

Editorial

The Role of Physiotherapy in Anterior Cruciate Ligament Injury and Reconstruction

Iliopoulos Efthymios MD¹, Galanis Nikiforos MD PhD^{1*}

¹*Division of Sports Medicine, Department of Orthopaedics, Papageorgiou General Hospital, Medical School, Aristotle University of Thessaloniki, Greece.*

**Corresponding author: Dr. Galanis Nikiforos, Division of Sports Medicine, Department of Orthopaedics, Papageorgiou General Hospital, Medical School, Aristotle University of Thessaloniki, Greece, Email: kyros@med.auth.gr*

Received: 08-16-2015

Accepted: 08-22-2015

Published: 09-05-2015

Copyright: © 2015 Galanis

Introduction

The anterior cruciate ligament (ACL) rupture has become a very common injury and it is usually sports related. The incidence of this injury has an increasing tendency, as people tend to engage more with sporting activities; in the USA the incidence recently was from 100.000 to 200.000 per year [1]. There are three timing stages where physiotherapy has a very important role to this injury. The first stage is before the injury and the strategies we are adopting in order to avoid a potential ACL injury. The second stage is after the injury and how we end up deciding an operative or conservative management for the patient. The third stage is the rehabilitation protocol after the ACL reconstruction surgery. In all of these stages the physiotherapist has the primary role in the patient's treatment.

Pre-injury prevention strategies

It has been reported that preventive neuromuscular training leads to a reduced relative risk of ACL injuries [2]. Especially strengthening and proximal control exercises seem to reduce the relative risk of an ACL injury in female athletes. The effect of plyometric exercises seems to have positive in preventing the ACL injury but not statistically significant [3].

Physiotherapy for ACL deficient patients

Physiotherapy has a very significant role after a knee injury which involves the ACL ligament. It is very important to begin as soon as the inflammation has subsided passive range of motion exercises of the knee and weight bearing as tolerated [4limitation of complete extension, delay in strength recovery, anterior knee pain]. Prevention of muscle atrophy is important as well. A balanced quadriceps-hamstrings coactivation ratio exercises, such as single-limb leg-lift, lateral and transverse hop-to-balance exercises can be proven beneficial for the ACL deficient patients. Lunge exercises can help for quadriceps strengthening [5]. A good hamstrings control is linked with high incidence of successful avoidance of surgery after an ACL rupture [6]. The use of knee brace has been proposed to reduce patients' instability feeling, but there are reports that could interfere with the day-to-day activities [7]. It is recently reported the weight-bearing closed chain exercises for ACL deficient patients should be preferred from the open chain exercises, as they are [8].

Patients who have high demands such as professional players engaging with sports which include pivoting movements and patients with other major knee injuries (pathology in the other ligaments, menisci tears or cartilage injuries) will be treated operatively with an ACL reconstruction. For the rest of them the conservative management is the initial option, which includes an intense physiotherapy protocol with the aim to return to the pre-injury activities without instability symptoms. This program lasts at least 6 weeks and consists from muscle strengthening exercises, cardiovascular endurance training and sport-specific and agility exercises such as quick start and stops, cutting and pivoting. At the end of the program the patients who achieve to return to their pre-injury activity level without symptoms are identified as 'copers', the rest of them are candidates for operative treatment and identified as 'non-copers' [9,10] thereby ultimately resulting in knee instability and dysfunction. However, ACL rupture does not automatically infer functional impairment and instability as confirmed by the ACL deficient (ACLD). Although 'copers' have normal activity levels and they manage to overcome their deficiency without functional problems, their walking economy remain impaired comparing to the healthy baseline. This fact could lead us to treat them operatively as well, when the energy cost is important for the patient [11].

Postoperative rehabilitation

The main aim of the physiotherapy after the ACL reconstruction is for the athlete to return to his pre-injury activity levels at the sixth month. Although the operation restores the stability of the knee joint, the physiotherapist has to confront many problems during this period. The initial pain and swelling after the operation has to be addressed. The range of motion of the knee joint as well as the muscle strength and the proprioception has to be restored. Cardiovascular fitness and endurance levels are important as well and have to be maintained in high levels. The patient has also to overcome his kinesiophobia before returning to sporting activities. Numerous rehabilitation protocols have been developed in order to achieve this goal. The main objective of all of them is to achieve the earliest maximum level of strengthening and loading without provoking an ACL re-injury [12].

One of the first goals of the postoperative rehabilitation is to regain full range of motion of the knee joint. It is proven that full ROM lead to better functional outcomes [13] and decrease the risk of arthrofibrosis [14]. Nevertheless the role of the aggressive approach of the restoration of ROM remains controversy [15]. Muscle strengthening and the prevention of muscle atrophy are very important for the postoperative rehabilitation, neuromuscular electrical stimulation combined with voluntary muscle contraction can lead to the desirable results [16]. Proprioception training has high correlation with better results after the surgery [17], despite the fact that muscle strengthening has been proven to be more beneficial [18]. Evi-

dence is still limited for the role of perturbation and vibratory training, but it is unlikely to be harmful for the patients and could provide small benefits for them [19]. The postoperative use of the knee brace has been proven by numerous studies that is not adding anything to the rehabilitation after an ACL reconstruction [19,20] of MEDLINE, AMED, EMBASE, EBM reviews, PEDro, Scopus, and Web of Science to identify systematic reviews of ACL rehabilitation. Two reviewers independently selected the studies, extracted data, and applied quality criteria. Study quality was assessed using PRISMA and a best evidence synthesis was performed. Five systematic reviews were included assessing eight rehabilitation components. There was strong evidence (consistent evidence from multiple high quality randomised controlled trials (RCTs)). Despite that fact, the use of brace may be beneficial for the early postoperative period (1-2 weeks) in order to give time to the patients to regain their confidence [12]. An early start of closed chain exercises has been proven to be beneficial and safe as well [21] it does not appear that clinicians should completely abandon more traditional OKC exercises and replace them with CKC exercises in postoperative ACL reconstruction rehabilitation programs. Both types of exercise apparently can be modified to minimize (1. A later start (at 6th postoperative week) of open chain exercises is also recommended [22].

Conclusion

In conclusion we can state that physiotherapy is the most important part of the patient's management and treatment. Physiotherapy has significant impact on prevention of ACL injury and a leading part on pre- and post- ACL reconstruction management. Main aims are to restore the full ROM of the knee and to restore muscle strength and proprioception. These aims have to be achieved by performing easy and safe exercises and by avoiding shear forces of the knee, in order to prevent re-injury.

References

1. Siegel L, Vandenakker-Albanese C, Siegel D. Anterior cruciate ligament injuries: anatomy, physiology, biomechanics, and management. *Clin J Sport Med.* 2012, 22(4): 349-355.
2. Myer GD, Sugimoto D, Thomas S, Hewett TE. The Influence of Age on the Effectiveness of Neuromuscular Training to Reduce Anterior Cruciate Ligament Injury in Female Athletes A Meta-Analysis. *Am J Sports Med.* 2013, 41(1): 203-215.
3. Sugimoto D, Myer GD, Foss KDB, Hewett TE. Specific exercise effects of preventive neuromuscular training intervention on anterior cruciate ligament injury risk reduction in young females: meta-analysis and subgroup analysis. *Br J Sports Med.* 2015, 49(5): 282-289.
4. Shelbourne KD, Nitz P. Accelerated rehabilitation after an-

- terior cruciate ligament reconstruction. *Am J Sports Med.* 1990,18(3): 292–299.
5. Begalle RL, DiStefano LJ, Blackburn T, Padua DA. Quadriceps and hamstrings coactivation during common therapeutic exercises. *J Athl Train.* 2012, 47(4): 396–405.
6. Walla DJ, Albright JP, McAuley E, Martin RK, Eldridge V et al. Hamstring control and the unstable anterior cruciate ligament-deficient knee. *Am J Sports Med.* 1985, 13(1): 34–9.
7. Swirtun LR, Jansson A, Renström P. The effects of a functional knee brace during early treatment of patients with a non-operated acute anterior cruciate ligament tear: a prospective randomized study. *Clin J Sport Med.* 2005, 15(5): 299–304.
8. Norouzi S, Esfandiarpour F, Shakourirad A, Salehi R, Akbar M et al. Rehabilitation after ACL injury: a fluoroscopic study on the effects of type of exercise on the knee sagittal plane arthrokinematics. *Biomed Res Int.* 2013.
9. Fitzgerald GK, Axe M, Snyder-mackler L. Proposed practice guidelines for non operative anterior cruciate ligament rehabilitation of physically active individuals. *J Orthop Sport Phys Ther.* 2000, 30(4):194–203.
10. Herrington L, Fowler E. A systematic literature review to investigate if we identify those patients who can cope with anterior cruciate ligament deficiency. *Knee.* 2006,13(4): 260–265.
11. Iliopoulos E, Galanis N, Iosifidis M, Zafeiridis A, Papadopoulos P et al. Anterior cruciate ligament deficiency reduces walking economy in “copers” and “non-copers.” *Knee Surgery, Sport Traumatol Arthrosc. Springer;* 2015.
12. Saka T. Principles of postoperative anterior cruciate ligament rehabilitation. *World J Orthop.* 2014, 5(4): 450–459.
13. Shelbourne KD, Gray T. Minimum 10-year results after anterior cruciate ligament reconstruction: how the loss of normal knee motion compounds other factors related to the development of osteoarthritis after surgery. *Am J Sports Med.* 2009, 37(3): 471–480.
14. Mayr HO, Weig TG, Plitz W. Arthrofibrosis following ACL reconstruction--reasons and outcome. *Arch Orthop Trauma Surg.* 2004, 124(8): 518–522.
15. Christensen JC, Goldfine LR, West HS. The effects of early aggressive rehabilitation on outcomes after anterior cruciate ligament reconstruction using autologous hamstring tendon: a randomized clinical trial. *J Sport Rehabil.* 2013, 22(3): 191–201.
16. Wright RW, Preston E, Fleming BC, Amendola A, Andrich JT et al. A systematic review of anterior cruciate ligament reconstruction rehabilitation: part II: open versus closed kinetic chain exercises, neuromuscular electrical stimulation, accelerated rehabilitation, and miscellaneous topics. *J Knee Surg.* 2008, 21(3): 225–234.
17. Dubljanin-Raspopović E, Matanović D, Kadija M. Influence of proprioceptive training in the improvement of neuromuscular performance after ACL reconstruction. *Srp Arh Celok Lek.* 2005, 133(9-10): 429–432.
18. Cooper RL, Taylor NF, Feller JA. A randomised controlled trial of proprioceptive and balance training after surgical reconstruction of the anterior cruciate ligament. *Res Sport Med.* 2005, 13(3): 217–230.
19. Kruse LM, Gray B, Wright RW. Rehabilitation after anterior cruciate ligament reconstruction: a systematic review. *J Bone Jt Surg Am.* 2012, 94(19): 1737–1748.
20. Lobb R, Tumilty S, Claydon LS. A review of systematic reviews on anterior cruciate ligament reconstruction rehabilitation. *Phys Ther Sport.* 2012, 13(4): 270–278.
21. Fitzgerald GK. Open versus closed kinetic chain exercise: issues in rehabilitation after anterior cruciate ligament reconstructive surgery. *Phys Ther.* 1997, 77(12): 1747–1754.
22. Glass R, Waddell J, Hoogenboom B. The Effects of Open versus Closed Kinetic Chain Exercises on Patients with ACL Deficient or Reconstructed Knees: A Systematic Review. *N Am J Sports Phys Ther.* 2010, 5(2): 74–84.