fear (11 to 44 points), and International Physical Activity Short Form (IPAQ-SF) to measure physical activity in metabolic equivalent minutes per week (MET minutes). Descriptive statistics were calculated for all demographic variables, patient reported outcome measure scores, and weekly MET minutes. A structural equation model was built to test the relationships between AKPS scores, TSK-11 scores, and weekly MET minutes. Bootstrapping was performed with 5,000 replications to obtain unstandardized coefficients (B), robust standard errors and confidence intervals (CIs). This study was deemed exempt from federal human subjects research regulations by the institutional review board (IRB#: 25-0409) and participants provided informed consent by completing the online surveys after a full review of study information.

RESULTS SECTION: 104 participants were included in the study (age: 32.8 ± 15.1 years, 64% female, 61% white). The average duration of anterior knee pain reported was 5.2 ± 6.7 years. Participants engaged in a variety of sporting activities with running being the most common (35/104, 36%) and an average of 1342 ± 988 MET minutes per week. Less knee pain/disability was significantly associated with lower-injury related fear (direct effect: $B = -0.2$, 95% CI: -0.3 to -0.1, $p < 0.01$) and higher injury-related fear was significantly associated with lower levels of self-reported weekly physical activity (direct effect: $B = -43.5$, 95% CI: -77.3 to -9.7, $p < 0.01$). Importantly, the indirect effect of knee pain on physical activity, acting through injury-related fear, was significant (indirect effect: $B = 8.2$, 95% CI: 1.0 to 15.5, $p = 0.03$), suggesting injury-related fear as a key mediator in this relationship. The direct relationship between knee pain and physical activity was also significant (direct effect: $B = -15.0$, 95% CI: -29.6 to -0.5, $p = 0.04$), suggesting a partial mediation model (i.e., injury-related fear explains some but not all the effect of knee pain on physical activity).

DISCUSSION: Injury-related fear partially explains how knee pain and disability may lead to reduced physical activity in people with patellofemoral pain. The findings of this study support the fear avoidance model which posits that injury-related fear contributes to avoidance and disuse, potentially leading to intensified and/or chronic pain and disability. Consistent with this model, a direct path between pain and physical activity independent of fear was identified, suggesting both psychological and physical factors influence activity engagement in this population.

SIGNIFICANCE/CLINICAL RELEVANCE: This study identified injury-related fear as a key psychological mediator linking knee function and pain to physical activity levels. These data justify targeted interventions addressing injury-related fear to enhance physical activity engagement in individuals with patellofemoral pain. Clinicians should consider 1) screening patients with patellofemoral pain for elevated levels of injury-related fear using measures like the TSK-11, and 2) implementing psychologically informed intervention strategies such as pain neuroscience education, mindfulness, or graded activity to address maladaptive fear and avoidance behaviors.