

Comparative Analysis of Functional Outcomes and Donor Site Morbidity in ACL Reconstruction: Peroneus Longus Tendon versus Hamstring Tendon Autografts

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Abstract:

Introduction: Anterior cruciate ligament (ACL) reconstruction commonly employs hamstring tendon autografts, but alternative sources like the peroneus longus tendon have gained attention. This study aimed to compare functional outcomes and donor site morbidity between peroneus longus and hamstring autografts for ACL reconstruction.

Methodology: Forty patients underwent ACL reconstruction using peroneus longus tendon autografts, while another 40 received hamstring tendon autografts. Preoperative, postoperative, and follow-up assessments included International Knee Documentation Committee (IKDC) and Lysholm scores, graft diameter measurements, knee stability evaluations, and ankle range of motion assessments.

Results: Functional scores (IKDC and Lysholm) showed substantial improvements postoperatively in both groups, with no significant differences between preoperative scores. Graft diameter differed significantly, with the peroneus longus tendon exhibiting a larger diameter. Knee stability, laxity, and ankle range of motion demonstrated no significant differences between the two groups.

Conclusion: Despite variations in graft diameter, both peroneus longus and hamstring tendon autografts yielded comparable functional outcomes and knee stability post-ACL reconstruction. Ankle range of motion remained unaffected following peroneus longus tendon harvesting. These findings suggest the viability of peroneus longus tendon as an alternative autograft choice for ACL reconstruction.

Keywords: ACL Reconstruction, Peroneus Longus Tendon, Hamstring Tendon, Functional Outcomes, Graft Diameter, Knee Stability, Ankle Range Of Motion.

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Introduction

Anterior Cruciate Ligament Reconstruction (ACLR) remains a crucial intervention for active individuals, especially in India, where sports participation and physical activity are increasingly prevalent among the younger population.[1] The choice of autograft for ACLR is pivotal, impacting both functional outcomes and potential donor site morbidity.

In India, where diverse patient demographics and lifestyle factors influence treatment decisions, the quest for an optimal autograft for ACLR gains paramount significance.[2] While hamstring tendon autografts have been widely employed, studies

comparing their outcomes with the lesser-explored peroneus longus tendon autografts in the Indian context are notably sparse.[3] This study aims to bridge this gap by conducting a comparative analysis focused on functional outcomes and donor site morbidity between peroneus longus and hamstring autografts in ACLR within the Indian populace.

The prevalence of ACL injuries among Indian athletes and physically active individuals warrants an in-depth exploration of graft options that ensure not only favorable postoperative knee functionality but also mitigate potential complications at the

donor site. [2,4,5] By investigating the efficacy of peroneus longus tendon autografts, this research strives to offer valuable insights into an alternative graft option that could potentially align with the specific needs and realities of patients within the Indian healthcare landscape. Moreover, within the Indian scenario, considerations encompassing postoperative recovery, rehabilitation protocols, and the ability to return to physically demanding activities, deeply rooted in cultural and occupational contexts, must be addressed comprehensively.

This study's findings have the potential to significantly impact the clinical decision-making process for orthopedic surgeons in India, aiding them in tailoring ACLR procedures to optimize patient outcomes while considering the specific demands and lifestyle factors prevalent in the Indian population.

Methodology

This prospective comparative study involved 80 participants who underwent ACL reconstruction at our institution between 2017 and 2019. Patients were divided into two groups: Group A (n=40) received quadrupled hamstring tendon autografts, and Group B (n=40) underwent ACL reconstruction using peroneus longus tendon autografts. All surgeries were performed by the same senior knee surgeon. Participants aged 18–50 years with diagnosed ACL ruptures were included. Exclusion criteria comprised concomitant chondral

lesions greater than grade III, previous knee surgery, revision cases, joint hypermobility syndrome, and ankle joint problems. ACLR was performed under spinal or general anesthesia. Diagnostic arthroscopy preceded graft harvesting. For Group B, peroneus longus tendon autografts were harvested with a 2 cm longitudinal skin incision at the posterolateral side of the fibula. In Group A, hamstring tendons were harvested through a 3 cm oblique skin incision over the anteromedial aspect of the proximal tibia. Patients were followed up for a minimum of 2 years (range 24-31 months). Functional outcomes were assessed using the International Knee Documentation Committee (IKDC), Lysholm score, and knee range of motion (ROM) preoperatively and at the 2-year follow-up. Graft harvesting problems were evaluated by measuring thigh circumference and assessing the conditions of the ankle donor site using the American Orthopedic Foot and Ankle Score (AOFAS), Foot & Ankle Disability Index (FADI) Score, and ankle ROM. Descriptive statistics, including range, mean, and standard deviation, were used. An Independent T-Test compared quantitative variables between groups. Normal distribution was confirmed using Q-Q Plots and the Shapiro-Wilk test. Statistical significance was set at $p < 0.05$ using SPSS software. The study protocol received approval from the Ethics Committee, and informed consent was obtained from all participants.

Results

Table 1: comparative analysis was conducted between patients receiving ACL reconstruction

	Peroneus Longus Tendon	Hamstring Tendon
Gender (m/f)	(35 / 5)	(38 / 2)
Age (years)	28.5 ± 6.8 (18-45)	26.9 ± 7.5 (20-48)
BMI (kg/cm ²)	25.9 ± 3.5	27.5 ± 2.3
Follow-up (months)	25.8 ± 2.1	32.1 ± 3.9

A comparative analysis was conducted between patients receiving ACL reconstruction using either the peroneus longus tendon or hamstring tendon autografts. The study encompassed demographic information for the two groups. The peroneus longus tendon group consisted of 35 males and 5 females, with an average age of 28.5 years (range: 18 to 45) and a mean BMI of 25.9 kg/cm². The follow-up duration for this group was 25.8 months ± 2.1. In comparison, the hamstring tendon group

comprised 38 males and 2 females, exhibiting a slightly younger average age of 26.9 years (range: 20 to 48) and a slightly higher mean BMI of 27.5 kg/cm². The follow-up period for this cohort was notably longer at 32.1 months ± 3.9.

These demographic data outline the distribution of gender, age range, body mass index (BMI), and follow-up duration for both groups undergoing ACL reconstruction with different tendon autografts.

Table 2: ACL injuries and associated injuries in patients undergoing ACL reconstruction

	Peroneus Longus Tendon	Hamstring Tendon
Isolated ACL injury	25	30
Associated injuries		
Medial meniscus tear (repair)	18	25
Meniscus tear (Partial meniscectomy)	6	4
Lateral meniscus tear repair	1	1

The study investigated ACL injuries and associated injuries in patients undergoing ACL reconstruction with either the peroneus longus tendon or hamstring tendon autografts. In the peroneus longus tendon group, 25 patients presented with isolated ACL injuries, while 18 cases involved a medial meniscus tear requiring repair, 6 cases necessitated partial meniscectomy due to meniscus

tear, and 1 case involved repair of a lateral meniscus tear. In comparison, the hamstring tendon group exhibited a higher count of isolated ACL injuries with 30 patients. Associated injuries in this group included 25 cases of medial meniscus tears repaired, 4 cases of meniscus tears managed through partial meniscectomy, and 1 case requiring repair for a lateral meniscus tear.

Table 3: Comparison of the diameter of grafts utilized in ACL reconstruction surgeries

	Peroneus Longus Tendon	Hamstring Tendon	P-value
Graft Diameter (mm)	8.5 ± 0.3 (range 8-9)	7.8 ± 0.5 (range 6.8-8.2)	<0.001

The study compared the diameter of grafts utilized in ACL reconstruction surgeries between patients receiving the peroneus longus tendon and hamstring tendon autografts.

The average graft diameter for the peroneus longus tendon group was 8.5 millimeters with a slight variation of ±0.3, ranging between 8 and 9 millimeters. In contrast, the hamstring tendon group had an average graft diameter of 7.8

millimeters with a slightly wider range of ±0.5, varying between 6.8 and 8.2 millimeters. A statistically significant difference in graft diameter between the two groups was observed, denoted by a P-value of less than 0.001.

These findings highlight a notable disparity in graft sizes used for ACL reconstruction procedures when employing peroneus longus tendon versus hamstring tendon autografts.

Table 4: functional outcomes using the International Knee Documentation Committee (IKDC) and Lysholm scores in patients undergoing ACL reconstruction

	Peroneus Longus Tendon	Hamstring Tendon	P-value
IKDC			
Preoperative	55.7 ± 2.8	53.9 ± 7.6	0.136 (n.s)
Last follow-up	93.2 ± 8.7	94.1 ± 5.9	0.334 (n.s)
Score change (percent)	37.5 (67)	40.2 (74)	<0.001
Lysholm			
Preoperative	63.8 ± 10.6	61.5 ± 9.1	0.255 (n.s)
Last follow-up	94.7 ± 6.4	95.3 ± 9.1	0.697 (n.s)
Score change (percent)	30.9 (48)	33.8 (55)	<0.001

The study evaluated functional outcomes using the International Knee Documentation Committee (IKDC) and Lysholm scores in patients undergoing ACL reconstruction with either the peroneus longus tendon or hamstring tendon autografts.

Preoperatively, patients in the peroneus longus tendon group had an average IKDC score of 55.7 ± 2.8, while those in the hamstring tendon group averaged 53.9 ± 7.6, showing a non-significant difference (p = 0.136). At the last follow-up, the respective IKDC scores were 93.2 ± 8.7 and 94.1 ± 5.9, with no statistically significant difference between groups (p = 0.334).

The score change percentage, indicating improvement postoperatively, was notable in both groups. The peroneus longus tendon group showed a 37.5% (67) improvement in IKDC score, while the hamstring tendon group exhibited a 40.2% (74)

improvement, with a statistically significant difference observed between the groups (p < 0.001). Similarly, in terms of the Lysholm scores, preoperative values for the peroneus longus and hamstring tendon groups were 63.8 ± 10.6 and 61.5 ± 9.1, respectively, displaying a non-significant difference (p = 0.255). At the last follow-up, scores were 94.7 ± 6.4 and 95.3 ± 9.1, respectively, with no significant difference observed between groups (p = 0.697). The percentage change in Lysholm scores demonstrated substantial improvement, with the peroneus longus group showing a 30.9% (48) increase and the hamstring tendon group showing a 33.8% (55) increase, revealing a significant difference between the groups (p < 0.001). These findings underscore comparable functional improvements post-ACLR between the two tendon autografts despite slight variations in preoperative scores.

Table 5: Comparison of postoperative knee stability outcomes

	Hamstring Tendon	Peroneus Longus Tendon
Stable	34	36
Mild to moderate laxity	2	1
Re-tear	4	2

Comparison of postoperative knee stability outcomes between patients receiving ACL reconstruction with hamstring tendon and peroneus longus tendon autografts revealed noteworthy findings. The hamstring tendon group displayed 34 cases with stable knee conditions, while the peroneus longus tendon group exhibited 36 cases

classified as stable post-surgery. Instances of mild to moderate laxity were observed in 2 cases in the hamstring tendon group and 1 case in the peroneus longus tendon group. Furthermore, re-tear of the reconstructed ACL was identified in 4 cases in the hamstring tendon group and 2 cases in the peroneus longus tendon group.

Table 6: Assessment of ankle range of motion in individuals who underwent ACL reconstruction

Motion (degree)	Peroneus Longus Harvested	Contralateral Side	P-value
Dorsiflexion	21.0 ± 7.0	21.5 ± 5.5	0.691
Plantarflexion	36.5 ± 6.5	37.0 ± 2.5	0.543
Inversion	31.0 ± 4.0	30.0 ± 5.0	0.384
Eversion	25.0 ± 9.0	26.0 ± 4.0	0.462

The investigation focused on assessing ankle range of motion in individuals who underwent ACL reconstruction using the peroneus longus tendon. Comparisons between the degrees of motion in the harvested peroneus longus tendon side and the contralateral side revealed no statistically significant differences. Dorsiflexion recorded an average motion of 21.0 degrees ± 7.0 on the harvested side and 21.5 degrees ± 5.5 on the contralateral side ($p = 0.691$). Similarly, plantarflexion demonstrated averages of 36.5 degrees ± 6.5 and 37.0 degrees ± 2.5, respectively, with no significant difference observed ($p = 0.543$).

Regarding inversion, the harvested peroneus longus tendon side exhibited an average motion of 31.0 degrees ± 4.0 compared to 30.0 degrees ± 5.0 on the contralateral side, showcasing no statistically significant difference ($p = 0.384$). Additionally, eversion showcased an average motion of 25.0 degrees ± 9.0 on the harvested side and 26.0 degrees ± 4.0 on the contralateral side, indicating no substantial variance between the two ($p = 0.462$).

Discussion

The present study sought to compare outcomes following ACL reconstruction utilizing peroneus longus tendon autografts against hamstring tendon autografts. The findings revealed several noteworthy observations that offer insights into the functional outcomes and anatomical considerations post-surgery.

Functional assessments using the IKDC and Lysholm scores indicated comparable postoperative improvements in both groups. Despite initial non-significant differences in preoperative scores between the peroneus longus and hamstring tendon groups, the percentage increase in scores post-surgery was substantial and statistically significant. This aligns with previous literature emphasizing the effectiveness of both grafts in achieving functional improvement post-ACL reconstruction. [6–8]

Graft diameter comparisons unveiled a significant difference between the two graft types. The peroneus longus tendon exhibited a larger diameter compared to hamstring tendons, which might correlate with differences in postoperative knee stability and functional outcomes. [9,10] However, this discrepancy in graft size didn't manifest as significant differences in knee laxity or stability between the groups, corroborating the multifactorial nature of knee stability beyond graft diameter.

Assessment of ankle range of motion demonstrated no significant differences between the harvested peroneus longus tendon side and the contralateral side. These findings align with studies suggesting that peroneus longus tendon harvesting for ACL reconstruction minimally impacts ankle function postoperatively. [11–13]

The study's strengths include a comparative analysis of functional outcomes, graft characteristics, and ankle motion between two commonly used autografts. However, limitations, such as the retrospective design and relatively short-term follow-up, warrant cautious interpretation of the findings. Further long-term studies are needed to comprehensively evaluate the durability and potential complications associated with peroneus longus tendon use in ACL reconstruction.

In conclusion, while graft diameter differed significantly between peroneus longus and hamstring tendons, functional outcomes and knee stability showed comparable improvements post-ACL reconstruction. Ankle range of motion remained unaffected following peroneus longus tendon harvesting. These findings suggest the viability of peroneus longus tendon as an alternative graft choice for ACL reconstruction, offering promising outcomes comparable to conventional graft sources.

Conclusion

In this comparative study evaluating ACL reconstruction outcomes using peroneus longus tendon versus hamstring tendon autografts, several significant insights emerged. While graft diameter differed notably between the two autograft sources, functional outcomes assessed through IKDC and Lysholm scores displayed comparable and substantial postoperative improvements in both groups. Despite variations in graft diameter, knee stability and laxity demonstrated no significant differences between the peroneus longus and hamstring tendon groups, suggesting that other factors beyond graft size may contribute to postoperative knee function.

Moreover, the assessment of ankle range of motion revealed no substantial differences between the peroneus longus tendon-harvested side and the contralateral side, affirming minimal impact on ankle function post-peroneus longus tendon harvesting for ACL reconstruction.

The findings of this study support the viability of the peroneus longus tendon as a promising alternative autograft source for ACL reconstruction, offering comparable functional outcomes and knee stability to the widely used hamstring tendon grafts.

However, while this study provides valuable insights, limitations such as the retrospective design and relatively short-term follow-up suggest the need for further prospective studies with longer-term evaluations to confirm the durability and potential complications associated with peroneus longus tendon use in ACL reconstruction.

In conclusion, the results indicate that the peroneus longus tendon demonstrates promise as an effective autograft option for ACL reconstruction, warranting consideration as a feasible alternative to traditional graft sources based on its favorable functional outcomes and comparable knee stability.

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