PERONEUS LONGUS VS HAMSTRING GRAFT ACL RECONSTRUCTION - AN ANALYSIS OF FUNCTIONAL OUTCOMES

Dr. Rahul P[1], Dr. Yashavanth Kumar C[1], Dr. Goutham G[2], Dr. Manjunatha R[3*]

[1]Associate Professor, Department of Orthopaedics, MS Ramaiah Medical College
[2]Senior Resident, Department of Orthopaedics, Sanjay Gandhi Institute of Trauma & Orthopaedics
[3]Senior Resident, Department of Orthopaedics, MS Ramaiah Medical College*
Author Contribution
Dr. Rahul P: Conceptualization, Methodology, Investigation, Manuscript Writing
Dr. Yashavanth Kumar C: Methodology, Patient follow-up, Statistics, Manuscript Writing
Dr. Goutham G: Reviewing and Supervision, Manuscript Writing,
Dr. Manjunatha R: Reviewing and Supervision, Manuscript Writing,
All authors read and approved the final version of the manuscript

KEY WORDS

Anterior cruciate ligament; Reconstruction; Autograft; Hamstring; Peroneus longus; IKDC; Lysholm.

ABSTRACT

BACKGROUND AND OBJECTIVES
ACL injury is one of the most common knee injuries and ACL reconstruction using various autografts is the gold standard treatment. Although hamstring tendon autograft has long been used, peroneus longus autograft is gaining increasing popularity. However, there are a lack of studies comparing the functional outcomes of the knee joint post ACL reconstruction using the above two grafts in the Indian population.

MATERIALS AND METHODS
The study included total of 52 patients. 26 patients in each group for ACL reconstruction with the use of PLT autograft in one group and hamstring autograft in second group. Functional outcome was assessed using IKDC score and Lysholm score for the knee joint. Clinical outcome was assessed using anterior drawer and Lachman tests. Both functional and clinical outcomes were assessed pre and post operatively at 3rd and 6th month.

RESULTS
There were no significant differences in the 3rd month and 6th month postoperative IKDC and Lysholm scores between the hamstring and peroneus longus groups. The mean diameter of the peroneus longus graft was larger than the hamstring graft, however there was no significant difference in knee stability, clinical or functional outcomes between the two groups.

CONCLUSION
Anterior cruciate ligament reconstruction with either hamstring or peroneus longus autografts produces a similar functional score (IKDC, Lysholm) at 6month follow-up. Peroneus longus graft can

	be considered as an alternative graft for primary ACL reconstruction.

INTRODUCTION

The incidence rate of anterior cruciate ligament (ACL) injury in general population is 1:3500.[1] ACL injury is one of the most common knee injuries, accounting for an estimated 200,000 injuries each year in the United States.[2] Its rupture most commonly occurs during sports injuries or during road traffic accidents.[3] In India 86.5% of sports related knee injuries account to ACL injury.[4]

The current gold standard for restoring knee stability, reducing the risk of secondary meniscal tears and symptomatic osteoarthritis is ACL reconstruction.[5] ACL reconstruction improves knee stability and function with a variety of graft types, including autografts and allografts.[6]

Autografts have been time-tested and consistently associated with positive clinical outcomes. [7] The Hamstring tendon (HT) autograft is the most commonly used graft for ACL reconstruction worldwide.[5] Other autografts used in ACL reconstruction include bone-patellar tendon-bone (BPTB) graft and quadriceps tendon, but there is no globally accepted gold standard choice of graft.[5] The use of peroneus longus tendon (PLT) autograft as an alternative to the traditional autograft is a recent advancement in the field of ACL reconstruction.[7]

MATERIALS AND METHODS

This is a prospective comparative study from March 2021 to October 2022.
All patients who fulfilled the inclusion and exclusion criteria underwent arthroscopic ACL reconstruction. Our study included 26 patients in each group for ACL reconstruction with the use of PLT autograft in one group and hamstring autograft in second group. The data was collected over a period of 18 months following ethical clearance and written informed consent was obtained from each patient enrolled in the study.

INCLUSION AND EXCLUSION CRITERIA

The inclusion criteria were patients aged 18-65 years with complete ACL tear (both acute and chronic), clinical /MRI evidence of symptomatic individuals with anterior cruciate ligament insufficiency, no history of previous surgery in the knee, a normal contralateral knee. The exclusion criteria were as follows: asymptomatic individuals, patients with systemic diseases compromising their pre-anaesthetic fitness, associated ligament injury, fracture around the knee, patients with failed ACL reconstruction.

PREOPERATIVE ASSESSMENT

As per the inclusion criteria, patients with ACL tear were counselled regarding the two graft options. All the advantages and disadvantages of both graft options were explained in detail. Those who consented for PLT graft were included in one group and the others in hamstring group. Following parameters were assessed preoperatively:

- CLINICAL TESTS: Anterior drawer test and Lachman Test.
- FUNCTIONAL SCORE: International Knee Documentation Committee (IKDC) score and Lysholm score.

INTRAOPERATIVE ASSESSMENT

Intra operatively autograft diameter was assessed in both the groups after harvesting the graft.

HARVESTING PERONEUS LONGUS TENDON

A 2 cm incision was made along the posterior border of the distal fibula to harvest the peroneus longus tendon. After carefully incising the fascia, the peroneus longus tendon was exposed on its posterolateral aspect through the incision. Peroneus brevis muscle was identified. Tenodesis of peroneus longus to peroneus brevis was done to prevent retraction of distal cut end of peroneus longus. The tendon was sutured with thick non-absorbable suture and cut with a scalpel before being harvested with a long tendon stripper. The harvested graft was pre-tensioned and then looped to prepare a triple graft on a tendon board. The length of the tripled graft was noted. The graft was run through cylindrical sizers to determine the precise diameter of the graft. [8]

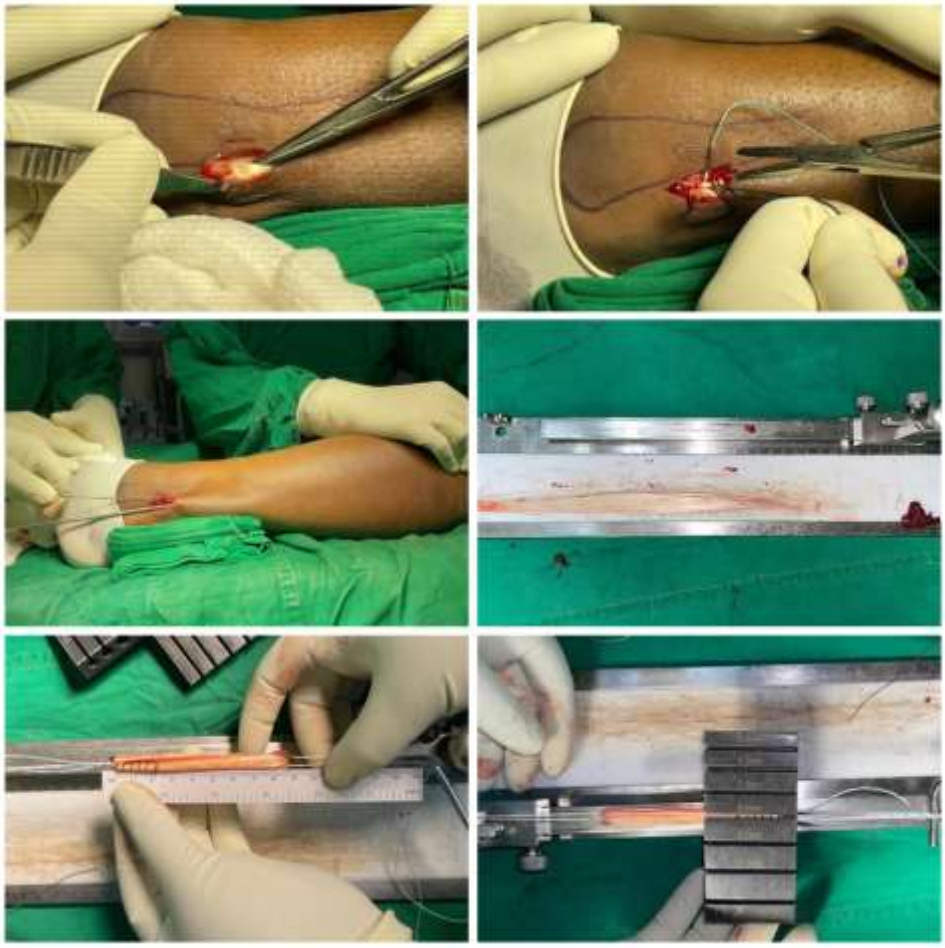

Figure 1: Steps of harvesting peroneus longus tendon

HARVESTING STG (SEMITENDINOSUS- GRACILIS) TENDON

A 3 cm skin incision was made on the anteromedial tibial surface at the level of the pes anserinus using no.10 scalpel. Further blunt dissection was carried through the subcutaneous tissue to the sartorial fascia. Under the sartorial fascia, the gracilis and

semitendinosus tendons can be palpated. The gracilis tendon is superior to the semitendinosus tendon at the pes level, but the semitendinosus tendon has a larger diameter than the gracilis tendon. Inverted L shaped incision is made in sartorial fascia, The transverse limb of the L runs along the superior border of the gracilis, and the longitudinal limb of the L runs along the tibial crest. Each tendon was identified and individually dissected away from the sartorial fascia and isolated. Tendon stripper is used to release each tendon from its musculotendinous attachment.[9] The length of the graft was noted. The graft was run through cylindrical sizers to determine the precise diameter of the graft after tripling the semitendinosus graft and doubling the gracilis graft.

Figure 2: Steps of harvesting STG (Semitendinosus- Gracilis) tendon

After graft harvesting, the grafts were prepared with suspensory fixation for the femoral side and interference screw fixation for the tibial side grafts. Reconstruction of ACL was performed by a single surgeon for all the patients in both the groups.

POSTOPERATIVE ASSESSMENT

Postoperatively, all patients received appropriate analgesia and underwent a standard rehabilitation program. The patients were put on a knee brace and were advised for weight bearing walk as tolerated from postoperative day1. The knee range of motion 0-90° began from postoperative day1 along with static quadriceps and hamstring strengthening exercise protocol. After 3 weeks, full weight bearing and knee range of motion >90° were allowed with continued quadriceps and hamstring strengthening

exercise protocol. After 6 months, running, jumping, cycling and swimming were advised.

Clinical outcome assessments were done using two tests post operatively at 6 weeks, 3rd month and 6th month. Subjective outcome assessment was done using patient reported outcome measure (PROM) scores such as International Knee Documentation Committee (IKDC) score and Lysholm score at 3rd month and 6th month.

STATISTICAL ANALYSIS:

Sample size was estimated by using the difference in Mean graft diameter of hamstring and peroneus longus from the study Sholahuddin R et. Al. as 8.2 ± 0.8mm and 8.8± 0.7mm. Using these values at 95% Confidence limit and 80% power sample size of 26 was obtained in each group. Data was entered into Microsoft excel data sheet and was analysed using SPSS 22 version software. Categorical data was represented in the form of frequencies and proportions. Chi-square was used as the test of significance. Continuous data was represented as mean and standard deviation. Independent t test was used as the test of significance to identify the mean difference between two groups. p value <0.05 was considered as statistically significant.

RESULTS

	GROUP	MEAN	S. D	p VALUE
GRAFT DIAMETER (mm)	**P**	8.82	0.5360	0.502
	H	8.134	0.3551	
GRAFT LENGTH (cm)	**P**	9.215	0.3655	0.504
	H	8.830	0.429	

Table 1: Mean graft length and diameter of the study groups

The mean graft diameter of study participants in group P and H were found to be 8.82±0.5360 and 8.134±0.3551 respectively. The mean graft length of study participants in group P and H were found to be 9.215±0.365 and 8.830±0.429 respectively. The association was not found to be statistically significant between graft diameter and the 2 groups of the study participants.

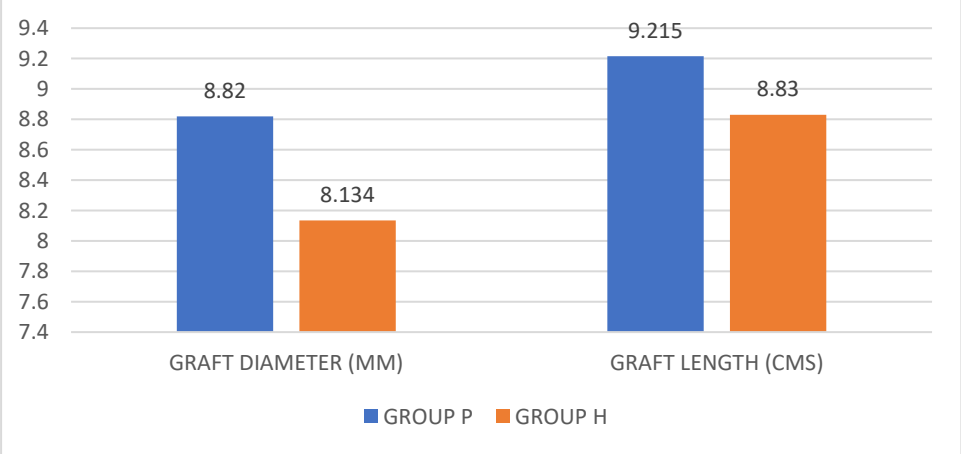

Figure 3: Mean graft length and diameter of the study groups

IKDC SCORE	GROUP	MEAN	S. D	p VALUE
PRE-OP	**P**	56.50	8.3	0.171
	H	53.15	8.9	
3RD MONTH	**P**	73.65	4.3	0.087
	H	71.85	2.9	
6TH MONTH	**P**	84.31	3.8	0.100
	H	82.42	4.2	

Table 2: Mean IKDC score of the study groups

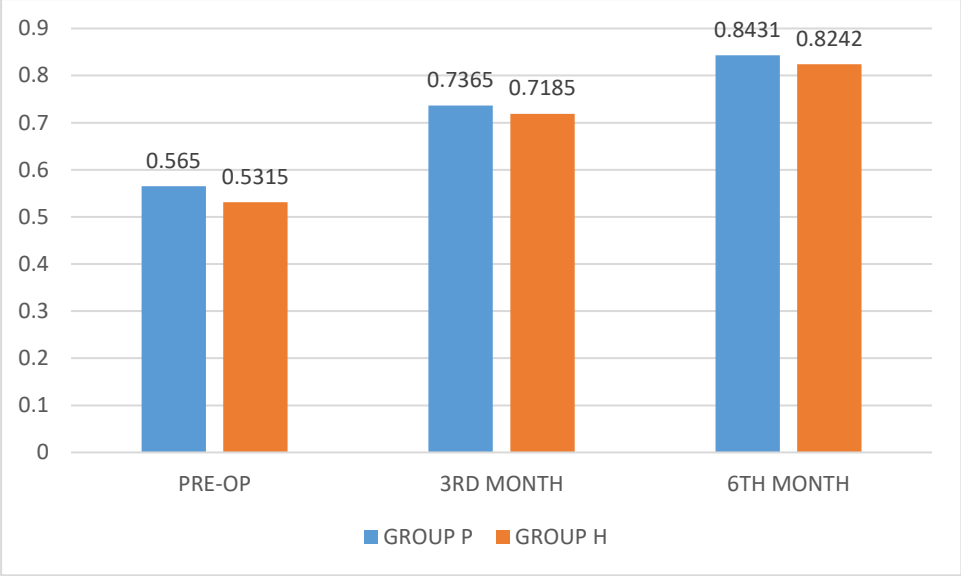

Figure 4: Mean IKDC score of the study groups

The mean pre-op IKDC score of study participants in group P and H were found to be 56.50±8.3 and 53.15±8.9 respectively. The mean 3rd month IKDC score of study participants in group P and H were found to be 73.65±0.04.3 and 71.85±2.9 respectively. The mean 6th month IKDC score of study participants in group P and H were found to be 84.31±3.8 and 82.42±4.2 respectively. This was not found to be statistically significant.

LYHOLM SCORE	GROUP	MEAN	S. D	p VALUE
PRE-OP	**P**	56.42	7.809	0.241
	H	53.85	7.857	
3RD MONTH	**P**	72.38	4.948	0.314
	H	71.08	4.298	
6TH MONTH	**P**	84.85	2.618	0.427

	H	84.19	3.238	

Table 3: Mean Lysholm score of the study groups

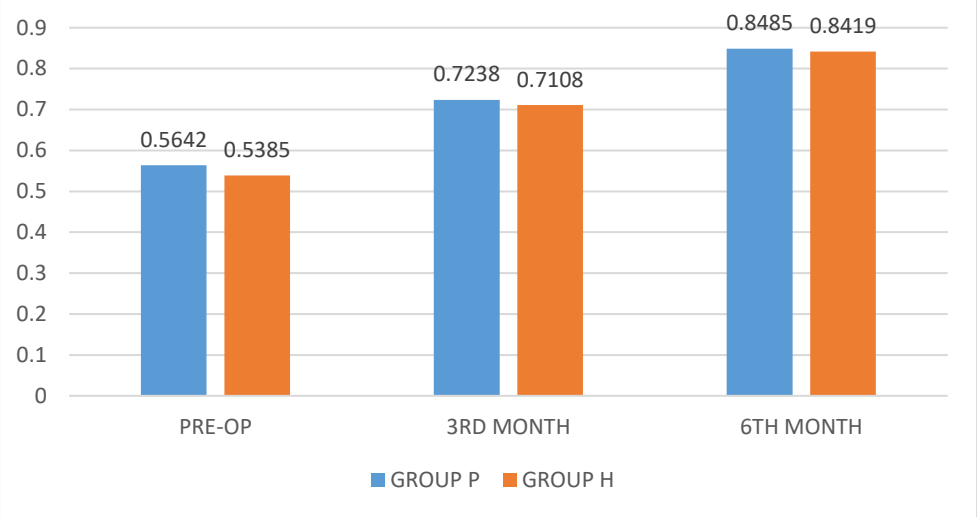

Figure 5: Mean Lysholm score of the study groups

The mean pre-op Lysholm score of study participants in group P and H were found to be 56.42±7.809 and 53.85±7.857 respectively. The mean 3rd month Lysholm score of study participants in group P and H were found to be 72.38±4.948 and 71.08±4.298 respectively. The mean 6th month Lysholm score of study participants in group P and H were found to be 84.85±2.618 and 84.19±3.238 respectively. This was not found to be statistically significant.

The anterior drawer test and Lachman tests were found to be positive in all the study participants in both the groups pre operatively. These tests could not be assessed immediate post-op. The Lachman test and anterior drawer test was found to be negative in the 3rd and 6th month follow-up in both the study groups.

DISCUSSION

Anterior cruciate ligament (ACL) reconstruction improves knee stability and function with a variety of graft types which have been widely studied.[10] However, graft choice for anterior cruciate ligament reconstruction remains a subject of interest amongst orthopaedic surgeons because no ideal graft has been found yet.[11] Each graft has its own advantages and disadvantages.

Bone-patellar tendon-bone (BPTB) autograft and quadrupled hamstring autograft are the most widely described and used autografts. Even though BPTB graft has been used for the longest time in the history of ACL reconstruction, it has its own complications such as anterior knee pain particularly in patients who spend a lot of time on their knees as part of their culture, career or sport. Postoperative patella fracture, fat pad fibrosis, patellar tendon contracture are other infrequent complications associated with BPTB autograft.[12] Invasive approach, large incision, fixed length are the drawbacks seen with BPTB autograft.[6] Hence, the hamstring autograft had become an increasingly popular alternative autograft.[13]

The hamstring autograft also has its own drawbacks such as donor site morbidity which includes thigh hypotrophy resulting in decreased hamstring strength

especially in deep flexion angles. Hypotrophy of the hamstring also results in quadriceps hamstring imbalance which leads to imbalance of dynamic knee stability. Studies have also reported hypoesthesia or loss of sensation caused by injury of infrapatellar branch of saphenous nerve.[14]

One of the most significant factors to consider during ACL reconstruction is the diameter of the graft. It has been advised to use grafts with a diameter of at least 8 mm in order to ensure proper graft size and biomechanical performance.[15] ACL reconstruction with quadrupled-strand hamstring autograft with a diameter of 8 mm or above has shown to reduce failure rates.[16] Studies have also shown that there was a strong positive correlation between 1 mm increase in graft diameter and higher KOOS and IKDC scores, as well as a greater revision rate with graft size smaller than 8 mm.[17] Hamstring tendons have been demonstrated to have varying diameters, a graft trait that cannot be corrected for, which can be problematic in the case of a smaller tendon.[18] Also patients with a height of less than 149 cm has a possible graft size of less than 7 mm and requires graft augmentation.[14]

Whereas the mean diameter of peroneus longus tendon autograft was more than 8 mm in the study done by Sholahuddin Rhatomy et al.[14] Studies have shown that harvesting the PLT will have little to no effect on foot and ankle function.[19] Also it is safe and effective choice of graft in ACL reconstruction with a concomitant grade III MCL tear.[12] Peroneus longus tendon autograft resembles hamstring tendon's biomechanical strength and easy to harvest when compared to hamstring autograft.[14] For these reasons the use of PLT autograft has been increasing in the recent years.

In our study, the mean graft diameter in PLT group was 8.82mm and hamstring group was 8.13mm. The mean diameter of the peroneus longus graft was larger than the hamstring graft, however there was no significant difference in knee stability, clinical or functional outcomes between the two groups. These results correlate with a few studies as discussed below.

In a study done by Rhatomy S et al,[6] the mean graft diameter of study participants in PLT group and Hamstring group were found to be 8.2 ± 0.8 and 8.8 ± 0.7 respectively. In a study done by Keyhani S et al,[20] the mean graft diameter of study participants in PLT group was found to be 8.71 ± 0.4 (range 8-9 mm) and in Hamstring group was 7.65 ± 0.6 (range 6.5-8.5 mm) with statistical significance.

In our study, knee stability and function were evaluated in both the groups clinically using the 2 tests, Anterior drawer test and Lachman test at 6 weeks, 3rd month and 6th months postoperatively. None of the patients in either group had instability and both the tests were negative in all the patients when compared pre operatively where all the patients had both the tests positive.

Subjective assessment of knee was done using International Knee Documentation Committee (IKDC) score and Lysholm score pre operatively and post operatively at 3rd and 6th months

In the present study, the mean pre-op IKDC score of study participants in PLT group and Hamstring group were found to be 56.50±8.3 and 53.15±8.9 respectively. The mean 3rd month IKDC score of study participants in PLT group and Hamstring group were found to be 73.65±0.04.3 and 71.85±2.9 respectively. The mean 6th month IKDC score of study participants in PLT group and Hamstring group were found to be 84.31±3.8 and 82.42±4.2 respectively. This was not found to be statistically significant. These results correlate with a few studies as discussed below.

In a study done by Rhatomy S et al,[6] the mean 1 yr. follow-up IKDC score in PLT group and Hamstring group was found to be 92.5 ± 6.2 and 88.8 ± 9.7 respectively. In a study done by Keyhani S et al,[20] the mean 2 yr. follow-up IKDC score in PLT group and Hamstring group was found to be 92.5±9.8 and 93.4±6.2 respectively. In a study done by Gunadham U et al,[21] the mean 3 yr. follow-up IKDC score in PLT group and Hamstring group was found to be 78.2 (35.6– 96.6) and 87.4 (67.8–100) respectively. In a study done by Shi FD et al,[12] the mean 6th month follow-up IKDC score in Group P and Group H was found to be 90.12±4.56 and 89.45±2.89 respectively.

In the present study, the mean pre-op Lysholm score of study participants in PLT group and Hamstring group were found to be 56.42±7.809 and 53.85±7.857 respectively. The mean 3rd month Lysholm score of study participants in PLT group and Hamstring group were found to be 72.38±4.948 and 71.08±4.298 respectively. The mean 6th month Lysholm score of study participants in PLT group and Hamstring group were found to be 84.85±2.618 and 84.19±3.238 respectively. This was not found to be statistically significant. These results correlate with a few studies as discussed below.

In a study done by Rhatomy S et al,[6] the mean 1 yr. follow-up Lysholm score in PLT group and Hamstring group was found to be 94.9 ± 5.6 and 93.1 ± 7.3 respectively. In a study done by Vijay C et al,[22] the mean 6th months follow-up Lysholm score in PLT group and Hamstring group was found to be 72.78 ±8.50 and 77.77±4.98 respectively. In a study done by Keyhani S et al,[20] the mean 2 yr. follow-up Lysholm score in PLT group and Hamstring group was found to be 95.1±6.2 and 94.9±10.5 respectively. In a study done by Shi FD et al,[12] the mean 6th month follow-up Lysholm score in PLT group and Hamstring group was found to be 95±2.35 and 94±6.02 respectively.

The therapeutic effects of ACL reconstruction surgery with PLT autograft and Hamstring autograft are comparable as suggested by our subjective functional scores. The findings of the study indicate that outcomes of ACL with PLT autograft are comparable with those obtained with hamstring autograft at short-term follow-up as quoted by several other studies also. [6,12,19].

CONCLUSION

At 6 months of follow-up, there was no significant difference in knee stability or clinical functional outcomes between the hamstring group and the peroneus group. Though PLT autograft had better Lysholm and IKDC subjective scores than hamstring autograft at both 3rd and 6th month of follow up, it wasn't statistically significant. Peroneus longus graft can serve as a reliable alternative graft option for primary ACL reconstruction.

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