Journal of Population Therapeutics & Clinical Pharmacology

RESEARCH ARTICLE
DOI: 10.53555/mss1mc67

SYMMTERICALITY OF LIMBS AFTER ACL RECONSTRUCTION

Dr. Mohit Dua[1*], Dr. Pramod Kumar[2], Dr. Shorya[3], Dr. Monika Dahiya[4]

[1*]Associate Professor, Department of Sports Medicine, Pt. B.D.Sharma PGIMS, Rohtak)
[2] Senior Resident, Department of Sports Medicine, SIC, Safdarjung Hospital and VMMC, NewDelhi)
[3]Junior Resident, Department of Sports Medicine , Pt. B.D.Sharma PGIMS, Rohtak)Delhi)
[4]Assistant Professor, Department of Ophthalmology, Pt. B.D.Sharma PGIMS, Rohtak)

***Corresponding Author:** Dr. Mohit Dua
[*]Associate Professor, Department of Sports Medicine, Pt. B.D.Sharma PGIMS, Rohtak)

Received date: 05-July-2025 **Accepted date:** 12-July-2025 **Published date:** 20-July-2025

Introduction

The knee joint is the largest and most complicated joint in the human body.[1] Primary knee stabilization is achieved through knee ligaments, while muscles around the knee play a secondary role.[2]The Anterior Cruciate Ligament (ACL) is an intra-articular but extra synovial collagenous structure with limited healing capacity.[3] ACL originates at the tibial plateau, anterior to and between the intercondylar eminences and continuous posteriorly to attach to the posterior middle portion of the lateral femoral condyle.[4] ACL can be divided into two functional and anatomic separate bundles: the antero-medial (AM) and the postero-lateral (PL) bundle.[5] Several mechanoreceptors such as Ruffini endings, Pacinian corpuscles, and Golgi tendon organs are present in the ACL.[6]

The role of the ACL in resisting internal tibial torque is partly due to the mechanical coupling of anterior tibial translation with this axial torque.[7]Sportsmen frequently suffer from the crippling anterior cruciate ligament (ACL) injury. Both indirect as well as direct approaches may lead to it.[8] The several forms of tears include proximal avulsion (distal remaining length >90% of the overall ligament length; type I), proximal (75%-90%); mid-substance (25%-75%); distal (10%-25%; type IV); and distal avulsion (>10%; type V).[9] For further analysis, an MRI may be performed.[10]
Over 75% of participants undergoing ACL reconstruction within the first year of injury, include majority of subjects under the age of eighteen.[11]. According to Webster and Feller, 84% of patients expect to be able to resume their pre-injury level of athletic activity, but just 24% of them had done so twelve months following surgery, and 15% of all patients had already made the decision to give up sports completely.[12]

After ACL reconstruction these individuals require long term rehabilitation to improve physical function and return to the sports they participated in before the ACL injury. Accelerated rehabilitation program has been evident in decreasing disability, depression, and pain, increasing functionality and improved quality of life.[14] For patients undergoing ACL repair, identifying specific pre-injury, pre-surgery, and post-operative characteristics may predict return to pre-injury sports.[13]

Material and Method

Study Period

October 2022- September 2023

Study Subjects

Sports persons undergoing ACL reconstruction

Sampling Criteria

Inclusion Criteria

1. Subjects in the age group of 18-30 years were included in the study.
2. Subjects with evidence of ACL tear on MRI.
3. Subjects who have undergone ACL reconstruction surgery.

Exclusion Criteria

1. Revised ACL Reconstruction.
2. Subject who is not willing to participate in study.
3. Any complication in which accelerated rehabilitation program is contraindicated.

Reliability of Single Hop test

The ICCs ranged from .82 to .93 and can be described as indicating excellent relative reliability. The single hop test and overall limb symmetry index scores demonstrated the highest relative reliability. The SEM was lowest for the single hop test and overall limb symmetry index scores, suggesting that these measures also demonstrated the highest absolute reliability. The error in an individual's limb symmetry index scores at one point in time and the minimal detectable changes upon reassessment, both at the 90% confidence level. Standard errors of measurement were 3.04% to 5.59%. Minimal detectable changes, at the 90% confidence level, were 7.05% to 12.96%. Changes in hop test scores on the operative limb were statistically greater than changes on the non-operative limb. Pearson correlations (r) between change in hop performances and self-reported measures ranged from .26 to .58.[15]

Limb symmetry index: - For SH testing, participants were asked to hop as far as they could on the contralateral limb first. There was a tape measure on the floor, and the hop distance was read from the starting line to the front tip of their shoes in centimeters. If subjects failed to stick the landing, those jumps were not counted.

Results

Mean values of LSI at 0 week, 4 weeks, 12 weeks and 24 weeks. The mean values of LSI in participants at 0 week, after 4 weeks, after 12 weeks and after 24 weeks was 21.232, 42.7, 64.41 and 76.123 respectively.

Mean values of LSI (%) at 0 week, 4 weeks, 12 weeks and 24 weeks in participants LSI	Mean ± SD	95% confidence interval for mean [LB, UB]
0 week	21.24 ± 9.65	[16.96, 25.51]
4 weeks	42.47 ± 10.69	[37.73, 47.21]
12 weeks	64.41 ± 9.71	[60.10, 68.72]
24 weeks	76.12 ± 5.52	[73.674, 78.57]

Comparison of LSI (%) using repeated measures of ANOVA LSI	Sum of squares	df	Mean square	F-ratio	p-value
Within group	38935.61	2.47	15748.02	288.26	.000**

There was statistically significant difference in LSI at 0 week, 4 weeks, 12 weeks and 24 weeks. Therefore, we can conclude that the results for the ANOVA indicate a significant time effect of ACL rehabilitation on LSI.

Discussion

The mean values of LSI (%) in participants at 0 week, after 4 weeks, after 12 weeks and after 24 weeks was 21.232, 42.7, 64.41 and 76.123 respectively. In the current study, limb symmetry index was investigated using hop test. Statistically significant differences were observed ($p<0.05$). This study is consistent with the study of Eric Rohman et al. who investigated changes in involved and uninvolved limb function during rehabilitation after anterior cruciate ligament reconstruction. Results indicated that LSI significantly improved in 4 tests, all of which had initial LSI below 90%, and showed involved limb improvement that was significant. They concluded that during ACL reconstruction rehabilitation, LSI improvements indicated absolute increases in involved limb ability and were not attributable to uninvolved limb deterioration.43 Comparison of hop scores over the 4 test occasions indicated that substantial motor learning took place on both the operative and nonoperative limbs from the first to second test occasions, which tended to level off by the third test occasion. There were substantial increases in hop scores on the fourth test occasion on the operative limb, suggesting that the functional status of the operative limb improved over the 6-week period. Limb symmetry index values provide important measures of performance on the operative limb in relation to the nonoperative limb.[15]

This early effect is due to the motor learning acquired during the testing itself and that the later LSI increases represent true improvement in the involved limb.

Conclusion

There was significant correlation between LSI score and return to sport.

Keywords ACL, LSI, Sports

References

1. Gualco M. Rehabilitation after anterior cruciate ligament reconstruction. Charles university. 2019;1-80.
2. Sakr M. Case study of physiotherapy treatment of a patient after anterior cruciate ligament reconstruction. 2021;1-85.
3. Sepulveda F, Sanchez L, Amy E, Micheo W. Anterior cruciate ligament injury: return to play, function and long-term considerations. Curr. Sports Med. Rep.2017;16(3):172-78.
4. Morales-Avalos R, Torres-Gonzalez EM, Padilla-Medina JR, Monllau JC. ACL anatomy: Is there still something to learn? Elsevier.2023:1-6.
5. Markatos K, Kaseta MK, Lallos SN, Korres DS, Efstathopoulos N. The anatomy of the ACL and its importance in ACL reconstruction. Eur J Orthop Surg Traumatol 2013; 23:747–52.
6. Silva F, Riberio F, Oliveira J. Effect of an accelerated ACL rehabilitation protocol on knee proprioception and muscle strength after anterior cruciate ligament reconstruction. Arch Exerc Health Dis. 2012;3(2):139-44.
7. Beaulieu ML, Ashton-Miller JA, Wojtys EM. Loading mechanisms of the anterior cruciate ligament. Sports Biomech.2023;22(1):1-29.
8. Montalvo AM, Schneider DK, Webster KE, Yut L, Galloway MT, Heidt RS, et.al. Anterior cruciate ligament injury risk in sport: a systematic review and meta-analysis of injury incidence by sex and sport classification. J. Athl. Train. 2019;54(5):472–82.
9. Van der list JP, Mintz DN, Difelice GS. The location of anterior cruciate ligament tears. OJSM.2017;5(6).1-9.
10. Yadav S, Singh S. Analysis of partial bundle anterior cruciate ligament tears- diagnosis and management with ACL augmentation. JCOT.2019;1-5

11. Sanders TL, Kremers HM, Bryan AJ, Larson DR, Dahm DL, Levy BA, et.al. Incidence of anterior cruciate ligament tears and reconstruction. AJSM.2016;44(6):1502-07.
12. Muller B, Yabroudi MA, Lynch A, Popchak AJ, Lai CL, Dijk CN, et.al. Return to pre-injury sports after anterior cruciate ligament reconstruction is predicted by five independent factors. SPRINGER.2021; 30(1):84-92.
13. Aizawa J, Hirohata K, Ohji S, Ohmi T, Mitomo S, Koga H, et.al. Cross-sectional study on relationships between physical function and psychological readiness to return to sport after anterior cruciate ligament reconstruction. BMC Sports Sci. Med. Rehabil.2022;14(1):1-11.
14. Waldron K, Brown M, Calderon A, Feldman M. Anterior cruciate ligament rehabilitation and return to sport: How fast is too fast? Sports Med. and Rehab. 2022;4(1):175-79.
15. Reid A, Birmingham TB, Stratford PW, Alcock GK, Giffin JR. Hop Testing Provides a Reliable and Valid Outcome Measure During Rehabilitation After Anterior Cruciate Ligament Reconstruction. J. Phys. Ther. 2007; 87(3):337-49.