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ORIGINAL ARTICLE

Primary ACL Reconstruction Using Peroneus Longus Tendon Autograft; Short Term Outcome

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ABSTRACT

BACKGROUND: ACL Reconstruction is a widely popular procedure. It requires ideal graft choice. For long period of time hamstring, PTP and quadriceps tendon autografts represented the different alternative for ACL Reconstruction autograft. They had local complications regarding strength and donor site complications. Peroneus longus tendon graft is an excellent autograft alternative giving excellent clinical and functional results with negligible ankle morbidity and keep knee clear of local tendon donor site morbidity. Peroneus longus can represent an excellent choice for substituting torn ACL. So, we aimed to evaluate advantage and disadvantages of using peroneus longus tendon autograft in primary isolated ACL reconstruction.

METHODS: 82 cases were operated by two strand peroneus longus for substituting torn ACL, followed up for 2 years. Intraoperative measurement of graft diameter was recorded. At 2 years follow-up patients were clinically evaluated for knee stability and donor site complications and functionally by ankle and knee functional scores.

RESULTS: Graft thickness for all cases exceeded 8 mm which is considered the minimum required diameter recommended by most authors, lachman stability testing gave negative result in 95.2% of our cases. Donor site complications were minimal, functional knee and ankle scores were excellent.

CONCLUSION: Peroneus longus tendinious unit can substitute torn ACL giving excellent clinical and functional results. It can be an excellent choice for primary ACL Reconstruction.

KEYWORDS: Peroneus longus; ACL Reconstruction; Hamstring, morbidity.

INTRODUCTION:

Surgical reconstruction of ACL tear using a tendon autograft has become commonly used in management of ACL injury to restore the previously stable and functional knee joint. Inspite of being commonly used; Patellar tendon autograft tends to resulting in anterior knee pain, fractures related to patella, quadriceps muscle weakness and wasting, tendon patellae rupture, and patellar tendonitis [1].

Hamstring tendon as a graft traditionally used may attenuate the flexion potency at the knee joint [2]. Moreover, it is associated with delayed graft to bone incorporation and tunnel problems. Added to that, progressive slackness of the graft over time. All these drawbacks impess the final result of the procedure [3].

Regarding the quadriceps tendon autograft, complex harvesting technique, possibility of patellar fracture and may be the long incision are main drawbacks for this choice of graft [4].

Hamstring tendon graft exhibits unpredictable graft length and diameter, a probable diminished flexion strength of knee joint, higher risk to infection due to and possible injury to sensory affection and anesthesia due to offense to the terminal knee sensory branch of the saphenous nerve at time of harvesting procedure [5].

All these valuable sources of tendon autograft alone may not be sufficient when there are

multiligament knee injuries needing to be dealt with in the same time and after failure of primary ligament reconstruction or repair making the need to search for more options for tendon graft [6].

Peroneus longus has recently emerged as an excellent, practical, safe and easily harvested alternative for commonly used tendon graft to reconstruct ACL tear as no secondary affection of the knee with no or minimal ankle affection. Besides, harvesting the tendon of peroneus longus keeps the knee away from donor site complications. Therefore, the employment of peroneus longus to substitute torn knee ligaments is becoming an option of choice in ACL Reconstruction aided by biomechanical strength and excellent functional results [7].

Graft diameter is very important determining factor for success of ligament reconstruction. In a study of Keyhani S, average thickness of the double layered harvested tendon of peroneus longus gave a measure of 8.71 ± 0.4. In contrast quadruple hamstring tendon yielded 7.65 ± 0.6, indicating peroneus tendon is superior to hamstring graft in this point [8].

Donor site affection and pain are insignificant at site of harvesting peroneus longus tendon behind lateral malleolus. Moreover, no significant change noticed in the range of ankle joint movement (plantarflexion/ dorsiflexion) and subtalar joint range of movement (inversion/eversion) between both donor ankle and the other healthy one. Rathomy et al. declared that peronus longus harvest led to minimal morbidity to donor ankle and foot [9].

We hypothesized that peroneus tendon autograft is excellent alternative for commonly used autografts for primary isolated ACL reconstructionwith comparable outcomes and lesser complications.

The aim of the study was to evaluate advantage and disadvantages of using peroneus longus tendon autograft in primary isolated ACL reconstruction

METHODS:

82 patients aged between the 19 and 38 years old were included in study: 66 of them were males and 16 females. In our retrospective study. All patients had isolated ACL injuries. We excluded patients with previous knee or ankle injury from this study.

Informed consent was obtained from all participants before any intervention or data collection and after informing them about the study and steps which will be done and their capability to withdraw at any time.

All cases were operated in our department during the period between February 2021 and May 2024. This study got approval from Ethical committee in faculty of Medicine, Zagazig University. An informed written consent was obtained from all participants of this study.

Patients diagnosed as isolated ACL tears based on history, clinical examination, X ray and MRI imaging.

ACL Reconstruction with peroneous longus was performed in all cases. The data concerning functional knee scores (International Knee Documentation Committee (IKDC) and Lysholm score) were collected, also we evaluated knee ROM. The final estimation of results was done two years postoperative. Ankle functional score (The American Orthopedic Foot & Ankle Society (AOFAS) score and Foot and Ankle Disability Index (FADI) score) and ankle ROM were recorded for statistical analysis.

Operative technique:

After preoperative dose of 1 gm cefazolin. Spinal anesthesia was given to patients and then we applied pneumatic tourniquet to 350mmHg. Diagnostic arthroscopy for ACL tear was done through standard portals, and then we harvested the tendon of Peroneus tendon from the same leg. An incision located 2-3cm superior and 1cm posterior to lateral malleolus was done. Then, we divided subcutaneous tissue and incised superficial fascia. After that we separated tendons of peronei from each other. (Figure 1).

Then a tendon stripped was used to harvest the tendon of peroneus longus. The stripper must not exceed the safe zone which is 4 to5 cm distal to fibular head to avoid injury to peroneal nerves (Figure 2).

Distally in the incision the two tendons were sutured together and the proneus longus was cut proximal to the suture site aiming to maintain the function of peroneus longus muscle. (Figure 3).

Then the knee joint was debrided to identify footprints while preparing of the two layered tendon graft. ACL remnants were kept to provide a guide for tunnel drilling and to maintain some vascularity and proprioception. Femoral tunnel was drilled first and suture loop inserted to shuttle the graft. Then, tibial tunnel was done through the C guide then the suture loop shuttled through tibial tunnel. After preparation and tensioning the graft we shuttled it through the tibial then femoral tunnel where it was suspended to femur through button and fixed to tibia by interference screw.

Rehabilitation:

Patients underwent rehabilitation regimen. In the first two weeks the main concern was to maintain full extension and prevent swelling by elevating the foot and application of ice. In next two weeks the patient must achieve 90 degrees of flexion. After 6 weeks of surgery patient should regain knee sense of stability and quadriceps strength. At 3 months postoperative the patient gradually returns to sport activity. At 6 months the patients should have returned safely to sport activity.

Regarding loading and weight bearing, partial weight bearing was allowed as tolerated after surgery using cruches. Full weight bearing was achieved at 4 weeks post operative.

Brace was used to enhance the sense of secure knee for 6 months.

Post-operative evaluation:

Post-operative knee and ankle functional outcomes and donor ankle morbidity were observed at two years after ACL Reconstruction. We evaluated IKDC, Lysholm scores for the knee and AOFAS score and FADI scores for the ankle; Also, lachmann test, knee and ankle ROM were assessed.

Statistical analysis:

Data of 2-year postoperative followup were collected, entered and analyzed using Microsoft Excel software. Data were then imported into Statistical Package for the Social Sciences (SPSS version 20.0) (Statistical Package for the Social Sciences) software for analysis.

RESULTS:

All cases were scheduled for routine follow-up at 2, 4, 6, and 8 weeks. After that all cases were followed up every 3 months for 2 years. The last follow up for all cases was at 2 years postoperative.

From February 2021 and May 2024, we operated 82 patients for ACL Reconstruction by the tendon of peroneus longus. Mean age of the patients was 27±4 ranging from 19 upto 38 years old (Demograhic data of patients tabulate in Table 1).

Graft thickness of each patient was measuered and recorded 8.6±0.5 mm. Results at 2 years post operative were as follows: Strength of knee flexion was the same as contralateral healthy side. Eversion and plantarflexion power of the ankle showed no difference to contralateral ankle. For lachman test 2 years postoperative, 78 patients graded 0and 4 patients were graded I. No patients were grade neither II nor III (Table 2). Mean IKDC was 96.6±1.3. Mean Lysholm score 90±7.4. Mean of AOFAS score was 98.93±1.1 and FADI score was 99.79±0.59. (Table 3)

Table 1: Demographic data of patients

Demographic Variable	Description/Range	Mean ± SD / Count (%)
Sample Size	82 patients	82 patients
Age (years)	19 – 38	27 ± 4
Gender	Male Female	66 (80.5%) 16 (19.5%)
Body Mass Index (BMI)	21 – 29 kg/m²	24.6 ± 2.1
Activity Level	Recreational & professional Non recreational (employees, manual workers and housewives)	12 professional (14.6%) 70 patients (85.4%)
Occupational Demands	Active lifestyle, sports-related	76 patients (92.7%)
Comorbidities	Prior knee/ankle injury	Excluded

Table 2: Lachman test examination at 2 years followup

Negative Lactest	78 patients (95.2%)
Grade I	4 patients (4.8%)
Grade II	0 patients
Grade III	0 patients

Table 3: Functional scores at 2 years followup

IKDC	96.6±1.3
Lysholm score	90±7.4
AOFAS	98.93±1.1
FADI	98.79±0.59

Figure 1: Identification and isolation of peroneus longus tendon at ankle.

Figure 2: stripping the tendon using stripper

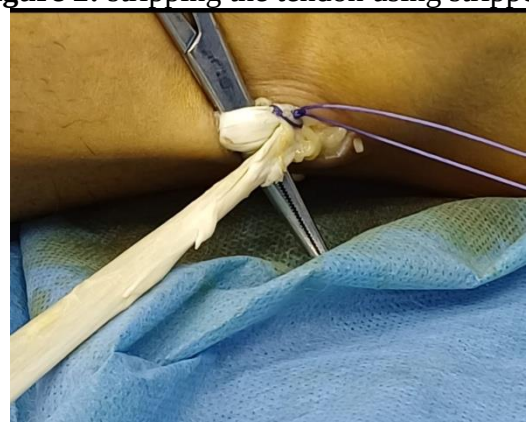

Figure 3: suturing peroneus longus to brevis

DISCUSSION:

Use of most suitable graft in ACL reconstruction is a main determinant factor in functional and clinical results and patient satisfaction. Events of graft failure after hyperextension or twisting trauma are prevented and stability of the knee becomes ideal with appropriate selection of the graft. Hamstring, quadriceps and PTB grafts are related to post-operative drawbacks such as anterior knee pain and limitation of ROM [10]. A graft thickness of 7 mm is not sufficient to prevent re-injury, rerupture and consequently revision surgery [11]. Other papers insisted that 8 mm diameter is the least accepted for graft to provide normal stability [12, 13].

Our results using this technique is comparable to studies of other regarding diameter of the graft, postoperative stability of the knee, absence of donor site morbidity to ankle and functional knee and ankle scores.

Compared to other autograft options; Extensor mechanism insult and anterior knee pain are related to bone patellar tendon bone autograft [1]. Knee donor site morbidity is frequently seen with hamstring autograft like paresthesia related to injury to terminal sensory branches of saphenous nerve [5]. Complex harvesting technique, possibility of patellar fractures are drawbacks of patellar tendon autograft [4]. These all complications are not met with our technique.

Although the peroneus longus tendon (PLT) autograft demonstrated excellent clinical and functional outcomes in our study, it is important to consider potential complications reported in the literature. Minor ankle weakness in eversion or plantarflexion has been a theoretical concern; however, most studies including ours found no statistically significant reduction in ankle strength or function postoperatively [9,15]. Donor site morbidity such as ankle pain or reduced range of motion is also infrequent. Wiradiputra et al. and Sharma et al. reported full recovery of ankle function with no chronic discomfort or instability [17,20].

Another concern is the risk of superficial or common peroneal nerve injury during tendon harvesting. This can be minimized by adhering to safe anatomical zones and meticulous dissection technique [16]. Additionally, although peroneus longus plays a biomechanical role in ankle stability, studies have shown that gait, proprioception, and return-to-sport levels are not significantly impacted when the tendon is harvested correctly [18,19].

Imaging studies have even suggested the possibility of partial regeneration of the harvested tendon, mitigating long-term deficits [7]. These findings support the use of PLT autograft as a safe, reliable option for ACL reconstruction with minimal long-term donor site morbidity.

In this study, the least diameter used was 8 mm with mean of 8.6±0.5 of PLT graft for ACL reconstruction, which was larger than the least accepted diameter approved by most of authors for successful ACL reconstruction.

Concerning graft diameter, in Rhatomy et al. [9] study diameter of two-strand peroneus longus tendon was 8.38±0.68 mm. Sakti et al. [14] in their study found that the diameter was 8.1±0.8 mm.

We found that the graft thickness was 8.5±0.5 mm concluding that peroneus longus graft can have sufficient diameter for ACL Reconstruction.

As for donor site complications, Bi et al. [15] found that peroneus longus does not decrease knee strength as hamstring does. Ankle and subtalar strength (especially plantarflexion and eversion were not affected [16]. Wiradiputraet al. [17] in their study found that the patient had no problem in walk tip-toed and without ankle and foot functional deficit. Peroneus longus as a graft does not cause patellofemoral pain nor decrease of extension, flexion in all patients [18].

These results were similar to results of our study where we found no difference between strength and active range of movement of operated knee and normal one and also between operated ankle and normal one. This means that peroneus longus graft for ACL Reconstruction has minimal ankle morbidity.

Regarding knee stability, negative lachman test (stable knee) was achieved in 95.2% of cases in Bi et al. [15] randomized controlled trial. In another study lachmann test gave

positive results in 3 patients out of 29 which means it was negative in 89.7% [18].

In our study negative results was achieved in 95.2% of patients. In these different studies the knee was stable in nearly more than 90% of patient which makes peroneus longus an excellent choice of grafts in primary ACL Reconstruction.

For knee functional scores; IKDC score was 95.69±3.35 in Rhatomy et al. [9] study and 90.13±3.01 in Shi et al. [19] study.

Lysholm score as another functional knee score was 89.70±8.34 in Rhatomy et al. study [9]. And 94±6.81 in Shi et al study [19].

Our study revealed nearly similar results for IKDC score which was 96.6±1.3 and 90±7.4 for Lysholm.

Regarding ankle scores as functional determinant for donor ankle morbidity in harvesting the tendon of peroneus longus, AOFAS and FADI scores were 98.93±3.10 and 99.79± 0.59 in study of Rhatomy et al. [9]. In sharma et al. [20] study results were 94.5 +/- 1.5 for AOFAS and 94.2 +/- 1.1 for FADI. These results denote minimal or absence of donor site morbidity in peroneus tendon graft.

These results were same as results as our AOFAS was 98.93±1.1 and our FADI score was 98.79±0.59.

Strengths and Limitations:

This study presents several strengths that enhance its clinical relevance. It includes a relatively large cohort of 82 patients undergoing primary isolated ACL reconstruction using the peroneus longus tendon, with uniform surgical technique, consistent postoperative follow-up over two years, and comprehensive evaluation using both knee and ankle-specific outcome measures (IKDC, Lysholm, AOFAS, and FADI). The high graft diameter observed (mean 8.6 ± 0.5 mm) and the excellent functional outcomes support the viability of PLT as a strong and safe autograft option.

However, these strengths must be weighed against certain limitations. The study is retrospective in nature, lacks a control group using other graft types (e.g., hamstring or patellar tendon), and was conducted at a single center. The study population was relatively young (19–38 years) and physically active, which may limit generalizability to older or sedentary populations. Additionally, long-term outcomes beyond two years, including potential degenerative changes or ankle/knee arthritis, remain unknown.

Despite these limitations, the findings suggest that peroneus longus tendon autograft provides a compelling alternative in ACL reconstruction, particularly in patients where minimizing knee donor site morbidity is prioritized. Future prospective studies with control groups and extended follow-up will be necessary to further validate these promising results.

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CONFLICT OF INTERESTS

The authors declare that they have no competing interest.

CONCLUSIONS:

Peroneus longus tendon autograft provides excellent clinical and functional outcomes in primary ACL reconstruction with minimal donor site morbidity at ankle joint and keeping knee away from donor site morbidity. These results support its use as a promising alternative to traditional autografts.

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