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STUDY ON COMPARATIVE ANALYSIS OF FUNCTIONAL OUTCOMES OF ARTHROSCOPIC SINGLE BUNDLE ACL RECONSTRUCTION UTILISING HAMSTRING VERSUS PERONEUS TENDON GRAFTS

Sachin Yadav	Associate Professor, Department of Orthopedics, SRN Hospital, Prayagraj (UP)
Vyas Narayan Shukla	Assistant Professor, Department of Orthopedics, Government Medical College & Super Facility Hospital, Azamgarh (UP)
Ravi Sahani*	Senior Resident, Department of Orthopedics, SRN Hospital, Prayagraj (UP) *Corresponding Author
Mukesh Kumar Sharma	Senior Resident, Department of Orthopedics, SRN Hospital, Prayagraj (UP)
Arun Kumar Yadav	Assistant Professor, Department of Orthopedics, Government Medical College & Super Facility Hospital, Azamgarh (UP)
Alok Kumar Dwivedi	Senior Resident, Department of Orthopedics, SRN Hospital, Prayagraj (UP)
Sriram	Senior Resident, Department of Orthopedics, SRN Hospital, Prayagraj (UP)

ABSTRACT **Introduction-** The anterior cruciate ligament (ACL) is the principal passive constraint to the anterior translation of the tibia on the femur. It is the most frequently injured ligament in the knee. This study aims to compare arthroscopic single bundle ACL reconstruction utilising hamstring versus peroneus tendon grafts. **Method-** In this study, a total of 30 patients (divided into two groups, i.e., Group 1- hamstring graft and Group 2- peronious longus graft) of age >18 years with radiological evidence of epiphyseal fusion, ACL tear and no signs of inflammation over affected knee were included. Morbidity, ipsilateral AOFAS, FADI, IKDC, Lysholm, and Modified Cincinnati scoring systems were used and compared in each group at postop and follow-ups. **Results-** The mean age of the Hamstring group and the Peroneus group were 25.7±8.5 and 24.6±8.1, respectively. The majority of patients belonged to the 18-30 age group. Males were outnumbered in both groups. The majority of patients in both groups had sports injuries with statistically insignificant differences (p=0.1832). The mean graft diameter of the Hamstring and the Peroneus groups were 7.58±0.16 and 8.07±0.13, respectively. While analysing intragroup comparison of mean IKDC, Modified Cincinnati and Lysholm between pre-op and follow-up, a statistically significant difference was found between them (p<0.0001*). Differences in thigh circumferences in the operated and sound leg between the Hamstring group and the Peroneus group were 10.5±2.71 and 1.65± 0.36, respectively. Mean AOFAS and FADI scores had no statistical differences. **Conclusion-** Peroneus longus as the graft of choice in single-bundle ACL reconstruction can be encouraged in clinical practice as it shows comparable functional scores.

KEYWORDS : Anterior Cruciate Ligament, Peroneus Longus Tendon, Hamstring Tendon, Osteoarthritis, International Knee Documentation Committee, Lysholm, Modified Cincinnati, American Orthopedic Foot And Ankle Society Score, Foot & Ankle Disability Index.

INTRODUCTION

ACL injuries frequently result in joint effusion, abnormal knee kinematics & gait, muscular weakness, and decreased functional status and are accompanied by significant clinical consequences such as meniscal tears, chondral lesions, and early onset post-traumatic osteoarthritis (OA). [1] Arthroscopic ACL restoration surgery is generally regarded as the gold standard procedure for restoring knee stability and functionality as it helps slow down the process of OA. [2] ACL reconstruction, including autografts (Hamstring tendon, Peroneus longus tendon, Patellar tendon, and Tibialis anterior tendon) and allografts. Hamstring tendon grafts have several advantages over patellar tendon autografts, including decreased postoperative patellofemoral crepitation, anterior knee pain, extension loss, and donor site morbidity, as well as smaller skin incisions at the harvest site. The use of PLT autograft in ACL reconstruction is a relatively recent breakthrough in the field. [3-4] Numerous published research demonstrates disagreement about the functional outcomes and durability of various ACL repair procedures. [5] Few investigations have found no significant difference in tensile strength between the peroneus longus and hamstring tendons. [6] As a result, we provide a comparative analysis of arthroscopic single bundle ACL restoration utilising hamstring and peroneus tendon grafts.

MATERIAL & METHODS

This prospective cohart study was conducted in the Department of Orthopedics, SRN HOSPITAL, Affiliated with MLN Medical College, Prayagraj. From 2019 to 2022. The patient with ACL tear presented in the OPD satisfied the inclusion (Age >18 years with radiological evidence of epiphyseal fusion, ACL tear and no signs of inflammation over the affected knee were included) and exclusion criteria (Age >60 years, Multi-ligamentous injury, Bilateral knee, pre-existing flat foot, ankle deformity, paralytic conditions, poliomyelitis or previous significant injuries to ankle, advanced degenerative knee disease, overlying skin infections over the knee or the ankle and chronic systemic medical diseases. After thorough history, clinical examination and valid informed consent patients were selected for the study and were divided (depending upon management) into two groups of 15 each. Group 1 was hamstring graft, while Group B was peroneus longus graft

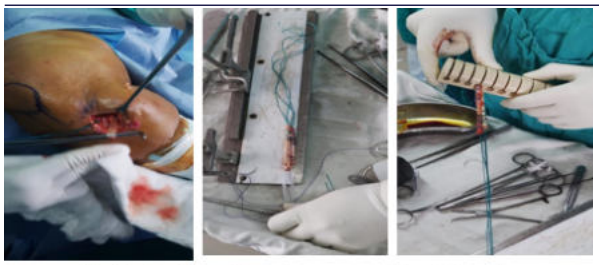
All the patients were preoperative evaluated with history and examination, skiagram, routine pre-operative all serological investigation ECG and comorbid medical issues allergy to the antibiotic.

Operative Procedure

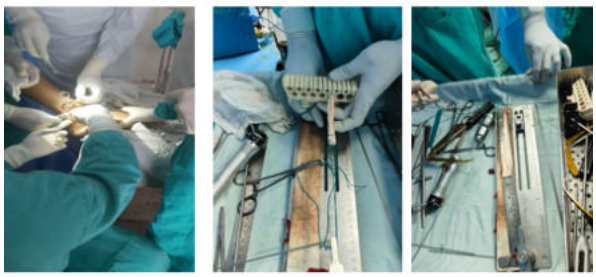
- Once the patient was taken under anesthesia examine the operative and non-operative leg for range of motion, Lachman, Pivot Shift, Lateral collateral, Medial collateral examination.

Patient Positioning- the patient was placed supine on the table with a thigh tourniquet placed over operated limb which was hanged at the edge of table

- HARVESTING OF HAMSTRING GRAFT-
- HARVESTING OF PERONIOUS LONGUS-
- GRAFT PREPRATION-
- ARTHROSCOPY-
- POST OP CARE- Knee brace was unlocked to allow 0-90 degree knee motion on 2nd – 3rd postop day and patient was discharged.



Identification, Preparation and measurement of hamstring graft



Identification, Preparation and measurement of peroneus graft

Preparation of femoral tunnel, tibial tunnel and Fixation of graft over tibia with the help of bio screw

All patients were examined for morbidity, ipsilateral thigh circumference, AOFAS (American orthopaedic foot and ankle score), and FADI (Foot and ankle disability index) score were assessed and compared to the normal side in each postop follow-up. Intraoperative harvested graft diameter was measured, and functional outcomes in the affected knee, IKDC, Lysholm, and Cincinnati scoring system were used.

Statistical Analysis

Statistical analysis was performed using SPSS software (SPSS Inc., Chicago, IL, USA) for the Windows program (21.0 version). The continuous variables were evaluated by mean (standard deviation) or range value when required. The dichotomous variables were presented in number/frequency. The correlation was done using Pearson correlation analysis. A p-value of < 0.05 or 0.001 was regarded as significant.

RESULTS

The mean age of the Hamstring group and the Peroneus group were 25.7±8.5 and 24.6±8.1, respectively with majority in both groups belonged to 18-30 age group [TABLE 1]. The majority of patients in both group were males followed by females [TABLE 2]. The mean height of both groups was statistically insignificant. [TABLE 1] The majority of patients in the Hamstring group had sports injuries [n=9(60%], followed by domestic injury [n=4(26.67%], respectively. Similarly, the Majority of patients in the Peroneus group had sports injury [n=13(86.67%], followed by domestic injury [n=2(13.33%], respectively and a statistically insignificant difference was found between them (p=0.1832). The mean graft diameter (mm) of the Hamstring group and the Peroneus group showed a statistically significant difference (p<0.0001*). [TABLE-3] While analysing intragroup comparison of mean IKDC, Modified Cincinnati and Lysholm between pre-op and follow-up, a statistically significant difference was found between them (p<0.0001*). [TABLE-4] The majority of patients in the Hamstring group had thigh circumference (Hypotrophy) less than 10 mm [n=9(60%], followed by between 10-20 mm [n=3(20%], respectively. Similarly, the Majority of patients in the Peroneus group had thigh circumference less than 10 mm [n=11(73.33%] followed by between 10-20 mm [n=4(26.67%], respectively and a statistically insignificant difference was found between them (p=0.1880). [FIGURE-1] Differences in thigh circumferences in the operated and sound leg between the Hamstring group and Peroneus group were 10.5±2.71 and 1.65± 0.36, respectively and a statistically significant difference was found between them (p<0.0001*). [FIGURE-2] Mean AOFAS and FADI score between the operated leg, and sound leg was [97.47±2.12 and 98.02±1.15] and [97.47±2.12 and 98.02±1.15], and no statistical differences (p=0.8832) were found between both the scores among the groups. [TABLE-5]

DISCUSSION

The present study included 30 patients who were randomly assigned to one of two groups. One group was managed by hamstring tendon grafts (n=15) collected from the ipsilateral side, whereas the other group managed by peroneus longus tendon grafts(n=15). Males constituted the majority of patients in both groups. The mean height and mode of injury were not significantly different between the Hamstring and Peroneus groups. The pre-operative mean IKDC score and Lysholm, Modified Cincinnati score showed insignificant differences. In both groups, the majority of patients had a thigh circumference of less than 10 mm. The mean difference in graft size between the Hamstring and Peroneus groups was 10.5±2.71 and 1.65±0.36, respectively, and this difference was statistically significant (p<0.0001*). Thus, the peroneus longus as the graft of choice in single-bundle ACL reconstruction. The mean age of the Hamstring and Peroneus groups did not differ statistically significantly, with the majority of patients falling between the ages of 18-30 [n=9(60%)]. The influence of the autograft diameter to the re-rupture and revision rate of the repaired ACL of the knee has been examined carefully. The graft failure rate is greater in younger patients. [7] Other studies demonstrated a substantial positive association between 1mm increase in graft diameter, higher KOOS score and IKDC score, and also increased revision rate with graft size of less than 8 mm. [8] Rhatomy et al. [9] findings, the present study also observed the mean graft of Hamstring group and Peroneus group were 7.58±0.16 and 8.07±0.13, respectively and the difference was statistically significant. (p<0.0001*). This data implies that peroneus longus autograft is a possible choice for ACL restoration and decreasing chances of re-rupture occurrence in the future. The hypotrophy of the hamstring also results in quadriceps hamstring imbalance which results in the imbalance of knee dynamic stability. [10] Injured leg is frequently smaller than the healthy leg in hamstring tendon utilization as an ACL repair graft. [20] Rhatomy et al. [9] stated the reason why their study has similar thigh circumference between damaged location and uninjured site is because of the peroneus longus as a graft for ACL restoration. Rhatomy et al. [9] research demonstrated outstanding outcomes in the IKDC score, Modified Cincinnati, and Tegner-Lysholm score. The present study finding corresponds with the above observations showing the potential of peroneus longus graft. We observed no significant differences in pre-operative mean IKDC score and Lysholm, Modified Cincinnati score of the Hamstring and Peroneus groups. While analysing intragroup comparisons of IKDC in the Hamstring and Peroneus groups between pre- and post-operative periods, a statistically significant difference was observed. Khajotia et al. [11] claimed improvement in IKDC score in 6 months after ACL restoration utilizing peroneus longus tendon with a mean score of 83.53. Kerimoglu et al. [12] demonstrated satisfactory performance in mean Lysholm score 83.7 in ACL repair with the adoption of peroneus longus tendon as a graft. Peroneus longus tendon is favoured because of there is no extension or flexion loss and no patellofemoral discomfort in patients. [93] Recent research by Angthong et al. [5] indicated probable donor site morbidity utilizing peroneus longus tendon, including lower peak torque version and inversion, impaired ankle function, and worry about ankle stability. In contrast to Angthong et al. [5] study, we found peroneus longus as the graft of choice in single-bundle ACL reconstruction. Rhatomy et al. [9] observed that the function of donor ankle was outstanding after harvesting the peroneus longus tendon according to an ankle functional test based on FADI and AOFAS scores. This is possibly because the donor's ankle has an intact peroneus brevis. Rhatomy S et al. [13] found a substantial difference in the diameter of hamstring and peroneus longus grafts, with a mean difference of 0.6 mm in favour of the peroneus graft. Similarly, the present study observed the mean difference in thigh circumferences in in graft size between the Hamstring and Peroneus groups was 10.5±2.71 and 1.65±0.36, and difference was statistically significant (p<0.0001*). Additionally, the probability of a patient requiring revision ACL repair decreased by0.82 times for every 0.5 mm increase in graft diameter between 7 and 9 mm. [14] Several previous studies indicated favourable outcomes

following ACL restoration using the peroneus longus tendon. [5-6, 12] investigated. When hamstring grafts were employed, there was some donor site morbidity, including thigh hypotrophy and subjective symptoms such as hypoesthesia or numbness produced by damage to the saphenous nerve's infrapatellar branch. Additionally, hamstring hypotrophy occurs in a quadriceps–hamstring imbalance, which results in a dynamic knee stability imbalance. [15] Angthong et al. [5] discussed potential donor site morbidity associated with peroneus longus tendon implantation, including lower peak torque eversion and inversion, impaired ankle function, and concerns about ankle stability. Rhatomy et al. [9] assessed ankle function in this study using the AOFAS-Hindfoot Scale and the FADI score. The mean AOFAS-Hindfoot Score was 97.3±4.2 (range 88–100) in the peroneus longus group, while the mean FADI score was 98±3.4 (85.6–100), both of which were regarded as good results. The foregoing result indicates that the donor ankle functioned normally following peroneus longus tendon harvesting. This is most likely due to the donor ankle's peroneus brevis being intact. Despite the fact that prior research, such as those by Angthong et al. [5], reported a decrease in ankle peak torque eversion and inversion, Rhatomy et al. [9] observed that the functional outcome remained outstanding. Further research could focus on ankle stability and power assessments and their correlation with functional scores following peroneus longus tendon harvesting.

Table-1: Mean Age And Height Of Patients In Hamstring Group And Peroneus Group

	HAMSTRING GROUP [n=15]		PERONEUS GROUP [n=15]		P-VALUE
	Mean	SD	Mean	SD	
AGE	25.7	8.5	24.6	8.1	t=0.3628 p=0.7194
HEIGHT	163.05	8.4	168.14	7.9	t=1.71 P=0.0984

Table-2: Gender And Age Wise Distribution Of Patients In Hamstring Group And Peroneus Group

GENDER		HAMSTRING GROUP [n=15]		PERONEUS GROUP [n=15]		P-VALUE
		N	%	N	%	
	MALE	12	80.00%	10	66.67%	X=0.6818
	FEMALE	3	20.00%	5	33.33%	p=0.4090
AGE DISTRI-BUTION	18-30	9	60.00%	11	73.33%	X=0.6762
	31-40	4	26.67%	3	20.00%	p=0.7131
	41-50	2	13.33%	1	6.67%	

Table-3: Mechanism Of Injury And Graft Diameter Of Patients In Hamstring Group And Peroneus Group

MECHANISM OF INJURY		HAMSTRING GROUP [n=15]		PERONEUS GROUP [n=15]		P-VALUE
		N	%	N	%	
	RTA	2	13.33%	0	0.00%	X=3.394
	SPORTS	9	60.00%	13	86.67%	p=0.1832
	DOMESTIC	4	26.67%	2	13.33%	
GRAFT Diameter (mm)		7.58	0.16	8.07	0.13	t=9.205 p<0.0001 *

Table-4: Mean Of IKDC, Modified Cincinnati, Lysholm Scores Of Patients In Hamstring Group And Peroneus Group

		HAMSTRING GROUP [n=15]		PERONEUS GROUP [n=15]		P-VALUE
		MEAN	SD	MEAN	SD	
IKDC	Pre-operative	55.7	14.5	57.6	10.4	t=0.4124 p=0.6832
	Follow-up	87.6	8.6	91.8	5.8	t=1.568 p=0.1281
		p<0.0001*	p<0.0001*			
MODIFIED CINCINNATI	Pre-operative	66.4	15.7	65.8	12.6	t=0.1154 p=0.9089
	Follow-up	87.6	7.9	91.6	4.9	t=1.666 p=0.1068
		p<0.0001*	p<0.0001*			
LYSHOLM	Pre-operative	68.7	14.6	69.89	9.86	t=0.2616 p=0.7955
	Follow-up	92.6	6.8	93.8	4.9	t=0.5545 p=0.5836
		p<0.0001*	p<0.0001*			

Table-5: Donor Aofas And Fadi Score In Peroneus Longus Group In Operated And Sound Leg Between In Peroneus Group

SCORE	PERONEUS LONGUS				P-VALUE
	OPERATED LEG [n=15]		SOUND LEG [n=15]		
	MEAN	SD	MEAN	SD	
AOFAS	97.47	2.12	98.02	1.15	t= 0.3846 p= 0.8832
FADI	98.11	2.16	98.23	1.34	t=0.1828 p=0.8562

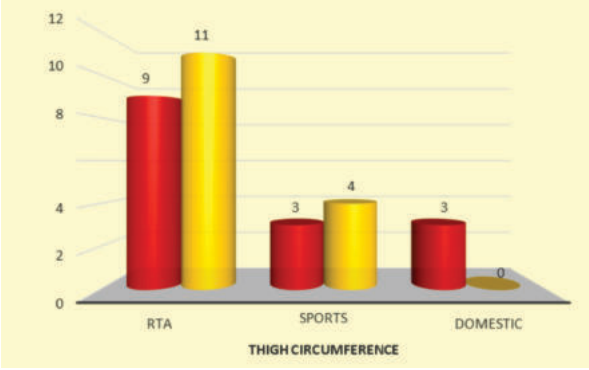


Figure-1: Distribution Of Patients According To Their Thigh Circumference (hypotrophy) In Hamstring Group And Peroneus Group.

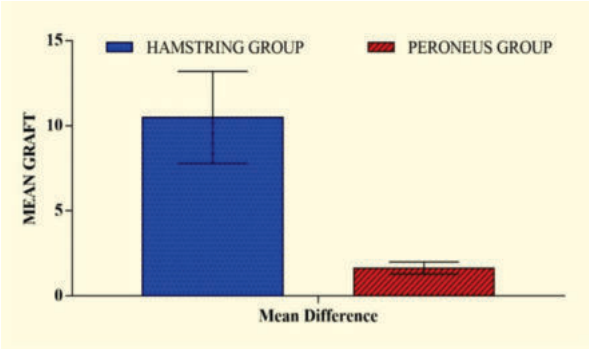


Figure-2: Differences In Thigh Circumferences In Operated And Sound Leg Between Graft In Hamstring Group And Peroneus Group.

CONCLUSION

The peroneus longus as the graft of choice in single-bundle anterior cruciate ligament (ACL) reconstruction can be encouraged in clinical practice because it shows comparable functional scores compared with the hamstring tendon with less donor site morbidity, especially in groups of patients who frequently kneel in their daily activities, as they do in our country. Single-bundle ACL reconstruction with peroneus longus tendon autografts had an excellent functional outcome (IKDC, modified Cincinnati, Lysholm) and showed comparable results to the four-strand hamstring tendon, with no donor site morbidity observed. Our study had various limitations such as the cohort was too small, and no assessment of stability or range of motion was conducted, making objective evaluation difficult. A short period of follow-up was also a shortcoming; it was limited to a single tertiary care hospital. However, to increase the reliability and generalizability of study observations, further multi-centric meta-analytic studies with large sample sizes and extended follow-up duration are needed.

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