

Title: Investigating Kinesiophobia Levels After Primary and Secondary ACL Reconstruction

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Abstract

Study Design: Secondary analysis using paired t-tests

Background: Kinesiophobia levels after secondary ACL reconstruction (ACLR) is unknown. Differences, if any, that exist in kinesiophobia levels between primary and secondary ACLR are also unknown.

Objective: To compare differences in kinesiophobia 4 to 8 months after an individual's primary versus secondary ACLR

Methods: This is a secondary analysis of the Lower Extremity Assessment Protocol (LEAP). Participants that were included in the present study included: 1) history of primary and secondary ACLR, 2) between the ages of 14 to 35, 3) no concomitant surgical procedures at the time of primary or secondary ACL reconstruction that significantly changed rehab protocol (e.g. meniscal repair), and 4) activity level reported as greater than or equal to 5 on the Tegner Activity Scale. Demographic and participant characteristics were collected as well as Tampa Scale of Kinesiophobia-17 (TSK-17) scores and KOOS subscore scores. We collected all these characteristics for both the primary and secondary ACLR. A paired t-test was used for analysis for the KOOS subscale scores and TSK-17 scores.

Results: Seventeen participants met inclusion criteria for the present study. Participants were on average about 18 years of age after primary ACLR and on average 19 years of age after secondary ACLR. The average score for TSK-17 for primary and secondary ACLR is 32.7 and 33.1, respectively. The TSK-17 scores, however, were not significantly different ($p=0.77$). There were no significant differences between the primary and secondary ACLR for any of the KOOS subscale scores.

Conclusion: There were no significant differences in kinesiophobia levels in individuals after their primary and secondary ACLR. Although non-significant, kinesiophobia levels still exist in both primary and secondary ACLR and are not at the floor of the instrument. Intentional and direct intervention to reduce kinesiophobia in individuals after ACLR may be important to decrease risk of reinjury, increase return to sport rates, and improve physical activity participation.

Introduction

Anterior cruciate ligament (ACL) rupture is a common orthopedic injury with an annual incidence of 68.8 per 100,000 people.¹ There has been a significant increase in the rate of ACL reconstruction (ACLR) over the past 20 years, often with the emphasis on undergoing the surgical procedure to achieve previous level of activity and return to sport.¹ There are common short and long-term consequences to this injury. One-third of athletes fail to return to their prior level of sport after ACLR.^{2,3} For those who return to sport, 30% sustain a secondary ACL injury to either the ipsilateral or contralateral knee.⁴ Also, people who undergo ACLR spend less time engaging in moderate-vigorous physical activity and have lower daily step count compared to their healthy, age-matched peers.^{5,6} This is especially concerning since the lack of regular physical activity can lead to a myriad of chronic diseases. Interestingly, psychological factors have been associated with each of these clinical outcomes.⁷⁻¹⁰ Therefore, a holistic approach to ACL rehabilitation that incorporates a biopsychosocial model inclusive of physical, cognitive, and psychological impairments is needed to optimize rehabilitation and keep athletes healthy in both the short and long term.

Recent literature suggests that psychological readiness, in addition to physical readiness, may be a critical factor in the decision to return to sport after ACLR.¹¹ For example, Nwachukwu et al.⁷ identified that lower psychological readiness delayed time to return to sport and lower return to sport rates. Additionally, Baez et al.⁸ identified that psychological outcomes, rather than functional outcomes, were associated with return to sport and physical activity engagement in individuals after ACLR. Individuals with high levels of self-reported fear of movement and reinjury are 4 times more likely to report lower levels of physical activity compared to individuals with lower self-reported fear.⁹ In combination, these studies suggest that psychological readiness may help explain the failure to return to sport and decreased physical activity participation even after successful rehabilitation in individuals after ACLR.

One aspect of psychological readiness that is frequently examined after ACLR is kinesiophobia.

Kinesiophobia is defined as “excessive, irrational and debilitating fear to carry out physical movement, due to a feeling of vulnerability to a painful injury or reinjury.”¹² Kinesiophobia is the most common reason for reduction in sports participation with 82% of participants returning to some kind of athletic activity, 63% returning to their preinjury level and only 44% returning to competitive sports with kinesiophobia being the main reason cited not to return.¹⁰ High levels of kinesiophobia are associated with greater levels of pain intensity and disability,¹² stiffened movement patterns, and decreased loading of the ACLR limb, all of which can increase risk of reinjury.^{13,14} Additionally, individuals who went on to suffer an ipsilateral secondary ACL injury had greater kinesiophobia at the time of return to sport than those who did not suffer a secondary ACL injury.⁹ While these results are extremely concerning, these relationships have been primarily observed in patients after their primary ACLR¹⁵ and have not been explored in patients with their secondary ACL injury.

Outcomes in individuals post-primary ACLR may look different than outcomes post-secondary ACLR, whether that is a revision or contralateral tear. Athletes after revision ACLR exhibit lower levels of activity and worse knee function compared to athletes after primary ACLR.¹⁶⁻¹⁸ Unfortunately, we do not know if these differences exist for kinesiophobia in individuals after secondary ACLR. Failure to identify these differences may result in failure to provide additional interventions needed for this population. There is a clear clinical need to enhance outcomes not only in individuals with primary ACLR, but also in individuals with secondary ACLR to facilitate successful return to sport and desired physical activity. Therefore, the purpose of this study is to compare differences in kinesiophobia 4 to 8 months after an individual’s primary versus secondary ACLR. This time range was selected because this is a typical time of transition in rehabilitation to potentially fear-evoking strength, agility, and return to sport activities.¹⁹

Methods

Study Design

We performed a secondary analysis using data from the Lower Extremity Assessment Protocol (LEAP) study. The LEAP study is an ongoing, prospective study that aims to include 5,000 participants to assess lower extremity strength, fatigue, postural control, and functional movement patterns in patients after knee injury. The study was approved by the Institutional Review Board at the University of Virginia and all informed consent (>18 years) or informed assent with parental permission (< 18 years) was obtained before enrollment. For the present study, we are performing a secondary data analysis looking at kinesiophobia via the Tampa Scale of Kinesiophobia-17 between the 4- and 8-month time point of the LEAP protocol. If participants had multiple visits between the 4-to-8-month timeframe, the visit with the most similar time since surgery for both surgeries was chosen.

Participants

Participants included in this secondary analysis were individuals with a history of both primary ACLR and secondary ACLR. Primary ACLR was defined as a reconstruction after a first-time ACL tear. A secondary ACLR was defined as reconstruction after either a contralateral ACL tear or ipsilateral graft rupture of the reconstructed limb. Primary ACLR status was initially self-reported and verified through chart review. Secondary ACLR status was also obtained via self-report and if the participant could not be contacted, verification via chart review was performed. The inclusion criteria for the secondary analysis patients with primary and secondary ACLR included: 1) between the ages of 14 to 35, 2) no concomitant surgical procedures at the time of primary or secondary ACL reconstruction that significantly changed rehab protocol (e.g. meniscal repair), and 3) activity level reported as greater than or equal to 5 on the Tegner Activity Scale.

Outcomes

Demographics

We collected demographics and participant characteristics, including, age, sex, height, weight, time since surgery, Tegner Activity scale before surgery, and self-reported knee function via all the Knee Injury and Osteoarthritis Outcome (KOOS) subscales. The KOOS is a knee specific, self-report outcome measure that is used to assess a patients' opinion about their knee and its function. This is a measure that has been validated in the ACLR population.²⁰ We collected this measure for self-reported knee function during this timeframe during the primary and secondary ACLR. The Tegner Activity Scale is used to measure level of activity. We collected all these characteristics for the individual's primary and secondary ACLR.

Tampa Scale of Kinesiophobia-17

Kinesiophobia was assessed with the Tampa Scale of Kinesiophobia-17 (TSK-17). Scores range from 17 to 68 points with scores higher than 37 indicating high levels of kinesiophobia.²¹ This cutoff point was established in chronic low back pain patients.²¹ The minimal clinically importance difference is 4 points in the chronic low back pain population.²² The TSK-17 has good internal consistency, test-retest reliability, and responsiveness.²² There is a lack of information on the TSK-17's psychometric properties in the ACLR population, however.

Statistical Analysis

Statistical analyses were conducted using Statistical Analysis Software (SAS 9.4). Descriptive statistics were calculated for demographic variables and TSK-17 levels. A paired t-test was used for data analysis for the KOOS subscale scores and Tampa Scale of Kinesiophobia scores. The alpha level was set a priori to 0.05.

Results

Seventeen participants met inclusion criteria for the present study. Demographics are presented in Table 1. There were no significant differences in any of the variables analyzed in this study. Participants were on average about 18 years of age after primary ACLR and on average 19 years of age after secondary ACLR. There were no significant differences in the TSK-17 scores between primary and secondary ACLR ($p = 0.77$). Patients reported similar KOOS subscales of ADL ($p=0.61$), Pain ($p=0.71$), and Symptoms ($p=0.90$) in both the primary and secondary ACLR. There were no significant differences between the primary and secondary ACLR for any of the KOOS subscale scores. Scores for all the self-reported outcome measures for primary and secondary ACLR are presented in Table 2.

Discussion

To our knowledge, this study is the first to compare kinesiophobia levels within the same individuals after both primary and secondary ACLR. Kinesiophobia levels were not different after primary vs secondary ACLR, which did not support our hypothesis of a significant increase in kinesiophobia after a secondary ACLR. Kinesiophobia scores were similar between both post-operative reconstructions. There were no significant changes in mean scores in any of the KOOS subscale scores between primary and secondary ACLR.

Kinesiophobia in individuals after primary ACLR has been studied extensively. High levels of kinesiophobia within the ACLR population is associated with higher levels of pain,¹² stiffened movement patterns,¹³ and decreased loading of reconstructed limb,¹⁴ all of which can increase risk for secondary ACL injury. Currently, there is a limited understanding of kinesiophobia levels in individuals after secondary ACLR. There is limited adjacent secondary ACLR research that found worse self-reported knee function and activity after revision ACLR compared to primary ACLR.¹⁶⁻¹⁸ Based on the results of the current study, kinesiophobia may be similar in 4 to 8 month time point after primary and secondary ACLR. Participants reported an average score of 32.7 out of 68 on the TSK-17 after primary ACLR. The

results of this study show that these participants were not scoring at the floor of the instrument and although this is not considered to be a clinically significant score for kinesiophobia based on a cut-off score of 37²¹, it still demonstrates that fear does exist in both primary and secondary ACLR and must be directly addressed in order to be reduced.

Bullock et al¹⁵ recently published a systematic review to investigate kinesiophobia and other forms of psychological readiness after ACLR. They found that kinesiophobia improved from before ACLR to 3-6 months after. Interestingly, scores after 6 months were stable with no increase or decrease. This reinforces the notion that fear does not resolve, or decrease, as time goes on in the rehabilitation process. Instead, however, this further highlights that fear must be intentionally and directly addressed during the rehabilitation process to decrease it. Bullock et al¹⁵ included studies with only primary ACLR. The results of this study suggest that fear is similar after secondary ACLR. We cannot assume that individuals with prior experience with ACLR and subsequent rehab will have a decreased level of fear because of navigating the experience previously.

This study sheds light on the challenges of using the TSK-17. The TSK-17 was originally developed for patients with chronic low back pain and all subsequent psychometric properties were done for this population.²¹ Given the population that the TSK-17 was made for, this cut-off score is not generalizable to the ACLR population and cannot be used to firmly determine who is and is not considered to have high kinesiophobia. This makes the analysis of our study population and identification of high kinesiophobia in individuals after ACLR difficult. Some psychometric properties have been done for the ACLR population, however, this was done for the TSK-11, the shortened form of the TSK-17.²³ The TSK-11 is the shortened form of the TSK-17 that dismissed questions with poor psychometric properties. The TSK-11 demonstrates good internal consistency, test-retest reliability, responsiveness, concurrent validity, and predictive validity.²² The TSK-11 is commonly used throughout ACLR literature,¹⁵ and is more advantageous to use for this population compared to the TSK-17. There is still a need for a specific

outcome measuring kinesiophobia in the ACLR population that must be created for accurate and confident measurement of this construct. The Photographic Series of Sports Activities for ACLR is an outcome measure that is used to identify fear of harm for specific movements in the ACLR population, but does not address overall kinesiophobia after ACLR.²⁴

Limitations

This study was not without limitations. A limitation that was discussed previously was use of the TSK-17, a measure and subsequent cut-off score that was created for chronic low back pain patients, rather than another measure that is specific to and validated for the ACLR population. Another limitation is a low sample size that fit the inclusion criteria for the study. While the within-subjects design is an important and unique strength of this study, a higher number of participants would have increased the power of the study results.

Conclusion

There were no significant differences in kinesiophobia levels in individuals after their primary and secondary ACLR. Although non-significant, kinesiophobia levels still exist in both primary and secondary ACLR and are not at the floor of the instrument. Intentional and direct intervention to reduce kinesiophobia in individuals after ACLR may be important to decrease risk of reinjury, increase return to sport rates, and improve physical activity participation.

Table 1. Participant Demographics (Mean +/- SD)

Patient Demographics	Primary	Secondary
Male	10	10
Female	7	7
Age (yr)	18.1 ± 1.3	19.0 ± 1.0
Height (cm)	172.9 ± 11.5	
Weight (kg)	73.5 ± 20.9	
Time Since Surgery (mo)	5.5 ± 1.0	5.7 ± 1.1
Tegner Pre	8.8 ± 1.3	
Tegner Current	6.0 ± 1.6	

Table 2. Self-Reported Outcome Measures (Mean +/- SD)

Patient Reported Outcome Measures	Primary	Secondary	p-value
KOOS_ADL	97.4 ± 4.1	97.8 ± 2.3	0.61
KOOS_Pain	92.1 ± 9.6	91.3 ± 6.4	0.71
KOOS_QOL	70.2 ± 18.9	62.9 ± 13.3	0.18
KOOS_Sport	84.1 ± 16.6	79.1 ± 11.6	0.29
KOOS_Symptom	85.5 ± 13.4	85.8 ± 9.3	0.9
TSK-17	32.7 ± 5.0	33.1 ± 5.2	0.77

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