

# Comparison of an Anterior Cruciate Ligament's Functional Outcomes Peroneus Longus Graft Reconstruction as an Option to the Hamstring Tendon Graft

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## ABSTRACT

**Background:** The utilization of peroneus longus graft for the main ACL reconstruction had not been considered since the advent of arthroscopic surgery of anterior cruciate ligament (ACL). There is not much written about it. Therefore, the purpose of this study is for comparison of functional results, morbidity of donor site, knee stability, and evaluation of the muscle of thigh worsening in the patients having the injury of ACL who underwent reconstruction of the arthroscopic single-bundle utilizing the PLT and the HT, respectively.

**Methods:** The crass sectional and survey designed was used to meet the study objectives. The population was Prior to surgery and rehabilitation, all patients who were included were randomly assigned to the HT and PLT groups The 194 individuals whose admitted for the arthroscopic single-bundle ACLR who had symptoms of symptomatic ACL insufficiency and was between the ages of 16 and 50 and of either gender was divided into two groups (hamstring tendon and peroneus longus). Preoperative measurements were taken as well as ones at six months and a year after surgery for functional, clinical knee evaluation, morbidity of donor site, and the thigh circumference. In both groups, the identical post-operative rehabilitation regimen was used.

**Results:** The criteria of inclusion were met by 174 patients. The scores of postoperative, preoperative 6-months, and the 1-year post-operative for hamstring and groups of PL in the IKDC where  $p = 0.3$  and score of the Lysholm knee where  $p = 0.28$  did not differ significantly from each other. The thigh muscle wasting was significantly reduced in group of PLT so at the last follow-up where the  $p < 0.001$ , while it was not significantly different in the HT group (mean for the AOFAS was  $99.05 \pm 3.56$  and  $99.80 \pm 0.70$ , respectively).

**Practical implication:** This study is for comparison of functional results, morbidity of donor site, knee stability, and evaluation of the muscle of thigh worsening in the patients having the injury of ACL who underwent reconstruction of the arthroscopic single-bundle utilizing the PLT and the HT, respectively. Given that there was no discernible donor site morbidity and improved recovery of the thigh muscle atrophy (better reactivity to the rehabilitation than the HT group), it was an effective and secure autograft choice for routine ACL restoration.

**Conclusion:** Similar knee stability and functional results were seen in both groups, and there was no clear donor site morbidity. Additionally, these patients recovered from the withering of their thigh muscles more quickly after receiving physiotherapy. Therefore, we can suggest that a PL graft may be a reliable, practical, and efficient alternative to the standard arthroscopic single-bundle replacement.

**Keywords:** Hamstring tendon, hamstring tendon grafts, anterior cruciate ligament reconstruction, hamstring tendons, anterior cruciate ligament

## INTRODUCTION

Since the anterior cruciate ligament (ACL) is the knee ligament that is most frequently injured,<sup>1</sup> it is crucial that it is satisfactorily repaired. The anterior cruciate ligament repair (ACLR) utilizing autograft (their own tendon of patient) was a commonly used treatment to treat ACL deficit.<sup>2</sup> The BPTB (Bone-patellar tendon-bone) and hamstring tendons (gracilis and semitendinosus),<sup>3</sup> and the tendon of quadriceps are most used autografts. According to studies, BPTB is preferred graft because it possesses bone to bone healing ability necessary for efficient fusion of the grafts along with tunnels and prompt returning to work for patient. Particularly for the professional athletes who have suffered ACL injuries, this distinguishing characteristic is crucial. However, due to its invasive approach, graft of fixed-length, and the weak tensile strength than the native ACL, this is not recommended for the reconstruction routine where without pain kneeling was also important, particularly during several religious practices.<sup>4</sup> It also carries risk of the patellar fracture<sup>5</sup>, the patellar tendon contracture<sup>8</sup> and the fat pad fibrosis.<sup>5</sup> Hamstring tendons are now the preferred transplant because to their relative ease of harvest, low risk of the donor site morbidity, and the tensile strength that is in comparison to the natural ACL. The potential for saphenous nerve paresthesia, uncertain graft size, risk of the weakness of hamstring muscle, that was important for the few athletes who require the hamstring power dominance, and risk of saphenous nerve paresthesia add to its drawbacks.<sup>6</sup> For people who have just undergone ACL reconstruction, having strong hamstrings is essential because it avoids quadriceps hamstring asymmetry and

counteracts the anterior translation of tibia caused by activation of quadriceps muscle.<sup>7</sup> Because these autografts have functional limits, surgeons are constantly looking for the ideal auto-graft which is simple in order to harvest along with morbidity of little donor site and might be utilized in the patients of the many ethnicities deprived of affecting their everyday activities. Peroneus longus tendon (PLT), a potential graft of preference for regular ACLR, has recently been under research. Additionally, there is zero chance that graft removal may cause saphenous nerve damage or post-operative hamstring muscle weakening.<sup>7,8</sup> PLT use as an ACLR graft is common among orthopaedic surgeons<sup>12</sup> due to its favourable biomechanical characteristics and high load-to-failure strength.<sup>9</sup> According to research, the peroneus brevis tendon (PBT) performs the duties of an ankle evolver more effectively than PLT, which justifies the harvest of PLT.<sup>10,11</sup> Additionally, PL has been employed in multi ligamentous injuries to rebuild the cruciate ligament as well as other ligaments. The utilization of the HT and PLT in the primary ACLR has not been compared to our knowledge. To compare functional outcomes of the arthroscopic ACLR with the hamstring tendon which against PL tendon and in order to assess the morbidity of donor site, knee stability, and development in the wasting of thigh in the patients having ACL injury. There are limited studies available on this topic and there are needs to giving awareness to the patients to improve their health outcomes.

## MATERIALS AND METHODS

**Research Method:** The cross-sectional method was used to conduct the study, and the survey design was used to obtain the

data from selected participants. Prior to surgery and rehabilitation, all patients who were included were randomly assigned to the HT and PLT groups. Patients in both groups were required to complete the score form of Lysholm, and the score form ankle-hindfoot prior to surgery as well as throughout the subsequent follow-up phases. A measurement of thigh of injured limb circumference was taken 15 cm from the patella's superior pole, and it is compared to other, healthy side. Likewise, utilising clinical testing, the knee stability of each patient was evaluated. The identical rehabilitation approach was used to treat both groups.

**Ethical consideration:** The ethics committee of the institute gave its formal clearance before this study was carried out at the Ayub Medical Complex Abbottabad under the reference number AMC-2022-5589.

**Population and Sample size:** The population was patients admitted in Ayub Medical Complex Abbottabad from June 2022-December 2022. After receiving sufficient written informed consent, 194 patients between the ages of 16 and 50 who have presented with the separate symptomatic ACL rupture that were included in this study between June and December 2022.

**Exclusion and exclusion criteria:** Patients were disqualified if they also had stiffness in the joint, multiple ligamentous injuries, or concomitant fractures near the knee joint. A measurement of thigh of injured limb circumference was taken 15 cm from the patella's superior pole, and it is compared to other, healthy side. Likewise, utilising clinical testing, the knee stability of each patient was evaluated. The identical rehabilitation approach was used to treat both groups.<sup>25-26</sup>

**RESULTS**

194 individuals who met the inclusion requirements received an isolated single bundle ACL reconstruction within the study's time frame. Table 1 displays the analysis of the study population's demographic data, and table 1 resents the evaluation of the observed population's occupation and form of injury.

Table 1: Demographic data of the data

Variable	Hamstring tendon	Peroneus Longus tendon	p
Injury duration to intervention	14.7 ± 6.68	15.1 ± 6.23	0.667
Age	27.5 ± 4.06	28 ± 4.91	0.546
Male	57	68	0.191
Female	39	30	0.191

Table 2: Injury modes of selected participants

Injury mode	Occupation	HTG group	PLG group	p	Chi-Square
		n	n		
Road traffic accident	Sportsman	0	0	0.59	0.29
	Student	15	18		
	other	24	40		
Non contact injuries	Sportsman	19	5	0.182	3.41
	Student	10	9		
	other	9	5		
Contact sport injuries	Sportsman	6	9	0.085	4.94
	Student	9	12		
	other	4	0		

Table 3: Pivot shift test of selected participants

	HTG group		PLG group	
	Negative	Positive	Negative	Positive
1 Year	96	0	97	1
6 Months	96	0	98	0
Pre-operation	0	96	0	98

**Evaluation of Knee Stability in Both Groups:** The anterior drawer test, Lachman test, and pivot shift test were used to measure knee stability. Tables 4 and 5 correspondingly demonstrate this. 6 patients having score in grade 1 on anterior drawer test, which show 187 patients in the both groups had the negative result at 1-year after surgery. The grade three anterior drawer test was recorded by 1-patient in group of PLT as result of re-injury. 16 patients in this study received a grade 1 result for the Lachman test, whereas 177 patients were assessed to have the

test negative at the last follow-up. Grade 3 Lachman and anterior drawer tests were both reported by one patient in group of PLT those who also got a grade-three Lachman test. With the exception of the one patient in group of PLT who experienced road traffic accident (RTA) incident that resulted in a recurrence of his injury after the 6 months period of follow-up period and continued to report instability of the knee in their daily activities at follow-up of 1-year, all of the patients in the study reported the negative pivot shift test.

**Patients Functional Outcome:** The IKDC (International Knee Documentation Committee) and the Lysholm knee score were used to evaluate the functional outcome of patients; the results were displayed in the Table 4. The IKDC mean score of 1 year and 6 months follow-ups was to be 94.13 and 83.28, respectively, for group of HT and PLT are 95.12 and 79.73 respectively. At 1 year and 6 months follow-ups, Lysholm knee mean score for HT and PLT group was found to be 99.15 and 97, respectively, whereas for HT group this was 99.85 and 96.35 at the particular follow-ups.

**Morbidity of Donor Site:** The AOFAS (American Orthopaedic Ankle and Foot Society score) is used to evaluate it; it was revealed to have 96 and 96.2 in HT and PLT groups respectively, and both of them were substantially higher in the post-operative periods to be 99.8 and 99.05 respectively. Between the two, we found that no significant difference as shown in Table 4.

Table 4: IKDC and Lysholm knee score

		HTG group	PLG group	p	t-test
IKDC	1 year	95.12±0.73	94.13±4.66	0.356	-0.93
	6 months	79.73±6.83	83.28±3.71	0.058	2.04
	Pre-operation	52.52±3.28	53.62±3.65	0.238	2.15
Thigh muscle circumference mean difference	1 year	0.88±0.54	0.216±0.451	<0.001	-4.199
	6 months	1.37±0.53	0.714±0.505	0.013	-2.583
	Pre-operation	1.93±0.57	1.72±0.67	0.289	-1.073
Lysholm Knee score	1 year	99.85±0.37	99.15±2.89	0.289	-1.08
	6 months	96.35±1.60	97±0	0.077	1.82
	Pre-operation	57.05±25.23	51.35±29.22	0.513	-0.66
Ankle hind foot Score	1 year	99.8±0.70	99.05±3.56	0.361	-0.924
	6 months	99.72±0.34	99.75±0.44	0.516	-0.517
	Pre-operation	96±1.03	96.29±0.95	0.527	0.639

**Thigh Circumference Difference Between Sound and Operated Leg:** Average differences in thigh injured side circumference (measured in the cm) from unaffected side were reported after analysis; the PLT group's thigh circumference increased significantly, increasing by the 1.72cm from injured side on the pre-operative condition to 0.216 cm and 0.714 cm at 1 year and 6 month follow-ups respectively, as indicated in Table 4, as compared to HT group, which is preoperative difference of the 1.93cm from normal side that decreased to 1.37 cm and the 0.88 cm at 6 month and 1 year follow-ups, respectively.

**DISCUSSION**

According to our study, there were no re-ruptures on the consequent follow-ups, and activity level after the one year was quite similar to the level of pre-injury.

ACL-deficient individuals treated with PLT and HT grafts have shown to have excellent knee stability. Utilizing Lachman, pivot shift, anterior drawer tests, we evaluated stability. The ADT and Lachman test were used to measure the tibial plateau's forward translation with respect to distal femur. Both groups experienced substantial improvements, and there was no significant difference in between them at any of the follow-up periods. In a study, which similarly revealed equivalent Lachman and anterior drawer test outcomes between the two groups, the researchers found results that were similar to those of our studies.<sup>12,13</sup> According to a study, the negative anterior drawer test had a rate of 96.7 percent, the Lachman test had a rate of 90

percent, and level one of the Lachman tests had a level of 10 percent, no longer being the level three and two.<sup>14</sup>

The test, pivot shift is utilized to evaluate knee's rotational stability. Only one patient in the PLT group in a study reported a positive test after surgery, and this was because of reinjury. Other trials that employed PLT grafts revealed that 93.3 percent of patients experienced a negative pivot shift; level-1 was 6.7 percent, and the levels three and two were no longer recorded.<sup>15</sup> According to a study, level-1 was 4 percent, levels-2 and 3 were not reported, and the negative rate was 96%.<sup>16</sup>

At every check-up, it was discovered that functional results of the patients in the both groups were equal. At the one-year check-up, the mean scores of Lysholm knee for group of PLT were 99.15, while the mean IKDC scores for the PLT and HT groups were 94.13 and 95.12, respectively. Nobody in either group of patients experienced any flexion or extension loss at the end of the follow-up. Additionally, studies revealed a negligible distinction between two groups' IKDC and Lysholm knee scores.<sup>17</sup> According to a study, those who underwent PLT had superior Lysholm knee scores.<sup>18</sup>

The score of ankle-hindfoot was used to assess donor site morbidity at the ankle, and it is discovered that no significant difference statistically in between two groups at 1-year follow-up between patients in HT and PLT groups, having the mean scores is 99.8 and 99.05 respectively. The patient's lack of eversion during stance phase of the patient of the ankle and gait instability were the main concerns for the donor site (ankle).<sup>19</sup> None of them in our patients of our complained about this. This could due to peroneus brevis' dominancy in the ankle eversion and excised graft's capacity for renewal. This suggests that neither the removal of the peroneus longus tendon nor its harvesting results in any morbidity for the ankle.<sup>20,21</sup>

Pre-op thigh circumference measurements were taken on the injured and uninjured sides, and they were compared. The patients in group of PLT improved more in terms of the muscle hypotrophy of thigh as compared to the pre-operative status, with the difference in mean in circumference of the thigh is of 0.216cm at last follow-up from the 1.72 cm, whereas HT group have mean difference of the 0.881cm from the 1.93cm. The PLT group had considerably less thigh hypotrophy at the one-year follow-up, according to a study, which found similar results.<sup>22</sup> Due to the removal of hamstring tendons, quadriceps and hamstrings become asymmetric, which affects the dynamic stability of the knee.<sup>23,24</sup> Medical resources, diagnosis, and treatment must improve in developing countries. There are limited resources available on medical education and research in Pakistan: lack of access to medical and health resources to the patients about disease; limited knowledge and trainings, and awareness about disease. The trainings should be conducted to improve the health literacy and how to access the medical resources for patients in Pakistan.<sup>27-35</sup> Therefore, it is clear that the patients of PLT group had the greater post-operative retrieval and much less thigh wasting.

## CONCLUSIONS

According to the results of our research, patients who had their PLT utilized as the autograft for the ACL (arthroscopic single-bundle) reconstruction have best functional results (based on Lysholm knee and IKDC scores) and showed comparable post-operative stability of knee (based on the pivot shift test, anterior drawer scores and Lachman) to that of the hamstring tendon graft quadrupled. Given that there was no discernible donor site morbidity and improved recovery of the thigh muscle atrophy (better reactivity to the rehabilitation than the HT group), it was an effective and secure autograft choice for routine ACL restoration.

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