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Original Research Article

A Comparative Study on Functional Outcome of Peroneus Longus Autograft versus Hamstring Autograft in Arthroscopic Anterior Cruciate Ligament Reconstruction

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Abstract:

Background: Anterior cruciate ligament (ACL) reconstruction can be performed using various autografts, with hamstring tendon and peroneus longus tendon being commonly used options.

Aim and Objective: To compare functional outcomes and donor site morbidity between these two grafts.

Materials and Methods: This prospective comparative study was conducted in a tertiary care centre in Bhopal and included 46 patients with ACL insufficiency, divided into two groups: peroneus longus (n=23) and hamstring (n=23). Patients underwent arthroscopic ACL reconstruction and were evaluated preoperatively and at 6 weeks, 3 months, and 6 months postoperatively using IKDC, Lysholm, range of motion, FADI, and AOFAS scores. Statistical analysis was performed using Stata 17.0, with $p < 0.05$ considered significant.

Results: Both groups showed significant improvement in functional outcomes over time. The peroneus longus group demonstrated significantly higher IKDC scores, range of motion, and Lysholm scores from 6 weeks onward compared to the hamstring group ($p < 0.05$). However, donor site morbidity was higher in the peroneus longus group initially, as reflected by lower FADI and AOFAS scores, but these improved over time and became comparable by 6 months ($p > 0.05$).

Conclusion: Both hamstring and peroneus longus autografts provide effective outcomes in ACL reconstruction. The peroneus longus graft shows better early functional recovery at the knee, while initial donor site morbidity is transient and resolves by 6 months. Both grafts are safe and reliable options for ACL reconstruction.

Keywords: ACL reconstruction, peroneus longus graft, hamstring graft, IKDC, Lysholm score, donor site morbidity.

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Introduction

Anterior cruciate ligament (ACL) injuries are among the most common ligamentous injuries of the knee, particularly affecting young and physically active individuals involved in pivoting sports and high-demand physical activities. The ACL plays a crucial role in maintaining knee stability by preventing anterior translation and rotational instability of the tibia. Injury to the ACL often results in pain, instability, functional impairment, and limitation of physical activity, frequently necessitating surgical reconstruction to restore knee function and allow return to pre-injury activity levels [1].

The reported annual incidence of ACL tears is approximately 68.6 per 100,000 individuals. Studies from North India have demonstrated that ACL injuries constitute the majority of sports-related knee injuries, with associated meniscal injuries being frequently observed [2, 3]. Non-contact mechanisms account for nearly 70% of ACL injuries, whereas the remaining cases are associated with direct trauma [4].

Arthroscopic ACL reconstruction is currently considered the gold standard treatment for symptomatic ACL tears. Various autograft options are available for reconstruction, including hamstring tendon autografts, bone-patellar tendon-bone grafts, quadriceps tendon grafts, and more recently, peroneus longus tendon autografts. An ideal graft should possess adequate tensile strength, allow effective biological incorporation, restore knee biomechanics, and produce minimal donor site morbidity [5, 6].

Hamstring tendon autografts, particularly semitendinosus and gracilis tendons, are widely used because of their ease of harvest, satisfactory

biomechanical strength, and relatively low donor site morbidity. However, disadvantages such as variable graft diameter, possible hamstring muscle weakness, and risk of saphenous nerve paresthesia have been reported [7, 8]. In recent years, the peroneus longus tendon has emerged as a promising alternative autograft for ACL reconstruction. Biomechanical studies have demonstrated that the peroneus longus tendon provides adequate graft diameter and tensile strength comparable to the native ACL, making it a suitable option for reconstruction [9].

Several comparative studies and meta-analyses have reported comparable functional outcomes between peroneus longus and hamstring tendon autografts in ACL reconstruction. Some studies have also suggested better preservation of thigh muscle strength in patients undergoing reconstruction with peroneus longus tendon autografts. Nevertheless, limited literature is available regarding the pattern of early postoperative recovery, progression of thigh muscle atrophy during rehabilitation, and donor site morbidity associated with these grafts during the critical early postoperative period. Additionally, detailed evaluation of ankle function and graft characteristics between the two autograft options has not been extensively investigated.

As early functional recovery and rehabilitation within the first six months after surgery are essential for successful return to daily activities and sports participation, further comparative evaluation of these graft options is warranted. Therefore, the present study was undertaken to compare the functional outcomes of peroneus longus autograft versus hamstring autograft in arthroscopic anterior cruciate ligament reconstruction.

Materials and Method

The present study was a prospective comparative study conducted in the Department of Orthopaedics at a tertiary care centre in Bhopal. A total of 46 patients fulfilling the predefined inclusion and exclusion criteria were enrolled in the study. Written informed consent was obtained from all participants prior to their inclusion in the study. Ethical clearance for the study was obtained from the Institutional Ethics Committee before commencement of the research.

Inclusion Criteria: The study included patients aged between 18 and 50 years with clinically and MRI-confirmed ACL insufficiency. Patients presenting with ACL tears, with or without associated meniscal injury, who were undergoing primary ACL reconstruction were included in the study. Only those patients who were willing to provide written informed consent for participation were considered eligible for inclusion.

Exclusion Criteria: Patients who were unwilling to participate or refused to provide consent were excluded from the study. Pregnant females and patients with ACL injuries associated with other ligamentous injuries or intra-articular fractures were also excluded. Additionally, patients with severe osteoarthritic changes detected on X-ray, asymptomatic individuals with incidental ACL injuries, and patients suffering from inflammatory knee diseases such as rheumatoid arthritis were not included in the study. Patients with systemic diseases affecting pre-anaesthetic fitness, a history of previous knee surgery, local skin infections, or bone tumours were also excluded from participation.

Data Collection Tool: Data were collected using a structured and standardized proforma developed by the principal investigator and research team to record demographic details, clinical findings, surgical details, and postoperative functional outcomes. The proforma incorporated validated scoring systems including the Lysholm Knee Scoring Scale, International Knee Documentation Committee (IKDC) score, American Orthopaedic Foot and Ankle Score (AOFAS), and Foot and Ankle Disability Index (FADI). The proforma was reviewed by senior orthopaedic surgeons, statisticians, and IEC members for content validity and was pilot tested on five patients prior to the main study.

Data Collection Procedure: After obtaining informed consent, baseline demographic and clinical details including age, sex, mechanism of injury, duration of symptoms, and functional limitations were recorded. Clinical examination included assessment of swelling, joint line tenderness, range of motion, and special tests such as Lachman test, Anterior Drawer test, and Pivot Shift test. Preoperative radiological evaluation included X-ray knee (anteroposterior and lateral views) and magnetic resonance imaging (MRI) to confirm ACL injury and assess associated meniscal or ligamentous injuries.

Preoperative functional assessment was performed using the Lysholm score, IKDC score, AOFAS, and FADI scoring systems. Participants subsequently underwent arthroscopic ACL reconstruction using either peroneus longus tendon autograft (Group A) or hamstring tendon autograft (Group B). Intraoperative details including graft type, graft diameter, tunnel placement, fixation technique, duration of surgery, and intraoperative complications were documented.

Postoperatively, patients were monitored for pain, swelling, infection, bleeding, stiffness, graft failure, and neurovascular complications. Follow-up assessments were conducted at 6 weeks, 3 months, and 6 months postoperatively. Functional outcomes were evaluated using Lysholm and IKDC scores,

while donor site morbidity in the peroneus longus group was assessed using AOFAS and FADI scores. Knee stability tests, range of motion assessment using a goniometer, and thigh circumference measurements were also recorded during follow-up visits.

Data Quality Assurance and Confidentiality: To ensure uniformity and accuracy of data collection, all assessments were performed under the supervision of senior faculty members. Regular data audits were conducted to ensure adherence to study protocols. Each participant was assigned a unique study identification number to maintain confidentiality. Paper records were stored securely in locked cabinets, and electronic data were password protected with access restricted to authorized personnel only.

Adverse Event Monitoring: Participants were monitored throughout the study period for postoperative complications including infection, graft failure, knee stiffness, reinjury, and donor site morbidity. Any adverse events were documented and managed appropriately under the supervision of the treating surgeon. Serious complications were reported to the Institutional Ethics Committee for review.

Statistical Analysis: Data were entered and analyzed using Stata software version 17.0. Descriptive statistics including mean, standard deviation, frequency, and percentage were used to summarize the data. Independent t-tests were applied for comparison of continuous variables between groups, while chi-square tests were used for categorical variables. Repeated measures ANOVA was used to assess changes in functional outcomes over time. A p-value of <0.05 was considered statistically significant.

Results

Table 1: Comparison of Baseline Demographic and Clinical Characteristics between Study Groups

Variable	Peroneus Longus (n=23)	Hamstring (n=23)
Age Group (years) (Mean ± SD)	33.70 ± 7.42	36.70 ± 6.51
Gender		
Male (n, %)	13 (56.52%)	16 (69.57%)
Female (n, %)	10 (43.48%)	7 (30.43%)
BMI Category (Mean ± SD)	26.40 ± 2.88	27.60 ± 3.44
Side		
Left (n, %)	16 (69.57%)	14 (60.87%)
Right (n, %)	7 (30.43%)	9 (39.13%)

The baseline characteristics of participants in both groups were comparable. The mean age and BMI were slightly higher in the hamstring group, while males constituted the majority in both groups. The distribution of side involvement was similar, with left-sided injuries being more common in both groups.

Table 2: Comparison of Injury Characteristics between Study Groups

Variable	Peroneus Longus (n=23) (n, %)	Hamstring (n=23) (n, %)
Time Since Injury (weeks)		
2	5 (21.74%)	4 (17.39%)
3	3 (13.04%)	8 (34.78%)
4	6 (26.09%)	4 (17.39%)
5	4 (17.39%)	4 (17.39%)
6	5 (21.74%)	3 (13.04%)
Mode of Injury		
Sports Injury	2 (8.70%)	6 (26.09%)
Road Traffic Accident	9 (39.13%)	4 (17.39%)
Fall from Height	6 (26.09%)	8 (34.78%)
Fight	6 (26.09%)	5 (21.74%)

The distribution of time since injury was comparable between both groups, with most patients presenting within 2–6 weeks. Road traffic accidents were the most common mode of injury in the peroneus longus group, whereas falls from height were more frequent in the hamstring group. Sports-related injuries were relatively higher in the hamstring group.

Table 3: Comparison of Functional Outcome Scores (IKDC, Range of Motion, and Lysholm Score) Between Study Groups

Parameter	Time	Peroneus Longus (Mean ± SD)	Hamstring (Mean ± SD)	P-value
IKDC	Baseline	42.7 ± 3.25	40.3 ± 4.13	0.12
	6 Weeks	65.7 ± 4.06	57.5 ± 4.55	0.012
	3 Months	90.7 ± 5.07	74.9 ± 5.96	<0.001
	6 Months	95.9 ± 3.40	91.4 ± 4.63	0.003
Range of Motion (°)	Baseline	76.0 ± 6.67	76.8 ± 6.47	0.84
	6 Weeks	92.6 ± 6.54	89.7 ± 6.59	0.043
	3 Months	104.0 ± 6.61	98.3 ± 6.67	0.032
	6 Months	114.0 ± 6.46	108.0 ± 6.53	0.009
Lysholm Score	Baseline	57.8 ± 5.44	55.7 ± 5.26	0.12
	6 Weeks	74.3 ± 6.53	65.1 ± 6.45	0.012
	3 Months	88.2 ± 7.42	72.7 ± 6.02	<0.001
	6 Months	93.1 ± 4.13	84.0 ± 6.88	<0.001

Both groups showed significant improvement in functional outcomes over time. The peroneus longus group demonstrated higher IKDC, range of motion, and Lysholm scores at all follow-up intervals, with statistically significant differences observed from 6 weeks onwards, indicating better functional recovery compared to the hamstring group.

Table 4: Comparison of Donor Site Morbidity Using FADI Score between Study Groups

Time	Peroneus Longus (Mean ± SD)	Hamstring (Mean ± SD)	P-value
Baseline	36.0 ± 4.12	92.8 ± 3.54	<0.001
6 Weeks	62.0 ± 5.12	92.8 ± 3.54	<0.001
3 Months	84.2 ± 5.89	93.6 ± 4.71	0.003
6 Months	89.7 ± 2.54	93.6 ± 4.71	0.089

The peroneus longus group showed significantly lower FADI scores at baseline and early follow-up, indicating higher initial donor site morbidity compared to the hamstring group. However, scores improved progressively over time, and by 6 months, the difference between the groups was not statistically significant.

Table 5: Comparison of AOFAS Scores (Ankle Function) Between Study Groups

Time	Peroneus Longus (Mean ± SD)	Hamstring (Mean ± SD)	P-value
Baseline	44.7 ± 5.67	90.3 ± 4.30	<0.001
6 Weeks	59.4 ± 5.65	90.3 ± 4.60	<0.001
3 Months	71.1 ± 7.21	90.6 ± 4.50	<0.001
6 Months	90.6 ± 7.45	91.1 ± 4.60	0.092

The peroneus longus group demonstrated significantly lower AOFAS scores at baseline and early follow-up, reflecting initial donor site morbidity. However, there was progressive improvement over time, and by 6 months, both groups showed comparable ankle function with no statistically significant difference.

Discussion

The present study demonstrates that the baseline characteristics of patients in the hamstring (HST) and peroneus longus (PL) groups were largely comparable, with only minor variations. Although the hamstring group showed slightly higher mean age and BMI, both groups were predominantly male, and left-sided involvement was more common. These findings are consistent with previous literature. Khalil et al. [10] similarly reported no significant differences between PL and HST groups in terms of age, gender distribution, or affected knee side, indicating well-matched cohorts. Ligu et al., [11] however, observed a marginally higher mean age in the PL group, though the difference was not clinically significant, and both groups remained male predominant. Overall, the comparability of baseline characteristics across studies strengthens the validity of outcome comparisons.

With respect to injury characteristics, the present study found a similar distribution of time since injury in both groups, with most patients presenting within 2–6 weeks. The mechanism of injury showed some variation, with road traffic accidents being more frequent in the PL group and falls from height more common in the HST group. Comparable heterogeneity is reported in the literature. Ligu et al.

[11] identified sports injuries as the most common cause, followed by road traffic accidents and self-falls, while Asif et al. [12] also reported road traffic accidents as the leading mechanism. In contrast, Akbar et al. [13] found sports-related injuries to predominate in both groups. Despite these variations, the pattern within individual studies remains balanced between groups, suggesting that injury mechanism is unlikely to confound outcome comparisons.

Functional outcomes in the present study revealed that the PL group demonstrated consistently higher IKDC, Lysholm scores, and range of motion across follow-up periods, with statistically significant differences emerging from as early as 6 weeks. This suggests a potential early functional advantage of the peroneus longus graft. However, findings from other studies provide a broader perspective. Khalil et al. [10] reported significant improvement in both IKDC and Lysholm scores within each group over time, but no significant differences between groups at 18 months, indicating comparable long-term outcomes. Similarly, Reddy et al. [14] observed no significant differences in functional scores between groups at 6 weeks, despite overall improvement. Taken together, these findings suggest that while the peroneus longus graft may offer earlier functional gains, both graft options yield similar outcomes over longer follow-up durations.

In the present study, the peroneus longus group demonstrated significantly lower FADI and AOFAS scores at baseline and during the early follow-up period, reflecting greater initial donor site morbidity compared to the hamstring group. However, both scores showed steady improvement over time, and by 6 months, the differences between the groups were no longer statistically significant, indicating satisfactory recovery of ankle function. In contrast, He J et al. [15] reported no significant differences in FADI scores, although AOFAS scores in the peroneus longus group remained lower at final follow-up compared to preoperative values, suggesting some residual donor site effects.

Similarly, Keyhani et al., [16] in a 2-year follow-up study of 130 patients, reported high AOFAS scores in the peroneus longus group (93.42 ± 1.7) with no significant difference compared to the hamstring group ($p > 0.05$). Collectively, these findings suggest that although peroneus longus graft harvest may be associated with early ankle morbidity, functional recovery over time is substantial, with minimal long-term differences between graft types.

Conclusion

Both peroneus longus and hamstring autografts provide effective outcomes in arthroscopic ACL reconstruction with significant functional improvement over time. The peroneus longus graft showed better early knee function (IKDC, ROM, Lysholm scores), while both groups achieved comparable results by final follow-up. Although the peroneus longus group had higher early donor site morbidity, ankle function recovered by 6 months with no significant difference between groups. Overall, both grafts are safe and effective options, with similar long-term outcomes.

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