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A PROSPECTIVE STUDY; TO COMPARE THE FUNCTIONAL OUTCOME OF PERONEUS LONGUS TENDON AUTOGRAFT WITH HAMSTRING TENDON AUTOGRAFT IN ISOLATED ANTERIOR CRUCIATE LIGAMENT RECONSTRUCTION.

Orthopedics

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ABSTRACT

Purpose: Different types of graft material have been used in the treatment of patients with an ACL injury. Our study aimed at comparing the functional outcomes and donor site morbidity in ACL reconstruction with peroneus longus tendon autograft against hamstring tendon autograft. **Methods:** 30 patients who had isolated single-bundle ACL repair were randomly assigned to two groups (hamstring and peroneus longus), each of which received 15 patients, and were then monitored over time. During surgery, graft diameter was measured. Lysholm scores, or functional scores, were measured both before and one year after surgery. Thigh circumference measures and grading with the AOFAS and ankle ROM were used to determine the extent of donor site morbidities. **Results:** Average graft diameters for Group A and B were 7.75 and 8.6 millimetre respectively. The stability and laxity of the knee were assessed using the Lachman and pivot shift tests. There were no discernible differences between the two groups. Between the two groups, the mean Lysholm scores are 80.8 ± 2.29 for group A and 82.2 ± 2.39 for group B. At the most recent follow-up, there was no change in either side's mean AOFAS score for the donor ankle, which was 94.52 ± 1.76 (range 84-100; Excellent=90-100 points, Good=75-89 points, Fair=60-74 points, and Poor=60 points). **Conclusion:** Anterior cruciate ligament reconstruction with peroneus longus autografts produces a functional score (Lysholm) comparable to that of hamstring autografts at a 1-year follow-up, with the advantages of larger graft diameter, less thigh hypotrophy and excellent ankle function based on AOFAS score.

KEYWORDS

Anterior Cruciate Ligament (ACL), Peroneus longus, Hamstring Tendon, Lysholm Score, American Orthopaedic Foot and Ankle Society Score (AOFAS).

INTRODUCTION

The anterior cruciate ligament (ACL) is one of the main stabilizers of the knee joint and as such patients with ACL rupture almost always need reconstruction for restoring preinjury level function. Anatomically, the anterior cruciate ligament is divided into two bundles: posterolateral and anteromedial.[1] Historically, several graft materials such as bone-patellar tendon-bone, hamstring tendon, and quadriceps tendon have been tried and tested in the treatment of such patients, especially athletes and people engaged in sports.[2,3] A hamstring autograft has become the choice for many surgeons as it has the same strength as a native ACL and is easy to harvest with low donor site morbidity. However, the graft size is uncertain, which may result in a loss of hamstring strength, which is critical for such athletes who demand high hamstring power.[4] As a consequence, some orthopaedic surgeons are attempting to use peroneus longus tendon as an alternative.[5] This is possible due to the synergistic activity of the peroneus longus and peroneus brevis. According to recent studies, the peroneus brevis is an even more powerful ankle evertor, lending credence to the harvesting of the longus tendon.[6,7,8] The present study aimed to compare the functional outcome and the morbidity of the donor site between the peroneus longus and hamstring autografts, focusing on the donor site morbidity with a minimum follow-up period of 1 year after ACL reconstruction.

MATERIALS AND METHODS

It was a prospective study, carried out from April 2021 to September 2022 at our institute, in which a total of 30 cases of ACL rupture, divided into two groups, were included and these were treated with anterior cruciate ligament reconstruction using a hamstring or peroneus longus graft. The selection of patients has been randomized, and an odd-even rule is used for the determination of which donors are to be allocated. Following approval by the Institute's Ethics Committee, this study was performed and patients were then followed up for a period of one year post-operatively.

The cases were selected based on the following inclusion and exclusion criteria:

The inclusion criteria included patients between the ages of 18 and 60 (skeletally mature people), those with clinical or MRI evidence of anterior cruciate ligament insufficiency, those without a history of prior knee surgery, and those with a normal contralateral knee.

Exclusion criteria included patients with systemic diseases that compromised their pre-anaesthetic fitness, patients with associated PCL tears or Grade III MCL and LCL injuries, patients with osteoarthritic knee / Cartilage injury, the presence of an ankle joint problem, the presence of a pathological condition in the lower extremity, patients with associated tibial plateau fractures, patients with local skin infections, and patients unwilling to give consent.

All patients were followed for at least a year, and the results were recorded by a single examiner. The functional scores include the International Knee Documentation Committee (IKDC) score, the Lysholm score, and knee range of motion (ROM) before and after surgery. In both groups, thigh circumference was measured and compared to the contralateral healthy side. The ankle donor site in the peroneus longus tendon group was evaluated using the American Orthopedic Foot and Ankle Score (AOFAS) and ankle ROM.

Operative Technique

Patients were laid supine under spinal or general anaesthesia, and a tourniquet was applied to the thigh. This was followed by a diagnostic arthroscopy of the knee, and graft harvesting (hamstring or peroneus longus) was done once ACL rupture was confirmed on arthroscopy.

The peroneus tendon was harvested in the ipsilateral leg. A 2 cm longitudinal skin incision was made on the posterolateral side of the fibula immediately over the peroneus tendon, 2-3 cm proximal to the posterior boundary of the lateral malleolus. To avoid peroneal nerve damage, the distal peroneus longus was exposed and harvested with a stripper to around 4-5 cm below the fibular head. The peroneus tendons were then sutured distally. The extracted tendon's superficial fascia and fat were removed, and the rough edge was meticulously trimmed. To create a 2-strand autograft, the tendon was folded longitudinally across the middle and whip-stitched with a No. 2 polyester suture (Ethibond).

A 3 cm oblique skin incision was made over the anteromedial portion of the proximal tibia above the pes anserinus in the hamstring group. An open tendon stripper was used to collect the semitendinosus and gracilis tendons. The tendons were then folded to form a 4-strand hamstring graft, and both ends were fastened with whip stitch suture (Ethibond) using a No. 2 polyester suture.

The intraarticular surgical technique was identical: The femoral tunnel and the tibial tunnel were drilled independently in anatomical position. The prepared autograft tendon was implanted, and femoral fixation was achieved with Tight Rope (ethibond), while tibial side fixation was achieved with a BioScrew . one size bigger than the tibial tunnel diameter.

Rehabilitation

Patients were discharged with the knee immobilizer the day after the surgery. Both groups were treated with the standard postoperative protocol for ACL reconstruction. Knee extension and ankle pump exercises began immediately after surgery. The first two weeks allowed partial weight bearing and a motion range of 0 to 90 degrees. Full flexion was obtained within 5 to 6 weeks, and the full weight bearing exercise was allowed at least 3 to 4 weeks after the surgery. Running was permitted after 3 to 4 months, and returning to sports activity was recommended after completing functional outcome tests 6 to 9 months after the operation.

RESULTS

In our study, 30 patients of ACL injury were operated. There were 15 (50%) patients in Group A (Hamstring tendon graft) and 15(50%) patients in Group B (Peroneus Longus tendon graft). There were no significant differences in demographic data and injuries between the two groups (P>0.05). Table1

Demographic DATA TABLE 1		
	Peroneus longus tendon group	Hamstring tendon group
Gender(M/F)	13/2	12/3
AGE(Years) BMI	29.80 ±7.5 years (18-47) 26.6 ± 3.2	27.60 ± 8.1 years (20-50) 27.9 ± 1.9

The mean diameter of the 2-strand peroneus longus tendon was 8.60 ± 0.5 (range 8-9 mm), and the mean diameter of the four-strand hamstring tendon autograft was 7.75 ± 0.5 (range 6.5-8.5 mm) that showed significant difference (P<0.001). In the second group, a five-strand hamstring autograft was used for some patients with an autograft diameter of 7 mm. Table 2

Comparision Of Graft Diameter Table 2		
Graft	Diameter	P value
Peroneus longus	8.60 ± 0.5 (range 8-9 mm)	P<0.001
Hamstring	7.75 ± 0.5 (range 6.5-8.5 mm)	P<0.001

Clinical Outcomes

Based on the obtained results, most patients had acceptable functional outcomes after ACL reconstruction operation in each group p (P<0.001); however, no significant differences between the two groups were observed in functional scores [Table 3].

The Lachman and pivot shift tests were used to assess knee laxity and stability. A failure was defined as any grade III Lachman or positive pivot shift test. There were no significant differences between the two groups. The Lachman test revealed normal results in 24 of the patients, whereas 6 individuals (4 in the hamstring group and 2 in the peroneus longus group) demonstrated modest laxity with a solid endpoint.

Table 3. Functional Outcomes Of The Hamstring And Peroneus Longus Groups

		Preoperative	Last follow up	Score change (percent)	P-value
	Peroneus longus	55.2±2.4	92.5±9.8	37.3 (66)	<0.001
IKDC	Hamstring	54.8±8.5	93.4±6.2	38.6 (69)	<0.001
	P-value	0.96	0. 589		
	Peroneus longus	63.5±11.2	95.1±6.2	31.6 (48)	<0.001
Lysholm	Hamstring P-value	62.2±7.3 0.490	94.9±10.5 0.522	32.7 (51)	<0.001

Donor Site Morbidity And Ankle Joint Function

The donor ankle morbidity following peroneus longus harvesting was evaluated using objective assessments of ankle ROM and the AOFAS score. Because of the peroneus longus autograft transfer, no patient suffered ankle joint dysfunction or trouble participating in athletic activities. There was no significant change in ankle ROM for any movements between the harvested peroneus longus and the contralateral side. At the latest follow-up, the mean AOFAS score for the donor's ankle was 94.52± 1.76 (range 84-100; Excellent=90-100 points, Good=75-89 points, Fair=60-74 points, and Poor=60 points), with no difference between both sides. There was no pain or complaint about ankle joint weakness, vascular and neurological problems, or any discomforts over the donor site of the ankle. In both groups, no severe instability or complications were discovered. At a minimum of 1 year of follow-up, thigh hypotrophy was significantly greater in the hamstring tendon group compared to the peroneus longus group (8.24±0.5 mm mean thigh hypotrophy in the hamstring group and 4.52±0.4 mm mean thigh hypotrophy in the peroneus longus group; P<0.001). Although the peroneus longus group had just 2-3 mm calf hypotrophy, there was no thigh hypotrophy. Two patients in the peroneus longus group complained of mild to moderate pain, paraesthesia, and dysesthesia at the donor site, and two patients had mild wound discharge from ankle incisions during the first two weeks of treatment and were managed with daily dressing changes and oral antibiotics.

DISCUSSION

In this study, we assessed the functional outcomes of 30 ACL injury patients who underwent ACL repair, and we discovered that both the peroneus longus and hamstring tendon groups had good to exceptional outcomes. The most important factor in the surgical plan is the graft selection. The right graft offers the best knee stability and reduces the risk of re-rupture or re-injury. Rousseau et al reported that hamstring tendon graft and bone patella tendon bone (BPTB) are related to postoperative complications, including anterior knee pain and stiffness.[9] In our study, to examine whether peroneus longus tendon could be considered a more effective alternative than hamstring autograft when replacing an injured ACL, we examined the two options against each other in terms of functional outcomes. Interestingly, the peroneus longus tendon graft's average diameter was 8.60± 0.5 mm, which was bigger than the recommended value to enable quick rebuilding. According to Magnussen et al, an 8 mm minimum graft diameter is desirable to prevent the need for revision surgery.[10] There were 15 patients in Group A (Hamstring tendon graft) and 15 patients in Group B (Peroneus Longus tendon graft). The average Lysholm score improved in both groups from preoperative to 6 months of follow-up, although the mean differences in Lysholm scores between the two groups were determined to be statistically insignificant at each follow-up. The mean IKDC score in both groups improved from preoperative to six months into the follow-up period, although the mean IKDC score differences between the two groups at each follow-up were determined to be statistically insignificant. Based on the IKDC and Lysholm Knee Scoring Scale, comparative functional outcome study on the utilization of hamstring tendon and peroneus longus tendon grafts revealed no appreciable changes between the pre- and 6-month post-surgery. In terms of functional outcome and knee stability, several studies have shown that ACL restoration using the peroneus longus tendon has positive outcomes. In their study with 130 patients, Keyhani et al. examined the functional result of a peroneus longus graft to a hamstring graft in ACL reconstruction and discovered no appreciable difference in the clinical outcome or knee stability.[11]

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.[12,13]

Bi et al. contrasted the usage of semitendinosus tendon to the single-bundle anterior half of the peroneus longus tendon.[14] The study observed no differences in either group's VAS scale, IKDC score, or pivot shift test at the 2-year follow-up. In comparison to the semitendinosus tendon group, the AOFAS score for the peroneus longus tendon group was superior. This research came to the conclusion that grafting peroneus longus tendon gives improved strength and is generally safe for repair. According to Trung et al., there were no post-operative problems in the ankle or foot following anterior half peroneus longus tendon graft ACL restoration.[15] According to some other researches, Lysholm-based improvements to knee functioning offset any differences in ankle functionality.[16]

There were no appreciable changes between the donor site and contralateral site at 6 months after surgery when comparing ankle eversion and first ray plantarflexion strength. In order to prevent the potential complication of quadriceps-hamstring imbalance that may emerge after harvesting the graft from the knee, He et al. came to the conclusion that the peroneus longus tendon graft is ideal as an autograft collected outside the knee.[17]

Despite all the benefits of peroneus longus tendon grafts in ACL

restoration, a random odd-even procedure was used to choose the graft in order to eliminate bias. The use of the proper graft depends on a number of variables, including the associated meniscal and ligament lesions, high- or low-demand patient activities, medical conditions or comorbidities, pre-surgical status, patient decision, and the post-operative rehabilitation protocol, in order to achieve an excellent result.[18]

CONCLUSION

When compared to hamstring tendon autograft, peroneus longus tendon autograft exhibited higher Lysholm and IKDC subjective scores. During short-term follow-up, the clinical and stability outcomes of anterior cruciate ligament with different peroneus longus tendon autograft preparation techniques are comparable to those of hamstring; however, there is sufficient evidence to support their use in the populations that motivated their implementation. As a result of its strength, larger graft diameter, satisfactory ankle function, and prevention of potential complications associated with hamstring autograft obtained from the knee region, peroneus longus tendon autograft may be considered a safe and practical autograft source for arthroscopic anterior cruciate ligament reconstruction.

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