

A Review on Rehabilitation and Return to Sport Criteria Post ACL Reconstruction in Athletes

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ABSTRACT

Background: Anterior Cruciate Ligament (ACL) injuries are most often found in young active athletes. They range from mild (small tears or sprain) to severe (complete tear of ligament) and are mostly seen in sports like football, basketball, cricket, gymnastics, skiing, etc ACL reconstruction is a surgical knee procedure that requires intensive postoperative rehabilitation by the athlete to be able to return to sport.

Methods: A systematic review was conducted considering the data sources PubMed (MEDLINE), Cochrane Library, PEDro, Google Scholar, EBSCO, Medscape, and Scopus databases using the keywords ACL reconstruction, rehabilitation, and return to sport criteria. The time frame ranged between 2017-2022.

Results: The study selection process is presented according to PRISMA guidelines. After title and abstract screening, 50 full-text articles were assessed for eligibility 20 were excluded; the remaining 30 articles were deemed to meet the inclusion criteria and were included. The total number of RCTs included was thirty.

Conclusion: The thirty included RCTs offer convincing results on post-operative outcomes of muscular strength, function, patient reported symptoms and determination of return to sport criteria. There is limitation in holistic evidence that looks into the psychological as well as

physical components of rehabilitation of an athlete that will also accelerate the return to sport duration.

Keywords: ACL reconstruction, rehabilitation, return to sport criteria

INTRODUCTION

Anterior cruciate ligament is the most commonly injured soft tissue in athletes and the reconstruction of the ligament is the gold standard treatment in cases of severe injuries. Traditional ACL graft options include autogenous bone-patellar tendon-bone or hamstring grafts as well as irradiated allograft alternatives. Timing for ACL grafting is dictated by multiple factors like associated injuries along with their extent and the involved structures. Usually, meniscal tears are repaired in the same settings as ACL reconstruction as they require a longer healing time. Allowing a patient to return to sport following restricted physical activity after ACL injury and reconstruction is one of the most challenging and difficult decisions a therapist must make. Indeed, many factors must be considered before it can be considered safe for a patient to load a reconstructed knee. The current literature contains plenty of studies aimed at evaluating return to sport along with the factors that may affect this outcome. The primary aim of this review is to evaluate the effectiveness of the published experimental

interventions and combine them with the return to sport guidelines. This review also aims to help develop a prospective effective and updated intervention for athletes after ACLR to aid them to return to sport with reduced risks of re-injury and better outcomes in play over a period of time

Aim

To review the past rehabilitation and return to sport criteria studies in athletes with ACL reconstruction. This review aims to help create an evidence-based approach to create an overall protocol for ACL rehabilitation and returning athlete to sport post reconstruction.

Objective

To compile the recent rehabilitation methods and the return to sport criteria in post ACL reconstruction athletes

MATERIALS & METHODS

This review protocol received ethical clearance and was developed in line with PRISMA guidelines.

Information sources

The PubMed (MEDLINE), Cochrane Library, PEDro, Google Scholar, EBSCO, Medscape, and Scopus databases were searched to collect articles published between the years 2017 and 2022.

Eligibility Criteria

Studies were included only if they had randomized controlled trial as their study

design and if they specified any RTS decision making process in athletes post anterior cruciate ligament reconstruction. However, studies that gathered results post-surgery along with outcome measures without any experimental intervention were excluded. RTS criteria included any criteria that were used in the RTS decision making process. Articles with other study designs were excluded.

Search Strategy

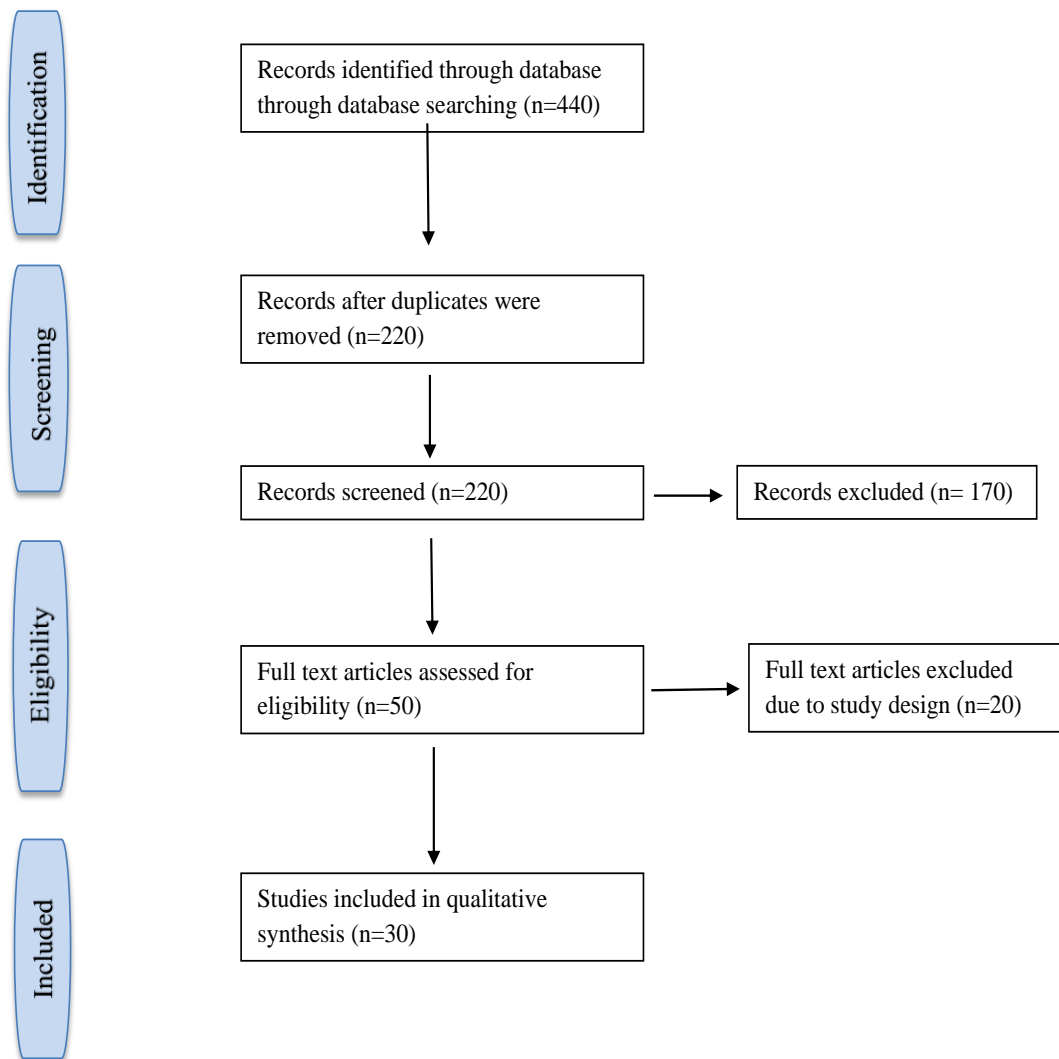
The search strategy used for this review included words like ‘ACL reconstruction’ ‘Rehabilitation’ ‘Return to Sport criteria’ and ‘athlete’ while the term sets were combined with ‘And’. Reference lists of included articles were screened to identify possible additional articles. This search strategy resulted into 50 potential articles for inclusion out of which 30 were selected for the review.

Data Extraction and Synthesis

To fulfil the objective of this review, the data was extracted in relation to the outcome measures, intervention as well as return to sport criteria (if applied), and results. Due to the differences in interventions implemented in the studies, study populations and outcome measures that were taken, it was deemed that included studies were not homogenous, and therefore a meta-analysis could not be done (Table 1) (Figure 1)

Table 1: Eligibility Criteria

Participants	Any age or sex athlete undergoing primary ACLR
Intervention	Any experimental therapy intervention completed prior or after ACLR along with criteria for returning to sport
Outcomes	Reported pre and post ACLR: Physical Any outcome related to pain, disability, or function, including but not exclusive to: joint range of movement, muscular strength, single leg hop distance and return to sport/physical activity Psychological Any outcome related to psychological status or well-being such as anxiety or depression scores
Study Design	Randomized Controlled Trials (RCTs) only
Language	English only



RESULT

The following systematic review includes the qualitative synthesis of thirty papers. The databases were scrutinised using key words ‘ACL reconstruction’ ‘Rehabilitation’ and ‘Return to sport criteria’. The study selection process is presented in the flowchart. The initial database search yielded 440 articles. After duplicates were removed, 220 articles were screened for inclusion. No additional articles were found from the screening of unpublished searches. After title and abstract screening, 50 full-text articles were assessed for eligibility. 20 were excluded due to study design (not RCT), data collection time points (not all studies assessed participants post

operatively) and study population (not all participants underwent ACLR); the remaining articles were deemed to meet the inclusion criteria and were included. The total number of RCTs included was thirty.

Characteristics of the included studies

The thirty RCTs included a control group with some articles including a pre surgery rehabilitation protocol and an experimental interventional group. 20 studies implemented single leg hop test, Knee Injury and Osteoarthritis Outcome Score (KOOS) and International Knee Documentation Committee (IKDC) scales as outcome measures. Other commonly used outcome measures included Visual

Analogue Scale (VAS), Lower Extremity Functional Scale (LEFS), Lynsholm -Tegner score. All the studies included varied pre- and post-operative outcome measures assessed at variable time points throughout the study duration. A single study⁽²²⁾ was found to utilise a psychological outcome measure.

Pre-operative Protocols

Most of the studies (75%) did not specify whether the rehabilitation was conducted before the reconstruction. The RCTs that conducted pre-operative rehabilitation^(9,27) mentioned that standard exercise therapy protocol was implemented. Pre-operative protocols differed across all studies with variable number of sessions conducted before surgery.

Outcome measures

The outcome measures used in all the studies are listed in the Table 2. On average, the duration of time from ACL injury to ACL reconstruction followed by rehabilitation was unique to every study. Out of the thirty RCTs analysed for this review, 43.3% reported successful International Knee Documentary Committee Score (IKDC) outcomes; which was the most reported outcome. Muscle strength was evaluated for knee flexor-extensors, quadriceps, and hamstring along with muscle torques which was significantly improved post intervention in 30% of the studies. Patient reported outcomes used were Tegner-Lynsholm Knee Score, quality of life assessment and mental component scores in 30% of the studies out of which 5 studies reported improvement

Table 2: Assessment Methods Used

Assessment Methods	Number of Studies
Clinical Outcome Measures:	
IKDC Score	13
KOOS Score	7
KT-1000 Arthrometer	2
Tegner/ Tegner-Lynsholm Score	6
QoL scales	3
Functional Tests:	
Single leg hop test for distance	8
6 min walk test	1
VAS	3
Others:	17

DISCUSSION

Summary of main findings

The purpose of this systematic review of Level II randomized controlled trials was to determine the published rehabilitation and return to sport guidelines (subjective and objective) following ACL reconstruction. The current evidence^(9,27) supports the use of pre and post-surgery rehabilitation, which reports successful outcomes in athletes. The number of sessions varied from 5 to 8 and were completed over varying time frames. The exercise interventions were predominantly completed with supervision

either face to face or as telerehabilitation. While the interventions were given for a longer duration, it is observed that it is not the sole determinant of positive return to sport outcomes seen. Extensive rehabilitation followed by return to sport training along with 6-months, 12 months follow-ups are necessary for a holistic intervention for effective results. Despite the information published in the medical literature, no conclusive guidelines exist to permit complete and safe return to sport. Return to sport following ACL reconstruction is dependent on several

different patient, knee, and ligament-specific variables. Validated, reliable, and responsive subjective and clinical outcome scores were reported in the studies included in this review. However, the ability to return to sport is broadly and variably defined based on the preinjury competitive level played, the goals of the patient postinjury, and the post-ACL reconstruction level of sport achieved. The rehabilitation of an athlete requires extensive post operative intervention; though it was achieved in few of these studies^(2,5,8,12,17), the outcomes of these RCTs remained insignificant. The study showed that less than 40% of patients were able to return to competitive sport, despite 90% of patients having normal or nearly normal knee function using validated outcome scores. The current study highlighted that a significant need exists to better define the outcome of return to sport following ACL reconstruction. This is represented in the fact that only 7^(5,9,11,14,17,23,29) (23%) studies reported whether patients were able to successfully return to sport. In efforts to achieve return to sport as quickly as possible, the surgical results may be compromised, putting the graft and knee at risk. Thus, several physiotherapists have lengthened the time of rehabilitation prior to return to sport and individualized permission to return to sport based on objective findings.

Recent Advances

Two RCTs in this review have given newer interventions like virtual reality and whole-body vibration as their experimental interventions. Karinna Sonálya Aires da Costa (2019) assessed the electromyographic activity of vastus medialis and vastus lateralis muscles in 44 men post ACL reconstruction. The whole-body rehabilitation protocol did not yield any significant improvement after intergroup analysis. Karakoc ZB (2019) combined exercise therapy sessions with Nintendo Wii balance games to the experimental group while accelerated rehabilitation program was given to control group in four phases. The results of this

study indicated that adding Nintendo Wii to the protocol did not provide any additional benefit in terms of pain, centre of gravity, and balance parameters.

Clinical Implications

Further research is necessary to determine the decision of return to sport and whether risk of reinjury is decreased in patients who undergo extensive training post-surgery because patients. This is because functional outcome immediately after ACL reconstruction is not likely to improve with time alone. These results, however, are relatively limited due to study design, population, outcome measures and setting of the studies included. The studies have emphasised the importance of evaluating post operative progression against objective and time-based criterion; a return to sport decision based on time alone is considered insufficient.

As time is an important factor it is necessary to customise the protocol according to the athlete and newer advances play a key role in this. Hence, this review has concluded some of these advances to be useful for this purpose. The clinical implications of these studies will lead to better outcomes in the athlete cohort and help to maintain the overall health of the athlete. Further studies need to be done in this aspect which will lead to further advancements in this field. Meta-analysis was unable to be performed due to heterogeneity of the studies included. Therefore, results are interpreted accordingly.

Limitations & Future Scope

This review included a small number of RCTs and all of which had level 2 evidence. Out of 30 studies only 2 had recent advancements such as virtual reality and whole body vibration as experimental interventions. 93% of the studies focused on exercise therapy as primary intervention combined with its experimental intervention which led to the results being insignificant in 50% of these studies. In future studies, a review of all recent advancements with a higher level of evidence as well as a greater number of studies can be conducted in order

to have a better perspective of the clinical implications of these strategies as interventions for athletes. Two studies^(3,23) have reported contradictory results after using cross-education as intervention in their respective studies.

CONCLUSION

The studies included in this review show satisfactory intervention results. Despite this most of the studies do not comment on pre-operative rehabilitation and its effects on return to sport. There is a need for further research to be conducted that will state a conclusive pre and post-operative rehabilitation programs along with psychological factors taken into consideration, to help the biopsychosocial outcomes in an athlete.

Declaration by Authors

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