ASPETAR CLINICAL PRACTICE GUIDELINE

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INTRODUCTION

A clinical practice guideline is a systematically developed statement or set of recommendations to assist practitioner and patient decisions about appropriate health care for specific clinical circumstances[1]. They are informed by a systematic review of evidence, and an assessment of the benefits and harms of alternative care options. Clinical guidelines are typically based on the best available evidence from scientific research and expert consensus, and they aim to assist healthcare professionals in delivering high-quality, evidence-based care. The potential benefits of guidelines are only as good as the quality of the guidelines themselves. Clinical guidelines should follow a sound, transparent methodology to translate the best available evidence into clinical practice, ultimately leading to improved patient outcomes.

In the world of anterior cruciate ligament (ACL) injuries, refining rehabilitation approaches plays a pivotal role in achieving success. However, there is substantial heterogeneity in the ACL rehabilitation protocols available online and in the scientific literature[2,3]. Moreover, there is little agreement on progression criteria and the key performance metrics during rehabilitation or the key criteria that should be met before return to sport[4,5].

Up until 2021, there were six guidelines on treatment after ACL reconstruction (ACLR). A recent systematic review summarised the recommendations and appraised the quality of these clinical practice guidelines[6]. This review underscored the need for substantial improvements in three critical domains: stakeholder involvement, the rigor of development, and applicability[6]. For ACL rehabilitation, the most recent guideline, issued by the American Physical Therapy Association (APTA)[7], dates back to 2017. Since then, a substantial body of research emerged, shedding new light on post-ACLR rehabilitation practices. This expansion in the literature indicated a pressing need to revisit and revise the existing guidelines. Recognizing the shortcomings in these areas, our primary objective was to create a set of recommendations that would not only address these deficiencies but also set a new standard, particularly for the methodological development.

The Aspetar clinical practice guideline[8] was intended to provide up-to-date and easy to implement recommendations of evidence-based best practice to clinicians who oversee patients undergoing ACLR. These recommendations are summarizing the highest quality of evidence available, including interventions that were not explored in previous guidelines such as exercise initiation, eccentric and plyometric training, and cross-education training, and proposing return to activities criteria where evidence is insufficient.

The goal was to evaluate the effectiveness of different rehabilitation components and translate these findings into actionable guidance that could positively shape clinical practice and ultimately the futures of our athletes.

OVERVIEW

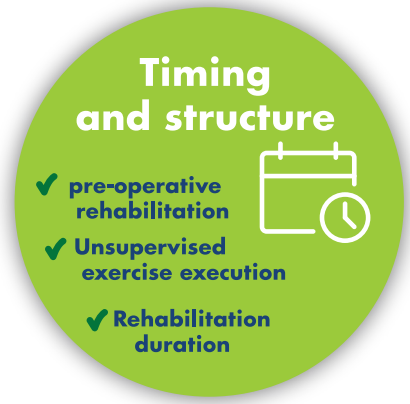
The Aspetar clinical practice guideline presents 26 recommendations, supported by the inclusion of data from 140 randomized controlled trials involving 5231 ACL injury patients, along with insights from 6 systematic reviews. All outcomes extracted from the included studies were assessed and reported in the supplementary file of the paper. Due to the extensive list of outcomes we opted to report those deemed clinically important in the results section for better understanding and interpretation of the evidence findings. A summary of these recommendations is provided in Figure 1.

Figure 1: Summary of the recommendations for rehabilitation after anterior cruciate ligament reconstruction.

It's important to note that the evidence for almost all outcomes in all rehabilitation interventions post-ACLR is of a very low level of certainty. According to the GRADE Handbook, users of guidelines may sometimes find themselves frustrated due to the absence of clear guidance when the guideline panel encounters low confidence in effect estimates or closely balanced consequences. However, GRADE encourages panels to confront this discomfort and make recommendations, recognizing that clinicians may not dive deeply into the evidence or contemplate trade-offs to the same extent as a guideline panel[9]. As the US Preventative Services Task Force highlights, decision makers cannot afford to wait for absolute evidence, and clinicians must still offer guidance, patients must make choices, and policymakers must establish policies[10]. To bridge the gap between limited evidence and applicability of the results, a further step was taken to assess the level of agreement of the recommendations among a group of experts, whom actively rehabilitate more than 200 patients on a weekly basis.

Timing and structure of rehabilitation

One of the most common questions from ACL patients is, 'How long will rehabilitation take?'. Research suggests that return to sport should be delayed until 9 months post-surgery, as this significantly reduces reinjury rates by 51% for each month delayed[11]. Based on the findings of the Aspetar guideline, a shorter rehabilitation protocol showed no differences on knee laxity or other outcomes compared to a longer duration protocol. However, the duration of the rehabilitation protocol is individualized and depends on the readiness of the patient to return to the pre-injury level of activity. The progression between phases is criteria-based, taking into consideration the minimum time for graft healing.



Evidence regarding preoperative rehabilitation is limited, yet the potential benefit for the patient in terms of pre-surgery education and restoration of the knee's clinical condition should be highlighted. There is no consensus on the optimal preoperative rehabilitation program in terms of length and frequency, and the ideal preoperative knee status is not established. However, minimal swelling, full knee extension, and good quadriceps activation all being achieved before surgery may facilitate knee recovery in the early post-operative phase.

Nine studies were conducted to evaluate the efficacy of unsupervised (home) rehabilitation programs in comparison to supervised ones. The findings revealed no differences in terms of laxity or other associated outcomes. However, it's important to note that all patients in the

home rehabilitation group received a certain level of oversight from physiotherapists. As a result, we cannot confidently endorse the adoption of a home exercise program without any form of physiotherapy supervision. It is imperative that they do so with some degree of supervision to monitor progress, be prescribed individualised programs, and address any potential issues that may arise, such as slow progress or other complications.

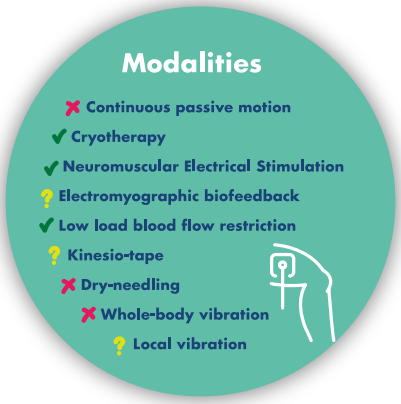
Exercise initiation

Exercise therapy should be the cornerstone of ACLR rehabilitation. It is well established that exercise therapy should be initiated as soon as possible (considering the surgeon's instructions if concomitant injuries are present). For patients with an isolated ACL injury, early range of motion (ROM) exercises, unrestricted weight-bearing, and isometric quadriceps exercises can be initiated immediately after surgery without compromising the knee laxity. Minimising immobilisation is crucial. Immobilisation does not provide pain relief as previously believed and may even contribute to muscle atrophy, thereby impeding the recovery process. Leg press and quadriceps eccentric strengthening may be initiated at 3 weeks after surgery without compromising graft integrity.

One hot topic in ACLR rehabilitation has been the influence of open kinetic chain exercises on outcomes like laxity and quadriceps strength. There were no differences in terms of laxity, strength, pain, range of motion, knee function, functional activities and balance when starting open kinetic chain exercises early at 4 weeks or later at 12 weeks in the rehabilitation protocol. However, it's essential to monitor knee pain and adjust the loading accordingly. It is important to approach each patient's post-ACL surgery rehabilitation individually, considering their specific circumstances and clinical presentation. The decision to start rehabilitation exercises at every phase of their journey should be based on clinical reasoning.

Modalities

While exercise therapy should be the foundation of ACLR rehabilitation, some modalities have proven effective in reducing pain and muscle atrophy. Cryotherapy and neuromuscular electrical stimulation are well-supported modalities that can be safely applied early in rehabilitation. Low-load blood flow restriction training (BFR) was included in this guideline due to the growing interest in its use in rehabilitation, particularly after ACLR, where it has demonstrated benefits in quadriceps and hamstrings strength in the early phase when patients are unable to sustain high knee joint loads.



We were unable to provide a recommendation for the use of electromyographic biofeedback due to the limited and low level of evidence available (only 2 studies and small sample sizes). However, in clinical practice it can be particularly useful in the early phase of rehabilitation to recover active end range of knee extension by improving quadriceps activation. Continuous passive motion has no additional benefit in the rehabilitation protocol after ACLR. We do not recommend the use of vastus medialis dry needling or whole body vibration in the very early phase due to reported complications.

Strength and motor control training

Strength training is an essential component of post-ACLR rehabilitation, yet it remains relatively under-researched compared to other areas included in the guideline. A combination of open and closed kinetic chain exercises have been shown to improve quadriceps strength and function without compromising knee stability. However, open kinetic chain exercises may sometimes induce increased anterior knee pain, necessitating regular monitoring. Patients can perceive an open kinetic chain program as more effective than a closed kinetic chain program. In terms of contraction mode, both eccentric and concentric training are effective in improving quadriceps and hamstrings strength and isotonic and isokinetic training combined produce better results than each intervention used in isolation. Although evidence starts to provide some clarity on the exercise mode to be applied, key exercise descriptors such as specific loads and load progression are poorly described in studies evaluating ACLR rehabilitation.

Strength and motor control training should be combined in the rehabilitation protocol, and one cannot replace the other. While the term "neuromuscular training" is commonly used in the ACL literature to describe components like balance, proprioception, agility, and plyometric training, it's worth noting that all types of training involve nerve and muscle action. In this guideline the term 'motor control' replaces 'neuromuscular training' to better differentiate it from strength training.

Plyometric and agility training is often neglected in rehabilitation, which may lead to significant deficits at the end phase, directly impacting the athlete's performance.

Cross-education training, characterized by increased motor output in one limb through contralateral limb training, is a

focus in ACLR rehabilitation, primarily for strength interlimb transfer. While cross-education training may have positive effects in neurological injuries, the evidence for ACLR rehabilitation remains conflicting. Implementing appropriate strength training for the operated leg not only eliminates the need for cross-education training but also serves as a preventative measure against the development of ongoing asymmetries which are common landmarks for progression and return to sport.

Return to activities

There is a considerable gap in the literature considering major milestones in ACL rehabilitation such as return to running and return to sports.

For driving, the key outcome is brake response time, which typically returns to normal values at approximately 2 to 3 weeks after left side ACLR and 4 to 6 weeks after right side ACLR. For manual transmission cars, a minimum of 4-6 weeks before driving is required regardless of the side of surgery.

Return to running is an important milestone in ACL rehabilitation with recommendations based on a combination of time, clinical and functional criteria. Most studies propose a minimum time of 12 weeks, but variations exist with suggestions of 8 to 16 weeks[12]. There is no conclusive evidence regarding the safety of returning to running at or before 12 weeks in terms of new injuries or exacerbating existing ones. The current guidelines emphasize the importance of mastering controlled jumping before resuming running, as running involves repetitive single-leg reactive jumps.

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There are four systematic reviews and meta analyses investigating any association between passing a battery of tests and the occurrence of a new ACL injury[13-16]. The results are contradictory, and it remains unclear whether passing a battery of tests will reduce the rates of a new ACL injury.

We propose minimum criteria for a professional athlete to be cleared from the clinical setting and start training with their club, where they should then gradually return to full participation. These criteria should be individualized according to their previous activity level. The objective is to restore athletes to their pre-injury state by addressing deficits typically present in the late stages of rehabilitation. This includes restoring clinical outcomes, subjective knee function, and psychological readiness. Athletes need to undergo a comprehensive, sport-specific training program, rebuilding strength not only in the quadriceps and hamstrings but also in all lower limb muscles. We need to restore jumping, change of direction, running and landing mechanics. Rehabilitation after an ACL injury is an ongoing process; it doesn't end when patients leave the clinic. Gradual exposure to different environments and situations is essential before returning to their pre-injury level.

CONCLUSION

The Aspetar guideline on rehabilitation following ACL surgery is grounded in the best available evidence. While some level of uncertainty persists in many aspects of ACLR rehabilitation, it is noteworthy that our expert clinicians in the field largely align with these recommendations. This comprehensive dataset can serve as a solid foundation for developing well-informed care pathways for individuals undergoing ACLR. Moreover, these guidelines shed light on emerging trends and innovations that hold promise for enhancing the future of ACL rehabilitation. As we continue to bridge the gap between science and practice, we take another step closer to optimizing the recovery journey for all ACLR patients.

References

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