

The relationship between knee function and psychology on sports readiness, overuse conditions, and physical activity post anterior aruciate ligament reconstructions: a literature review

Vinzenza Villia Ardike Bondeng¹, I Putu Gde Surya Adhitya^{2,*}, Sayu Aryantari Putri Thanaya²

¹Bachelor and Professional Program of Physical Therapy, College of Medicine, Universitas Udayana, Bali, Indonesia

²Physical Therapy Department, College of Medicine, Universitas Udayana, Bali, Indonesia

ABSTRACT

Background: Giant cell tumor (GCT) is a relatively rare type of primary benign bone tumor, characterized by multinucleated giant cells resembling osteoclasts. Treatment of GCT with intralesional resection and bone cement filling, especially in tumors that develop around the knee joint. After GCT surgery around the knee joint, in general, patients will experience several symptoms such as pain in the operating area and surrounding structures, limited range of motion, then symptoms that are quite worrying, namely related to the ability of knee function in the future. The role of physiotherapy after GCT surgery around the knee joint, especially the distal anterolateral part of the femur, was stated to be able to restore the functional ability of the knee without limitations.

Objective: To determine the relationship between knee function and psychology on readiness to return to sports, overuse conditions, and physical activity after Anterior Cruciate Ligament Reconstructions.

Methods: The method used is a literature review study using secondary data from published literature. The literature search was conducted online through PubMed, Pedro, Garuda and Google Scholar, using the "key words" Anterior cruciate ligament reconstructions (ACLR), ACL injury, psychological factors, physical activity of ACL athletes, and overuse injuries and selected based on inclusion and exclusion criteria.

Results: From the literature used, it is stated that poor knee function can cause severe pain and fear of re-injury, impacting readiness to return to sports and decreased physical activity levels after ACLR. Poor knee function due to surgical factors such as the ipsilateral ACL autograft surgical technique can result in an overuse condition characterized by the emergence of patellofemoral pain syndrome.

Conclusion: There is a relationship between knee function on psychological readiness to return to sports, level of physical activity and overuse conditions in athletes after ACL reconstruction.

Keywords: ACLR Athletes, ACL Reconstruction, Physical Activity, Psychological Readiness.

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***Corresponding author:** I Putu Gde Surya Adhitya, Department of Physical Therapy, College of Medicine, Universitas Udayana, Bali, Indonesia; Email: surya_adhitya@unud.ac.id

Background

A tear in the ligament that links the femur and tibia results in an anterior cruciate ligament injury. Non-contact mechanisms in sports, including jumping, dodging, and turning, cause these injuries. ACL injuries account for more than half of all knee joint injuries;¹ in the United States ranges from 250,000 to 300,000 each year,² with over 100,000 people having their ACLs repaired (ACLR).³ The ACL ligament is replaced via an ACLR operation with grafts from the patellar tendon, hamstring tendon, and gracilis.^{4,5}

Although ACLR is considered the standard of treatment, it was found that only 65% of patients were able

to exercise at pre-injury levels, and 55% of patients returned to competitive sports.⁶ Reduced knee function and poor psychological readiness can lead to not returning to sports after injury. This decline in knee function is characterized by joint instability, swelling, pain, reduced range of motion and muscle function, and altered movement patterns.⁷ Individual readiness can be interpreted as psychological readiness to return to sports, which consists of three main aspects: confidence to return to sports, realistic expectations of sports abilities, and motivation to regain pre-injury performance.⁸ It was found that the cause of decreased psychological readiness after ACLR was fear of re-injury (19%), followed by

decreased knee ability (18%), knee disorders (13%), and lifestyle changes (11%).⁹

Surgical factors such as allograft use during ACLR, undergoing meniscectomy or meniscus repair, undergoing ACLR revision, and smaller HS autograft size are associated with the patient-reported decline in knee function over time after ACLR.¹⁰ This is evidenced by patellar ligament autograft, which is correlated with the emergence of patellofemoral pain syndrome (PFPS).¹¹ PFPS itself is classified as an overuse disorder.¹² So, poor knee function due to surgical factors such as the use of patellar ligament autograft can lead to overuse in post-ACLR patients.

Several measuring tools are used to evaluate knee function after ACLR, namely by using the Knee Injury and Osteoarthritis Outcome Score (KOOS), the Lysholm Knee Scoring Scale, and the Tegner Activity Score (TAS).¹³ KOOS is a validated measurement tool for ACLR that aims to evaluate the symptoms and difficulties experienced by patients.¹⁴ The measuring instruments for assessing good knee function and the rate of returning to exercise as quickly as possible are the Lysholm score and the Tegner activity scale. A psychological examination is needed to see psychological readiness after ACLR, which can be measured using several scales, such as the ACL-Return to Sport after Injury Scale (ACL-RSI) and the Tampa Scale for Kinesiophobia (TSK). ACL-RSI is a measurement tool developed and published in 2008 that assesses psychological readiness to return to sports after ACL injury or surgery,¹⁵ while TSK is a scale used to measure fear related to activities that allow repetitive injury in post-ACLR patients.

Psychological conditions may be essential in determining the patient's readiness to return to exercise. In addition, functional knee ability and psychological readiness significantly impact post-ACLR patients' physical activity ability. In Indonesia, few studies have related knee function and psychological readiness to return to exercise. Therefore, this literature review aims to examine the relationship between knee function and the psychological readiness of ACLR patients and their relationship to overuse and physical activity in the possibility of returning to exercise.

Methods

The method used is a literature review study using secondary data from published literature. An online literature search was done through PubMed, Pedro, Garuda, and Google Scholar, using "key words": anterior cruciate ligament reconstructions (ACLR), ACL injury, psychological factors, physical activity of ACL athletes, and overuse injuries. The literature selection was selected based on inclusion and exclusion criteria. The inclusion criteria used in this literature review are: Libraries published by reputable organizations, the reviewed literature is a library of printed books from the last 15 years, contains two or more variables such as aclr, ACL injury, and psychological, the literature taken contains measuring instruments: acl-rsi, tsk score, Koos, lysholm score, and tegner activity scale. The exclusion criteria in this literature review are: the library is not from a credible

institution, it has been used for more than 15 years since its publication, it uses one variable, and it does not contain the appropriate measuring instrument. The literature used in the literature review has met the criteria set by the author.

Results

Based on the study of Betsch et al. (2021), of 113 patients who were joined and analyzed using a multivariable regression model, it was found that the pain symptoms reported by patients at one year postoperatively, as measured by the KOOS pain subscale, were significantly associated with a higher ACL-RSI score. It is a psychological readiness questionnaire with [95% CI: .62-1.60] $P < .001$. Poor knee condition marked by severe pain significantly correlates with lower psychological and physical readiness to return to sports.¹⁶

Psychological readiness plays an essential role in determining athlete readiness. Research conducted by Hart et al. (2019), with a total sample of 118 people, found that 82.1% of participants experienced decreased confidence in knee function. 59% of participants experienced damaging psychological readiness to return to sports (score < 56). Based on the statistical results obtained: Excessive fear of movement : $P=0.019$, knee pain (KOOS) : $P<0.001$, ACL-RSI : $P<0.001$. Individual fear of movement, confidence in the knee, and psychological readiness to restore health and pain are closely related to post-ACLR knee function.¹⁷

In addition to pain, the fear of recurring injuries also reduces interest in returning to sports. This is supported by the research of Alhamam et al. (2020). In his study with 135 participants and using the Tampa Scale for Kinesiophobia measuring instrument, it was found that the prevalence of patients experiencing kinesiophobia after ACL work was very high. It was found that 77% of patients had high kinesiophobia scores, and 31% had low kinesiophobia scores. However, the emergence of kinesiophobia is not related to the age and status of the athlete but instead to the gender and work occupied by the athlete after ACLR.¹⁸

Regarding the level of physical activity after ACLR, a study by YH Lee et al. (2008) with 146 participants and a measuring device using the Lysholm Knee, Tegner activity score, and International Knee, found that the activity level of patients decreased after ACLR. This statement is based on the results of the Strong Activity Scale. The results of the Tegner Activity score analysis: 28 patients (62.2%) returned to their pre-injury exercise level, 17 patients (37.8%) did not return to their previous exercise level, and there was a decrease in activity. Nine patients (20%) did not recover due to fear of re-injury, and eight (17.8%) did not recover due to persistent knee instability causing pain. 17.8% of patients did not return to sports due to knee instability, with a low Lysholm score of 72.¹⁹

Another complication after the ACLR was performed was discovering an overuse condition in the form of patellofemoral pain. This was found by Culvenor's study et al. (2015), using retrospective analysis and cross-sectional analysis designs on 110 study subjects. 30% of participants

experienced patellofemoral pain 12 months after ACLR. Statistical data showed that there was a significant relationship between PFP pain and activities that burdened the patellofemoral joint: $P < 0.02$.²⁰

Discussions

ACL rupture is the most common injury in jumping and spinning sports.²¹ ACL reconstructions (ACLR) is one of the most widely performed orthopaedic procedures for managing ACL injuries, and its success rate in easy athletes ranges from 85% to 95%.²² One of the important reasons for performing ACLR is to regain good knee function and return to sports as quickly as possible.²³ The function of the knee is to maintain stability and body weight in various situations.²⁴ It was found that the results after ACLR were satisfactory for the athlete's knee. However, participation in returning to exceptionally competitive sports is meagre and more than a recovery of physical abilities is required to ensure a triumphant return to sports.²⁵ According to several studies, psychological readiness contributes to seeing an athlete's return to sport, including post-injury performance levels, anxiety/fear, and events. Re-injury.²⁶ Another benefit of the ACLR is that in addition to being able to return to sports, it is also possible to carry out activities at the pre-injury level of activity. However, in other studies, it was found that there was a decrease in physical activity and the emergence of other disorders, such as patellofemoral pain, after ACLR.

Psychological responses such as fear of re-injury can be considered to see the patient's ability to continue participating in sports. Research conducted by Betsch et al.,¹⁶ showed that poor knee conditions characterized by severe pain showed a significant relationship with psychological readiness to return to sport. These results are consistent with the study of Alhamam et al.,¹⁸ who found that patients did not return to pre-injury activities due to fear of re-injury. Avoidance of activity due to fear explains the development of chronic pain.²² This is reinforced by the results of Hart et al.,¹⁷ that 59% of participants experienced damaging psychological readiness to return to sports and showed that self-confidence and knee pain were associated with poor function based on patient reports. The emergence of fear of re-injury may be related to poor knee function, so athletes cannot perform physical activities that give them to experience knee pain or instability during specific movements.²⁷ Pain occurs when afferent nerve endings translate stimuli into nociceptive impulses transmitted to the horns. dorsalis spinal cord, then to the brain and finally, the perception of pain appears.^{28,29} If it is associated with psychology, the pain will cause the body to react to flight-or-fight because of conditions that have the potential to threaten the stability of the body's condition.³⁰ If this continues, it can lead to other harmful conditions. in athletes. Negative responses to pain and avoidance of active activities due to fear of recurring pain are two psychological factors that strongly correlate with a lack of return to exercise.

In addition to psychological readiness, what also needs to be considered in ACLR patients is how they can return to their

pre-injury level of activity. In the study of Lee et al.,³¹ it was found that there was a decrease in activity levels after ACLR. Further explanation from the study was that 62,2% of patients returned to their original pre-injury exercise level and had maintained their activity level. Meanwhile, 37,8% of patients did not return to their previous level of exercise and were injured, and they experienced a decrease in their activity level. Of the 37,8% of patients who did not return to their pre-injury level of exercise, 20% said they did not return due to fear of re-injury, and 17,8% said they did not return to sports due to persistent knee instability and pain. These results are supported by the study of Lentz et al.,^{9,2} who found only 55% of athletes reported returning to their pre-injury level of participation in sports with the main reason for not returning, namely fear of re-injury and knee joint symptoms such as pain, swelling, instability and weakness muscle.

The study by Culveno et al.,²⁰ stated that patellofemoral pain syndrome (PFPS) is a complication after ACLR, regardless of the graft source or the tissue used. This is evidenced by the finding that 30% of participants experienced PFPS 12 months after ACLR. However, the study of Borges et al.,^{11,2} described the existence of a correlation between ACLR using patellar ligament autograft, mainly when used with the ipsilateral technique in ACLR surgical procedures. Therefore, the condition of post-ACLR PFPS can also be influenced by the selection of replacement tissue for the damaged ACL ligament. The study of Ithurburn et al.,^{10,2} also confirmed that surgical factors were associated with the patient-reported decline in knee function over time after ACLR. Patellofemoral pain syndrome is a term for various pathologies or anatomical abnormalities that lead to anterior knee pain.³¹ PFPS is classified under Overuse syndromes^{12,2}, which is also caused by the inadequate recovery that can result in decreased performance and participation in returning to sports.^{15,2} Poor knee function due to surgical factors such as using patellar ligament autograft, one of the ipsilateral techniques, can result in overuse conditions in post-ACLR patients.

Conclusion

Based on some of these literature reviews, knee function can affect psychological readiness to participate again in sports and knee function also affects levels of post-ACLR physical activity. In addition, poor knee function due to surgical factors such as using other tissues to replace the ACL can lead to overuse conditions such as patellofemoral pain syndrome.

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Conflict of interest

The author states there is no potential conflict of interest in connection with the research, authorship and or publication of this article.

Author contributions

VVAB conceived the study design and data collection and drafted the manuscript; SAPT collected the data and revised the manuscript.

Ethical consideration

This review study used published articles that are accessible. Thus, this study did not require any informed consent or ethical consideration

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