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FUNCTIONAL OUTCOME OF RECONSTRUCTION OF ANTERIOR CRUCIATE LIGAMENT TEAR USING PERONEUS LONGUS TENDON AUTOGRAFT VS HAMSTRING TENDON AUTOGRAFT: A PROSPECTIVE OBSERVATIONAL COMPARATIVE STUDY

Orthopaedics

Dr Ashish Tiwari* *Corresponding Author

Dr Vishal Bansal Prof. And Head, Dept Of Orthopaedics, Pcms & Rc, Bhopal, Mp, India

Dr Abhinendra Singh Assistant Prof., Dept Of Orthopaedics, Pcms & Rc, Bhopal, Mp, India

Dr Sameer Gambhir Assistant Prof., Dept Of Orthopaedics, Pcms & Rc, Bhopal, Mp, India

Dr Mani Bagga

ABSTRACT

Background: An appropriate substitute autograft for anterior cruciate ligament restoration (ACLR) is the peroneus longus tendon. The current study compared the use of hamstring tendon autograft vs peroneus longus tendon autograft in ACLR with respect to donor site morbidity and clinical result. **Methods:** The study involved comparing ACL reconstruction (ACLR) outcomes using different autograft types. Quadrupled hamstring tendon autografts were used in 20 patients, while peroneus longus tendon autografts were used in another 20 patients. All surgeries were performed by the same senior knee surgeon between 2022 and 2024.Patients aged 18-50 with ACL ruptures were included. Exclusion criteria ruled out patients with significant chondral lesions, previous knee surgeries, revision cases, joint hypermobility syndrome, and ankle joint issues. ACL ruptures were diagnosed based on medical history, physical exams (including Lachman and pivot shift tests), and MRI results. All patients were followed for at least one year. A single examiner recorded the results. Functional scores were assessed using the International Knee Documentation Committee (IKDC) before and one year after surgery. Postoperative graft harvesting issues were evaluated by measuring thigh circumference (15 cm above the patella) compared to the healthy side. The condition of the ankle donor site in the peroneus longus tendon group was assessed using the Foot & Ankle Disability Index (FADI) Score. **Results:** A total of 40 patients (20 patients in each group) were evaluated with a minimum follow-up of 1 year. Peroneus longus group showed significant differences in clinical outcomes and knee stability compared to Hamstring group. **Conclusion:** To conclude that peroneus longus tendon autograft had shown better results and potential in ACL reconstruction compared to hamstring tendon autograft in terms of strength, stability, and complications and comorbidity, in this present study.

KEYWORDS

Anterior cruciate ligament reconstruction, Hamstring tendon autograft, Peroneus longus tendon autograft

INTRODUCTION

Anterior cruciate ligament reconstruction (ACLR) is widely accepted as the primary method to regain knee stability and function following an ACL tear. Various autograft options are available for ACLR, including bone-patellar tendon-bone, hamstring tendon, and quadriceps tendon. Each type of autograft comes with its own set of pros and cons. Surgeons need to evaluate factors such as graft strength, size, and the ease and safety of graft harvesting, while also aiming to minimize donor site complications. Some research has proposed the peroneus longus tendon as a viable alternative autograft for ACL reconstruction (ACLR) (1-3). This tendon is of adequate size and has been shown to possess sufficient strength for ACLR (4-6). For instance, Rudy et al. found no significant difference in tensile strength between the peroneus longus and hamstring tendons (7). Additionally, Rhatomy et al. reported better functional outcomes with the peroneus longus tendon compared to the hamstring tendon. (8) In another study by Rhatomy et al., it was observed that there was no dysfunction at the donor site when comparing ankle eversion and first ray plantarflexion strength with the healthy contralateral site.(9) However, there are limited comparative studies on the clinical outcomes of the peroneus longus tendon versus other grafts, and the assessment of ankle morbidity post-harvesting is incomplete.(8,10,11) This study aims to compare the functional outcomes and donor site morbidity between the peroneus longus and hamstring autografts, with a minimum follow-up period of 12 months post-ACLR. The hypothesis is that the peroneus longus autograft could serve as an alternative if it demonstrates acceptable clinical outcomes and minimal severe side effects at the donor site.

MATERIALS AND METHODS-

The Ethics Committee approved our institute's study protocol, and all participants provided informed consent. This comparative study involved ACL reconstruction (ACLR) using quadrupled hamstring tendon autografts in 20 patients and peroneus longus tendon autografts in another 20 patients, all performed by the same senior knee surgeon between 2022 and 2024. ACL ruptures were diagnosed through medical history, physical exams (Lachman and pivot shift tests), and MRI results. Inclusion criteria included patients aged 18-50 with ACL ruptures, while exclusion criteria ruled out those with significant chondral lesions, previous knee surgeries, revision cases, joint hypermobility syndrome, and ankle joint issues. All patients were followed for at least one year, with a single examiner recording the results. Functional scores were assessed using the International Knee Documentation Committee (IKDC) before and one year after surgery. Postoperative graft harvesting issues were evaluated by measuring thigh circumference (15 cm above the patella) compared to the healthy side. The condition of the ankle donor site in the peroneus longus tendon group was assessed using the Foot & Ankle Disability Index (FADI) Score.

Procedure- Patients were positioned supine under either spinal or general anesthesia, with a tourniquet applied to the thigh. Initially, anterior portals were used for diagnostic knee arthroscopy, followed by graft harvesting (either hamstring or peroneus longus). Any additional joint procedures, including meniscus repair suturing, were completed, and a partial meniscectomy was performed if necessary.

Peroneus longus tendon harvesting- The peroneus tendon was harvested from the same leg. A 2 cm longitudinal incision was made on the posterolateral side of the fibula, just above the peroneus tendon, 2-3 cm proximal to the posterior border of the lateral malleolus. After exposing the distal peroneus longus, a stripper was used to harvest the tendon up to 4-5 cm below the fibular head to avoid injuring the peroneal nerve. Both peroneus tendons were then sutured distally. The superficial fascia and fat were removed from the harvested tendon, and the rough edges were carefully trimmed. The tendon was folded longitudinally to create a 2-strand autograft, with the ends whip-stitched using No. 2 polyester suture (Ethibond, Arthrex, Naples, Florida, USA).

Hamstring Tendon Harvesting- In the hamstring group, a 3 cm oblique incision was made on the anteromedial side of the proximal tibia, over the pes anserinus. The semitendinosus and gracilis tendons were harvested using an open tendon stripper. These tendons were then folded to create a 4-strand hamstring graft, with both ends secured using a whip-stitch suture with No. 2 polyester suture (Ethibond, Arthrex, Naples, Florida, USA).

Autograft Fixation- The intraarticular surgical technique was consistent for both groups: the femoral and tibial tunnels were drilled independently in their anatomical positions. The prepared autograft tendon was then implanted. Femoral fixation was achieved using a TightRope (Arthrex, Naples, Florida, USA), while tibial fixation was secured with a BioScrew (Arthrex, Naples, Florida, USA) that was one size larger than the tibial tunnel diameter.

Rehabilitation- Patients were discharged with a knee immobilizer the day after surgery. Both groups followed the standard postoperative protocol for ACLR. Knee extension and ankle pump exercises started immediately after surgery. For the first two weeks, partial weight-bearing was allowed with a motion range of 0 to 90 degrees. Full flexion was achieved within 5 to 6 weeks, and full weight-bearing exercises were permitted at least 3 to 4 weeks post-surgery. Running was allowed after 3 to 4 months, and returning to sports activities was recommended after completing functional outcome tests 6 to 9 months post-operation.

RESULTS-

Results During the present study, 40 patients who underwent ACLR in two groups of hamstring tendon (n=20) and peroneus longus tendon (n=20) were followed up for at least 12 months. There were no significant differences in demographic data and injuries between the two groups (P>0.05). The mean thickness of the graft obtained in our study was 8.24mm as compared to thickness of 7.5mm in Kerimoglu's study. The maximum thickness of the graft was 9.5 mm and minimum thickness was 7.5mm. In 44% (11 cases) graft of 8 mm thickness was harvested.

Outcome-

Based on the obtained results, most patients had acceptable functional outcomes after ACLR operation in each group (P< 0.001); however significant differences between the two groups were observed in functional scores [Table 4] Lachman test, anterior drawer test and pivot shift tests were performed to evaluate the knee laxity and stability. significant differences were witnessed between both groups. Latchman test- During post operative evaluation, majority of the patients were observed to be at grade 0 on Lachman evaluation. The observed difference was statistically significant. (table 9) Anterior drawer test- There were 75% of the patients who turned out to be grade 0 after the operation. The observed difference was statistically significant. (Table 8) Pivot shift test- More than half of the patients (65%) improved after the operation and shown grade 0 of pivotal shift. There were still 6 patients who had pivotal shift of grade 2 severity. (Table 10). The observed difference was statistically significant. (Table 10) In our present study, the pre-operative IKDC mean score was (48.31) in the Hamstring group and (49.12) in the Peroneus group, and in the postoperative period, it was recorded at 61.22, 71.41, 83.55,92.55 in the first month, the Third month, the Sixth month, one-year follow-up respectively in the Hamstring group. On the other Hand, in the Peroneus group, it has improved to 66.27, 76.92, 86.28, 94.28 in the first month, the Third month, the Sixth month, and the one-year follow-up, respectively. IKDC Knee Examination Ratings (>90% =normal, 76- 89% = nearly normal, 50-75% = abnormal, below 50% =severely abnormal). The observed difference was significant. (Table 11) Table 14 shows the outcome of the various grafts applied to the patients recruited in the present study. 45% of the patients reported the surgical outcome to be good. 35% patients obtained good outcome. There were 4 patients whose surgical outcome was observed to be poor. There was statistical significance observed in outcome.

Table 1: - comparison Ant. Drawer test result

	Ant. Drawer		Hamstring	Peroneus	Total
Pre-op	Grade 1	Count	0	2	2
		% within Graft Type	0.0%	10.0%	5%
	Grade 2	Count	10	8	18
		% within Graft Type	50.0%	40.0%	45%
	Grade 3	Count	10	10	20
		% within Graft Type	50.0%	50.0%	50%
Post op	Grade 0	Count	12	18	34
		% within Graft Type	60.0%	90.0%	75%
	Grade 1	Count	8	2	6
		% within Graft Type	40.0%	10.0%	25%

Table 2: - comparison Pivot shift result

	Pivot shift result		Hamstring	Peroneus	Total
Pre-op	Grade 2	Count	2	8	10
		% within Graft Type	10.0%	40.0%	25%
	Grade 3	Count	18	12	30
		% within Graft Type	90.0%	60.0%	75%
Post op	Grade 0	Count	10	16	26
		% within Graft Type	50%	80%	65%
	Grade 1	Count	5	3	8
		% within Graft Type	25%	15%	20%
	Grade 2	Count	5	1	6
		% within Graft Type	25%	5%	15%

Table 3: - IKDC score

Graft Type	Hamstring		Peroneus		P value	t-score	Df.
	Mean	Std. Deviation	Mean	Std. Deviation			
Preoperative	48.3067	2.807	49.12	2.141	0.309	-1.0303	37
Postoperative							
1 Month	61.22	3.597	66.2733	4.669	0.0004	-3.839	37
3 Month	71.4133	3.909	76.92	4.881	0.0003	-3.958	37
6 Month	83.5533	1.858	86.2867	2.84	0.0009	-3.602	36
12 Month	92.5533	1.868	94.2867	2.87	0.0297	-2.263	36

Table 4: - FADI Score

Duration	FADI SCORE	SD	FADI SPORTS SCORE	SD
Preoperatively	102.45	1.94	30.22	2.23
Postoperatively At final follow-up (12 months)	98.49	2.33	29.33	1.89

Donor site morbidity and Ankle joint function- "After harvesting the peroneus longus autograft, researchers evaluated donor ankle morbidity using objective measurements of ankle range of motion (ROM) and the Foot and Ankle Disability Index (FADI) score. Remarkably, no patients experienced ankle joint dysfunction or sports-related difficulties due to the graft. Furthermore, there was no significant difference in ankle ROM between the peroneus longus-harvested ankle and the contralateral side."[Table 6]. The mean FADI score was 98.49 at the donor site and 98.91 at the contralateral healthy side. No significant difference was found in the FADI score between the donor and the contralateral side (P>0.0001). No pain or complaint about the weakness of the ankle joint, vascular and neurological complications, or other discomforts over the donor site of the ankle was noted. No serious instability or complication was found in both groups. Thigh hypotrophy was considerably more significant in the hamstring tendon group compared to the peroneus longus group at a minimum of 12 months of follow-up.

DISCUSSION-

The most crucial finding of this study was that the peroneus longus tendon seemed to be an appropriate autograft option for ACLR, provided good functional results, prevented potential complications of the autograft harvested from the knee region, and did not significantly affect the ankle joint. The type of harvested graft often depends on the surgeon's preferences. Autograft size, strength, donor site morbidity, availability, patient activity level, and lifestyle should be considered in preoperative autograft selection (5, 10, 12, 13). An appropriate alternative autograft source can shorten the surgical time and reduce (the morbidity of the harvest side and postoperative pain. In a biomechanical study by Rudy et al., no significant difference between the peroneus longus and hamstring tendon tensile strength was found (7). Wiradiputra et al. concluded that the peroneus longus tendon could be considered the first option graft in ACLR because there was no significant postoperative morbidity associated with biomechanical inconveniency to the donor site (14). As a result of this comparative study, knee laxity for peroneus longus tendon autograft was lesser to

hamstring tendon autograft, and significant difference were found between the two groups in terms of functional scales the knee joint after ACLR. In a systematic review by He et al., patients with peroneus longus tendon autograft ACLR reported equal functional outcomes (Lysholm score, IKDC subjective score) compared with hamstring tendon (15). According to the related literature, autograft diameter has an essential effect on the re-rupture and revision rate (4). Recent studies argued that a less than 8mm graft diameter is not acceptable (16-18). In the current study, the mean diameter of the peroneus longus tendon was more than 8 mm. The current study enrolled a total of 40 patients to study the functional outcome of arthroscopic ACL reconstruction by Hamstring and Peroneus longus tendon autografts with the follow-up up to 12 months to evaluate improvements. There were 47.5% of the patients who were below the age of 25 years whereas 52.5% patients were older than 25 years. Majority of the recruited patients were having right sided knee injury (55%) whereas remaining (45%) were having left sided injury. Most of the patients reported the history of injury while engaging in the RTA (45%). There were other patients (35%) who reported injury due to sports activity and 20% due to fall from height. While treating the patients, grafting was done using hamstring and peroneus longus tendon graft, as shown in table 07, half of the patients were treated using hamstring and rest half with peroneus grafts. During pre op evaluation, 10% patients of peroneus grafts were at grade 1 on Ant. Drawer (with MRI finding of complete ACL tear). There were total of 18 patients who were of grade 2 on ant drawer. Out of them, 10 patients received hamstring grafts, 8 received peroneus graft. 20 patients showed grade 3 on pre op evaluation. There were majority of the patients who turned out to be grade 0 after the operation. During pre-operative evaluation, majority of the patients showed grade 3 results upon Lachman test, out of these 24 patients, 14 received hamstring graft, 10 received peroneus graft. 16 patients showed grade 2 Lachman results preoperatively. During post operative evaluation, majority of the patients were observed to be at grade 0 on Lachman evaluation. Majority of the patients showed pivotal shift of grade 3 severity during pre-operative evaluation. (75%). There were 25% patients who had pivotal shift of grade 2 severity. More than half of the patients (65%) improved after the operation and shown grade 0 of pivotal shift. There were still 6 patients who had pivotal shift of grade 2 severity. During pre op evaluation, the mean IKDC score in patients who received Hamstring and peroneus grafts were 48.3067 and 49.12 respectively. Whereas, after operation, the same scores for these grafts were at final follow up is 92.5533 and 94.2867 respectively. This difference in both types of graft was statistically significant. The mid-thigh girth difference of 0.5 cm was in the 4 patients who received hamstring graft. six patients who received hamstring graft showed 1 cm of midthigh girth difference. 8 patients showed the difference of 2 cm. Out of these, 6 received hamstring grafts whereas two patient received peroneus graft. There was five patient who showed the mid-thigh girth difference of 2.5 cm. A total of 14 patients showed no mid-thigh girth difference. The observed difference was statistically significant. There were 22.5% patients who developed deep infection after the surgery. Out of these, 30% were with hamstring grafts and 15% were with peroneus graft. 32.5% patients didn't develop any complications afterwards. 15% patients complained of post operative knee pain. 20% patients reported occurrence of superficial infection. There was no statistical significance observed in the occurrence of complication during the post operative stage. Ankle functions were grossly preserved in all the patients. No paraesthesia was noted in the region of the extracted graft except for pressure pain in 2 patients. The FADI score outcome mean at final follow up was 98.49 and was not found significant as there were no significant changes were found in ankle function after graft harvesting.

The present study has some limitations. Because the follow-up period was relatively short, we could not evaluate the long-term clinical efficacy or long-term complications. Due to the small sample size, the results might not be generalizable to a larger population.

The clinical relevance of the current study is that the peroneus longus as an alternative graft in ACLR can be recommended because it shows good functional results compared to the hamstring tendon with less donor site morbidity.

The present study demonstrated that peroneus longus tendon autograft might be considered a safe and practical autograft source for arthroscopic anterior cruciate ligament reconstruction with respect to its strength, larger graft diameter, satisfactory ankle function, and prevention of potential complications of hamstring autograft obtained from the knee region.

Conflict Of Interest: All authors declare that they have no conflict of interest related to this study.

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Ethical Approval: This study was approved by the people's college of medical sciences and research centre, Bhopal, MP, India

REFERENCES:

1. Liu CT, Lu YC, Huang CH. Half-peroneus-longus-tendon graft augmentation for unqualified hamstring tendon graft of anterior cruciate ligament reconstruction. J Orthop Sci 2015; 20(5):854- 60.
2. Shi FD, Hess DE, Zuo JZ, Liu SJ, Wang XG, Zhang Y, et al. Peroneus Longus Tendon Autograft is a Safe and Effective Alternative for Anterior Cruciate Ligament Reconstruction. J Knee Surg 2019; 32(8):804-811.
3. Nazem K, Barzegar M, Hosseini A, Karimi M. Can we use peroneus longus in addition to hamstring tendons for anterior cruciate ligament reconstruction? Adv Biomed Res 2014; 3:15.
4. Magnussen R, Lawrence J, West R, Toth A, Taylor D, Garrett W. Graft size and patient age are predictors of early revision after anterior cruciate ligament reconstruction with hamstring autograft. Arthroscopy 2012; 28(4)526-31.
5. Marchand J, Ruiz N, Coupry A, Bowen M, Robert H. Do graft diameter or patient age influence the results of ACL reconstruction? Knee Surg Sports Traumatol Arthrosc 2016; 24(9):2998-3004. 6. Zhao J, Huangtu X. The biomechanical and clinical application of using the anterior half of the peroneus longus tendon as an autograft source. Am J Sports Med 2012; 40(3):662-71.
7. Rudy, Mustamsir E, Phatama KY. Tensile strength comparison between peroneus longus and hamstring tendons: A biomechanical study. International Journal of Surgery Open 2017; 9:41-44.
8. Rhatomy S, Asikin AIZ, Wardani AE, Rukmoyo T, Lumban-Gaol I, Budhiparama NC. Peroneus longus autograft can be recommended as a superior graft to hamstring tendon in single-bundle ACL reconstruction. Knee Surg Sports Traumatol Arthrosc 2019; 27(11):3552-3559.
9. Rathomy Sh, Wicaksono F, Roshadiansyah Soekarno NR, Setyawan R, Primasara Sh, Budhiparama N. Eversion and First Ray Plantarflexion Muscle Strength in Anterior Cruciate Ligament Reconstruction Using a Peroneus Longus Tendon Graft. Orthop J Sports Med. 2019;7(9):2325967119872762.
10. Song X, Li Q, Wu Z, Xu Q, Chen D, Jiang Q. Predicting the graft diameter of the peroneus longus tendon for anterior cruciate ligament reconstruction. Medicine (Baltimore) 2018; 97(44):e12672. 11.Angthong C, Chernchujit B, Apivatgaroon A, Chaijenkit K, Nualon P, Suchao-in K. The Anterior Cruciate Ligament Reconstruction with the Peroneus Longus Tendon: A Biomechanical and Clinical Evaluation of the Donor Ankle Morbidity. J Med Assoc Thai 2015; 98(6)555-60.
12. Hoshino Y, Fu FH. Matching the Anterior Cruciate Ligament Graft to the Patient. Operative Techniques in Orthopedics 2017; 27(1):14-19. 13.Parkinson B, Robb C, Thomas M, Thompson P, Spalding Factors That Predict Failure in Anatomic SingleBundle Anterior Cruciate Ligament Reconstruction. Am J Sports Med 2017; 45(7):1529-1536. 14.Wiradiputra A, Febyan, Aryana G. Peroneus longus tendon graft for anterior cruciate ligament reconstruction: A case report and review of literature. International Journal of Surgery Case Reports. 2021:38:106028.
15. He J, Tang Q, Ernst S, Linde M, Smolinski P, Wu S, et al. Peroneus longus tendon autograft has functional outcomes comparable to hamstring tendon autograft for anterior cruciate ligament reconstruction: a systematic review and meta-analysis. Knee Surg Sport Traumatol Arthrosc 2020; Sep27.
16. Park SK, Oh H, Park S, Lee J, Lee S, Yoon K. Factors predicting hamstring tendon autograft diameters and resulting failure rates after anterior cruciate ligament reconstruction. Knee Surg Sports Traumatol Arthrosc 2013; 21(5):1111-8.
17. Conte EJ, Hyatt AE, Gatt CJ, Dhawan A. Hamstring autograft size can be predicted and is a potential risk factor for anterior cruciate ligament reconstruction failure. Arthroscopy 2014; 30(7):882-90. 18.Mariscalco M, Flanigan D, Mitchell J, Pedroza A, Jones M, Andrish J, et al. The influence of hamstring autograft size on patient-reported outcomes and risk of revision after anterior cruciate ligament reconstruction: a Multicenter Orthopaedic Outcomes Network (MOON) Cohort Study. Arthroscopy 2013; 29(12):1948-53.