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Original Research Article

EFFECTIVENESS OF PERONEUS LONGUS TENDON GRAFT VERSUS HAMSTRING TENDON GRAFT IN ANTERIOR CRUCIATE LIGAMENT RECONSTRUCTION: A RETROSPECTIVE COMPARATIVE STUDY

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ABSTRACT

Background: Anterior cruciate ligament (ACL) rupture represents one of the most prevalent knee injuries affecting athletes and active individuals. The selection of an appropriate graft material remains a critical determinant of successful ACL reconstruction outcomes. While hamstring tendon (HT) autografts have traditionally been utilized, peroneus longus tendon (PLT) grafts have emerged as a promising alternative with potentially favorable characteristics.
Materials and Methods: This retrospective comparative study evaluated 78 patients who underwent arthroscopic ACL reconstruction at R.L. Jalappa Hospital, Kolar, between January 2021 and December 2024. Patients were divided into two groups: Group A (n=40) received PLT grafts, while Group B (n=38) received HT grafts. Clinical outcomes were assessed using the International Knee Documentation Committee (IKDC) score, Lysholm knee score, and American Orthopaedic Foot and Ankle Society (AOFAS) ankle-hindfoot score at preoperative, 2-week, 1-month, 3-month, and 6-month postoperative intervals.
Results: Both groups demonstrated significant improvements in functional outcomes following surgery. The mean IKDC scores at 6 months were 87.42 ± 5.63 for Group A and 85.89 ± 6.21 for Group B (p=0.248). Lysholm scores reached 89.15 ± 4.82 and 87.63 ± 5.44 respectively (p=0.186). The AOFAS ankle-hindfoot score in Group A remained satisfactory at 94.28 ± 3.92 at final follow-up, indicating minimal donor-site morbidity. No significant differences were observed in knee stability assessments between groups.
Conclusion: Peroneus longus tendon graft demonstrates comparable clinical outcomes to hamstring tendon graft in ACL reconstruction, with acceptable donor-site morbidity. PLT graft represents a viable alternative, particularly when hamstring tendons are unavailable or inadequate.
Keywords: Anterior cruciate ligament reconstruction, peroneus longus tendon, hamstring tendon, autograft, knee stability, functional outcomes.

INTRODUCTION

The anterior cruciate ligament (ACL) constitutes one of the primary stabilizing structures of the knee joint, and its rupture represents the most frequently encountered ligamentous injury affecting this articulation.[1] The incidence of ACL injuries has witnessed a substantial increase globally, particularly among athletes participating in sports involving cutting, pivoting, and jumping maneuvers.[2] Epidemiological studies indicate that approximately 200,000 ACL injuries occur annually in the United

States alone, with a significant proportion requiring surgical intervention.[3]

Anatomically, the ACL originates from the posteromedial aspect of the lateral femoral condyle and inserts onto the anterior intercondylar area of the tibia. The ligament comprises two functional bundles: the anteromedial bundle, which primarily resists anterior tibial translation, and the posterolateral bundle, which provides rotational stability.[4] Disruption of the ACL results in knee instability, functional impairment, and predisposes the joint to secondary meniscal injuries and accelerated osteoarthritic degeneration.[5]

Contemporary management of ACL ruptures predominantly involves arthroscopic ligament reconstruction, which has demonstrated superior outcomes compared to conservative treatment in active individuals.[6] The selection of graft material remains a fundamental consideration in surgical planning, with autografts, allografts, and synthetic materials representing available options.[7] Among autografts, bone-patellar tendon-bone (BPTB) and hamstring tendon (semitendinosus with or without gracilis) grafts have traditionally dominated clinical practice.[8]

Hamstring tendon autografts have gained widespread acceptance due to their favorable biomechanical properties, reduced anterior knee pain compared to BPTB grafts, and satisfactory clinical outcomes.[9] However, concerns regarding hamstring weakness, particularly affecting knee flexion strength, and occasional inadequate graft diameter have prompted the exploration of alternative graft sources.[10]

The peroneus longus tendon has recently emerged as a promising alternative autograft for ACL reconstruction. Biomechanical studies have demonstrated that the peroneus longus tendon possesses adequate tensile strength and dimensions suitable for ligament reconstruction.[11] Furthermore, the functional redundancy provided by the peroneus brevis muscle in eversion and plantarflexion theoretically permits sacrifice of the longus tendon without significant functional compromise.[12]

Several recent investigations have reported encouraging outcomes following ACL reconstruction using peroneus longus tendon grafts, with comparable knee stability and functional scores to traditional graft choices.[13] However, concerns regarding potential donor-site morbidity, including ankle instability and first ray dysfunction, necessitate further investigation.[14]

Despite growing interest in peroneus longus tendon utilization, comparative studies evaluating its effectiveness against established graft options remain limited, particularly within the Indian population. This study aimed to compare the clinical and functional outcomes of arthroscopic ACL reconstruction using peroneus longus tendon graft versus hamstring tendon graft, and to evaluate the impact on ankle function following peroneus longus tendon harvest.

MATERIALS AND METHODS

Study Design and Setting: This retrospective comparative study was conducted at the Department of Orthopaedics, R.L. Jalappa Hospital, Kolar, affiliated with Sri Devaraj Urs Academy of Higher Education and Research. The study protocol received approval from the Institutional Ethics Committee prior to data collection.

Study Population and Sample Size: Medical records of all patients who underwent arthroscopic ACL reconstruction between January 2021 and December 2024 were retrospectively reviewed. A total of 78 patients meeting the inclusion criteria were enrolled and categorized into two groups based on the graft utilized: Group A (peroneus longus tendon graft, n=40) and Group B (hamstring tendon graft, n=38).

Inclusion Criteria

Patients were included if they met the following criteria: confirmed ACL rupture diagnosed clinically and by magnetic resonance imaging, age between 18 and 50 years, primary ACL reconstruction, minimum follow-up duration of 6 months, and complete medical records including preoperative and postoperative assessments.

Exclusion Criteria

Patients were excluded based on the following criteria: associated intraarticular pathology requiring additional intervention, pre-existing knee joint stiffness, multi-ligamentous injury, concomitant fractures around the knee joint, active or previous knee joint infection, revision ACL reconstruction, and incomplete follow-up or missing documentation.

Surgical Technique: All procedures were performed under spinal anesthesia with tourniquet control. Diagnostic arthroscopy was initially performed to confirm ACL rupture and assess for associated intraarticular pathology.

For Group A, the peroneus longus tendon was harvested through a 3-cm longitudinal incision posterior to the lateral malleolus. The tendon was identified, isolated, and harvested using a closed tendon stripper. The harvested tendon was prepared on a back table, with both ends whip-stitched using non-absorbable sutures.

For Group B, the hamstring tendons (semitendinosus and gracilis) were harvested through a 3-cm oblique incision over the anteromedial tibia. The tendons were identified, released from their insertions, and harvested using a tendon stripper. The grafts were prepared and quadrupled to achieve adequate diameter.

Anatomic single-bundle ACL reconstruction was performed using the transportal technique. Femoral and tibial tunnels were created at anatomic footprint locations. The graft was passed through the tunnels and fixed using suspensory fixation on the femoral side and interference screw fixation on the tibial side.

Postoperative Rehabilitation: A standardized rehabilitation protocol was implemented for all patients. Immediate postoperative care included knee immobilization in a hinged brace, isometric quadriceps exercises, and ankle pumps. Progressive range of motion exercises commenced at 2 weeks, with weight-bearing as tolerated initiated at 4 weeks. Closed kinetic chain exercises were introduced at 6 weeks, and return to sports activities was permitted after 9 months.

Outcome Assessment: Clinical outcomes were evaluated using validated scoring systems at preoperative baseline and at 2 weeks, 1 month, 3 months, and 6 months postoperatively. The International Knee Documentation Committee (IKDC) subjective knee evaluation form assessed symptoms, function, and sports activity. The Lysholm knee scoring scale evaluated knee function across eight domains including pain, instability, locking, swelling, stair climbing, squatting, limp, and support requirements. Knee stability was assessed clinically using the Lachman test and pivot shift test. For Group A patients, the American Orthopaedic Foot and Ankle Society (AOFAS) ankle-hindfoot score was utilized to evaluate donor-site function.

Statistical Analysis: Data were entered into Microsoft Excel spreadsheets and analyzed using Statistical Package for Social Sciences (SPSS) version 25.0. Continuous variables were expressed as mean ± standard deviation, while categorical variables were summarized using frequencies and percentages. Independent samples t-test was employed for comparison of continuous variables between groups. Chi-square test was utilized for categorical variable comparisons. Paired t-test assessed within-group changes over time. Statistical significance was established at $p<0.05$.

RESULTS

Demographic Characteristics: The study population comprised 78 patients with a mean age of 28.64 ± 6.82 years. The demographic and baseline characteristics of both groups are presented in Table 1. No statistically significant differences were observed between groups regarding age, gender distribution, body mass index, injury-to-surgery interval, or preoperative functional scores.

Table 1: Demographic and Baseline Characteristics of Study Population

Parameter	Group A (PLT) n=40	Group B (HT) n=38	p-value
Age (years), mean ± SD	27.85 ± 6.54	29.47 ± 7.12	0.296
Gender (Male/Female)	34/6	31/7	0.624
BMI (kg/m²), mean ± SD	24.32 ± 2.86	23.98 ± 3.14	0.612
Injury-to-surgery interval (months), mean ± SD	4.28 ± 2.15	4.56 ± 2.42	0.584
Side affected (Right/Left)	24/16	21/17	0.642
Mechanism of injury - Sports	28 (70%)	25 (65.8%)	0.684
Mechanism of injury - RTA	8 (20%)	9 (23.7%)	0.698
Mechanism of injury - Fall	4 (10%)	4 (10.5%)	0.942
Preoperative IKDC score, mean ± SD	42.56 ± 8.34	43.21 ± 7.98	0.724
Preoperative Lysholm score, mean ± SD	48.72 ± 9.16	49.34 ± 8.87	0.762
Graft diameter (mm), mean ± SD	8.24 ± 0.68	7.92 ± 0.74	0.048*

PLT: Peroneus Longus Tendon; HT: Hamstring Tendon; BMI: Body Mass Index; RTA: Road Traffic Accident; IKDC: International Knee Documentation Committee; *Statistically significant

Functional Outcomes: Both groups demonstrated progressive improvement in functional scores throughout the follow-up period. The comparative analysis of functional outcomes at various time points is presented in [Table 2].

Table 2: Comparison of Functional Outcomes Between Groups at Different Follow-up Intervals

Outcome Measure	Time Point	Group A (PLT) mean ± SD	Group B (HT) mean ± SD	p-value
IKDC Score	Preoperative	42.56 ± 8.34	43.21 ± 7.98	0.724
	2 weeks	51.24 ± 6.42	50.87 ± 6.18	0.792
	1 month	62.38 ± 5.86	61.45 ± 6.24	0.492
	3 months	76.84 ± 5.12	75.26 ± 5.68	0.194
	6 months	87.42 ± 5.63	85.89 ± 6.21	0.248
Lysholm Score	Preoperative	48.72 ± 9.16	49.34 ± 8.87	0.762
	2 weeks	54.36 ± 7.24	53.82 ± 7.56	0.746
	1 month	65.48 ± 6.32	64.26 ± 6.84	0.412
	3 months	78.92 ± 5.46	77.18 ± 5.92	0.176
	6 months	89.15 ± 4.82	87.63 ± 5.44	0.186

IKDC: International Knee Documentation Committee; PLT: Peroneus Longus Tendon; HT: Hamstring Tendon

The mean improvement in IKDC score from preoperative to 6-month follow-up was 44.86 ± 7.24 points in Group A and 42.68 ± 6.98 points in Group B (p=0.178). Similarly, the Lysholm score improvement was 40.43 ± 6.82 points and 38.29 ± 7.14 points respectively (p=0.168).

Knee Stability and Donor-Site Morbidity: Clinical assessment of knee stability and donor-site complications is summarized in Table 3. At 6-month follow-up, negative Lachman test was observed in 92.5% of Group A patients and 89.5% of Group B patients. Negative pivot shift test was documented in 90% and 86.8% respectively.

Table 3: Knee Stability Assessment and Complications at 6-Month Follow-up

Parameter	Group A (PLT) n=40	Group B (HT) n=38	p-value
Lachman Test - Negative	37 (92.5%)	34 (89.5%)	0.642
Lachman Test - Grade 1	3 (7.5%)	4 (10.5%)	0.642
Pivot Shift Test - Negative	36 (90%)	33 (86.8%)	0.662
Pivot Shift Test - Grade 1	4 (10%)	5 (13.2%)	0.662
AOFAS Ankle-Hindfoot Score	94.28 ± 3.92	N/A	-
Donor-site pain	3 (7.5%)	5 (13.2%)	0.412
Wound complications	1 (2.5%)	2 (5.3%)	0.524
Deep vein thrombosis	0 (0%)	0 (0%)	-
Graft failure	1 (2.5%)	1 (2.6%)	0.968

AOFAS: American Orthopaedic Foot and Ankle Society; PLT: Peroneus Longus Tendon; HT: Hamstring Tendon; N/A: Not Applicable

The AOFAS ankle-hindfoot score in Group A patients at 6-month follow-up was 94.28 ± 3.92, indicating excellent preservation of ankle function following peroneus longus tendon harvest. Transient donor-site pain was reported by 3 patients (7.5%) in Group A, which resolved completely by 3 months. One patient in each group experienced graft failure requiring revision surgery.

DISCUSSION

The present study demonstrates that peroneus longus tendon graft yields comparable clinical and functional outcomes to hamstring tendon graft in arthroscopic ACL reconstruction. Both groups exhibited significant improvements in IKDC and Lysholm scores, with no statistically significant differences observed at final follow-up. These findings contribute to the growing body of evidence supporting the viability of peroneus longus tendon as an alternative autograft source for ACL reconstruction.

The selection of graft material in ACL reconstruction has been extensively debated, with each option presenting distinct advantages and limitations.[15] Hamstring tendon autografts have traditionally been favored due to their favorable biomechanical properties and reduced anterior knee pain compared to bone-patellar tendon-bone grafts.[16] However, the potential for inadequate graft diameter, particularly in female patients, and concerns regarding persistent hamstring weakness have prompted the exploration of alternative graft sources.[17,18]

One notable observation in the present study was the significantly greater graft diameter achieved with peroneus longus tendon (8.24 ± 0.68 mm) compared to hamstring tendon (7.92 ± 0.74 mm). This finding holds clinical significance, as graft diameter has been identified as an independent predictor of reconstruction success.[9] Adequate graft diameter ensures sufficient mechanical strength and may reduce the risk of graft failure and subsequent revision surgery.

The preservation of ankle function following peroneus longus tendon harvest represents a critical consideration for this graft option. In our study, the mean AOFAS ankle-hindfoot score at 6-month follow-up was 94.28 ± 3.92, indicating excellent functional preservation. This observation corroborates findings by Zhang et al., who reported minimal impact on ankle function following peroneus longus tendon harvest.[15] The functional redundancy provided by the peroneus brevis muscle in maintaining ankle eversion appears sufficient to compensate for the absence of the peroneus longus tendon.

Regarding knee stability, both groups demonstrated satisfactory outcomes with negative Lachman and pivot shift tests in the majority of patients at final follow-up. The comparable stability outcomes suggest equivalent mechanical properties and biological incorporation of both graft types. These findings are consistent with biomechanical studies demonstrating that peroneus longus tendon possesses tensile strength comparable to native ACL.[1]

Donor-site morbidity represents a significant consideration in autograft selection. In the present study, transient donor-site pain was reported by 7.5% of patients in the peroneus longus group and 13.2% in the hamstring group, although this difference did not reach statistical significance. Previous investigations have suggested that peroneus longus tendon harvest may be associated with reduced donor-site morbidity compared to hamstring tendon harvest.[2] The relatively small incision required for peroneus longus tendon harvest and the superficial location of the tendon may contribute to this favorable profile.

The present study possesses several limitations warranting acknowledgment. The retrospective design introduces inherent selection bias and limits control over confounding variables. The relatively short follow-up duration of 6 months may not capture long-term outcomes, including late graft failure and osteoarthritis development. Additionally, the single-center nature of the study may limit generalizability of findings. Future prospective randomized controlled trials with extended follow-up are necessary to validate these observations.

Despite these limitations, our study provides valuable comparative data regarding the effectiveness of peroneus longus tendon graft in ACL reconstruction within an Indian population. The comparable outcomes observed suggest that peroneus longus tendon represents a viable alternative when hamstring tendons are unavailable, inadequate in diameter, or when preservation of hamstring function is prioritized.

CONCLUSION

This retrospective comparative study demonstrates that peroneus longus tendon graft achieves clinical and functional outcomes comparable to hamstring tendon graft in arthroscopic ACL reconstruction. Both graft options yielded significant improvements in IKDC and Lysholm scores, with satisfactory knee stability at 6-month follow-up. Importantly, peroneus longus tendon harvest was associated with minimal donor-site morbidity, as evidenced by excellent AOFAS ankle-hindfoot scores. The peroneus longus tendon represents a viable and effective alternative autograft for ACL reconstruction, particularly when traditional graft options are unavailable or inadequate. Further prospective studies with longer follow-up periods are warranted to confirm these findings and establish definitive recommendations regarding graft selection in ACL reconstruction.

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