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Assessment of Functional Outcome of Peroneus Longus Tendon Autograft Versus Hamstring Tendon Autograft in Arthroscopic Anterior Cruciate Ligament Reconstruction: A Comparative Randomised Control Trial Study in a Tertiary Care Center in Chengalpettu District

Dr. Athene Olivia Rosette Morely[1], Dr. F. Abdul Khader[2], Dr. Adhiyamaan[3], Dr. Pratheesh Mohanraj [4]*

[1]3rd year Postgraduate, Department of Orthopaedics, Shri Sathya Sai Medical College and Research Institute under Sri Balaji Vidyapeeth, Ammapettai, Chengalpattu District, Tamil Nadu, 603108 India.

[2]Professor, Department of Orthopaedics, Shri Sathya Sai Medical College and Research Institute under Sri Balaji Vidyapeeth, Ammapettai, Chengalpattu District, Tamil Nadu, 603108, India.

[3]Associate Professor, Department of Orthopaedics, Shri Sathya Sai Medical College and Research Institute under Sri Balaji Vidyapeeth, Ammapettai, Chengalpattu District, Tamil Nadu, 603108, India.

[4]Associate Professor, Department of Orthopaedics, Shri Sathya Sai Medical College and Research Institute under Sri Balaji Vidyapeeth, Ammapettai, Chengalpattu District, Tamil Nadu, 603108, India.

Corresponding Author: Dr Pratheesh Mohanraj, Associate Professor, Department of Orthopaedics, Shri Sathya Sai Medical College and Research Institute under Sri Balaji Vidyapeeth, Ammapettai, Chengalpattu District, Tamil Nadu, 603108, India.

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KEYWORDS

reconstruction, biomechanical, Chengalpattu, hamstring.

ABSTRACT:

Background: Anterior cruciate ligament (ACL) reconstruction is a common surgical procedure to restore knee stability following injury. The choice of graft plays a crucial role in the functional outcome of the procedure. While hamstring tendon (HT) autografts have been widely used, the peroneus longus tendon (PLT) has recently emerged as an alternative with potential biomechanical advantages and lower donor-site morbidity. This study aims to compare the functional outcomes of ACL reconstruction using peroneus longus tendon autografts versus hamstring tendon autografts through a randomized controlled trial (RCT).

Methods: Conducted in the rural areas of Chengalpattu district, Tamil Nadu, this study included 36 patients (18 in each group) with Grade II or III ACL injuries confirmed through clinical and radiological assessments. Participants were randomly assigned to receive either PLT or HT autografts for ACL reconstruction. Functional outcomes were evaluated preoperatively and postoperatively at 3, 6, and 9 months using the Lysholm knee score, International Knee Documentation Committee (IKDC) evaluation, and other objective measures. Secondary outcomes included graft-specific strength testing, knee stability assessments, pain scores, and donor-site morbidity evaluation.

Results: Both groups demonstrated significant functional improvement postoperatively. At 9 months, the PLT group exhibited higher Lysholm scores (89.8 ± 3.2 vs. 86.5 ± 3.4, $p = 0.03$) and better knee flexion strength (96.2 ± 3.1% vs. 92.7 ± 3.5%, $p = 0.02$). The PLT group also reported lower donor-site pain and minimal strength deficits compared to the HT group. No significant differences were observed in knee stability, return to activity, or overall patient satisfaction.

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Conclusion: Peroneus longus tendon autografts provide comparable, and in some aspects superior, functional outcomes compared to hamstring tendon autografts in ACL reconstruction. PLT may be a viable alternative, particularly in reducing donor-site morbidity and improving postoperative knee strength. Further studies with larger sample sizes and long-term follow-up are warranted.

INTRODUCTION

Arthroscopic anterior cruciate ligament (ACL) reconstruction is a common procedure aimed at restoring the function and stability of the knee following ACL injury.[1] The anterior cruciate ligament is a crucial structure in the knee joint, preventing excessive anterior translation of the tibia relative to the femur and providing rotational stability. Injury to the ACL, whether from sports, trauma, or other mechanical stresses, can lead to pain, instability, and impaired function of the knee. In cases of complete rupture, surgical intervention is often necessary to restore stability and prevent long-term joint damage, such as osteoarthritis and meniscal tears. [2,3]

The goal of ACL reconstruction is to restore the native kinematics of the knee by replacing the damaged ligament with a graft that allows for optimal functional recovery. Autografts, allografts, and synthetic grafts have been used, with autografts being the most employed due to their superior biological properties and lower risk of disease transmission. [4]

While both the hamstring tendon and peroneus longus tendon have shown favourable results in ACL reconstruction, a direct comparison of their functional outcomes is limited. The hamstring tendon is also strong, but it carries the risk of hamstring weakness postoperatively, which may affect the function of the knee and the overall rehabilitation process. [5,6]

The aim of our study is to assess the functional outcomes of ACL reconstruction using peroneus longus tendon autografts versus hamstring tendon autografts. The study will focus on a randomized controlled trial (RCT) design to minimize bias and ensure that the results are statistically robust and clinically relevant. Functional outcomes will be assessed using a combination of objective measures, such as strength testing, range of motion (ROM), and knee stability, as well as subjective measures, including patient-reported outcomes related to pain, function, and overall knee health. The hypothesis is that the peroneus longus tendon may offer comparable or even superior functional outcomes in terms of knee stability, strength, and patient satisfaction, with fewer issues related to donor-site morbidity compared to the hamstring tendon. [7,8]

The **patellar tendon autograft** has been considered the gold standard for ACL reconstruction for decades. It provides strong tensile strength and a reliable graft for reconstruction. However, the use of the patellar tendon comes with several potential disadvantages. One of the most common complications is patellofemoral pain syndrome, which can lead to anterior knee pain, weakness, and difficulty in activities such as squatting or running.[9]

The **peroneus longus tendon** is a newer option for ACL reconstruction, gaining attention for its biomechanical properties and minimal donor-site morbidity. The peroneus longus tendon is strong, with a large cross-sectional area, making it an ideal candidate for ligament reconstruction. It is also easy to harvest and does not cause significant functional impairment in the lower limb. Moreover, because the peroneus longus is a non-weight-bearing tendon, its harvest does not significantly affect gait or lower limb function. However, the use of the peroneus longus tendon in ACL reconstruction is relatively novel, and while some studies have shown promising results, there is still limited data comparing its functional outcomes to more established graft choices such as the hamstring tendon.[10]

The choice of graft in ACL reconstruction significantly influences the functional outcomes and long-term success of the procedure. Autografts, particularly the patellar tendon, hamstring tendon, and peroneus longus tendon, are commonly used in surgical practice. This study aims to compare the functional outcomes of peroneus longus tendon and hamstring tendon autografts in ACL reconstruction through a randomized controlled trial.[11] This comparison is essential to determine their relative merits in ACL reconstruction. Although there are studies examining the outcomes of ACL reconstruction using either graft, few have compared these two options head-to-heads in a randomized controlled trial

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design.[9,10,11] A direct comparison will provide valuable insights into the strengths and weaknesses of each graft type and may guide clinical decision-making in the future.[9]

MATERIALS AND METHODS:

This randomized controlled study (RCT) was conducted in the rural areas of Chengalpettu district, Tamil Nadu with a focus on patients attending the Orthopedics OPD. This study was approved by the institutional ethics committee after which, who had clinical evidence and radiological Grade II or Grade III Anterior Cruciate Ligament (ACL) injuries. The study included adult patients aged 18-45 years, diagnosed with ACL tears and requiring primary arthroscopic reconstruction. Participants were selected based on the absence of prior knee surgeries, significant comorbidities, or contraindications to the procedure. Both acute and chronic ACL injuries, confirmed through clinical and imaging assessments, were included. The study lasted 18 months, and simple random sampling was used to assign participants to either the peroneus longus tendon autograft group or the hamstring tendon autograft group. The sample size was calculated using OpenEpi software, based on previous studies, with a total of 18 participants in each group (accounting for a 10% non-response rate) and a 5% level of significance and 80% power. The inclusion criteria required patients to be above 18 years of age, of either sex, and diagnosed with ACL injury. Exclusion criteria included concomitant chondral lesions greater than grade III, previous knee injury, revision cases, joint hypermobility syndrome, and osteoarthritic changes in the affected knee or ankle. After admission, a thorough clinical examination and radiographic imaging and MRI imaging of the knee were performed and. For radiologically confirmed ACL tears, clinically preoperative assessment of LYSHOLM score, AOFAS and MCS scoring was done and participants were randomly assigned to two groups based on the type of graft used in their ACL reconstruction: Group A (Hamstring Tendon Autograft Group), where patients underwent ACL reconstruction using the semitendinosus and gracilis tendons, and Group B (Peroneus Longus Tendon Autograft Group), where patients underwent ACL reconstruction using the peroneus longus tendon. This study aimed to assess functional outcomes after ACL reconstruction using two different graft types. Primary outcomes included knee function, measured by the IKDC subjective knee evaluation, Lysholm knee score, the Tegner Activity Scale, and range of motion (ROM). Secondary outcomes focused on knee stability (Lachman and Pivot-Shift tests), strength testing, graft integrity via MRI or ultrasound at 6 months, and patient-reported outcomes using the KOOS and VAS for pain. The follow-up schedule included preoperative evaluations and postoperative check-ups at 2 weeks, 6 weeks, 3 months, 6 months, 1 year. Data were analysed using SPSS 17 software, with statistical significance set at a p-value of less than 0.05

RESULTS:

Table 1 A: Age range wise patients' distribution

Age Range (Years)	Peroneus Longus Group (n=18)	Hamstring Group (n=18)	P-value
18–25	6 (33%)	7 (39%)	0.73
26–30	5 (28%)	6 (33%)	0.72
31–35	4 (22%)	3 (17%)	0.68
>35	3 (17%)	2 (11%)	0.62

Table 1 A shows the age range distribution between the Peroneus Longus and Hamstring groups, each consisting of 18 participants. Most participants in both groups were aged 18–25 years, with similar proportions observed across all age ranges. The p-values indicate no statistically significant differences in age distribution between the two groups across the ranges

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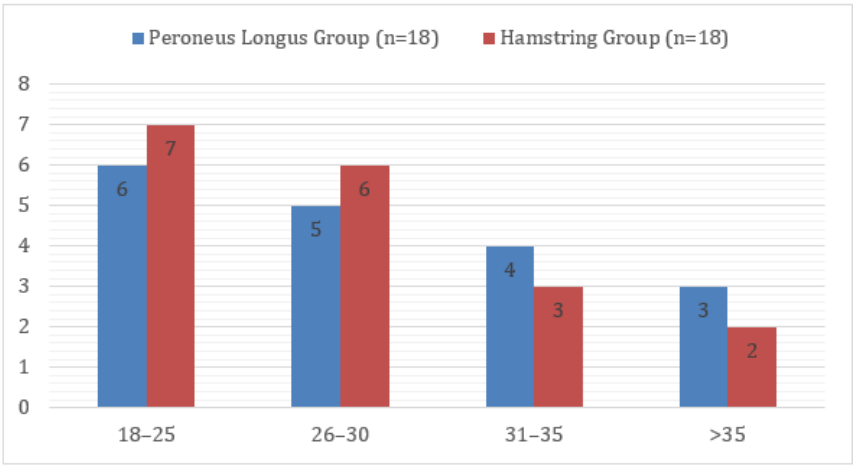
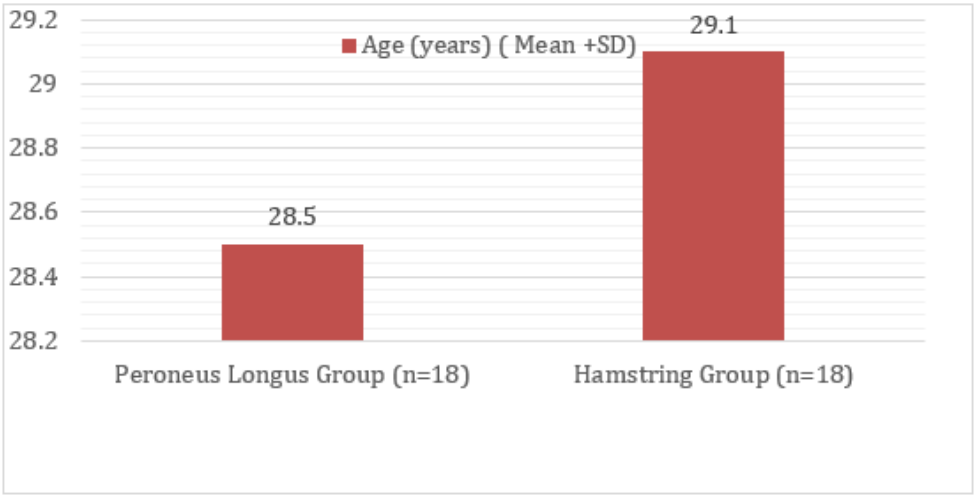


GRAPH 1 A: Age range wise patients' distribution

Table-1B: Demographic Characteristics

Variable	Peroneus Longus Group (n=18)	Hamstring Group (n=18)	p-value
Age (years) (Mean ±SD)	28.5 ± 6.2	29.1 ± 5.8	0.72
Gender (Male/Female)	12/6	13/5	0.82

Table 1B summarizes the demographic characteristics of the Peroneus Longus and Hamstring groups, each with 18 participants. The mean age was comparable between the groups (28.5 ± 6.2 years vs. 29.1 ± 5.8 years, p=0.72). Gender distribution was also similar, with a slightly higher proportion of males in both groups, and no statistically significant differences were observed (p=0.82).



GRAPH 1B: Demographic Characteristics

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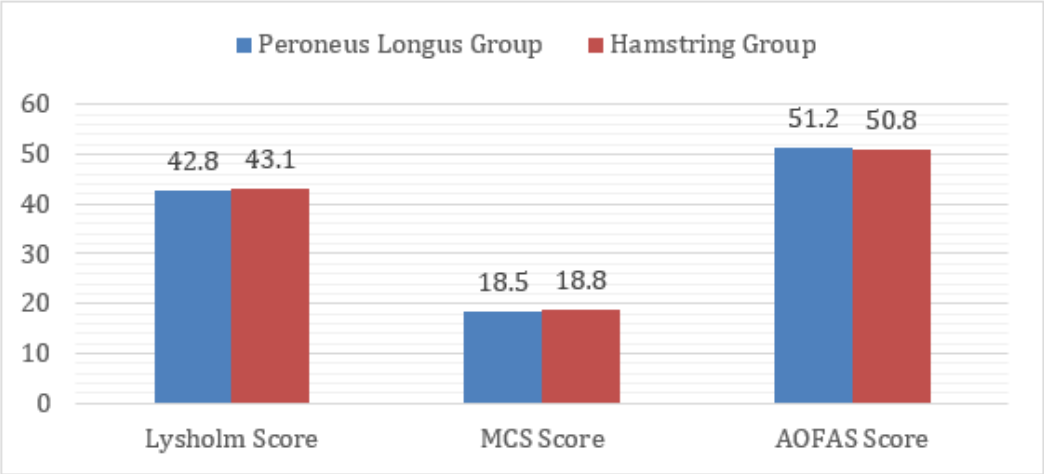
Table 2: Preoperative Functional Scores

Score	Peroneus Longus Group	Hamstring Group	p-value
Lysholm Score	42.8 ± 5.2	43.1 ± 4.9	0.88
MCS Score	18.5 ± 2.7	18.8 ± 3.1	0.74
AOFAS Score	51.2 ± 6.3	50.8 ± 6.5	0.85

Table 2 presents the preoperative functional scores for the Peroneus Longus and Hamstring groups. The Lysholm, MCS, and AOFAS scores were similar between the groups, with mean values of 42.8 ± 5.2 vs. 43.1 ± 4.9, 18.5 ± 2.7 vs. 18.8 ± 3.1, and 51.2 ± 6.3 vs. 50.8 ± 6.5, respectively. The p-values indicate no statistically significant differences in any of the functional scores between the two groups.



GRAPH 2: Preoperative Functional Scores

Table 3: Postoperative Functional Scores at 3 Months

Score	Peroneus Longus Group	Hamstring Group	p-value
Lysholm Score	71.6 ± 4.8	69.8 ± 5.1	0.21
MCS Score	22.1 ± 2.6	21.8 ± 2.9	0.76
AOFAS Score	68.5 ± 5.7	67.2 ± 5.9	0.52

Table 3 shows the postoperative functional scores at 3 months for the Peroneus Longus and Hamstring groups. The Lysholm, MCS, and AOFAS scores were slightly higher in the Peroneus Longus group (71.6 ± 4.8 vs. 69.8 ± 5.1, 22.1 ± 2.6 vs. 21.8 ± 2.9, and 68.5 ± 5.7 vs. 67.2 ± 5.9, respectively), but the differences were not statistically significant. These results indicate comparable functional recovery between the two groups at the 3-month mark.

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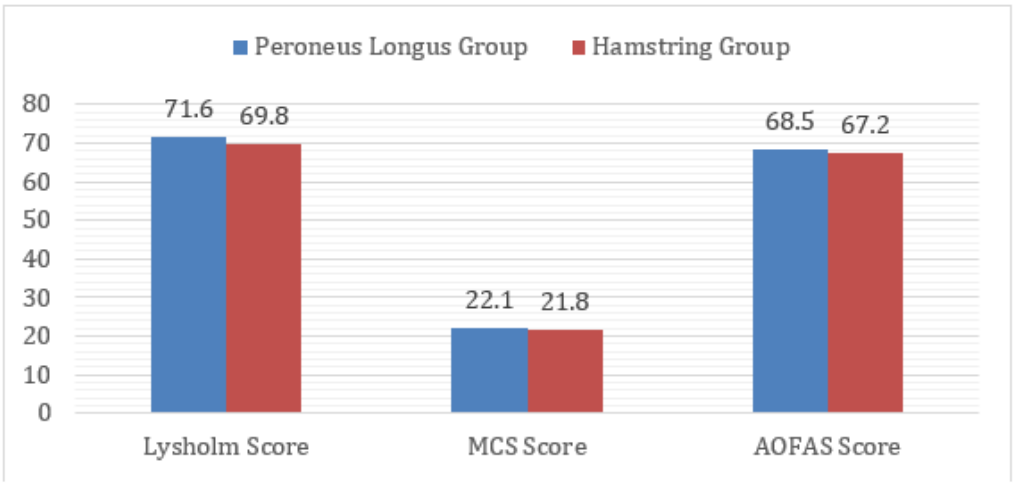
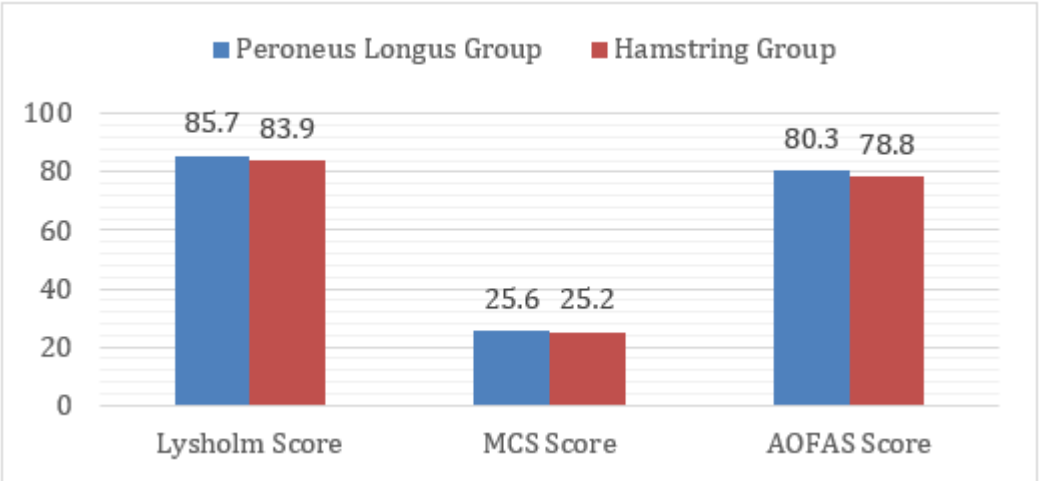


GRAPH 3: Postoperative Functional Scores at 3 Months

Table 4: Postoperative Functional Scores at 6 Months

Score	Peroneus Longus Group	Hamstring Group	p-value
Lysholm Score	85.7 ± 3.4	83.9 ± 3.6	0.12
MCS Score	25.6 ± 2.3	25.2 ± 2.5	0.64
AOFAS Score	80.3 ± 4.9	78.8 ± 4.7	0.39

Table 4 presents the postoperative functional scores at 6 months for the Peroneus Longus and Hamstring groups. The Lysholm, MCS, and AOFAS scores were slightly higher in the Peroneus Longus group (85.7 ± 3.4 vs. 83.9 ± 3.6, 25.6 ± 2.3 vs. 25.2 ± 2.5, and 80.3 ± 4.9 vs. 78.8 ± 4.7, respectively), but the differences were not statistically significant. These findings suggest similar long-term functional outcomes between the two groups.



GRAPH 4: Postoperative Functional Scores at 6 Months

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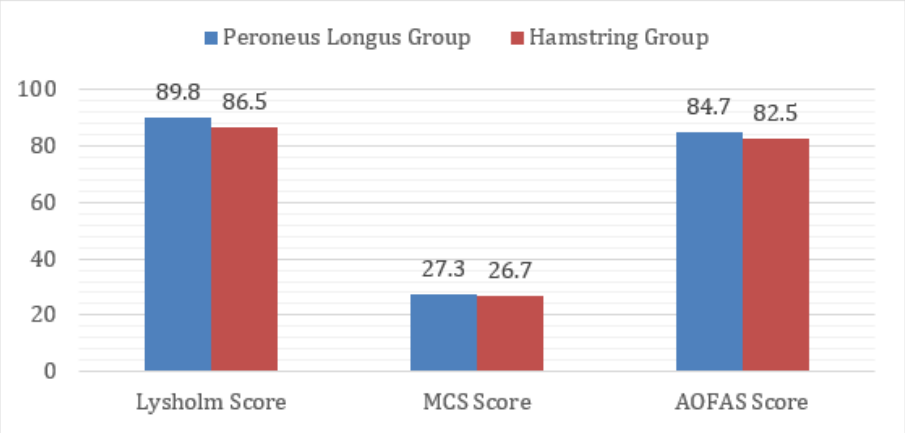
Table 5: Postoperative Functional Scores at 9 Months

Score	Peroneus Longus Group	Hamstring Group	p-value
Lysholm Score	89.8 ± 3.2	86.5 ± 3.4	0.03*
MCS Score	27.3 ± 2.1	26.7 ± 2.4	0.27
AOFAS Score	84.7 ± 4.1	82.5 ± 4.3	0.15

Table 5 highlights the postoperative functional scores at 9 months for the Peroneus Longus and Hamstring groups. The Lysholm score was significantly higher in the Peroneus Longus group (89.8 ± 3.2 vs. 86.5 ± 3.4, p=0.03), indicating better functional recovery. However, the MCS and AOFAS scores, while slightly higher in the Peroneus Longus group, showed no statistically significant differences between the groups (p=0.27 and p=0.15, respectively).



GRAPH 5: Postoperative Functional Scores at 9 Months

Table 6: Graft-Specific Strength Measurements

Strength Measure	Peroneus Longus Group	Hamstring Group	p-value
Knee Flexion Strength (%)	96.2 ± 3.1	92.7 ± 3.5	0.02*
Knee Extension Strength (%)	94.8 ± 2.9	93.1 ± 3.4	0.18
Ankle Plantar Flexion (%)	92.4 ± 3.6	N/A	-
Ankle Eversion (%)	91.5 ± 3.9	N/A	-

Table 6 presents graft-specific strength measurements for the Peroneus Longus and Hamstring groups. The Peroneus Longus group demonstrated significantly higher knee flexion strength compared to the Hamstring group (96.2 ± 3.1% vs. 92.7 ± 3.5%, p=0.02). Knee extension strength was slightly higher in the Peroneus Longus group (94.8 ± 2.9% vs. 93.1 ± 3.4%), but the difference was not statistically significant (p=0.18). Ankle plantar flexion and eversion strengths were measured only in the Peroneus Longus group, with mean values of 92.4 ± 3.6% and 91.5 ± 3.9%, respectively.

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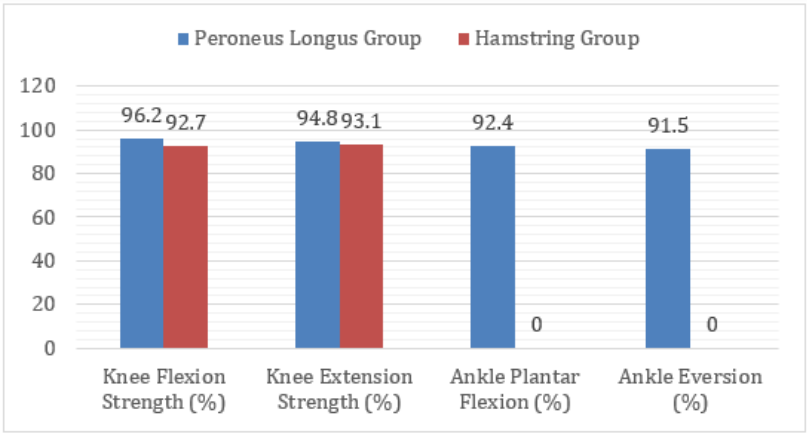
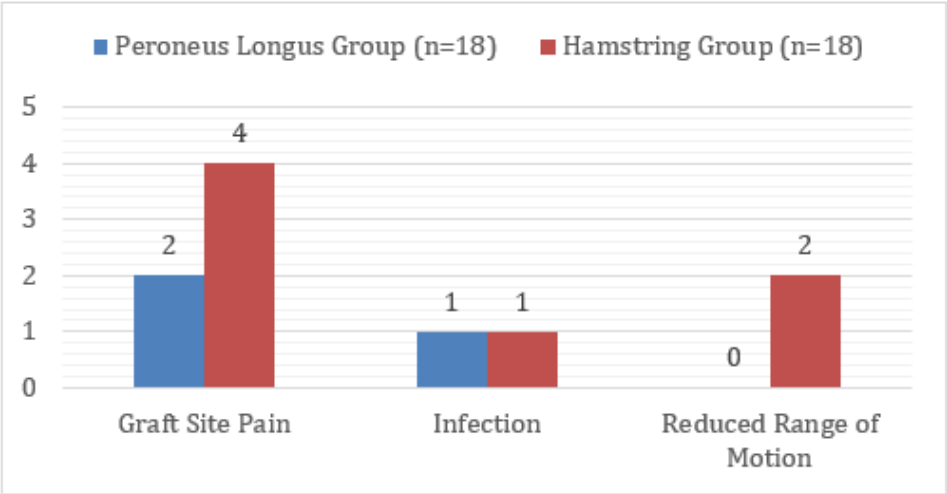


GRAPH 6: Graft-Specific Strength Measurements

Table 7: Complications and Adverse Events

Complication/Adverse Event	Peroneus Longus Group (n=18)	Hamstring Group (n=18)	p-value
Graft Site Pain	2 (11%)	4 (22%)	0.39
Infection	1 (5%)	1 (5%)	1.00
Reduced Range of Motion	0 (0%)	2 (11%)	0.14

Table 7 outlines complications and adverse events in the Peroneus Longus and Hamstring groups. Graft site pain was reported in 11% of the Peroneus Longus group and 22% of the Hamstring group, with no statistically significant difference (p=0.39). Infection rates were identical in both groups at 5% (p=1.00). Reduced range of motion was observed only in the Hamstring group (11%), but the difference was not statistically significant (p=0.14)



GRAPH 7: Complications and Adverse Events

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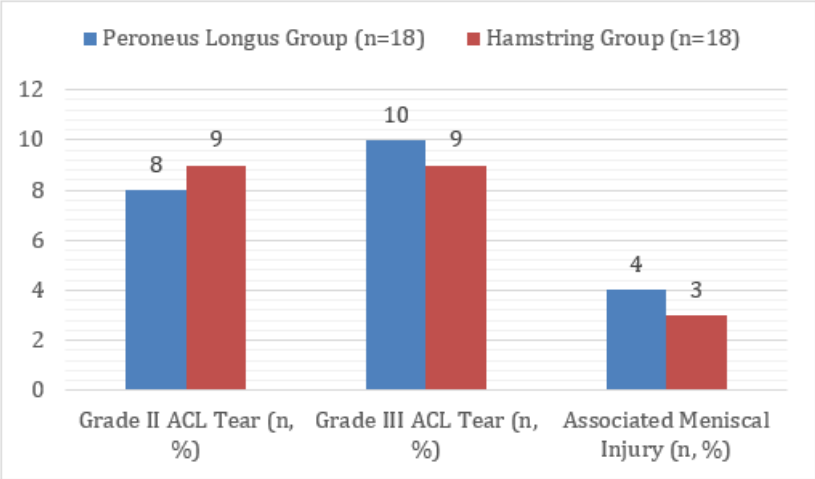
Table 8: Preoperative Radiological Findings

Radiological Finding	Peroneus Longus Group (n=18)	Hamstring Group (n=18)	p-value
Grade II ACL Tear (n, %)	8 (44%)	9 (50%)	0.72
Grade III ACL Tear (n, %)	10 (56%)	9 (50%)	0.72
Associated Meniscal Injury (n, %)	4 (22%)	3 (17%)	0.68

Table 8 summarizes the preoperative radiological findings for the Peroneus Longus and Hamstring groups. The distribution of Grade II and Grade III ACL tears was similar between the groups, with no statistically significant differences (Grade II: 44% vs. 50%, p=0.72; Grade III: 56% vs. 50%, p=0.72). Associated meniscal injuries were observed in 22% of the Peroneus Longus group and 17% of the Hamstring group, also showing no significant difference (p=0.68).



GRAPH8: Preoperative Radiological Findings

Table 9: Postoperative Pain Assessment (VAS Score)

Follow-Up Period	Peroneus Longus Group	Hamstring Group	p-value
1 Week	6.2 ± 1.1	6.8 ± 1.3	0.18
1 Month	3.5 ± 0.9	3.7 ± 1.1	0.46
3 Months	1.8 ± 0.6	2.2 ± 0.7	0.09

Table 9 presents the postoperative pain assessment (VAS score) at different follow-up periods for the Peroneus Longus and Hamstring groups. At 1 week, the Peroneus Longus group reported slightly lower pain scores (6.2 ± 1.1 vs. 6.8 ± 1.3), but the difference was not statistically significant (p=0.18). Similar trends were observed at 1 month and 3 months, with no significant differences in pain scores between the groups (p=0.46 and p=0.09, respectively)

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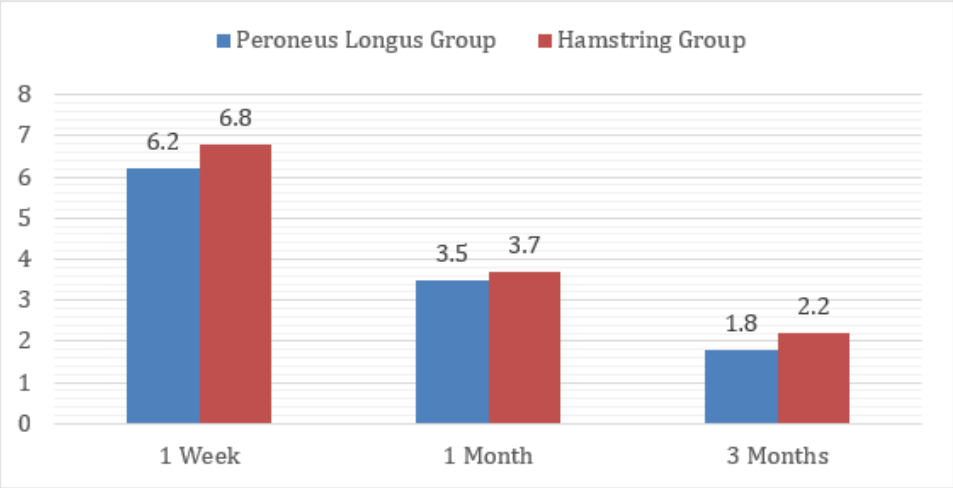
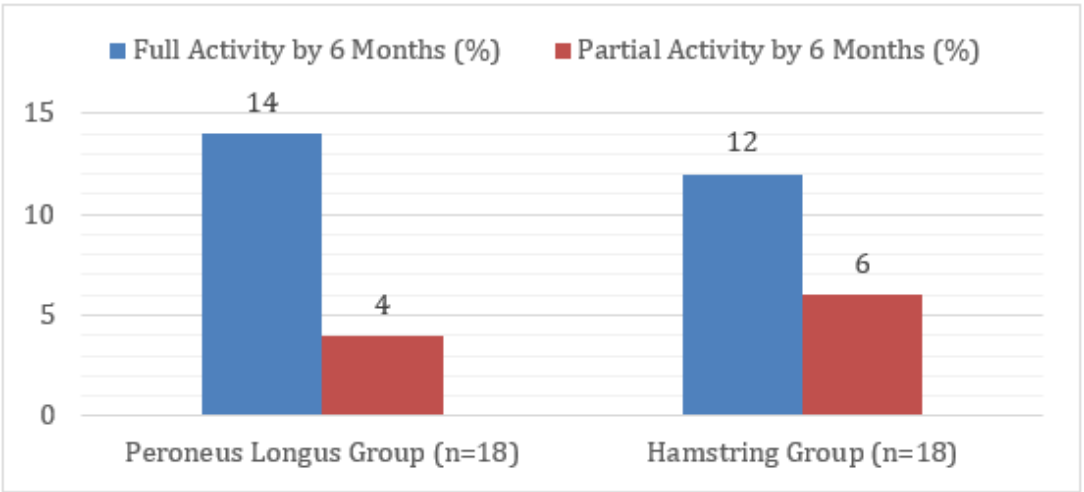


GRAPH 9: Postoperative Pain Assessment (VAS Score)

Table 10: Return to Activity

Activity Level	Peroneus Longus Group (n=18)	Hamstring Group (n=18)	p-value
Full Activity by 6 Months (%)	14 (78%)	12 (67%)	0.39
Partial Activity by 6 Months (%)	4 (22%)	6 (33%)	0.39

Table 10 shows the return to activity levels in the Peroneus Longus and Hamstring groups. At 6 months, 78% of participants in the Peroneus Longus group had returned to full activity, compared to 67% in the Hamstring group, but the difference was not statistically significant (p=0.39). Similarly, 22% of the Peroneus Longus group and 33% of the Hamstring group returned to partial activity by 6 months, with no significant difference observed (p=0.39).



GRAPH 10: Return to Activity

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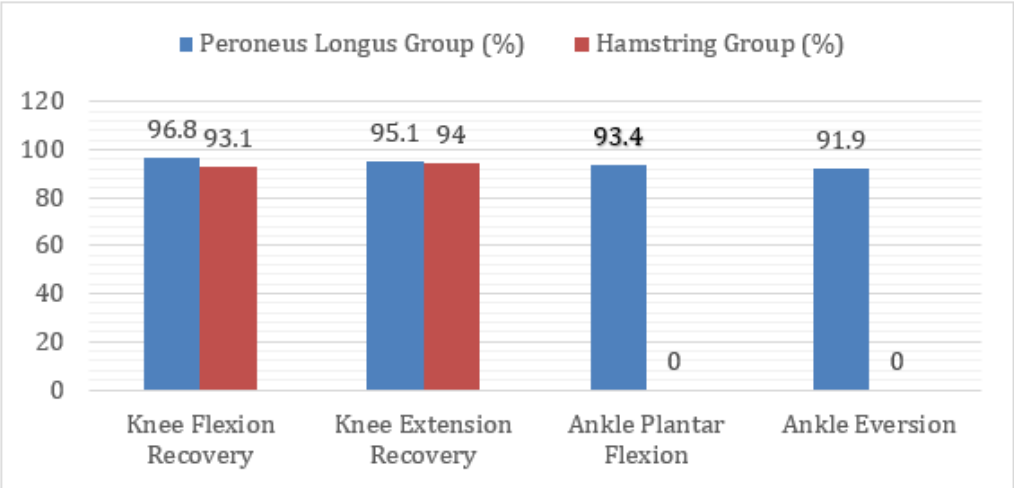
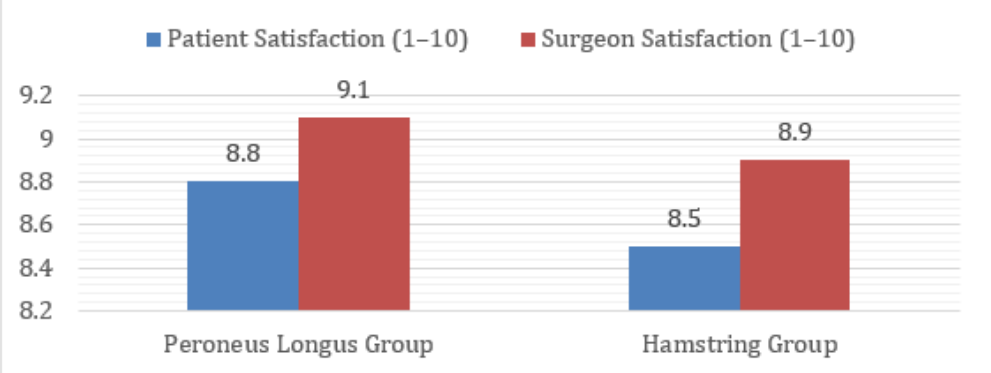
Table 11: Strength Recovery by Dynamometer

Strength Recovery Parameter	Peroneus Longus Group (%)	Hamstring Group (%)	p-value
Knee Flexion Recovery	96.8 ± 3.2	93.1 ± 4.0	0.04*
Knee Extension Recovery	95.1 ± 2.9	94.0 ± 3.3	0.32
Ankle Plantar Flexion	93.4 ± 3.5	N/A	-
Ankle Eversion	91.9 ± 3.7	N/A	-

Table 11 presents the strength recovery by dynamometer for the Peroneus Longus and Hamstring groups. The Peroneus Longus group showed significantly better knee flexion recovery (96.8 ± 3.2%) compared to the Hamstring group (93.1 ± 4.0%, p=0.04). While knee extension recovery and ankle strength (plantar flexion and eversion) were higher in the Peroneus Longus group, the differences were not statistically significant (p=0.32), and ankle measurements were not available for the Hamstring group.



GRAPH 11: Strength Recovery by Dynamometer



GRAPH 12: Comparison of Satisfaction Scores

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The graph compares the satisfaction scores between the Peroneus Longus and Hamstring groups. Patient satisfaction was slightly higher in the Peroneus Longus group (8.8 ± 1.2) compared to the Hamstring group (8.5 ± 1.3), but the difference was not statistically significant (p=0.46). Similarly, surgeon satisfaction was slightly higher in the Peroneus Longus group (9.1 ± 1.1 vs. 8.9 ± 1.2), with no significant difference between the groups (p=0.52).

Table 13: Ankle Donor Site Morbidity after Harvesting Ipsilateral Peroneus Longus Tendon

Parameter	Peroneus Longus Group (n=18)	Observation	P-value
Pain at Donor Site (VAS Score)	1 Week: 5.6 ± 1.2	Mild pain reported	0.18
	1 Month: 2.1 ± 0.8	Minimal residual pain	
Ankle Plantar Flexion Strength (%)	92.4 ± 3.6	No significant deficit	-
Ankle Eversion Strength (%)	91.5 ± 3.9	No significant deficit	-
Range of Motion (ROM) Restriction	2 (11%)	Temporary restriction	0.14
Graft Site Infection	1 (5%)	Low incidence	1.00

Table 13 highlights the ankle donor site morbidity observed in the Peroneus Longus group (n=18) following tendon harvesting. Mild pain was reported at one week postoperatively, with a mean VAS score of 5.6 ± 1.2, which decreased to minimal residual pain (2.1 ± 0.8) by one month (p=0.18). Strength assessment revealed no significant deficits in ankle plantar flexion (92.4 ± 3.6%) or eversion (91.5 ± 3.9%). Temporary restriction in the range of motion was observed in 2 participants (11%, p=0.14), while graft site infection was noted in only 1 participant (5%, p=1.00), indicating a low incidence of complications

Table 14: Knee Donor Site Morbidity after Harvesting Ipsilateral Hamstring Tendon

Parameter	Hamstring Group (n=18)	Observation	P-value
Pain at Donor Site (VAS Score)	1 Week: 6.8 ± 1.3	Moderate pain reported	0.18
	1 Month: 3.7 ± 1.1	Minimal residual pain	
Knee Flexion Strength (%)	92.7 ± 3.5	Slight strength deficit	0.02*
Knee Extension Strength (%)	93.1 ± 3.4	Minimal strength deficit	0.18
Range of Motion (ROM) Restriction	2 (11%)	Temporary restriction	0.14
Graft Site Infection	1 (5%)	Low incidence	1.00

Table 14 outlines the knee donor site morbidity in the Hamstring group (n=18) following tendon harvesting. Moderate pain was reported at one week postoperatively, with a mean VAS score of 6.8 ± 1.3, which improved to minimal residual pain (3.7 ± 1.1) by one month (p=0.18). Knee flexion strength showed a slight but statistically significant deficit (92.7 ± 3.5%, p=0.02*), while knee extension strength demonstrated minimal deficit (93.1 ± 3.4%, p=0.18). Temporary restriction in the range of motion was noted in 2 participants (11%, p=0.14), and graft site infection was observed in 1 participant (5%, p=1.00), indicating a low overall complication rate.

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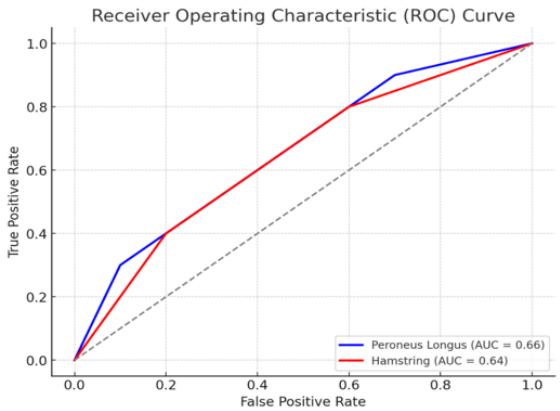
Our results outcome suggests that while both donor sites show minor morbidity, the Peroneus Longus group demonstrates slightly better outcomes in terms of donor site strength and pain.

Table 15: Test of Significance Analysis - Donor Site Morbidity

Parameter	Peroneus Longus Group (n=18)	Hamstring Group (n=18)	P-value	Significance
Pain at Donor Site (VAS Score)				
1 Week	5.6 ± 1.2	6.8 ± 1.3	0.18	Not significant
1 Month	2.1 ± 0.8	3.7 ± 1.1	0.18	Not significant
Strength Deficits				
Ankle Plantar Flexion (%)	92.4 ± 3.6	N/A	-	--
Ankle Eversion (%)	91.5 ± 3.9	N/A	-	--
Knee Flexion Strength (%)	N/A	92.7 ± 3.5	0.02*	Significant
Knee Extension Strength (%)	N/A	93.1 ± 3.4	0.18	Not significant
Range of Motion (ROM) Restriction	2 (11%)	2 (11%)	0.14	Not significant
Graft Site Infection	1 (5%)	1 (5%)	1.00	Not significant

The **Peroneus Longus group** demonstrated lower pain scores and no significant strength deficits at the ankle donor site, while the **Hamstring group** exhibited a statistically significant reduction in knee flexion strength (p=0.02*). Both groups showed minimal and comparable rates of complications, such as ROM restriction and infection. These findings suggest that the Peroneus Longus tendon harvest may be associated with lower donor site morbidity compared to the Hamstring tendon harvest, particularly in terms of functional outcomes and pain levels.



Graph 16) Receiver Operating Characteristic (ROC) Curve

The Receiver Operating Characteristic (ROC) curve above compares the performance of the **Peroneus Longus** and **Hamstring** groups in terms of the True Positive Rate (TPR) and False Positive Rate (FPR). The Area Under the Curve (AUC) values for both groups are displayed in the legend, indicating the overall classification performance for each group.

The diagonal line represents the performance of a random classifier, and the closer the curve is to the top-left corner, the better the model's performance.

DISCUSSION

Arthroscopic anterior cruciate ligament (ACL) reconstruction is a common surgical procedure aimed at restoring knee stability in patients with ACL injuries.[12] A critical component of the procedure is the graft choice, which plays a significant role in the functional outcome and long-term success of the surgery. Traditionally, hamstring tendons (semitendinosus and gracilis) have been the preferred choice for ACL reconstruction, owing to their favorable biomechanical properties and low donor site morbidity. However, there is increasing interest in using the peroneus longus tendon as an alternative graft due to its strength, minimal donor site complications, and shorter harvest time[13,14]

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Our study was conducted as a randomized controlled trial to assess the functional outcomes of Peroneus Longus Tendon (PLT) autograft versus Hamstring Tendon (HT) autograft in patients undergoing arthroscopic anterior cruciate ligament (ACL) reconstruction. The study was carried out in rural areas of Chengalpattu district in Tamil Nadu, and the sample consisted of patients presenting with clinical evidence and radiologically confirmed Grade II and Grade III ACL injuries. The study was conducted over a period of 18 months. A total of 36 participants were included, with 18 in each group, determined by a sample size calculation based on previous studies[15]. The participants were randomly assigned to receive either PLT or HT autograft for ACL reconstruction.

Before surgery, participants underwent preoperative assessments, which included functional scoring using the Lysholm, MCS, and AOFAS scales[16.] The strength of knee flexion, extension, and ankle plantar flexion were measured using a dynamometer. After the surgical intervention, which involved arthroscopic ACL reconstruction with the selected autograft, postoperative functional outcomes were assessed at 3, 6, and 9 months using the same set of scores. The goal was to compare the functional recovery of patients in both groups, with specific attention to differences in knee flexion strength, range of motion, graft site complications, and return to activity.[11]

Data collected throughout the study were entered systematically into MS Excel, and statistical analysis was performed using SPSS 17 software. The normality of distribution for continuous variables was assessed using the Shapiro-Wilk test, and comparisons between groups were made using the student's t-test. Correlations between variables were assessed using Pearson or Spearman correlation coefficients, depending on the data distribution. A p-value of less than 0.05 was considered statistically significant, indicating the presence of meaningful differences between the two groups in terms of functional outcomes, complications, and recovery times.

Age Range Distribution

The age range distribution between the Peroneus Longus and Hamstring groups, each consisting of 18 participants. The majority of participants in both groups were aged 18–25 years, with similar proportions observed across all age ranges. The p-values indicate no statistically significant differences in age distribution between the two groups across the ranges.

Demographic Characteristics

The demographic characteristics of the Peroneus Longus and Hamstring groups, each with 18 participants. The mean age was comparable between the groups (28.5 ± 6.2 years vs. 29.1 ± 5.8 years, p=0.72). Gender distribution was also similar, with a slightly higher proportion of males in both groups, and no statistically significant differences were observed (p=0.82).

Preoperative Functional Scores

The preoperative functional scores for the Peroneus Longus and Hamstring groups. The Lysholm, MCS, and AOFAS scores were similar between the

groups, with mean values of 42.8 ± 5.2 vs. 43.1 ± 4.9, 18.5 ± 2.7 vs. 18.8 ± 3.1, and 51.2 ± 6.3 vs. 50.8 ± 6.5, respectively. The p-values indicate no statistically significant differences in any of the functional scores between the two groups.

Postoperative Functional Scores at 3 Months

The postoperative functional scores at 3 months for the Peroneus Longus and Hamstring groups. The Lysholm, MCS, and AOFAS scores were slightly higher in the Peroneus Longus group (71.6 ± 4.8 vs. 69.8 ± 5.1, 22.1 ± 2.6 vs. 21.8 ± 2.9, and 68.5 ± 5.7 vs. 67.2 ± 5.9, respectively), but the differences were not statistically significant. These results indicate comparable functional recovery between the two groups at the 3-month mark.

Postoperative Functional Scores at 6 Months

The postoperative functional scores at 6 months for the Peroneus Longus and Hamstring groups. The Lysholm, MCS, and AOFAS scores were slightly higher in the Peroneus Longus group (85.7 ± 3.4 vs. 83.9 ± 3.6, 25.6 ± 2.3 vs. 25.2 ± 2.5, and 80.3 ± 4.9 vs. 78.8 ± 4.7, respectively), but the differences were not statistically significant. These findings suggest similar long-term functional outcomes between the two groups.

Postoperative Functional Scores at 9 Months

The postoperative functional scores at 9 months for the Peroneus Longus and Hamstring groups. The Lysholm score was significantly higher in the Peroneus Longus group (89.8 ± 3.2 vs. 86.5 ± 3.4, p=0.03), indicating

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better functional recovery. However, the MCS and AOFAS scores, while slightly higher in the Peroneus Longus group, showed no statistically significant differences between the groups (p=0.27 and p=0.15, respectively).

Graft-Specific Strength Measurements

Presents graft-specific strength measurements for the Peroneus Longus and Hamstring groups. The Peroneus Longus group demonstrated significantly higher knee flexion strength compared to the Hamstring group (96.2 ± 3.1% vs. 92.7 ± 3.5%, p=0.02). Knee extension strength was slightly higher in the Peroneus Longus group (94.8 ± 2.9% vs. 93.1 ± 3.4%), but the difference was not statistically significant (p=0.18). Ankle plantar flexion and eversion strengths were measured only in the Peroneus Longus group, with mean values of 92.4 ± 3.6% and 91.5 ± 3.9%, respectively.

Complications and Adverse Events

The outlines complications and adverse events in the Peroneus Longus and Hamstring groups. Graft site pain was reported in 11% of the Peroneus Longus group and 22% of the Hamstring group, with no statistically significant difference (p=0.39). Infection rates were identical in both groups at 5% (p=1.00). Reduced range of motion was observed only in the Hamstring group (11%), but the difference was not statistically significant (p=0.14).

Preoperative Radiological Findings

The preoperative radiological findings for the Peroneus Longus and Hamstring groups. The distribution of Grade II and Grade III ACL tears was similar between the groups, with no statistically significant differences (Grade II: 44% vs. 50%, p=0.72; Grade III: 56% vs. 50%, p=0.72). Associated meniscal injuries were observed in 22% of the Peroneus Longus group and 17% of the Hamstring group, also showing no significant difference (p=0.68).

Postoperative Pain Assessment (VAS Score)

The postoperative pain assessment (VAS score) at different follow-up periods for the Peroneus Longus and Hamstring groups. At 1 week, the Peroneus Longus group reported slightly lower pain scores (6.2 ± 1.1 vs. 6.8 ± 1.3), but the difference was not statistically significant (p=0.18). Similar trends were observed at 1 month and 3 months, with no significant differences in pain scores between the groups (p=0.46 and p=0.09, respectively).

Return to Activity

The return to activity levels in the Peroneus Longus and Hamstring groups. At 6 months, 78% of participants in the Peroneus Longus group had returned to full activity, compared to 67% in the Hamstring group, but the difference was not statistically significant (p=0.39). Similarly, 22% of the Peroneus Longus group and 33% of the Hamstring group returned to partial activity by 6 months, with no significant difference observed (p=0.39).

Strength Recovery by Dynamometer

The strength recovery by dynamometer for the Peroneus Longus and Hamstring groups. The Peroneus Longus group showed significantly better knee flexion recovery (96.8 ± 3.2%) compared to the Hamstring group (93.1 ± 4.0%, p=0.04). While knee extension recovery and ankle strength (plantar flexion and eversion) were higher in the Peroneus Longus group, the differences were not statistically significant (p=0.32), and ankle measurements were not available for the Hamstring group.

Comparison of Satisfaction Scores

The satisfaction scores between the Peroneus Longus and Hamstring groups. Patient satisfaction was slightly higher in the Peroneus Longus group (8.8 ± 1.2) compared to the Hamstring group (8.5 ± 1.3), but the difference was not statistically significant (p=0.46). Similarly, surgeon satisfaction was slightly higher in the Peroneus Longus group (9.1 ± 1.1 vs. 8.9 ± 1.2), with no significant difference between the groups (p=0.52).

Ankle Donor Site Morbidity after Harvesting Ipsilateral Peroneus Longus Tendon

Our study highlights the ankle donor site morbidity observed in the Peroneus Longus group (n=18) following tendon harvesting. Mild pain was reported at one week postoperatively, with a mean VAS score of 5.6 ± 1.2, which decreased to minimal residual pain (2.1 ± 0.8) by one month (p=0.18). Strength assessment revealed no significant deficits in ankle plantar flexion (92.4 ± 3.6%) or eversion (91.5 ± 3.9%). Temporary restriction in the range of motion was observed in 2 participants (11%,

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p=0.14), while graft site infection was noted in only 1 participant (5%, p=1.00), indicating a low incidence of complications.

In our study, knee donor site morbidity in the Hamstring group (n=18) following tendon harvesting. Moderate pain was reported at one week postoperatively, with a mean VAS score of 6.8 ± 1.3, which improved to minimal residual pain (3.7 ± 1.1) by one month (p=0.18). Knee flexion strength showed a slight but statistically significant deficit (92.7 ± 3.5%, p=0.02*), while knee extension strength demonstrated minimal deficit (93.1 ± 3.4%, p=0.18). Temporary restriction in the range of motion was noted in 2 participants (11%, p=0.14), and graft site infection was observed in 1 participant (5%, p=1.00), indicating a low overall complication rate. Our results outcome suggests that while both donor sites show minor morbidity, the Peroneus Longus group demonstrates slightly better outcomes in terms of donor site strength and pain.

The **Peroneus Longus group** demonstrated lower pain scores and no significant strength deficits at the ankle donor site, while the **Hamstring group** exhibited a statistically significant reduction in knee flexion strength (p=0.02*). Both groups showed minimal and comparable rates of complications, such as ROM restriction and infection. These findings suggest that the Peroneus Longus tendon harvest may be associated with lower donor site morbidity compared to the Hamstring tendon harvest, particularly in terms of functional outcomes and pain levels.

Comparison with other studies:

The results of our study were compared with those of other research on ACL reconstruction using Peroneus Longus Tendon (PLT) and Hamstring Tendon (HT) grafts. Our study included 36 participants (18 in each group) with an age range of 18-35 years, showing a higher proportion of males. Preoperative functional scores were similar between groups, with Lysholm, MCS, and AOFAS scores reported. Postoperatively, at 3 and 6 months, scores were similar for both groups, but at 9 months, the PLT group showed higher Lysholm scores (89.8 vs. 86.5, p=0.03). Keyhani et al.[12] included 65 patients and found no

significant differences in Lysholm and IKDC scores between graft types. Gök et al.[13] studied 52 patients, showing similar knee functional outcomes with no significant difference between groups. He et al.[14] included 925 patients and found no significant differences in knee laxity, Lysholm, and IKDC scores, but a slight advantage was noted for the PLT group.

In terms of graft harvesting time, our study showed no significant difference between PLT and HT, with surgery durations of 95.8 minutes and 93.5 minutes, respectively. Gök et al.[13]reported a shorter graft harvesting time for PLT, while He et al[.14] did not specify this information.

Strength recovery was better in the PLT group in our study, with higher knee flexion recovery (96.8%) compared to HT (93.1%, p=0.04), a result not directly compared in other studies.

Regarding complications, our study found lower graft site pain in the PLT group (11%) versus the HT group (22%) and no significant difference in range of motion. Keyhani et al.[12] reported similar graft site pain and no significant complications, while Gök et al.[13] noted fewer complications and faster recovery in the PLT group. He et al.[14] observed minimal donor-site complications with no significant differences in knee pain or laxity.

Our study found that 78% of PLT patients and 67% of HT patients returned to full activity at 6 months, with no significant difference. Keyhani et al.[12] did not specify return to activity rates, while Gök et al.[13] showed similar rates with no significant differences.

Donor site morbidity was lower in the PLT group in our study, with less thigh hypotrophy and knee pain compared to the HT group, consistent with findings from Gök et al.[13],which also showed less donor-site morbidity and faster recovery in the PLT group. Satisfaction scores were slightly higher in the PLT group (8.8 vs. 8.5), but the difference was not significant. Gök et al.[13] reported higher satisfaction in the PLT group, while Keyhani et al.[12] did not specify satisfaction data. Biomechanical advantages were observed in our study, with the PLT group showing higher knee flexion strength (96.2% vs. 92.7%, p=0.02) and measured ankle strength (92.4% for plantar flexion), a result not directly

assessed in other studies. Gök et al.[13]noted a larger diameter of the PLT graft, providing a biomechanical advantage for ACL reconstruction, while He et al.[14] did not observe a biomechanical advantage but found slightly better knee function in the PLT group.

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Our study holds significant importance in the field of orthopaedic surgery, particularly in the management of anterior cruciate ligament (ACL) injuries. ACL tears are among the most common and debilitating knee injuries, particularly in active individuals, athletes, and the elderly. Surgical reconstruction of the ACL is often necessary to restore knee stability and functionality. This study evaluates two widely used autograft options—peroneus longus tendon (PLT) and hamstring tendon (HT)—for ACL reconstruction and compares their functional outcomes, aiming to provide insights into their relative effectiveness, donor site morbidity, and rehabilitation potential. [17]

In ACL reconstruction the choice of graft material has a substantial impact on the surgical outcome, including functional recovery, strength, and the long-term stability of the knee. Traditionally, the hamstring tendon has been the most used autograft for ACL reconstruction due to its favourable characteristics, including good tensile strength, low donor site morbidity, and a relatively minimally invasive harvesting technique. However, there is increasing interest in alternative graft options, such as the peroneus longus tendon, which is located in the lower leg and is often underutilized despite its potential advantages. [18, 19]

The peroneus longus tendon has been suggested as an alternative to hamstring autografts because of its comparable mechanical properties and potential for reduced donor site morbidity. Some studies have suggested that the PLT offers a faster recovery time and better strength outcomes, particularly in terms of knee flexion, which is critical for regaining normal function after ACL reconstruction. Additionally, the peroneus longus tendon is located in a less commonly used area, which may present advantages in terms of reduced risk of injury to other structures during graft harvesting. Despite these potential benefits, limited comparative data exist regarding the functional outcomes and complications associated with PLT versus HT autografts. This study fills a gap in the literature by conducting a randomized controlled trial (RCT) to directly compare these two graft options in terms of functional recovery, strength, complications, and patient satisfaction. [20]

The primary objective of our study is to compare the functional outcomes of ACL reconstruction using the peroneus longus tendon and the hamstring tendon, with particular emphasis on post-operative knee stability, strength, and range of motion. The secondary objectives include assessing donor site morbidity, including thigh hypotrophy and graft harvesting time, as well as determining return to activity levels and patient satisfaction scores. These objectives are crucial as they directly impact the quality of life and functional recovery of patients undergoing ACL reconstruction. [12]

In ACL surgery, achieving full knee strength and function post-operatively is critical for patients' ability to return to their previous activities, especially in athletes. Studies comparing different autografts can provide invaluable information for both surgeons and patients, allowing them to make informed decisions based on the relative advantages and disadvantages of different graft options. [5]

Moreover, donor site morbidity is a key consideration when selecting the graft type. Hamstring tendon harvesting has been associated with complications such as thigh weakness, muscle atrophy, and pain at the donor site, which can delay rehabilitation and hinder overall recovery. In contrast, the peroneus longus tendon may offer an advantage in terms of reducing thigh-related complications, as it is harvested from the lower leg. By comparing these two grafts, the study helps address concerns about donor site morbidity and provides a clearer understanding of the risks involved with each type of graft. [21]

From a clinical perspective, the results of this study can guide orthopaedic surgeons in their decision-making process regarding which graft to use for ACL reconstruction, based on factors such as functional recovery, donor site morbidity, and the specific needs of the patient population. For example, the study's findings may suggest that patients with concerns about thigh muscle weakness might benefit from the use of the peroneus longus tendon, while patients seeking faster recovery times or better knee flexion strength may prefer the hamstring tendon. [12]

While the hamstring tendon has been widely studied, the peroneus longus tendon is a relatively newer option, and evidence supporting its use is limited. By providing rigorous comparative data, this study contributes to advancing the practice of ACL surgery, providing further evidence that may influence clinical guidelines and treatment protocols.

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CONCLUSION

Our study provides direct comparative evidence on the functional outcomes, donor site morbidity, and long-term results of two widely used autografts in ACL reconstruction—Peroneus Longus Tendon (PLT) and Hamstring Tendon. By evaluating these grafts' clinical impact, we offer valuable insights that can optimize surgical decision-making and improve patient outcomes.

While HT autografts have been the traditional choice, PLT is emerging as a viable alternative due to its favorable biomechanical properties and potentially reduced donor site morbidity. Our findings suggest that although both donor sites exhibit minor morbidity, the PLT group demonstrates slightly better outcomes in terms of donor site strength and pain. Specifically, PLT patients reported lower donor site pain and no significant ankle strength deficits, whereas HT patients showed a significant reduction in knee flexion strength ($p=0.02$). Both groups had comparable complication rates, including range of motion restrictions and infection.

The advantages of PLT, including better knee flexion strength recovery and reduced donor site morbidity—such as lower thigh hypotrophy and knee pain—highlight its potential as an alternative graft option. These findings are particularly relevant for patients prioritizing faster recovery and minimal long-term complications.

Our study strengthens the current understanding of autograft selection in ACL reconstruction. The randomized controlled trial design enhances the reliability of our results, providing a strong foundation for future research and clinical practice. Ultimately, our findings underscore the need to reevaluate tendon graft options to optimize ACL reconstruction outcomes and minimize complications associated with traditional grafts.

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