

The relationship between patella position, Tampa scale kinesiophobia score, single hop test, and International Knee Documentation Committee knee score in post-anterior cruciate ligament reconstruction patients

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ABSTRACT

Background: Anterior cruciate ligament reconstruction (ACLR) is a surgical procedure to replace a torn or damaged ACL. However, long-term functional recovery is often hampered by fear of movement or re-injury (kinesiophobia), as measured by the Tampa Scale Kinesiophobia (TSK) Score. The aim of this study is to investigate the relationship between patella position, the level of kinesiophobia measured using the Tampa Scale of Kinesiophobia (TSK), functional performance assessed by the single hop test, and subjective knee function evaluated through the International knee documentation committee (IKDC) score in patients after anterior cruciate ligament (ACL) reconstruction.

Methods: This study used the literature review method. Article searches through PubMed and Google Scholar databases using the keywords Patella Position, TSK Score, Single Hop Test, IKDC Score and Post ACL Patients.

Results: The five literature reviews found that proper baby walker use provides positive stimulation for walking, while misuse leads to adverse effects. Likewise, learning to walk without a walker requires careful guidance, as poor balance increases the risk of falls. The six articles reviewed found a significant negative correlation between TSK Score and IKDC Score. High TSK Score tends to have low physical performance and poor IKDC Score. In addition, knee functional status and psychological preparedness play more of a role in determining quality of life than physical measures alone.

Conclusion: There was a significant negative relationship between TSK Score and IKDC Score and single hop test performance. A high TSK Score affects physical functions such as the single hop test and a low IKDC Score. An unstable patellar position can be predicted using the Single Hop Test. These findings support the importance of a multidimensional approach in the comprehensive management of post-ACLR patients.

Keywords: IKDC score, pasien post acl reconstruction, patella position, single hop test, TSK score.

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Introduction

Injury or trauma to the anterior cruciate ligament (ACL) is often experienced by individuals aged 20 to 40 years usually due to sports activities such as soccer, basketball, volleyball and others.¹ In America, more than 250,000 cases of ACL injury occur each year, with one case occurring per 3,000 people.² In addition, a population-based study in Australia revealed that the country's ACLR rate is one of the highest in the world. Compared to men, women have a 3-6 times higher risk of ACL injury and this has not changed for more than twenty years.³ Sports injuries, particularly ACL injuries, are emerging as an internationally recognized health problem so it is important to know the traits associated with

an increased risk of ACL injury and also the treatment process with reconstruction.⁴ This injury is often treated by means of surgical reconstruction.

ACL reconstruction (ACLR) is the main surgical procedure to restore stability to the knee and allow patients to return to physical activity.⁵ Although surgical and rehabilitation techniques continue to evolve, many patients still experience long-term functional limitations, such as knee instability and decreased muscle strength.⁶ There have been many studies examining how this reconstructive surgery affects knee function, and the patient's psychological response to the injury can be long-lasting as well as negatively impact rehabilitation.⁷ This psychological

response is in the form of fear where patients experience fear of moving or returning to exercise due to pain and fear of re-injury, known as kinesiophobia.⁸

The Tampa Scale Kinesiophobia (TSK) Score is a self-report measurement tool developed to assess 'fear associated with pain movement' in musculoskeletal pain patients and is often used as a tool to evaluate the patient's level of anxiety about the risk of recurrent injury that could potentially hinder the recovery process.⁹ The single hop test is one of the most commonly used methods to assess knee function. This test is especially applicable for knee recovery post-ACLR.¹⁰ The test is performed by asking the patient to hop as far as possible in a straight line using one leg without losing balance or falling, and the results are usually measured by the distance of the hop as well as the symmetry of performance between the legs.¹¹

The single hop test not only assesses lower limb muscle strength, but also neuromuscular endurance, joint stability, as well as movement coordination.¹² This test is very important in determining a patient's readiness for return to sport as it reflects the functional performance required in athletic activities.¹³ In the recovery process after ACLR, good performance on the single hop test often correlates with better rehabilitation outcomes, reflected by a higher IKDC Score that objectively and subjectively evaluates the functional condition of the knee.¹⁴ In addition, the single hop test has the advantage of being simple, inexpensive, and not requiring complex equipment, yet able to provide rich information regarding the patient's functional readiness to face physical activities with a high risk of injury.¹⁵ Patellar position refers to the alignment relative to the femur and tibia for normal function of knee biomechanics.¹⁶

This study shows that the position of the patella after total knee arthroplasty undergoes significant changes, especially in the patellar height index measured using the Insall-Salvati index.¹⁷ A decrease in the ISI value indicates that the patella tends to descend (steel patella) after surgery, which may affect knee biomechanics and clinical function.¹⁸ In addition, the position of the patella was also evaluated through the patellar tilt angle and congruence angle. The results showed that the patellar tilt angle was significantly different before and after surgery, indicating a change in the lateral or medial position of the patella. This is important to know as abnormal patellar positioning can lead to pain, dysfunction and other complications such as patellofemoral pain syndrome.¹⁹ The position of the patella plays a crucial role in the biomechanics of the knee joint. The patella functions as a lever that increases the work efficiency of the quadriceps muscle in knee extension movements, as well as a protector for the patellofemoral joint.²⁰

A normal patella position maintains stability of the knee joint and supports even distribution of load and pressure along the articulating surfaces.⁹ However, muscle imbalance or structural changes due to trauma or surgical intervention can cause patellar malalignment after ACLR. The abnormal position of the patella can cause mechanical

disturbances such as increased pressure on the patellofemoral joint, anterior knee pain, and limitation of motion.²¹ This malalignment also impacts the patient's confidence to move or return to activity, as they feel instability or fear of re-injury.⁹ Therefore, assessment of patellar position is important in the context of rehabilitation as it determines the effectiveness of functional exercises, including the single hop test. A non-ideal patella position can reduce overall functional performance as it triggers muscle compensation and suboptimal changes in movement patterns.²² The association between patella position and single hop test results becomes even more significant when examined in relation to TSK Score and IKDC Score. Patients with a disproportionate patella position often experience an increased fear of movement (kinesiophobia) due to pain or discomfort, which in turn affects their willingness to perform functional tests such as the Single Hop Test.⁸

This kinesiophobia can lead to poor performance, not because of muscle weakness per se, but because of psychological barriers that limit the patient's maximum effort.²³ Conversely, if the patella position is in a near-normal and stable configuration, patients tend to show better physical performance in the Single Hop Test and have a higher IKDC Score because they feel confident and are not burdened by the fear of re-injury.²⁴ Therefore, a comprehensive rehabilitation approach should consider the interaction between structural (patella position), functional (single hop test results) and psychological (kinesiophobia) factors.²⁵ A thorough evaluation of the patella position and targeted corrective exercises can help improve joint mechanics, improve functional test results, and facilitate a safer transition for patients to return to physical activity or sports.⁸ The aim of this study is to investigate the relationship between patella position, the level of kinesiophobia measured using the Tampa Scale of Kinesiophobia (TSK), functional performance assessed by the Single Hop Test, and subjective knee function evaluated through the International Knee Documentation Committee (IKDC) score in patients after ACLR.

Methods

This research used the literature review method. The data collection technique was carried out systematically by searching for various relevant scientific articles through leading database search engines such as Google Scholar and PubMed. Inclusion and exclusion criteria were used to select literature. The inclusion criteria of this study were patients who had undergone ACLR or experienced patellar dislocation, individuals with abnormalities in patellar position accompanied by kinesiophobia, and those whose knee function was measured using the single hop test and the International Knee Documentation Committee (IKDC) Score. In addition, only studies written in English and published within the last 10 years were considered.

The exclusion criteria included patients with ACL injuries who did not undergo surgery or reconstruction,

studies that discussed topics other than patellar position abnormalities and kinesiophobia, studies that assessed knee functionality using methods other than the single hop test and IKDC Score, studies written in languages other than English, and studies published more than 10 years ago. The literature search process used Boolean logic with a combination of keywords such as "Patella Position," "TSK Score," "Single Hop Test," "IKDC Score," and "Post ACL Reconstruction." From the search, we identified seven studies related to the relationship between patella position, tampa scale of kinesiophobia score, single hop test, and international knee documentation committee knee score in post-ACLR patients.

Results

The results of research from Tavares et al.¹³ with a total of 131 participants showed that there was a strong relationship between ACL-QoL variables with IKDC, GRS, ACL-RSI and TSK-17, with the results of IKDC ($r = 0.69$), GRS ($r = 0.55$), ACL-RSI ($r = 0.50$) and TSK-17 ($r = -0.49$). Results also showed a significant relationship between IKDC and TSK-17. There was a negative correlation where IKDC ($r = 0.69$) and TSK ($r = -0.49$). Both questionnaires also had a p-value (<0.01) which means significant. Variables related to knee functional status and psychological factors (IKDC, GRS, ACL-RSI, and TSK-17) were found to be predictors of QoL ($R^2 = 0.56$; $p = 0.01$).

This article also focuses on the relationship between knee-related quality of life and functional, psychological, strength, performance, and postural stability factors after ACLR. This study also sheds light on the key finding of patient quality of life: Patients who had undergone ACLR showed reduced quality of life compared to healthy control patients. Quality of life was measured using the Anterior Cruciate Ligament - Quality of Life (ACL-QoL). Predictors of Quality of Life: The study found that knee functional status, psychological preparedness, and kinesiophobia (fear of movement) were significant predictors of QoL after ACLR. These variables explained 56% of the variation in ACL-QoL scores. Correlation with Other Measures: ACL-QoL showed moderate correlations with the (IKDC), Global Rating Scale (GRS), and Anterior Cruciate Ligament Return to Sport after Injury Scale (ACL-RSI). However, there were no or only low correlations with muscle strength, postural stability, and performance in the Single Hop Test.

In the study of Van Wyngaarden et al explained TSK-17 had a significant relationship with all patient-reported outcomes, one of which was IKDC with a p-value ($p \leq 0.01$) in linear regression analysis where kinesiophobia or fear of movement or injury greatly influenced perceptions of recovery.¹² This study also sheds light on long-term functional outcomes after ACLR, with a particular focus on the relationship between physical performance measures, psychological factors, and patient-reported outcomes.

The findings of the article by Silva et al is Correlation with Other Measures: There was a correlation between both questionnaires and other measurement tools such as the tampa scale kinesiophobia score and the international knee documentation committee.¹⁰ This suggests that the ACL-RSI and ACL-QoL can also be used to assess psychological and functional aspects of recovery after ACLR. Good Measurement Properties: Both questionnaires showed good measurement properties, with high Test-Retest Reliability. The ACL-RSI had an intraclass correlation coefficient (ICC) of 0.78, while the ACL-QoL had an ICC of 0.84. This indicates that both instruments can be relied upon to measure consistent outcomes over time. Internal Consistency: ACL-RSI: Cronbach's $\alpha = 0.87$ (good consistency). ACL-QoL: Cronbach's $\alpha = 0.96$ (excellent consistency), with subdomains ranging from 0.83 to 0.95. Construct Validity: ACL-RSI correlation: Reasonable negative correlation with the Tampa Scale for Kinesiophobia (TSK) ($\rho = 0.51$), indicating higher psychological preparedness correlated with lower fear of movement. A reasonable positive correlation with the IKDC ($\rho = 0.58$), linking psychological preparedness with better knee function. Weak to low correlations with SF-36 domains ($\rho = 0.14-0.44$), as expected due to the generic nature of the SF-36.

In the study by Nilsgard et al found that performance on the single hop test and triple hop test at baseline was significantly associated with the risk of persistent patellar instability after 12 months.⁹ Participants who had higher limb symmetry index scores on the tests were less likely to have sustained patellar instability. In addition, most participants had improved KOOS scores and high levels of stability after 12 months, although not all hop tests showed a significant association with changes in sport and recreation function. These results suggest that the hop test can be used as a risk prediction tool for patellar instability, but further research is needed to corroborate these findings.

Findings from the cross-sectional study by Norte et al. support the argument in this review. In the study of Norte et al found that the Tampa Scale for Kinesiophobia Score had a significant negative correlation with single hop test performance, meaning that the higher the patient's level of fear of movement or the possibility of re-injury, the lower their ability to perform an optimal single-leg hop.¹¹ This correlation was even stronger in the high physical activity patient group, suggesting that even if one is physically active, the presence of kinesiophobia can still be a significant barrier to ideal functional performance. Not only that, TSK-17 also showed a negative correlation with the IKDC Score, which measures the patient's perception of their knee function; in other words, psychological fear of movement or re-traumatization is closely related to the low positive perception of knee condition after ACLR surgery. This fact provides a deep understanding that psychological evaluations such as TSK are not only related to the emotional aspects of the patient, but also markedly affect

the functional performance and perception of the patient's own physical condition.

The study of Genç et al presented the main findings ssrelated to the single hop test showed that there was a significant difference between the operation side and the non-operation side in the single hop distance results.⁸ The operative side showed a lower performance with an average hop distance of approximately 104.96 cm compared to the non-operative side which reached 115.08 cm, with a p value = 0.004, indicating a functional deficit that still exists after 6 months post ACL surgery. In addition, the position of the patella, particularly the Q angle, also plays an important role. This study confirmed that there was no significant difference in Q angle between the two sides, however, patella position measurements and foot posture indices were generally correlated with hop performance, suggesting that non-optimal patella position may affect limb strength and stability during dynamic activities. This confirms that biomechanical factors such as patella position and foot posture contribute to functional outcomes and recovery after ACL surgery.

Discussion

Knee functional outcomes in patients post ACL reconstruction and psychological factors, namely kinesiophobia as measured by the Tampa Scale for Kinesiophobia (TSK) score. In the study of Tavares et al.¹³ found that the main factors indicating quality of life after ACL surgery were knee functional status as measured by IKDC and GRS, and psychological readiness, such as ACL-RSI and TSK-17. Where a negative correlation between TSK-17 and QoL indicated that the higher the patient's fear, the lower their perception of knee function and quality of life Kinesiophobia, as measured by the Tampa Scale for Kinesiophobia Score (TSK-17) had a negative correlation with QoL, meaning the higher the patient's level of fear of movement, the lower their perceived quality of life.

This suggests that interventions aimed at reducing fear of movement may improve patients QoL. Although muscle strength and postural stability showed no significant association with QoL, it is important to note that muscle strength, especially quadriceps strength, remains a major focus in rehabilitation. This study highlights the need for a multidimensional approach in ACLR rehabilitation, which includes not only physical but also psychological aspects, to achieve optimal outcomes for patients. Overall, these findings provide valuable insights for clinicians in designing more effective rehabilitation programs, taking into account both functional and psychological factors to improve patients' quality of life after ACLR.

Van Wyngaarden et al also showed that TSK-17 had a significant influence on patients' perceptions of recovery, with quadriceps muscle strength being the main physical predictor, but was outweighed by the psychological influence on IKDC score.¹² This study also emphasized that kinesiophobia affects how patients perceive their knee's

ability, regardless of the objective condition of the knee. The findings suggest that psychological and functional factors have a very important role in determining patients' quality of life after ACLR. Psychological readiness, as measured by the ACL-RSI, showed that patients who felt more mentally prepared to return to activity tended to have better QoL. This suggests that psychological aspects should not be overlooked in the rehabilitation process. Analysis of these findings suggests that quadriceps muscle strength and psychological factors such as kinesiophobia have a significant impact on long-term outcomes after ACLR. Quadriceps muscle strength has been shown to be a major predictor of good knee function, which underscores the importance of rehabilitation that focuses on strengthening this muscle. This suggests that an effective rehabilitation program should include exercises designed to improve quadriceps strength, especially in the later stages of recovery.

On the other hand, kinesiophobia also suggests that psychological aspects are also very important in the recovery process. Fear of movement can hinder a patient's progress and affect their quality of life. The study by Silva et al found that ACL-RSI (Return to Sport Index) was negatively correlated with TSK-17, meaning that patients with higher fear tended to be less psychologically prepared to return to sport.¹⁰ This finding supports that psychological factors (such as confidence and fear) are as important as physical recovery in determining readiness to return to activity. Analysis of these findings showed that there are good measurement properties of both questionnaires, as indicated by the high Test-retest Reliability results, suggesting that these instruments are reliable for use in clinical practice and research. This is important as consistent results can aid in clinical decision-making and evaluation of the effectiveness of rehabilitation interventions. The correlations found between the ACL-RSI and ACL-QoL with other measurement tools such as TSK and IKDC indicate that these two questionnaires measure not only physical aspects but also psychological factors that affect patient recovery. This emphasizes the importance of a holistic approach in ACL rehabilitation, where psychological factors such as kinesiophobia must be considered to achieve optimal outcomes.

Overall, these findings provide valuable insights for healthcare practitioners and researchers in designing more effective and integrated rehabilitation programs, taking into account both the physical and psychological aspects of recovery after ACLR. Norte et al reported that patients with high physical activity showed a stronger correlation between TSK scores and single pop test performance, whereas less active patients showed higher kinesiophobia and lower overall functional performance, indicating that the patient's activity background also plays an important role in the impact of fear on recovery.¹¹ The results of this study showed that kinesiophobia was negatively correlated with single hop test results, especially in patients with high

Table 1. Results of the relationship between patella position, Tampa Scale of Kinesiophobia score, single hop test, and IKDC knee score in post-ACLR patients.

Authors	Study Design	Population	Sample Size	Methods	Main Results
Silva et al. (2017) ¹⁰	Cross-sectional	Patients with ACL Reconstruction	100	Test the validity and reliability of ACL-RSI and ACL-QoL, and correlation with TSK and IKDC.	1. Negative Correlation: A lower TSK score correlates with a higher IKDC score. Reasonable correlation between ACL-RSI and TSK ($\rho = -0.51$) and IKDC ($\rho = 0.58$). 2. Fear of movement (kinesiophobia) may hinder recovery of knee function, which may affect functional test performance.
Norte et al. (2019) ¹¹	Cross-sectional	Patients with ACL Reconstruction	77	Correlation of TSK-17 with Single Hop Test and IKDC based on physical activity level.	1. TSK-17 showed a significant negative correlation with Single Hop Test performance (low to moderate correlation coefficient). That is, the higher the kinesiophobia (fear of movement/injury) score, the worse the Single Hop Test performance. 2. In patients with high physical activity, the correlation between TSK-17 and Single Hop Test was stronger (higher correlation coefficient) than in patients with low physical activity. 3. TSK-17 also showed a negative correlation with IKDC Score (low to moderate correlation coefficient). The higher the kinesiophobia score, the lower the IKDC score (patient-reported knee function).
Van Wyngaarden et al. (2021) ¹²	Cross-sectional	Participants with ACL Reconstruction	40	Linear Regression between TSK-17 score and IKDC score to assess the effect of kinesiophobia.	1. TSK-17 (Tampa Scale for Kinesiophobia) was significantly correlated with IKDC ($P \leq 0.01$) in linear regression analysis. 2. Higher TSK scores (motion/reinjury fear) were associated with decreased patient-reported knee function (lower IKDC). 3. Significance: this correlation suggests that psychological factors (kinesiophobia) influence patients' perception of knee function, which is reflected in the IKDC score.
Genc et al. (2023) ⁸	Cohort	Patients with ACL Reconstruction	25	A retrospective cohort study involving measurements of biomechanical and	1. Functional performance such as single hop distance is still lower on the operating side

						structural parameters in post-ACL surgery patients, including Q angle, femur length, foot posture index, and single hop and triple hop performance.	although within normal limits, indicating that the process of function recovery is still ongoing.
Nilsgard (2023) ⁹	et al.	Randomized Controlled Trial	Pasien Lateral Dislocation	Recurrent Patellar	61	Linear regression and logistic regression analysis to evaluate the relationship between the performance of single hop test and triple hop test with changes in patella function and patella stability.	1. The Single Hop Test is used to predict the likelihood of a patient having persistent patellar instability after 12 months. 2. Based on the study, no significant relationship was found between performance on the single hop test and persistent patellar instability after 12 months.
Tavares (2023) ¹³	et al.	Cross-sectional	Patients with ACL Reconstruction		131	Correlation analysis between knee quality of life with IKDC score, GRS, ACLRSI, and TSK-17.	1. There is a strong relationship between ACL-QoL variables with IKDC, GRS, ACL-RSI, and TSK-17. 2. Results also showed a significant relationship between IKDC and TSK-17. 3. Knee function condition, psychological readiness, and fear of movement are factors that predict knee-related quality of life in patients post-ACL reconstruction.

activity levels. This suggests that movement fear may limit actual physical ability, not just patient perception.

The correlation was stronger in active individuals, suggesting that athletes or more active individuals may be more functionally affected by their fears. Analysis of these findings suggests that kinesiophobia plays an important role in patient recovery after ACLR. Fear of movement not only affects muscle strength and physical performance, but can also hinder a patient's ability to return to daily activities and sports. This emphasizes the importance of psychological assessment in rehabilitation, where kinesiophobia should be identified and proactively addressed. Differences in the relationship between kinesiophobia and clinical outcomes based on physical activity levels suggest that rehabilitation approaches should be tailored to the individual needs of the patient. Less active patients may require additional support to overcome their fears and increase confidence in performing physical activities.

On the other hand, more active patients may require a greater focus on improving physical performance and reducing fears associated with sports activities. These findings also suggest that rehabilitation after ACLR should be multidimensional, combining physical and psychological interventions to achieve optimal outcomes. By understanding the relationship between kinesiophobia, lower limb function, and physical activity engagement, practitioners can design more effective and integrated rehabilitation programs that address not only the physical but also the psychological aspects of a patient's recovery.

The study of Nilsgard et al in 2023 showed that performance on the single leg hop for distance and triple hop for distance at baseline was significantly associated with the risk of persistent patellar instability after 12 months.⁹ Higher LSI scores on these two tests were associated with a lower likelihood of sustained patellar instability, with ORs of 0.94 and 0.91 respectively ($p < 0.05$). Changes in Performance and Prediction Although participants experienced improved performance on the hop test and PROM scores during follow-up, changes in LSI on the single hop test were not significantly associated with sustained patellar instability. This suggests that performance on the single hop test before treatment can be used as an indicator of risk, but changes in performance during treatment do not directly predict long-term stability. These results confirm that performance on the single hop test, particularly LSI, has prognostic value in assessing the likelihood of sustained patellar instability.

However, this study also suggests that the clinical value of the hop test in follow-up after treatment is limited, as not all relationships were significant and this study may have limited statistical power. In the study of Genç et al showed that after six months post-ACL surgery, structural parameters such as Q angle, femur length, and leg posture index showed no significant differences between the operative and non-operative sides.⁸ This indicates that structurally, patients tend to have a good recovery and

achieve biomechanical stability close to the pre-injury condition. This finding is in line with previous studies which state that structural recovery can be achieved within about 6 months post-surgery.

However, in terms of functional performance, especially in the single hop test, there was a significant decrease in performance on the operative side although these values were still within normal limits. This suggests that although the patient appears to be structurally recovered, dynamic function and limb strength have not fully returned to their pre-injury state. This finding emphasizes the importance of thorough functional evaluation, not just structural parameters, in the rehabilitation process. In addition, the influence of patella position and foot biomechanics, such as excessive pronation and calcaneus position, also play a role in limb performance. The positive correlation between hop distance and foot posture index, as well as the negative correlation between calcaneus pronation and single hop performance, suggest that foot biomechanical factors may influence limb stability and strength during dynamic activities.

This confirms that rehabilitation should not only focus on muscle strength and joint stability, but also on correcting posture and foot biomechanics to improve functional outcomes. Overall, these six articles consistently support that the rehabilitation approach for patients after ACLR should not only address biomechanical aspects and physical performance, but should also include psychological interventions that focus on reducing fear, increasing self-confidence, and mental preparedness to ensure a more comprehensive and sustainable recovery outcome.

This study has several limitations that should be acknowledged. First, the use of a literature review design limits the ability to establish causal relationships between patella position, kinesiophobia levels, and functional outcomes such as the single pop test and IKDC score. The findings are based on secondary data, which may be influenced by variability in study design, population characteristics, and assessment methods across the included articles. Second, the heterogeneity in measurement tools for patella position and kinesiophobia, as well as differences in post-operative rehabilitation protocols, may affect the consistency of the outcomes. Lastly, the literature search was limited to selected databases, which might not fully capture all relevant research on the topic. Future studies with a prospective design and larger, more diverse populations are needed to confirm these associations and explore the underlying mechanisms in greater depth.

Conclusions

This literature review highlights the association between patella position and kinesiophobia, as measured by the tampa scale for kinesiophobia, with knee function outcomes assessed through the single hop test and international knee documentation committee score in patients after ACLR. The findings suggest that the Single Hop

Test can serve as a predictive tool for patellar instability, while ACLR generally improves patients' quality of life and recovery. However, a higher TSK score, reflecting greater fear of movement, is negatively correlated with both functional performance and self-reported knee function. This emphasizes that psychological factors, such as mental readiness and self-confidence, play a more significant role in postoperative outcomes than physical measures alone. Consequently, rehabilitation following ACLR should integrate psychological strategies alongside physical therapy to reduce kinesiophobia and enhance patients' readiness to return to activity.

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Conflict of interest

The authors declare that there are no potential conflicts of interest, financial or otherwise, that could be construed as influencing the research, the preparation of the manuscript, or the publication and dissemination of this manuscript. All authors affirm that their participation in this study and the preparation of this manuscript were conducted with the highest scientific integrity and without external pressures or personal interests that could compromise the objectivity or validity of the reported findings..

Author contributions

LANK developed the study design, conducted data collection, and prepared the initial manuscript; IP was responsible for data collection and provided revisions to the manuscript.

Ethical consideration

This review study utilized publicly available published articles, so informed consent and ethical approval were unnecessary.

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