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Original Article

Comparative Functional Outcomes and Donor-Site Morbidity of Peroneus Longus Versus Hamstring Tendon Autografts in Arthroscopic Anterior Cruciate Ligament Reconstruction

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Abstract

Background: Hamstring tendon (HT) autografts are widely used in anterior cruciate ligament (ACL) reconstruction; however, donor-site morbidity remains a recognized limitation. The peroneus longus tendon (PLT) has emerged as a potential alternative autograft, though comparative clinical data—particularly from resource-limited settings—remain limited.

Objective: To compare functional outcomes, postoperative complications, and donor-site morbidity between PLT and HT autografts in patients undergoing arthroscopic ACL reconstruction.

Methodology: This retrospective cohort study included 34 patients undergoing primary arthroscopic ACL reconstruction between January 2022 and November 2024, with follow-up completed through December 2025. Patients were equally divided into PLT (n = 17) and HT (n = 17) groups. Functional outcomes were assessed at a minimum 12-month follow-up using the International Knee Documentation Committee (IKDC) subjective score and the Lysholm Knee Scoring Scale. Postoperative complications and donor-site morbidity were also evaluated.

Results: The mean IKDC score was 85.53 ± 2.69 in the PLT group and 86.47 ± 2.58 in the HT group (mean difference −0.94; 95% CI −2.77 to 0.89; p = 0.306). The mean Lysholm score was 87.18 ± 2.74 and 87.53 ± 2.58, respectively (mean difference −0.35; 95% CI −2.18 to 1.47; p = 0.702). Postoperative complication rates were comparable between groups (p = 0.419). Donor-site morbidity was significantly higher in the HT group (58.8%) compared to the PLT group (0%) (p < 0.001). No clinically detectable ankle instability or deformity was observed in the PLT group.

Conclusion: PLT autografts demonstrated comparable short- to medium-term functional outcomes to HT autografts, with significantly lower donor-site morbidity. These findings are preliminary and hypothesis-generating. Larger, prospective studies incorporating objective stability measures and validated ankle assessments are required before definitive conclusions can be drawn.

Keywords: ACL Reconstruction, Autograft, Cohort Study, Hamstring Tendon, Peroneus Longus.

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Introduction

Anterior cruciate ligament (ACL) rupture is among the most common ligamentous injuries of the knee, particularly affecting young, physically active individuals and athletes. The global incidence of ACL injuries has increased over the past two decades, largely attributed to greater participation in high-demand sports and recreational activities [1,2]. If left untreated, ACL deficiency can lead to chronic instability, recurrent episodes of knee giving way, meniscal injury, and progressive osteoarthritis, significantly impairing long-term joint function and quality of life [3].

Arthroscopic ACL reconstruction is the standard surgical treatment aimed at restoring knee stability, enabling return to pre-injury activity levels, and preventing secondary intra-articular damage [4]. Among the available graft options, autografts are generally preferred in young and active populations due to superior biological incorporation and lower failure rates compared to allografts [5].

Hamstring tendon (HT) autografts, typically involving the semitendinosus with or without the gracilis tendon, are among the most commonly utilized graft choices. These grafts offer several advantages, including favorable biomechanical properties, smaller incision size, and reduced anterior knee pain compared to bone–patellar tendon–bone grafts [6]. However, HT harvest is associated with well-documented donor-site morbidity, including hamstring weakness, reduced knee flexion strength, sensory disturbances, and delayed functional recovery in some patients [7,8]. These limitations have prompted exploration of alternative autograft sources that may preserve muscle function while maintaining graft efficacy.

The peroneus longus tendon (PLT) has recently emerged as a promising alternative autograft for ACL reconstruction. Biomechanical studies have demonstrated that PLT possesses tensile strength and diameter comparable to HT grafts, making it structurally suitable for ligament reconstruction [9]. Clinical studies have reported encouraging functional outcomes and acceptable donor-site profiles following PLT harvest [10–12]. Concerns regarding potential ankle instability or eversion weakness have not been consistently substantiated, particularly when partial tendon harvesting techniques are employed and appropriate rehabilitation protocols are followed [11,13].

Comparative studies between PLT and HT autografts have generally demonstrated similar functional outcomes, as measured by validated scoring systems such as the IKDC and Lysholm scores [12,14]. However, the current evidence base is limited by relatively small sample sizes, heterogeneity in study design, and short follow-up durations. Furthermore, data from low- and middle-income countries—including Pakistan—remain scarce, where graft selection may also be influenced by factors such as cost, surgical expertise, and resource availability.

Given the growing clinical interest in PLT autografts and the lack of region-specific comparative data, this study aimed to evaluate and compare the functional outcomes, postoperative complications, and donor-site morbidity associated with PLT and HT autografts in arthroscopic ACL reconstruction at a tertiary care center in Pakistan. By providing locally relevant evidence, this study seeks to inform surgical decision-making in similar healthcare settings.

Methodology

Study Design

This study was designed as a retrospective cohort analysis conducted to compare functional outcomes, postoperative complications, and donor-site morbidity between peroneus longus tendon (PLT) and hamstring tendon (HT) autografts in arthroscopic anterior cruciate ligament (ACL) reconstruction. The retrospective nature allowed evaluation of real-world surgical practices over a defined period while enabling comparison of two clinically relevant graft options.

Ethics

Ethical approval was obtained from the Institutional Review Board (IRB) prior to study initiation. All procedures were conducted in accordance with the principles of the Declaration of Helsinki. Patient confidentiality was strictly maintained, and all collected data were anonymized before analysis.

Setting

The study was conducted at the Department of Orthopaedics, Saidu Group of Teaching Hospitals (SGTH), Swat, Pakistan. Patient recruitment and surgical procedures were carried out between January 2022 and November 2024, with follow-up and outcome assessment extending through December 2025. This ensured a minimum follow-up duration of 12 months for all included participants, with a mean follow-up period of 17.35 ± 3.54 months.

Participants

Patients were identified through hospital databases and operative records. Inclusion criteria comprised individuals aged 18–50 years with MRI-confirmed primary ACL rupture who underwent primary arthroscopic ACL reconstruction

using either PLT or HT autografts and had complete follow-up data of at least 12 months. Patients with multiligament injuries, revision ACL reconstruction, associated periarticular fractures, prior knee surgery, advanced osteoarthritis (Kellgren–Lawrence grade ≥3), or incomplete records were excluded. Patients with minor incidental intra-articular findings, such as partial meniscal tears or low-grade chondral lesions, were included if these were managed during the index procedure.

Variables

Primary outcome variables included functional outcomes assessed using the International Knee Documentation Committee (IKDC) subjective score and the Lysholm Knee Scoring Scale. Secondary variables included postoperative complications and donor-site morbidity. Additional variables recorded were demographic characteristics (age, sex, BMI) and clinical parameters such as side of injury, time from injury to surgery, graft type, graft diameter, follow-up duration, and presence of intra-articular lesions.

Data Sources / Measurement

Data were retrospectively collected from medical records, operative notes, and outpatient follow-up documentation using a structured data collection proforma. Functional outcomes were assessed at the latest follow-up visit using validated scoring systems (IKDC and Lysholm). Donor-site morbidity was defined differently for each group: in HT patients, it included knee flexor weakness, sensory disturbances, or difficulty in knee flexion activities; in PLT patients, it included ankle instability, eversion weakness, gait abnormalities, or sensory deficits along the peroneal nerve distribution. Assessment of ankle morbidity was limited to clinical examination and patient-reported outcomes, without use of validated ankle scoring systems or objective biomechanical testing.

Bias

Given the retrospective cohort design, potential sources of bias included selection bias and confounding. Graft selection was not randomized but based on surgeon discretion and patient-specific factors, introducing possible allocation bias. Although baseline characteristics were compared between groups to assess comparability, unmeasured confounders may still exist. Information bias was minimized through the use of standardized hospital records, although incomplete documentation of certain variables (e.g., objective knee stability measures and return-to-sport outcomes) may have influenced findings.

Study Size

A total of 34 patients were included, equally divided into two groups (PLT = 17, HT = 17). The sample size was determined by the number of eligible patients meeting inclusion criteria within the study period. A post hoc power analysis demonstrated limited statistical power (~22%) to detect small differences between groups, indicating that the study was underpowered for definitive conclusions.

Quantitative Variables

Continuous variables such as age, BMI, follow-up duration, and functional scores were expressed as mean ± standard deviation. Categorical variables such as sex, complications, and donor-site morbidity were presented as frequencies and percentages. Functional outcome scores (IKDC and Lysholm) were treated as continuous variables for statistical comparison.

Statistical Methods

Statistical analysis was performed using SPSS version 25. Normality of continuous variables was assessed using the Shapiro–Wilk test. Normally distributed variables were compared using independent samples t-tests, while non-normally distributed variables were analyzed using the Mann–Whitney U test. Categorical variables were compared using the chi-square test or Fisher's exact test where appropriate. Mean differences with 95% confidence intervals (CI) were reported for continuous variables, and odds ratios (OR) with 95% CI were calculated for categorical outcomes where feasible. A p-value of <0.05 was considered statistically significant.

Results

Participants

A total of 34 patients met the eligibility criteria and were included in the final analysis, with equal allocation to the peroneus longus tendon (PLT) group (n = 17) and the hamstring tendon (HT) group (n = 17). All patients completed a minimum follow-up duration of 12 months, with an overall mean follow-up of 17.35 ± 3.54 months. There was no loss to follow-up among the included participants. Baseline comparability between the two groups was assessed and is summarized in Table 1.

Descriptive Data

The baseline demographic and clinical characteristics of the study population are presented in Table 1 . The mean age of patients was 31.2 ± 8.1 years in the PLT group and 30.7 ± 8.0 years in the HT group (p = 0.857). Similarly, the mean body mass index (BMI) was comparable between groups (23.9 ± 2.5 kg/m² in PLT vs 23.8 ± 2.4 kg/m² in HT; p =

0.891). The distribution of sex was also similar, with males comprising 58.8% of the PLT group and 52.9% of the HT group (p = 0.745).

The mean follow-up duration was 17.1 ± 3.6 months in the PLT group and 17.6 ± 3.5 months in the HT group (p = 0.678). Incidental intra-articular lesions identified at diagnostic arthroscopy were equally distributed between the groups (23.5% in each group; p = 1.000). These included partial meniscal tears and low-grade chondral lesions, all of which were managed during the index procedure. Overall, there were no statistically significant differences in baseline characteristics, indicating that the two groups were comparable prior to outcome assessment.

Outcome Data

Functional outcomes were assessed using the IKDC subjective score and the Lysholm Knee Scoring Scale at the final follow-up visit, as shown in Table 2. The mean IKDC score was 85.53 ± 2.69 in the PLT group and 86.47 ± 2.58 in the HT group. Similarly, the mean Lysholm score was 87.18 ± 2.74 for the PLT group and 87.53 ± 2.58 for the HT group.

Postoperative complications and donor-site morbidity are detailed in Tables 3 and 4, respectively. Complications were observed in 29.4% of patients in the PLT group and 17.6% in the HT group. Donor-site morbidity occurred exclusively in the HT group (58.8%), while no cases were reported in the PLT group.

Main Results

Comparative analysis demonstrated no statistically significant difference in functional outcomes between the two graft groups. The mean difference in IKDC score was −0.94 (95% CI −2.77 to 0.89; p = 0.306), and the mean difference in Lysholm score was −0.35 (95% CI −2.18 to 1.47; p = 0.702), indicating comparable patient-reported knee function (Table 2).

Postoperative complication rates did not differ significantly between groups (odds ratio 1.94; 95% CI 0.39–9.6; p = 0.419), as presented in Table 3. In contrast, donor-site morbidity was significantly higher in the HT group compared to the PLT group (58.8% vs 0%; p < 0.001), as shown in Table 4.

No clinically detectable ankle instability, eversion weakness, or foot deformity was observed in the PLT group during routine clinical evaluation. However, it is important to note that assessment of ankle function was limited to clinical examination and patient-reported outcomes, and subtle functional impairments cannot be excluded.

Table 1: Baseline Characteristics by Graft Group

Variable	PLT Group (n=17)	HT Group (n=17)	p-value
Age (years)	31.2 ± 8.1	30.7 ± 8.0	0.857
BMI (kg/m²)	23.9 ± 2.5	23.8 ± 2.4	0.891
Follow-up (months)	17.1 ± 3.6	17.6 ± 3.5	0.678
Male sex	10 (58.8%)	9 (52.9%)	0.745
Incidental intra-articular lesions†	4 (23.5%)	4 (23.5%)	1.000

Table 2: Functional Outcomes Between PLT and HT Groups

Outcome	PLT Mean ± SD	HT Mean ± SD	p-value	Mean Difference (95% CI)
IKDC Score	85.53 ± 2.69	86.47 ± 2.58	0.306	−0.94 (−2.77 to 0.89)
Lysholm Score	87.18 ± 2.74	87.53 ± 2.58	0.702	−0.35 (−2.18 to 1.47)

CI = confidence interval. Independent samples t-test used. Scores reflect patient-reported outcomes only; objective stability data were not available.

Table 3: Comparison of Postoperative Complications

Graft Type	No Complication (%)	Complication (%)	p-value	OR (95% CI)
PLT	12 (70.6)	5 (29.4)		
HT	14 (82.4)	3 (17.6)	0.419	1.94 (0.39–9.6)

OR = odds ratio; CI = confidence interval. Chi-square test used.

Table 4: Comparison of Donor-Site Morbidity

Graft Type	No Morbidity (%)	Morbidity Present (%)	p-value*
PLT	17 (100)	0 (0)	
HT	7 (41.2)	10 (58.8)	<0.001

* Fisher's exact test applied due to low expected cell count. Ankle assessment in PLT group was by clinical examination and patient-reported symptoms only; validated ankle outcome measures were not used.

Discussion

This retrospective cohort study evaluated and compared patient-reported functional outcomes and donor-site morbidity between peroneus longus tendon (PLT) and hamstring tendon (HT) autografts in arthroscopic anterior cruciate ligament (ACL) reconstruction. The principal finding of this study is that both graft types produced comparable short- to medium-term functional outcomes, as reflected by similar IKDC and Lysholm scores, while donor-site morbidity was significantly lower in the PLT group.

The absence of a statistically significant difference in IKDC ($p = 0.306$) and Lysholm scores ($p = 0.702$) between the two groups suggests that graft selection may not substantially influence subjective functional recovery when standardized surgical techniques and rehabilitation protocols are employed. These findings are consistent with previous comparative studies reporting no clinically meaningful differences in functional outcomes between PLT and HT autografts [12,14]. Rhatomy et al. similarly demonstrated comparable knee function and stability between graft types [15], while Keyhani et al. reported no significant differences in patient-reported outcomes at two-year follow-up [16]. Furthermore, a recent meta-analysis has reinforced these observations, concluding that PLT and HT autografts yield similar functional outcomes and graft stability in ACL reconstruction [17].

From a biomechanical perspective, the PLT has been shown to possess tensile strength and graft diameter comparable to conventional hamstring grafts, supporting its suitability as an alternative autograft [9,13]. Additionally, preservation of the hamstring muscle group may offer functional advantages, particularly in physically active individuals where maintenance of knee flexion strength is important. This theoretical advantage may not be fully captured by subjective outcome measures alone and warrants further investigation using objective strength assessments.

A notable finding of this study is the significantly higher donor-site morbidity observed in the HT group (58.8%) compared to the PLT group (0%), consistent with prior literature documenting hamstring weakness, sensory disturbances, and prolonged recovery following tendon harvest [7,8,18]. Persistent alterations in hamstring morphology and strength have been reported even up to two years postoperatively [19], which may have implications for functional performance, particularly in athletic populations.

In contrast, no clinically detectable ankle instability, eversion weakness, or deformity was observed in the PLT group during routine clinical follow-up. This aligns with existing literature suggesting that partial harvesting of the peroneus longus tendon does not result in significant functional impairment of the ankle [20–22]. However, it is important to interpret these findings cautiously, as subtle deficits in ankle biomechanics or proprioception may not be detectable through routine clinical examination alone. The absence of validated ankle outcome measures in this study limits definitive conclusions regarding donor-site safety.

Postoperative complication rates were comparable between the two groups ($p = 0.419$), supporting previous reports that graft choice does not significantly influence short-term complication profiles [16,18]. This suggests that PLT autografts may provide a safe alternative to HT grafts without increasing procedural risk.

From a clinical perspective, these findings are particularly relevant in resource-limited settings, where graft availability, cost considerations, and surgical expertise influence decision-making. The PLT offers a reproducible graft option that avoids hamstring harvest-related morbidity and may be especially advantageous in patients where preservation of hamstring function is desired or when hamstring graft size is inadequate.

Importantly, the findings of this study should be interpreted as preliminary and hypothesis-generating. The lack of statistically significant differences in functional outcomes does not imply equivalence or non-inferiority between graft types, particularly given the limited sample size and

statistical power. Larger, well-designed prospective studies are required to establish definitive comparative effectiveness.

Limitations

This study has several limitations. Its retrospective design introduces potential selection bias, and the small sample size (n = 34) results in limited statistical power, preventing definitive conclusions regarding equivalence between graft types. Graft selection was non-randomized, allowing for possible confounding. The study relied solely on patient-reported outcomes without objective knee stability assessments (e.g., KT-1000, pivot shift), limiting evaluation of graft integrity. Donor-site morbidity in the PLT group was assessed only clinically without validated ankle outcome measures, so subtle deficits may have been missed. Additionally, return-to-sport data were not systematically collected, follow-up was limited to the short-to-medium term, and the single-center setting may restrict generalizability.

Conclusion

In this retrospective cohort study, peroneus longus tendon autografts demonstrated patient-reported functional outcomes comparable to hamstring tendon autografts in arthroscopic ACL reconstruction, with no significant differences in IKDC and Lysholm scores. Postoperative complication rates were similar between the two groups. Notably, donor-site morbidity was significantly higher in the hamstring tendon group, while no clinically detectable ankle morbidity was observed in the peroneus longus group.

Authors' Contributions:

All authors meet the ICMJE criteria for authorship.

Author 1: Substantial contribution to conception and design, drafting the manuscript, final approval, agreed to be accountable for all the work.
Author 2: Substantial contribution to conception and design, data acquisition, drafting the manuscript, final approval, agreed to be accountable for all the work.
Author 3: Analysis and interpretation of data, drafting the manuscript, final approval, agreed to be accountable for all the work.
Author 4: Analysis and interpretation of data, critical revision, final approval, agreed to be accountable for all the work.

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