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### RESEARCH ARTICLE

#### COMPARATIVE STUDY OF FUNCTIONAL OUTCOME OF ACL RECONSTRUCTION BY HAMSTRING VS PERONEUS LONGUS AUTOGRAFT

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#### Abstract

**Introduction:** Anterior cruciate ligament (ACL) reconstruction improves knee stability and function with many graft types, either autografts or allografts, which have already been studied extensively. Among these grafts, bone-patellar tendon-bone (BPTB) and four-strand hamstring autografts are the two most common autografts used for ACL reconstruction and each has its advantages and disadvantages. Orthopaedic surgeons are attempting to use peroneus longus tendon as a graft. Peroneus longus tendon autografts are commonly used in some orthopaedic procedures, including spring ligament reconstruction, deltoid ligament reconstruction and medial patellofemoral ligament reconstruction. The purpose of this study is to compare the functional outcome between the peroneus longus tendon and hamstring tendon in ACL Reconstruction.

**Material And Methods:** In our study we took 40 cases of ACL tear fulfilling inclusion and exclusion criteria. Patient selection was randomised, half of the patients were operated by Diagnostic Arthroscopy with ACL reconstruction using hamstring autograft and the other half by using peroneus longus autograft. Patients were in the age group of 19 to 54 years. The male/female ratio is 32 males and 8 females.

**Results:** Patient was followed at 6 weeks, 3 and 6-months post operatively for clinical and radiological evaluation and results at end of 6 months were calculated by using IKDC and Lysholm knee score. The functional and radiological outcome is similar in both groups

**Conclusion:** Anterior cruciate ligament reconstruction with peroneus longus autografts produces a functional score (IKDC, Lysholm) comparable to that of hamstring autografts at a 6-month follow-up.

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**Introduction:-**

Anterior cruciate ligament (ACL) tear is the commonest ligamentous injury of knee. ACL is pivotal in maintaining knee joint stability, so if an injury occurs, it can be followed by degenerative changes and future meniscal injuries. One of the two cruciate ligaments that helps to stabilize the knee joint is the ACL<sup>1</sup>. It is a thick band that extends posteromedially from the anteromedial aspect of the intercondylar region of the tibial plateau and connects to the lateral femoral condyle. It is made of connective tissue and collagenous fibres<sup>2</sup>. With a variety of graft types, such as autografts or allografts, that have been thoroughly studied, ACL reconstruction enhances knee stability and function. Among these grafts, bone-patellar tendon-bone (BPTB) and four-strand hamstring autografts are the two most common autografts used for ACL reconstruction and each has its advantages and disadvantages. According to the latest studies, BPTB is the ideal graft option because it has bone-to-bone healing which permits the effective incorporation of tunnel and graft, leading to a faster return to function and sports activity. This characteristic is important in professional athletes with ACL injuries. However, it carries the risk of patellar fracture, with an invasive approach and a large incision, fixed length and a weaker than native ACL, making it unsuitable for double-bundle reconstruction and anterior kneeling pain. Asians, particularly Indians, value pain-free kneeling as being extremely important. These factors contribute to the rise in popularity of hamstring autografts among Asians<sup>3</sup>. The strength of a hamstring autograft is like the native ACL, and it is simple to harvest with little donor site morbidity. However, it has uncertain graft size and may result in a loss of hamstring strength, which is essential for such athletes who require strong hamstring power. Therefore, peroneus longus tendon grafting is being attempted by some orthopaedic surgeons<sup>4</sup>. Peroneus longus autografts are frequently used in certain orthopaedic procedures, such as the reconstruction of the medial patellofemoral ligament (MPFL), the deltoid ligament, and the spring ligament. Due to the synergistic action of the peroneus longus and brevis, this is possible<sup>5</sup>. According to some studies, the peroneus brevis is even a more potent ankle evolver, supporting the procedure to harvest the longus tendon<sup>4</sup>. In some previous case series for reconstruction, the peroneus longus tendon was the autograft of choice, with good results and minimal donor site morbidity, but other researchers did not certainly agree due to donor-site morbidity<sup>5</sup>. According to studies, there is no discernible difference between the hamstring and peroneus longus tendons tensile strength<sup>6</sup>. The purpose of our study is to compare the functional outcome between the peroneus longus tendon and hamstring tendon in ACL Reconstruction.

**Material and Methods:-**

This was a Cross-sectional study, and 40 cases of ACL injuries were included which were operated by anterior cruciate ligament reconstruction using hamstring or peroneus longus graft at our institute between April 2021 to September 2022. Patient selection was randomized, and odd-even rule was followed to assign which graft would be taken. The study was undertaken after obtaining the institute's ethical committee approval. The cases were selected based on the following inclusion and exclusion criteria.

Inclusion Criteria were clinical /MRI evidence of symptomatic individuals with anterior cruciate ligament insufficiency, patients between age 18 to 60 years (skeletally matured patients), no history of previous surgery in the knee and a normal contralateral knee

Exclusion Criteria were asymptomatic individuals, patients with systemic diseases compromising their pre-anaesthetic fitness, associated with PCL tear or associated Grade III MCL and LCL injuries, patient with osteoarthritic knee / Cartilage injury, patients with associated fracture of tibial plateau, patients with local skin infections and patients unwilling to give consent.

After admission, OT profile was sent, and PAC fitness was obtained for all patients. Preoperative planning included plain radiograph ap and lateral view of the affected knee, MRI scan and the choice of implant. All the patients were operated under spinal or combined spinal-epidural anaesthesia with tourniquet applied in all cases. Intravenous antibiotics were given 1 hour prior to surgery and continued till the second post operative day, after which oral antibiotics were continued till suture removal, which was done on the 13<sup>th</sup> post operative day. All the patients were operated using standard arthroscopy techniques. Peroneus tendon was harvested from the ipsilateral leg. Incision was 2-3 cm above and 1 cm behind lateral malleolus. After dissection, Peroneus longus and peroneus brevis tendon were identified and the longus was stripped and prepared.

Post operatively, active assisted knee rom was encouraged from POD-1 and patients were given long knee brace and were mobilised full weight bearing with the brace from the next day of surgery. All patients were taught static and

dynamic quadriceps strengthening exercises. Post operative dressing was done on post operative day 2, day 5 and sutures were removed on post operative day 13. Knee brace was continued for walking till 3 weeks post op. The first follow up of the patient was done 2 weeks post operatively where sutures were removed, and knee range of motion checked. Subsequent follow ups were done at 6 weeks, 3 months and 6 months and functional scores were recorded using the lysholm knee score and IKDC score along with a ap and lateral plain x ray of the affected knee at each follow up.



**Figure 1:- Patient Position.**



Figure 2:- Preoperative Lachman test.



Figure 3:- Torn ACL visualised during diagnostic arthroscopy.



Figure 4:- Harvesting Peroneus Longus Tendon.



Figure 5:- Graft Preparation.

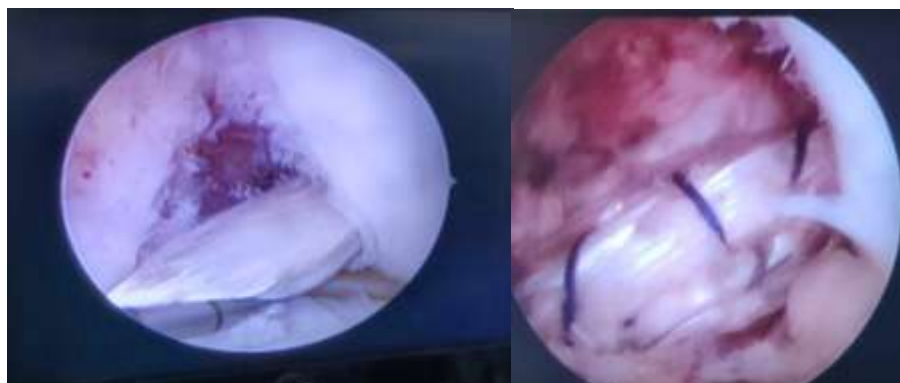


Figure 6:- Reconstructed Anterior Cruciate Ligament.

**Results:-**

In our study, 40 patients of ACL injury were operated. There were 20 (50%) patients in Group H (Hamstring tendon graft) and 20 (50%) patients in Group P (Peroneus Longus tendon graft). The mean age of patients in Group-H was

33.10 ± 9.17 years (range 20-54 years) and in Group-P, it was 30.90 ± 6.98 years (range 19-42 years). In both groups, males predominated in terms of gender (75% in group H and 85% in group P). In Group-H, most of the patients had left side involvement and in Group-P, most of the patients had right side involvement. The mean height in Group-H was 167.00 ± 7.05 cm and in Group-P, it was 166.95 ± 5.53 cm. The mean weight in Group-H was 63.40 ± 6.56 kg and in Group-P, it was 65.25 ± 6.34 kg. In both groups, majority of patients sustained injury due to road traffic accident, and sports related injuries were relatively less in our study. The average graft diameter of Group H was 8.3 ± 0.47 mm and that of Group P was 8.4 ± 0.35 mm.

**Table No. 1:-** Summary of Patient Data.

	<b>Group-H (Hamstring tendon)</b>	<b>Group-P (P. Longus tendon)</b>
Total Patients	20	20
Sex		
Male	15	17
Female	5	3
Side Involved		
Left side	13 65.0%	7 35.0%
Right side	7 35.0%	13 65.0%
Mean Age	33.10 ± 9.17 years (range 20-54 years)	30.90 ± 6.98 years (range 19-42 years)
Mean Height	167.00 ± 7.05 cm	166.95 ± 5.53 cm
Mean Weight	63.40 ± 6.56 kg	65.25 ± 6.34 kg
Average Graft Diameter	8.3 ± 0.47 mm	8.4 ± 0.35 mm

**Table No. 2:-** Comparison of mean Lysholm Score between the two groups.

<b>Time Period</b>	<b>Group-H (mean±SD)</b>	<b>Group-P (mean±SD)</b>	<b>'t' value, df</b>	<b>P value</b>
Preoperative	25.50 ± 4.35	26.00 ± 2.05	-0.465, df=38	0.644, NS
At 6 weeks	44.15 ± 3.88	44.80 ± 3.09	-0.586, df=38	0.561, NS
At 3 Months	69.70 ± 4.71	70.65 ± 3.62	-0.715, df=38	0.479, NS
At 6 Months	80.80 ± 2.91	81.20 ± 2.35	-0.478, df=38	0.636, NS

**Unpaired 't' test applied. P value <0.05 was taken as statistically significant**

In both groups, the mean Lysholm score showed an improvement over the period of follow-ups, from preoperative to 6 months, but the mean differences in Lysholm scores between the two groups at each follow-up were found to be statistically not significant.

The mean Lysholm scores were comparable between the two groups at each follow-up.

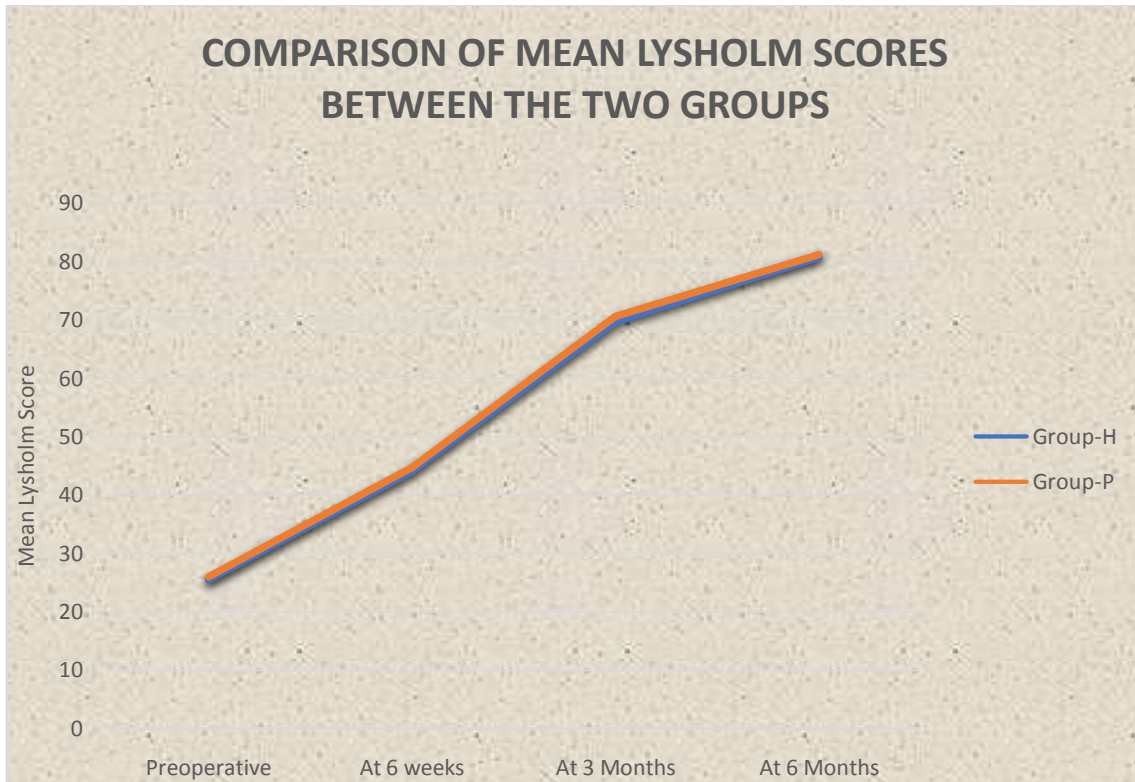


Figure 7:- A line diagram shows the comparison of mean Lysholm scores between the two groups.

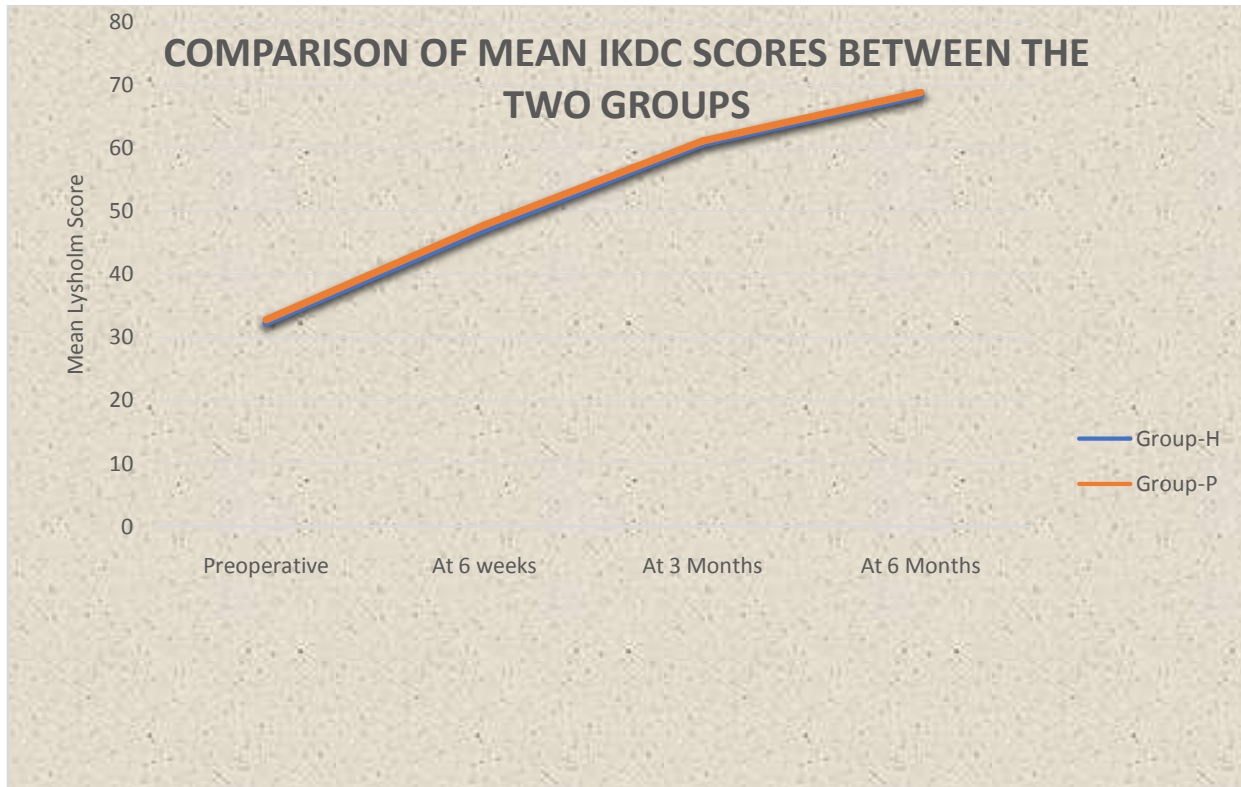
Table No. 3:- Comparison of mean IKDC Score between the two groups.1.

Time Period	Group-H (mean±SD)	Group-P (mean±SD)	't' value, df	P value
Preoperative	32.27 ± 2.31	32.77 ± 1.84	-0.759, df=38	0.452, NS
At 6 weeks	47.13 ± 2.46	47.81 ± 2.14	-0.926, df=38	0.360, NS
At 3 Months	60.69 ± 1.44	61.12 ± 1.54	-0.926, df=38	0.360, NS
At 6 Months	68.43 ± 1.59	68.84 ± 1.44	-0.847, df=38	0.402, NS

Unpaired 't' test applied. P value <0.05 was taken as statistically significant

In both groups, the mean IKDC score showed an improvement over the period of follow-ups, from preoperative to 6 months, but the mean differences in IKDC scores between the two groups at each follow-up were found to be statistically not significant.

The mean IKDC scores were comparable between the two groups at each follow-up.



**Figure 8:-** A line diagram shows the comparison of mean IKDC scores between the two groups.

**Table No. 4:-** Comparison of postoperative complications between the two groups.

Postoperative Complications	Group-H	Group-P	Fisher’s Exact Test P value
No Complications	15	18	
Knee stiffness	4 (20.0%)	1 (5.0%)	0.342, NS
Infection requiring Arthroscopic debridement	1 (5.0%)	1 (5.0%)	1.000, NS

**Fisher’s Exact test applied. A P value of <0.05 was taken as statistically significant**

In **Group-H**, 4 (20%) patients complained of knee stiffness and 1 (5%) patient required arthroscopic debridement due to infection. In **Group-P**, 1 (5%) patient complained of knee stiffness and 1 (5%) patient required arthroscopic debridement due to infection. The incidence of knee stiffness was comparable between the two groups (Fisher’s exact test P value = 0.342) and similarly, the incidence of requirement of arthroscopic debridement was also comparable between the two groups (Fisher’s exact test P value = 1.000). The postoperative complication rate between the two groups were comparable.



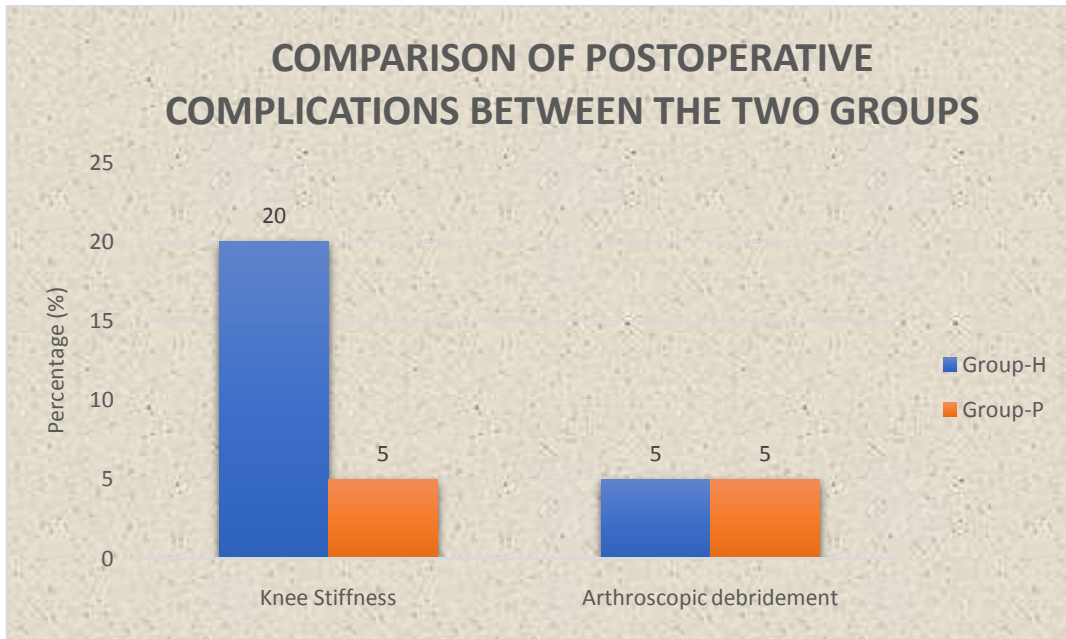


Figure 9:- A bar diagram shows the comparison of postoperative complications between the two groups.



Figure 10:- 6 months follow up of Group P patient.



**Figure 11:-** 6 months follow up of Group H patient.

### **Discussion:-**

In our study, we only evaluated functional outcome of 40 ACL injury patients operated for ACL reconstruction and our study found good to excellent results in both the peroneus longus and hamstring tendon groups. The choice of graft is the most crucial operative plan consideration. The appropriate graft helps to prevent re-injury or re-rupture incidents and provides optimal knee stability. Rousseau et al<sup>7</sup> reported that hamstring tendon graft and bone patella tendon bone (BPTB) are related to postoperative complications, including anterior knee pain and stiffness. In our study, we used peroneus longus tendon graft to replace the injured ACL to evaluate it as an alternative to hamstring autograft and compared the two graft options in terms of functional outcome. Surprisingly, the average diameter of the peroneus longus tendon graft was  $8.4 \pm 0.35\text{mm}$ , which was larger than the ideal in diameter so that the reconstruction could be performed rapidly. Magnussen et al<sup>8</sup> stated the ideal minimum graft diameter of 8 mm is best to avoid revision surgery. There were 20 patients in Group H (Hamstring tendon graft) and 20 patients in Group P (Peroneus Longus tendon graft). Both the groups were comparable in terms of age, sex, height, weight and side involved. In both groups, the mean Lysholm score showed an improvement over the period of follow-ups, from preoperative to 6 months, but the mean differences in Lysholm scores between the two groups at each follow-up were found to be statistically not significant. In both groups, the mean IKDC score showed an improvement over the period of follow-ups, from preoperative to 6 months, but the mean differences in IKDC scores between the two groups at each follow-up were found to be statistically not significant. Comparative functional outcome analysis on the use of hamstring tendon and peroneus longus tendon grafts showed no significant differences between the pre- and 6-month post-surgery, based on the IKDC and Lysholm Knee Scoring Scale. Many studies have reported good results after ACL reconstruction with the peroneus longus tendon, in terms of both functional outcome and knee stability. Keyhani et al<sup>9</sup> in their study comprising of 130 patients compared functional outcome of peroneus longus vs hamstring graft in ACLR and found no significant difference in clinical outcome and knee stability. Some studies found that peroneus longus tendon graft was more superior because it provides larger graft diameter and less thigh hypotrophy with excellent ankle function<sup>10,11</sup>.

Bi et al<sup>12</sup> compared the use of single-bundle anterior half of PLT vs. semitendinosus tendon. At the 2-year follow-up, the study found no differences between both groups in the VAS scale, IKDC score, pivot shift test, and KT-1000. Besides, the AOFAS score in the PLT group was more excellent than the semitendinosus tendon group. This finding concluded that PLT graft provides greater strength and relatively safe for reconstruction. Trung et

al<sup>13</sup> reported that ACLR using anterior half peroneus longus tendon graft showed no complications in ankle and foot post-surgery. Another study revealed enhancement on knee functionality based on the Lysholm, leaving no ankle functionality differences<sup>14</sup>. A comparative study of the ankle eversion and first ray plantarflexion strength on the donor site vs. contralateral site at 6 months post-surgery revealed no significant differences. Furthermore, the donor site were excellent. These findings were similar to our patient, who could perform tiptoe walking with no ankle and foot function limitation after reconstruction. He et al<sup>16</sup> concluded that the peroneus longus tendon graft is suitable as an autograft harvested outside the knee to avoid the complication of quadriceps-hamstring imbalance that may occur after harvesting the graft from the knee. Regardless of all the advantages of peroneus longus tendon grafts in ACL reconstruction, the graft preference was decided based on a randomized odd-even method to remove bias. In achieving an excellent result, the consideration of the appropriate graft usage depends on many factors, including the associated meniscal and ligament lesions, high or low demand patient's activities, medical condition or comorbidities, pre-surgical status, patient decision, and the post-operative rehabilitation protocol<sup>17</sup>.

### Conclusion:-

The clinical and stability outcomes of anterior cruciate ligament with different peroneus longus tendon autograft preparation techniques are comparable with those of hamstring during short-term follow-up; however, there is sufficient evidence to support their use in the populations that motivated its implementation. Thus, 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.

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