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A study on functional outcome of anterior cruciate ligament reconstruction using peroneus longus tendon auto graft

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Abstract

Background: The objective of the study is to evaluate the functional outcome and donor site morbidity post arthroscopic reconstruction of ACL using ipsilateral Peroneus longus tendon autograft in patients with a torn ACL.

Methods: This is a prospective study that included 15 patients, between the ages 18-50 years, with pre-op clinical tests and MRI to confirm the tear. These patients underwent arthroscopic ACL reconstruction using Peroneus longus tendon autograft in a tertiary care Centre. The post-operative knee function was assessed at 6 months using the modified Lysholm Knee score, whereas the donor site morbidity of the foot and ankle was assessed using the AOFAS (American Orthopaedic Foot and Ankle Society) Score.

Results: In this study, post-operative knee function (modified Lysholm knee scoring) was excellent in 11 patients (73%) and good in 4 patients (27%) of the study sample. The ankle functions at the donor site were exceptionally normal in almost all the patients, explicated by the post-harvest AOFAS score which was excellent in 5 patients (33%) and good in 10 patients (67%).

Conclusions: The peroneus longus tendon is a viable autograft for ACL restoration because it is simple to harvest, is of a suitable size, and is aesthetically pleasing when taking into account excellent post-operative knee scores. Additionally, removing the Peroneus longus tendon has little impact on the ankle's stability. Therefore, it can be utilised in primary arthroscopic ACL

reconstruction procedures as an alternative autogenous graft.

Keywords: Anterior cruciate ligament, Arthroscopic reconstruction, Peroneus longus, Lysholm knee score, AOFAS.

Introduction

Traumatic knee injuries are one of the common injuries in active adults due to an exponential increase in road traffic accidents and more involvement in sports related activities by common people. The anterior cruciate ligament (ACL) is the most commonly injured ligament in the knee joint, forceful valgus and external rotation of the knee being the most common mechanism of injury. This is a serious injury as the primary role of ACL is to provide translational and rotational stability to the knee joint. Because of its key function as the primary restraint against anterior tibial translation, ACL disruption inevitably causes alterations in knee kinematics which are most likely to result in secondary degenerative changes and long-term functional impairment [1, 2]. Thus, the primary aim of ACL reconstruction is to restore the stability and native kinematics of the knee joint while protecting the menisci and joint surfaces from further damage. [3,4]

Surgical reconstruction using a commonly originated graft from the patient's muscle (autograft) has become a widely performed procedure in management for an ACL injury to maintain the functionality and stability of the knee [5]. Graft selection is a vital aspect of the pre-operative planning for ACL reconstruction, but the ideal graft source still remains controversial.

Hamstring tendon (HT) autograft is the most popular graft choice for ACL reconstruction worldwide [6]. Other graft options include bone-patellar tendon-bone (BPTB) and quadriceps tendon. All commonly used autografts are harvested from the knee which carries several potential disadvantages, such as knee laxity or quadriceps-hamstring imbalance after harvest [7,8]. Recently, the peroneus longus tendon (PLT) autograft, harvested just proximal and posterior to the lateral ankle, has been explored as an alternative autograft for ACL reconstruction [9]. The advantages of PLT are that its strength and mean thickness are nearly same as that of the native ACL and it is very easy to harvest. But there are very little studies regarding the donor site morbidity. [9]

In this study, we evaluate the functional outcome of Peroneus Longus tendon as a graft option for primary ACL reconstruction and assess its possible effects on the foot and ankle function.

Methodology

This study was conducted in the Department of Orthopaedics, in a tertiary care hospital in Maharashtra between June 2021 to April 2022. The patients coming to OPD and casualty showing clinic-radiological signs of ACL injury were admitted. On admission, a detailed patient history was elicited to reveal the mechanism of injury and the severity of the trauma. Thorough clinical examination was done (Lachman test, anterior drawer test and pivot shift test) including tests to rule out any associated tears such as the Posterior cruciate ligament (PCL) and the Postero-Lateral Corner (PLC). Routine antero-posterior and lateral radiographs of the affected knee to exclude any chip or avulsion fractures. Pre-operative MRI of the knee was done for confirming ACL tear and associated meniscal injury, if any.

Inclusion criteria

- Patients with primary injuries of the ACL.
- Anterior Cruciate Ligament Injury in ages 15-50 years.

- Isolated ACL injuries/ ACL injuries with grade 1,2 meniscal injury
- Monotrauma cases
- Medically fit for surgery
- Willing for arthroscopic surgery

Exclusion criteria

- Multi-ligamentous injury.
- ACL injuries with avulsion injuries or associated intra-articular condylar fractures.
- Patients with pre-existing flat foot, ankle deformity, paralytic conditions, poliomyelitis or previous significant injuries to ankle.
- Patients with overlying skin infections over the knee or the ankle.
- Meniscal injuries requiring total meniscectomy /meniscal repair
- Patients with chronic systemic medical diseases.

All the patients were explained about the aims of the study, the methods involved and an informed written consent is obtained for the same. Prior to surgery all patients were advised to wear a knee immobilizer and educated to avoid deep squatting and low chairs. Muscle strengthening physiotherapy was taught so as to maintain symmetric quadriceps strength and to have near full range of motion. Once the acute inflammatory period resolved, patients were posted for surgery after due an aesthetic fitness, under spinal anaesthesia, in supine position. Before the harvesting of graft, a diagnostic arthroscopy was performed in all patients to confirm ACL injury with/without associated meniscal injury.

Surgical technique for harvesting PL graft

After identification of bony landmarks, the skin incision is marked 2 to 3 cm above and 1 cm behind the lateral malleolus. A 3cm skin incision mark is made until the peroneal retinaculum. The peroneus longus and peroneus brevis tendons are identified (Fig. 1). Using blunt dissection, the peroneus longus tendon is released from the surrounding soft tissue proximally. Tenodesis is done 2 cm distally for which the distal part of the peroneus longus tendon is sutured to the peroneus brevis tendon with end-to-side sutures. The peroneus longus tendon is then cut proximal to the tenodesed tendons and the proximal cut end of the peroneus longus is whip-stitched (Fig. 2). Using a tendon stripper, the peroneus longus tendon is now stripped proximally up to a mark 5 cm from the fibular head in order to prevent peroneal nerve injury.

Fig 1:

Fig 2:

Fig 3:

Fig 4:

Fig 5:

For graft preparation the muscle remnants are cleared and the graft is folded into double strand and the ends stitched together with a running whip stitch 4 to 5 cm from the free ends using ethi bond sutures (Fig. 3,4). The graft is then quadrupled by passing an endo button midway (Fig. 5). The graft size is measured using a sizer.

After appropriate drilling of femoral and tibial tunnels the endo button along with the prepared graft are passed with the help of the beath pin. Once the endo button is flipped and confirmed, manual tensioning of the graft is done by cyclic loading of the graft and checked for impingement. After confirming the position of the reconstructed ACL under arthroscopic vision, the tibial site was fixed with appropriate size interference screw. A check x-ray was done post operatively to confirm the position of the screw and the endo button (Fig. 6)

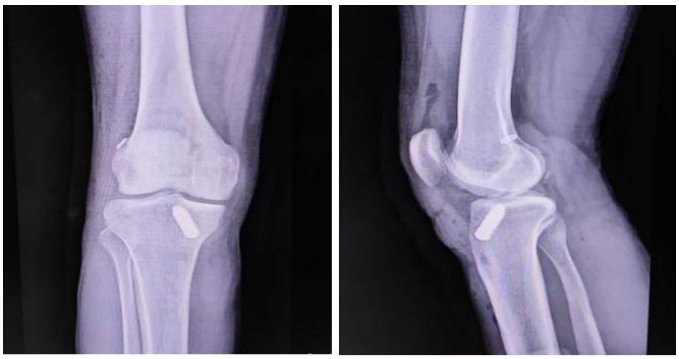

Fig 6:

Post-operative protocol

Post operatively, patient is taught static quadriceps, ankle and knee range of motion exercises and toe touch weight bearing. Each patient was encouraged to stretch the affected ankle gently and actively from first postoperative day. Patients were allowed to full weight bear after 3 weeks. Patients were assessed immediate post operatively and then followed up regularly at 6 weeks, 3 months and 6 months using modified Lysholm score. Ankle function was assessed using AOFAS score. Eversion power of ankle were noted at every follow-up (Fig. 7).

This Study aims to assess the functional outcome of arthroscopic ACL reconstruction with Peroneus longus autograft using modified Lysholm knee scoring system, and donor site morbidity using the AOFAS scoring system.

Result

In our study we have performed arthroscopic ACL reconstruction in a sample of 15 patients, of whom 13(87%) were male and 2(13%) were female. Intraoperatively, only 4 (26.6%) patients had partial tear of the medial menisci for which partial meniscectomy was done.

The minimum length of Peroneus longus graft harvested in our study was 27.5 cm and the maximum length was 30 cm. The mean length of the graft was 28.8 cm (Table 1).

Table 1: Length of peroneus longus tendon autograft

Length of Grafts(cm)	Number of patients	Percent (%)
27.5-28.5	5	33
28.6-29.5	7	47
29.6-30.5	3	20
>30.5	-	-

The maximum thickness of the graft was 9. 6 mm and minimum thickness was 8.2 mm. The mean thickness of the harvested PLT graft obtained in our study was 8.82 mm. (Table 2).

Table 2: Thickness of peroneus longus tendon autograft

Thickness of Grafts(mm)	Number of patients	Percent(%)
7.5-8.0	-	-
8.1-8.5	2	13
8.6-9.0	9	60
>9	4	27

At follow up of 6 months, Lachman test showed normal findings in 11(73%) patients while 4 (27%) of the patients showed 1+ anterior laxity (Table 3).

Table 3: Lachman test at follow up

Lachman test Grade	Number of patients	Percent (%)
Negative	11	73
1+	4	27
2+	-	-
3+	-	-

The results of our study were assessed using the modified Lysholm knee scoring sustem at 6 months post-operative follow up. According to these 11 cases (73%) showed excellent outcome and 4 cases (27%) showed good outcome. The mean Lysholm knee score at 6 months was 92.2 ± 2.65 (SD). For the assessment of donor site morbidity at the ankle the AOFAS score was used, which was excellent in 5 cases (33%) and good in 11 cases (67%) with a mean value of 92.06 +/- 3.78 (SD). None of the cases showed any abnormal finding in the knee or ankle function. (Table 4)

Table 4: Functional scores at 6 months follow up

Sr. No.	Lysholm score at 6 months follow up	Aofas score at 6 months follow up	Lachman test at 6 months follow up
1	91 - Excellent	94	NEG
2	90 - Good	95	NEG
3	96 - Excellent	97	NEG
4	94 - Excellent	97	NEG
5	95 - Excellent	91	NEG
6	88 - Good	95	1+
7	91 - Excellent	84	NEG
8	91 - Excellent	93	1+
9	88 - Good	88	1+
10	95 - Excellent	94	NEG
11	95 - Excellent	88	NEG
12	94- Excellent	91	NEG

13	94 - Excellent	91	NEG
14	91 - Excellent	88	NEG
15	90 - Good	95	1+

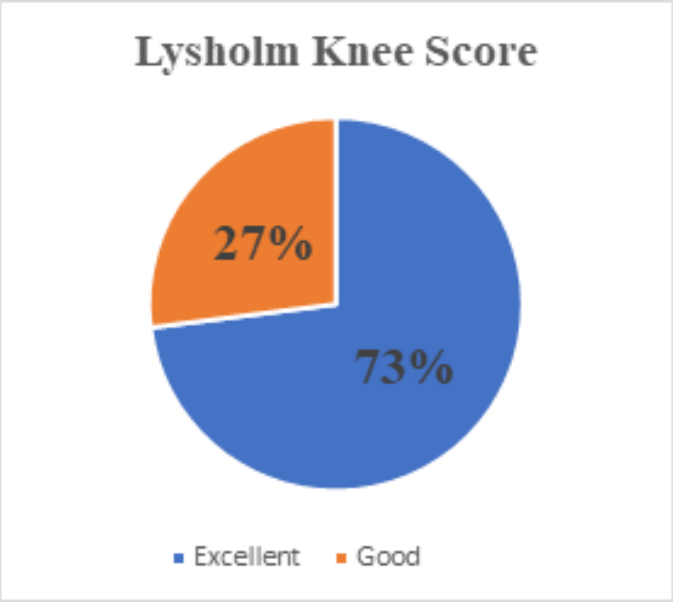

Fig 7:

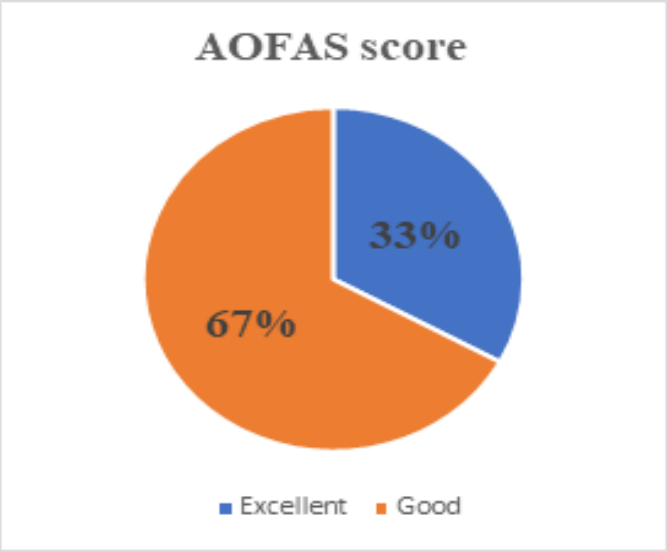

Fig 8:

Discussion

Arthroscopic ACL reconstruction incorporating an autograft is a surgical procedure frequently carried out with the aim of restoring the stability and kinematics of the knee joint. The most important factor in the surgical plan is the graft selection, as the right graft will offer optimal knee stability and reduce the risk of re-rupture or re-injury. The goal is to achieve an effective biological connection between the graft and bone to ensure optimum osteointegration. However, the site of graft harvest is vulnerable to donor site complications.

The most popular graft choices worldwide include hamstring tendon and bone-patellar tendon-bone (BPTB) graft [10]. The gold standard for ACL reconstruction is BPTB graft (Bone-patellar tendon-bone graft) because of its strength, consistency, size of the graft, and most importantly because of bone-to-bone healing within the tibial and femoral tunnel [11,12] However, because of its complications like patellar tendon rupture, patellar/tibial fracture, quadriceps weakness, loss of full extension, anterior knee pain, difficulty in kneeling, its use has now declined. The hamstring tendon grafts have greater mechanical strength than a bone-patellar tendon-bone graft. Also, patients treated with hamstring tendon grafts are less likely to suffer anterior knee pain. Successful clinical outcomes following ACL reconstruction with a semitendinosus graft have been reported by many authors [13]. However, the use of hamstring tendon graft is decreasing due to unpredictable graft size and reduction in hamstrings power post-harvest [14].

An alternate autograft option with acceptable strength and reduced donor site morbidity will be crucial given the growing drawbacks of the frequently utilised grafts and the accompanying donor site morbidity. As a result, numerous research studies on the utilisation of peroneus longus tendon (PLT) autograft as an alternative graft option for Single bundle ACL reconstruction are being conducted. The choice of fixation in ACL reconstruction is still evolving and the current fixation device which have been widely used are the Endo-button and the Bio-composite interference screws which has helped to

render an improved rehabilitation program post operatively [15].

The Peroneus longus tendon is just as sturdy as the native ACL biomechanically. According to a research by Kerimoglu et al., the single strand Peroneus longus tendon could withstand a maximum tensile load of 1950N, compared to the natural ACL's maximum tensile load of 1725N [9].The mean thickness of the graft obtained in our study was 8.76mm which was way satisfactory as compared to the thickness obtained in most hamstring grafts.

The primary function of the PLT in the ankle is to support first ray plantarflexion and foot eversion. After the removal of the peroneus longus tendon, there is some concern about how the strength of the first ray plantarflexion and ankle eversion are affected. The other concern being about the ankle instability [16]. Thus, considering donor site morbidity, the peroneus longus tendon's usage in ACL reconstruction has been debatable. Using FADI and AOFAS scores, a previous study examined the ankle functional outcomes and found that the peroneus longus tendon produced excellent outcomes. [17]

Comparative studies on the use of HT and PLT grafts showed no significant differences between the pre- and 1-year post-surgery, based on the IKDC, modified Cincinnati, and Lysholm Knee Scoring Scale. The PLT graft was considered more superior because it provides larger graft diameter and less thigh hypotrophy with excellent ankle function based on AOFAS and Foot and Ankle Disability Index (FADI) [17,18]. According to Shi et al [16] there were no variations between preoperative and postoperative ankle strength, stability and range of motion after PLT harvest. Karanikas et al [19] found no difference in isokinetic strength for first ray plantarflexion of the donor versus contralateral ankle between 3 and 6 months or 6 and 12 months after ACL reconstruction.

Regarding aesthetic considerations, the harvesting of a PLT graft conceals the tendon harvesting scar behind the lateral malleolus and also results in a substantially reduced scar around the tibial tunnel. Thus, it gives sportsmen who frequently have to display their legs for their profession an aesthetic edge.

The limitation of this study was that assessment of the ankle function was subjective. However, newer devices such as arthrometers which measure ankle functions objectively are available. Other drawbacks include a small number of study sample, short time period of follow-up, and no comparison between preoperative and postoperative results.

The results of our study are very encouraging, but long term follow up and large number of patients are needed to further conclude these results and observations.

Conclusion

Peroneus longus tendon autograft demonstrated remarkable functional outcomes in patients undergone ACL reconstruction surgery. It carries the advantages of ease of harvesting, large graft diameter and negligible donor site morbidity. Hence, Peroneus longus tendon may be considered as one of the first option autografts for ACL reconstruction to avoid the complication of quadriceps-hamstring deficiency which can occur when harvesting autografts from the knee.

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