

The Impact of Preoperative and Postoperative Physical Therapy on the Success of Anterior Cruciate Ligament (ACL) Reconstruction Surgery Using Hamstring Autograft

Abstract

Introduction: Anterior cruciate ligament (ACL) rupture compromises knee stability and increases the risk of meniscal injury and degenerative joint disease. ACL reconstruction is among the most common orthopedic surgeries. This study aimed to evaluate the impact of preoperative and postoperative physical therapy on the success of ACL reconstruction using hamstring autograft based on the eight parameters of the Lysholm Knee Scoring Scale (LKSS).

Methods: This descriptive-analytical study included 140 patients who underwent ACL reconstruction using hamstring autograft from 2019 to 2023. The correlation between the number of preoperative and postoperative physical therapy sessions and the timing of postoperative physical therapy initiation with the LKSS score one year after surgery was analyzed using SPSS software version 22.

Results: The study included 112 men and 28 women. There was no significant correlation between LKSS scores and the number of preoperative and postoperative physical therapy sessions, although patients with 1 to 10 preoperative sessions and those with fewer than 10 postoperative sessions scored higher on the LKSS. Additionally, patients who began physical therapy in the first week post-surgery had better outcomes.

Conclusion: While the number of preoperative and postoperative physical therapy sessions did not significantly impact ACL reconstruction outcomes, patients who received preoperative physical therapy or began postoperative physical therapy earlier had better outcomes.

Keywords: Lysholm knee score, Physical Therapy Modalities, Hamstring Tendons, Autografts, Anterior Cruciate Ligament.

Accepted: 10 days before printing

Davood Mashreghi, MD¹, Mohammad Fakoor, MD¹, Payam Mohammadhoseini MD¹

1. Department of Orthopedics, Ahvaz Jundishapur University of Medical Sciences, Ahvaz, Iran.

Corresponding Author:
Mohammad Fakoor
Email Address:
Dr_m_fakoor@hotmail.com

Introduction

The anterior cruciate ligament (ACL) of the knee is part of the neuromuscular system that contributes to the emergence or modification of motor responses necessary to maintain dynamic stability of the knee and coordination of the lower extremities⁽¹⁻⁵⁾. The ACL is often involved in knee injuries, with most knee injuries affecting the anterior cruciate ligament⁽⁶⁾. Due to this, most recent studies on the knee have focused on the ACL, with treatments for its tears including conservative treatments and surgery⁽⁷⁾. Conservative treatment involves avoiding activities that cause knee instability and is based on long-term and intensive physical therapy and lifestyle changes. However, even the use of functional knee braces may not prevent reinjury if returning to intense activities⁽⁸⁾.

Recent studies have shown that in ACL reconstruction with a four-layer hamstring graft, fixing the graft in the tibia with an absorbable interference screw is an appropriate method of fixation and can provide sufficient initial stability^(9,10). The most common mechanism of ACL tear is knee external rotation with valgus stress. The tear may occur at the attachment site of the ligament to the distal femur, proximal tibia, or mid-portion⁽¹¹⁾. Sports that involve jumping and running increase the risk of ACL injury, and the likelihood of injury is higher in the middle part of the ligament. Additionally, female athletes are more prone to ACL tears, with an increased risk associated with higher levels of estrogen^(12,13).

Methodology

This descriptive-analytical study was conducted on patients who underwent ACL reconstruction surgery with hamstring autograft following ACL tears at Imam Khomeini and Arvand Hospitals in Ahvaz. A total of 140 eligible individuals were selected based on inclusion and exclusion criteria, and after providing informed written consent, they participated in the study. The study was approved by the Research Council and received an ethics code from the Ethics Committee of Jundishapur University of Medical Sciences in Ahvaz.

Inclusion criteria included obtaining written consent from the patient before the study and a minimum of six months since the surgery. Exclusion criteria included bilateral ACL injuries, simultaneous multiple ligament injuries, severe joint destruction due to osteoarthritis or any other destructive factor, any previous surgeries on the studied knee, any fractures in or around the knee, injury to other ligaments of the same knee, incomplete study data, and patients who required revision surgery.

Preoperative assessment and examination of these patients were conducted by a surgeon, and clinical tests were performed under local or general anesthesia before the ACL reconstruction surgery. Data from pre- and postoperative records were extracted, including the number of physical therapy sessions before and after surgery and the start time of postoperative physical therapy. The level of rehabilitation after ACL reconstruction was evaluated using the Lysholm Knee Scoring Scale (LKSS) one year after the surgery. All surgeries were performed by the same surgeon using the same method. Postoperative knee joint movements were allowed up to 90 degrees from the first day, with isometric quadriceps strengthening starting on the

first day and hamstring muscle strengthening beginning two weeks later. Patients wore a knee brace during walking exercises and walked with crutches. Physical therapy started in the second week, and by the fourth week, full range of motion exercises were performed. Weight-bearing was limited to partial in the first month, starting at 30% of body weight and gradually increasing to full weight-bearing over four weeks.

Results

The study included 112 men and 28 women with a mean age of 36.4 years. As shown in Table 1, 87 patients did not undergo any preoperative physical therapy (mean LKSS score: 82.07), 34 patients had 1-10 sessions (mean LKSS score: 83.06), and 19 patients had more than 11 sessions (mean LKSS score: 77.63). Although the correlation between LKSS score and the number of preoperative physical therapy sessions was not statistically significant (P-value = 0.26), patients with 1-10 sessions had higher scores.

Based on Table 2, 26 patients underwent between 0-10 physiotherapy sessions after anterior cruciate ligament (ACL) reconstruction surgery, with an average Lysholm Knee Scoring Scale (LKSS) score of 83.46. Additionally, 84 patients had between 11-30 sessions (with an average score of 80.48), and 30 patients had more than 30 sessions (with an average score of 81). As observed, there is no statistically significant correlation between the LKSS score and the number of physiotherapy sessions post-surgery (P-value = 0.36). Interestingly, the LKSS score is higher among those who had 0-10 sessions compared to those who had 11-30 sessions or more than 30 sessions.

According to Table 3, 11 patients began their

Table 1. Correlation of Lysholm Knee Scoring Scale (LKSS) Scores with the Number of Preoperative Physical Therapy Sessions

Variable	Number of Preoperative Physical Therapy Sessions	Number of Patients	Mean	Standard Deviation	p-value
LKSS* Score One Year Post-Surgery	No sessions	87	82.07	12.17	0.26
	1-10 sessions	34	83.06	10.92	
	More than 11 sessions	19	77.63	13.27	

physiotherapy in the first week after ACL reconstruction surgery, with an average Lysholm Knee Scoring Scale (LKSS) score of 86.45. Fifty patients started in the second week (with an average score of 82), and 79 patients began after the second week (with an average score of 80.86). As shown, there is no statistically significant correlation between the LKSS score and the timing of starting physiotherapy after surgery (P-value = 0.34). However, those who initiated physiotherapy earlier tend to have higher LKSS scores.

Discussion

This study aimed to evaluate the impact of pre- and post-operative physiotherapy on recovery outcomes following anterior cruciate ligament (ACL) reconstruction using hamstring autograft, based on eight LKSS parameters one year after surgery. No significant correlation was found between the number of pre-operative physiotherapy sessions, the number of post-operative physiotherapy sessions, or the timing of starting post-operative physiotherapy with the LKSS score. However, patients who had 1 to 10 pre-operative physiotherapy sessions and those who had fewer than 10 post-operative sessions (compared to those

who did not receive physiotherapy or had more than 10 sessions) had higher LKSS scores. Additionally, patients who began physiotherapy in the first week post-surgery showed considerably better results.

In a 2023 study by Simonsson et al. on post-operative ACL repair (ACLR) physiotherapy centers, clinics were divided into two groups: low-volume clinics (fewer than 100 ACLR patients) and high-volume clinics (more than 100 ACLR patients). Among the 115 centers examined, 111 were low-volume and 4 were high-volume. There was no significant difference in secondary ACL injuries between the two clinic types after ACLR rehabilitation⁽¹⁴⁾.

Dauty et al., in a 2024 study involving 470 patients who underwent ACL reconstruction with hamstring autograft, found that 148 patients were still undergoing physiotherapy even 4 months after the surgery (average of 49±14 sessions). 211 patients completed their physiotherapy within 3 months (average of 33±9 sessions). No correlation was found between the number of post-operative physiotherapy sessions and the Lysholm Knee Scoring Scale score, which aligns with the results of our study⁽¹⁵⁾.

Additionally, a 2018 study by Łyp M et al. involving 30 patients with an average age of 34 years who sustained ACL injuries due to trauma, found that all

Table 2. Relationship between Lysholm Knee Scoring Scale (LKSS) Score and the Number of Physiotherapy Sessions Post-Surgery

Variable	Number of Physiotherapy Sessions Post-Surgery	Number of Patients	Mean	Standard Deviation	p-value
LKSS* Score One Year Post-Surgery	0-10 sessions	26	83.46	10.98	0.36
	11-30 sessions	84	80.48	12.64	
	More than 30 sessions	30	81	15.51	

Table 2. Relationship between Lysholm Knee Scoring Scale (LKSS) Score and the Number of Physiotherapy Sessions Post-Surgery

Variable	Timing of Starting Physiotherapy Post-Surgery	Number of Patients	Mean	Standard Deviation	p-value
LKSS Score One Year Post-Surgery	0-7 days	11	86.45	16.08	0.34
	8-14 days	50	82.00	9.48	
	More than 14 days	79	80.86	12.88	

patients underwent ACL reconstruction surgery between 120-180 days post-injury. Rehabilitation outcomes were evaluated using the Lysholm Knee Scoring Scale and IKDC2000 criteria. Łyp M's study indicated that early initiation of rehabilitation post-surgery had a greater impact than early surgery itself, underscoring the importance of early post-operative rehabilitation. This study's results were different from ours⁽¹⁶⁾.

Limitations and issues in this study include the lack of a control group, not accounting for the inherent laxity of the joint, a limited sample size, and variations in physiotherapy practices across different clinics. In addition, reasons for continuing physiotherapy beyond 30 sessions after ACL reconstruction include restricted range of motion and persistent pain.

Conclusion

Although the number of pre- and post-operative physiotherapy sessions does not have a clear impact on ACL reconstruction outcomes with hamstring autograft, patients who underwent pre-operative physiotherapy and those who started their post-operative physiotherapy as early as possible achieved significantly better results compared to those who did not have pre-operative physiotherapy or those who started physiotherapy later.

References

- Gillquist J, Messner K. Anterior cruciate ligament reconstruction and the long-term incidence of gonarthrosis. *Sports Med.* 1999;27(3):143-56. doi: 10.2165/00007256-199927030-00001. PubMed PMID: 10222538.
- Boden BP, Dean GS, Feagin JA Jr, Garrett WE Jr. Mechanisms of anterior cruciate ligament injury. *Orthopedics.* 2000;23(6):573-8. doi: 10.3928/0147-7447-20000601-15. PubMed PMID: 10875418.
- Duthon VB, Barea C, Abrassart S, Fasel JH, Fritschy D, Ménétrey J. Anatomy of the anterior cruciate ligament. *Knee Surg Sports Traumatol Arthrosc.* 2006 Mar;14(3):204-13. doi: 10.1007/s00167-005-0679-9. Epub 2005. PubMed PMID: 16235056.
- Panagopoulos A, Billis E, Floros GR, Stavropoulos T, Kaparounaki E, Moucho M, et al. Cross-Cultural Adaptation of the Greek Versions of the Lysholm Knee Scoring Scale and Tegner Activity Scale. *Cureus.* 2020;12(7):e9372. doi: 10.7759/cureus.9372. PubMed PMID: 32850240; PMCID: PMC7444989.
- Wagner KJ 3rd, Sabatino MJ, Zynda AJ, Gans CV, Chung JS, Miller SM, et al. Activity Measures in Pediatric Athletes: A Comparison of the Hospital for Special Surgery Pediatric Functional Activity Brief Scale and Tegner Activity Level Scale. *Am J Sports Med.* 2020;48(4):985-990. doi: 10.1177/0363546520904009. PubMed PMID: 32167838.
- Kapoor B, Clement DJ, Kirkley A, Maffulli N. Current practice in the management of anterior cruciate ligament injuries in the United Kingdom. *Br J Sports Med.* 2004;38(5):542-4. doi: 10.1136/bjism.2002.002568. PubMed PMID: 15388535; PMCID: PMC1724936.
- Magnussen RA, Lawrence JT, West RL, Toth AP, Taylor DC, Garrett WE. Graft size and patient age are predictors of early revision after anterior cruciate ligament reconstruction with hamstring autograft. *Arthroscopy.* 2012;28(4):526-31. doi: 10.1016/j.arthro.2011.11.024. Epub 2012. PubMed PMID: 22305299.
- Corry IS, Webb JM, Clingeffer AJ, Pinczewski LA. Arthroscopic reconstruction of the anterior cruciate ligament. A comparison of patellar tendon autograft and four-strand hamstring tendon autograft. *Am J Sports Med.* 1999;27(4):444-54. doi: 10.1177/03635465990270040701. PubMed PMID: 10424213.
- Nelson C, Rajan L, Day J, Hinton R, Bodendorfer BM. Postoperative Rehabilitation of Anterior Cruciate Ligament Reconstruction: A Systematic Review. *Sports Med Arthrosc Rev.* 2021;29(2):63-80. doi: 10.1097/JSA.0000000000000314. PubMed PMID: 33972483.
- Vutescu ES, Orman S, Garcia-Lopez E, Lau J, Gage A, Cruz AI Jr. Psychological and Social Components of Recovery Following Anterior Cruciate Ligament Reconstruction in Young Athletes: A Narrative Review. *Int J Environ Res Public Health.* 2021;18(17):9267. doi: 10.3390/ijerph18179267. PubMed PMID: 34501857; PMCID: PMC8430793.
- Fu FH, Bennett CH, Ma CB, Menetrey J, Lattermann C. Current trends in anterior cruciate ligament reconstruction. Part II. Operative procedures and clinical correlations. *Am J Sports Med.* 2000;28(1):124-30. doi: 10.1177/03635465000280010801. PubMed PMID: 10653557.
- Paschos NK, Howell SM. Anterior cruciate ligament reconstruction: principles of treatment. *EFORT Open Rev.* 2017;1(11):398-408. doi: 10.1302/2058-5241.1.160032. PubMed PMID: 28461919; PMCID: PMC5367541.
- Fakoor, M., Sadoni, H., Mohammad Hosseini, P., Bastan, S. Statistical Relationship Between Clinical and Functional Findings Based on the Lysholm Standard Score on the Success Rate of ACL Arthroscopic Reconstruction Surgery. *Iranian Journal of Orthopedic Surgery,* 2020; 18(3): 83-88. doi: 10.22034/ijos.2020.121419
- Simonsson R, Högberg J, Lindskog J, Piussi R, Sundberg A, Sansone M, et al. A comparison between physical therapy clinics with high and low rehabilitation volumes of patients with ACL reconstruction. *J Orthop Surg Res.* 2023;18(1):842. doi: 10.1186/s13018-023-04304-4. PubMed PMID: 37936163; PMCID: PMC10629052.
- Dauty M, Le Mercier E, Menu P, Grondin J, Hirardot T, Daley P, et al. Prolonged Physiotherapy after Anterior Cruciate Ligament Reconstruction Does Not Improve Muscular Strength and Function. *Journal of Clinical Medicine.* 2024; 13(9):2519. doi:10.3390/jcm13092519.
- Łyp M, Stanisławska I, Witek B, Majerowska M, Czarny-Działak M, Włostowska E. The Timing of Rehabilitation Commencement After Reconstruction of the Anterior Cruciate Ligament. *Adv Exp Med Biol.* 2018;1096:53-7. doi: 10.1007/5584_2018_210. PubMed PMID: 29737496.