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# Functional evaluation of ACL reconstruction using peroneus longus tendon autograft versus hamstring tendon autograft

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***Abstract*---Background**: Anterior cruciate ligament (ACL) reconstruction improves knee stability and function with many graft types, either autografts or allografts, which have already been studied extensively. **Aim of the study**: To compare between the clinical and functional outcomes of ACL reconstruction using peroneus longus tendon autograft versus hamstring tendon autograft. **Patients and Methods:** This study is a controlled randomized prospective study, that was conducted at Menoufia University Hospitals from February 2023 to February 2024. Twenty patients underwent ACL reconstruction using peroneus longus tendon autograft and twenty patients underwent ACL reconstruction using Hamstring autograft. A written well informed patient consent was obtained from all the participants. The patients were followed up for 12 months. **Results:** In HT group, the Lyshlom score has improved from 59.1±11.2 with range between 36-84 pre-operatively to become 93.9±4.6 with range between 84-100 post- operatively. While in PLT group, it has


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improved from 54.6±6.4 with range between 42-65 to become 94.8±4.7 with range between 85-100 post-operatively. In HT group, IKDC Score has improved from 36.6±4.1 with range between 31-44 pre-operatively to become 80.0±9.9 with range between 44.8-94 post-operatively. While in PLT group, it has improved from 36.6±4.0 with range between 31-43 pre-operatively to become 82.8±3.7 with range between 75-87 post-operatively. **Conclusion:** Both groups are valid options for ACL reconstruction with comparable results with no significant difference between both groups regarding clinical and functional results and also donor site morbidity.

***Keywords*---**ACL, Hamstring graft, Peroneus longus, Lysholm score.

## Introduction

The anterior cruciate ligament (ACL) is one of 2 cruciate ligaments that aids in stabilizing the knee joint. It is a strong band made of connective tissue and collagenous fibers that originate from the anteromedial aspect of the intercondylar region of the tibial plateau and extends posterolaterally to attach to the medial aspect of the lateral femoral condyle, where there are two important landmarks; The lateral intercondylar ridge which defines the anterior boundary of the ACL, and the bifurcate ridge which separates the 2 ACL bundles.(1)

Incidence of anterior cruciate ligament injuries is very common and occur with increasing manner, from approximately 33 cases in 100 000 in 1994 to 40-60 incidents in 100 000 in 2014 in USA. Especially in those who participate in organized sport activities.(2)

The most serious long-term consequence of anterior cruciate ligament tear is development of knee osteoarthritis, which increases by ten-folds. More than 50% of patients that sustain an ACL injury is suggested to develop symptomatic osteoarthritis in the following 10 to 20 years.(1, 2)

Reconstruction of anterior cruciate ligament is one of the most common orthopedic surgeries worldwide. It is estimated that around 200000 ACL reconstructions are performed each year in the USA alone, this number expected to increase further as a result of increased participation in athletic activities by adolescents and young adults.(3, 4)

The primary goal of an anterior cruciate ligament reconstruction is restoring stability to the knee. That's why measurements of knee stability are one of the most important determinants of success after an anterior cruciate ligament reconstruction.(5, 6)

Anterior cruciate ligament (ACL) reconstruction improves knee stability and function with many graft types, either autografts or allografts, which have already been studied extensively.(7, 8)

**Patients and Methods**

This study is a controlled randomized prospective study, that was conducted at Menoufia University Hospitals from February 2023 to February 2024. Twenty patients underwent ACL reconstruction using peroneus longus tendon autograft and twenty patients underwent ACL reconstruction using Hamstring autograft. A written well informed patient consent was obtained from all the participants. The study was reviewed by the Institution Review Board of Faculty of Medicine, Menoufia University for approval.

Inclusion criteria were age between 18 and 40 years, all patients with anterior cruciate ligament rupture, and all ACL reconstructions have been done using hamstring autografts or peroneus longus tendon autografts.
Exclusion criteria were patients younger than 18 years or above 40 years, patients with multi-ligamentous injuries, patients with associated meniscus injury needing repair, patients with associated chondral lesions needing repair, and revision ACL.

**Data of Pre-operative Evaluation**

A)Detailed history taking including patients' age and gender, mode of trauma, occupation, side of knee affected, medical comorbidities, and past history of previous operative procedure of the affected knee.
B)Examination:
1. Inspection: for scars, swelling, skin condition, deformities and muscle atrophy. 2.Palpation: for points of tenderness over soft or bony points, and temperature. 3.Provocative tests: Lachman test, pivot shift test, and anterior drawer test were done. C)Imaging:
1)Plain X rays: There was no fractures, loose bodies, degenerative disease, osteophyte formation, or other associated injuries in all the patients. 2)Magnetic Resonance Imaging (MRI): It showed discontinuity of ACL fibers in all the patients. None of the patients had shown meniscal injury in MRI.

(2) Data of Operative Evaluation:
Diagnostic arthroscopy was done to all patients before harvesting of the grafts.
Then, the antero-medial (working) portal was established. The needle was introduced just medial to medial border of patellar tendon and just above medial joint line aimed towards the interchondylar notch. It was used as working and viewing portal.
Hamstring graft harvest and graft preparation:
After identifying bony landmarks including tibial tuberosity, medial joint line and posteromedial border of the tibia; about 3 to 4 cm oblique skin incision was made starting about 4 cm below the medial joint line along the palpable pes-anserinus attachment midway between tibial tuberosity and posteromedial border of the tibia.
Incision was carried to sartorial fascia through the subcutaneous tissue with blunt dissection. Then, with the pad of the surgeon's finger, the borders of gracilis and semitendinosus were identified and felt running from above downwards.

Then, the sartorius fascia was divided along the course of the tendons (gracilis and semitendinosus), taking care to preserve the deep layer containing the Medial Collateral Ligament. A tendon stripper (closed or open-ended) was used to harvest each tendon. A tendon stripper was advanced over the tendon in line with maintaining firm, steady and gentle pressure.
Then, around 3-4 cm of both ends of the processed tendons were stitched together and the processed graft was then passed through the graft sizer.
Pernous longus tendon harvesting and graft preparation
The graft was released from the ipsilateral PLT by making a 2 cm longitudinal incision over the posterior border of the lateral malleolus. The superior peroneal retinaculum was elevated until the posterolateral side of the PLT tendon is visible. Tenodesis of peroneus longus with peroneus brevis then cut of peroneus longus at 2 to 3 cm above the lateral malleolus were done.
The proximal end was released by the tendon stripper, with an approximated length of 4–5 cm distal to the fibular head to prevent peroneal nerve injury.
On the Graft-master board, tendons were removed of any residual muscle fibers with the help of blunt edge of the blade and ends were trimmed to achieve uniform size. Graft approximate length and size were estimated using graft sizer and a ruler to make sure of getting a graft size over 7mm with length more than 90mm. Then, around 3-4 cm of both ends of the processed tendons were stitched together and the processed graft was then passed through the graft sizer.
The diameter of the tunnel to be made was equal to the smallest sizing sleeve through which the graft passed with minimum friction.The graft length to be placed inside the femoral tunnel was marked to ensure correct placement of graft within the femoral tunnel while being viewed arthroscopically. Then, the loop of graft was tied to the posts in the graft-master board and pre-tensioning was done.

(3) Data of Post-operative Evaluation:
All patients were instructed immediate postoperative to limb elevation and knee ice packs for 20 – 30 minutes 4 to 5 times for couple of days. Wound was inspected at 7th and 14th day. Sutures were removed at 14th day.
ACL Rehabilitation protocol: All patients were rehabilitated according their individual findings on examination, patient's progression and presence of post-operative complications.

**Results**

The number of the patients with ACL reconstruction using PLT autograft was 20 patients, mean age of them was 25.4±6.4 with range between 18-38 years old, while the number of the patients with ACL reconstruction using HT autograft was 20 patients, mean age of them was 28.8±7.2 with range between 19-40 years old.
No significant difference between both groups regarding age. Eighteen patients were male and 2 patients were female in PLT group, while 15 patients were male and 5 patients were female in HT group. No significant difference between both groups regarding gender.

Manual workers were 8 patients, 3 patients were sportive, and 9 patients were with other occupations in PLT group, while manual workers were 10 patients, 1

patient was sportive, and 9 patients were with other occupations in HT group. No significant difference between both groups regarding occupation (P-value > 0.05).
None of the patients with ACL reconstruction using PLT autograft was diabetic, 2 of them were smokers and 18 patients were not smokers. Two of the patients with ACL reconstruction using HT autograft were diabetic, while 18 patients were not diabetic. Four of them were smokers and 16 patients were not smokers. No significant difference between both groups regarding being diabetic or smoker or not (P-value > 0.05).

Mode of trauma in the patients with ACL reconstruction using PLT autograft was RTA in 13 patients, and sports related injury in 2 patients and others in 5 patients. 14 patients were with right sided injury, while 6 patients were left. Graft diameter was 8.5±0.7 with range between 8-9 in mm. Mode of trauma in the patients with ACL reconstruction using HT autograft was RTA in 12 patients, and sports related injury in one patient and others in 7 patients. Thirteen patients were with right sided injury, while 7 patients were left. Graft diameter was 8.1±0.7 with range between 8-9 in mm. No significant difference between both groups regarding mode of trauma, side and graft diameter (P-value > 0.05). In HT group, the Lyshlom score has improved from 59.1±11.2 with range between 36-84 pre-operatively to become 93.9±4.6 with range between 84-100 post-operatively. While in PLT group, it has improved from 54.6±6.4 with range between 42-65 to become 94.8±4.7 with range between 85-100 post-operatively.
In the current study, in HT group, IKDC Score has improved from 36.6±4.1 with range between 31-44 pre-operatively to become 80.0±9.9 with range between 44.8-94 post-operatively. While in PLT group, it has improved from 36.6±4.0 with range between 31-43 pre-operatively to become 82.8±3.7 with range between 75-87 post-operatively.

P-value for pre-operative and post-operative Lyshlom score progress in ACL with HT autograft group was <0.001 which is highly significant. P-value for pre-operative and post-operative Lyshlom score progress in ACL with PLT autograft group was <0.001 which is highly significant.(**Table 1**)
ACL with HT autograft group had preoperative IKDC score of 36.6±4.1 with range between 31-44, while ACL with PLT autograft group had preoperative score of 36.6±4.0 with range between 31-43, with no significant difference.
HT group had post-operative IKDC score of 80.0±9.9 with range between 44.8-94, while PLT group had post-operative IKDC score of 80.0±9.9 with range between 44.8-94, with no significant difference. P-value for pre-operative and post- operative IKDC score progress in ACL with HT autograft group was <0.001 which is highly significant. P-value for pre-operative and post-operative IKDC score progress in ACL with PLT autograft group was <0.001 which is highly significant. (**Table 2**)
AOFAS mean score in ACL with Peroneus Longus Tendon autograft group was 79.9±6.5 with range between 70-90.
ACL with PLT autograft group had one patient with knee stiffness, 2 patients with post-operative infection and 17 patients with no post-operative complications. ACL with HT autograft group had 2 patients with knee stiffness, 2 patients with post-operative infection and 16 patients with no post- operative complications. No significant difference between both groups regarding post-operative complications (P-value of 0.834). (**Table 3**)

Table 1. Comparison between both groups regarding pre-operative and postoperative Lyshlom score

| | ACL with HT autograft (n=20) | ACL with PLT autograft (n=20) | t | P-value |
|---|---|---|---|---|
| **Pre-operative Lyshlom score:** | | | | |
| Mean ± SD | 59.1±11.2 | 54.6±6.4 | 1.58 | 0.123 |
| Range | 36-84 | 42-65 | | |
| **Post-operative Lyshlom score:** | | | | |
| Mean ± SD | 93.9±4.6 | 94.8±4.7 | 0.61 | 0.547 |
| Range | 84-100 | 85-100 | | |
| **P-value** | ≤0.001 | ≤0.001 | | |

Table 2. Comparison between both groups regarding pre-operative and postoperative IKDC score

| | ACL with HT autograft (n=20) | ACL with PLT autograft (n=20) | t | P-value |
|---|---|---|---|---|
| **Pre-operative IKDC score:** | | | | |
| Mean ± SD | 36.6±4.1 | 36.6±4.0 | 0.04 | 0.969 |
| Range | 31-44 | 31-43 | | |
| **Post-operative IKDC score:** | | | | |
| Mean ± SD | 80.0±9.9 | 82.8±3.7 | 1.19 | 0.243 |
| Range | 44.8-94 | 75-87 | | |
| P-value | ≤0.001 | ≤0.001 | | |

Table 3. Comparison between the studied groups regarding post-operative complications

| | ACL with PLT autograft (n=20) | | ACL with HT autograft (n=20) | | x2 | P-value |
|---|---|---|---|---|---|---|
| | N | % | N | % | | |
| **Complications:** | | | | | | |
| Knee stiffness | 1 | 5.0 | 2 | 10.0 | | |
| Infection | 2 | 10.0 | 2 | 10.0 | 0.36 | 0.834 |
| No | 17 | 85.0 | 16 | 80.0 | | |

**Discussion**

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.(7, 8)
This study is a controlled randomized prospective study, that was conducted at Menoufia University hospital. Twenty patients underwent ACL reconstruction using peroneus longus tendon autograft and twenty patients underwent ACL reconstruction using Hamstring autograft.

In this study, the number of the patients with ACL reconstruction using PLT was 20 patients, mean age of them was 25.4±6.4 with range between 18-38 years old. 18 patients were male while 2 patients were female. The number of the patients with ACL reconstruction using HT was 20 patients, mean age of them was 28.8±7.2 with range between 19-40 years old. 15 patients were male while 5 patients were female. No significant difference between both groups regarding age, and gender (P-value > 0.05).

In the current study, graft diameter in the patients with ACL reconstruction using PLT was 8.5±0.7 with range between 7-9 in mm, while graft diameter in the patients with ACL reconstruction using HT was 8.1±0.7 with range between 7-9 in mm. No er- rupture was reported.
During the study by Hossein Ronaghi and Mehran Soleymanha, 130 patients who underwent ACLR in two groups of hamstring tendon (n=65) and peroneus longus tendon (n=65) were followed up for at least 2 years (range 24–31 months). There were no significant differences in demographic data and injuries between the two groups (P>0.05), that was similar to our results.(9)

The most important findings in the study by Sohrab Keyhani and Mohamad Qoreishi, were as follows. The peroneus longus autograft showed a comparable functional score at the 1-year follow up compared with the hamstring tendon; the peroneus longus autograft had a larger diameter compared with the hamstring autograft; less thigh atrophy was found in the peroneus longus graft group. They found that there was a significant difference in graft diameter between the hamstring and peroneus longus tendons, with a mean difference of 0.6 mm in favour of the peroneus graft.(9, 10)
In this study, pre-operative anterior drawer, Lachman and pivot shift tests were positive in all the patients, similar to the results reported by Abhishek and Rhatomy et al.(10)

In the current study, post-operative anterior drawer, Lachman and pivot shift tests were negative in all the patients. The study by Abhishek et al had similar findings to those of Rhatomy, S et al., who also reported comparable anterior drawer and Lachman test results between both groups. Trung et al. evaluated the rate of the negative anterior drawer test to be 96.7%; level one was 3.3% and was no longer level two and three; and the rate of the Lachman test to be 90%; level one was 10% and was no longer level two and three. The pivot shift test was used to assess the rotational stability of the knee.(10, 11)

In the current study, in HT group, the Lyshlom score has improved from 59.1±11.2 with range between 36-84 pre-operatively to become 93.9±4.6 with range between 84-100 post-operatively. While in PLT group, it has improved from

54.6±6.4 with range between 42-65 to become 94.8±4.7 with range between 85-100 post-operatively.

In the current study, in HT group, IKDC Score has improved from 36.6±4.1 with range between 31-44 pre-operatively to become 80.0±9.9 with range between 44.8-94 post-operatively. While in PLT group, it has improved from 36.6±4.0 with range between 31-43 pre-operatively to become 82.8±3.7 with range between 75-87 post- operatively.
Functional outcomes of patients among both groups in the study by Abhishek et al were found to be equivalent at every follow-up, with a mean Lysholm knee score of 99.15 among the PLT group and 99.85 among HT patients at one-year follow-up and a mean IKDC score of 94.13 and 95.12 in patients of the PLT and HT groups, respectively. At the end of the follow-up, no patients in either group had flexion or extension loss.(11, 12)

Studies like Rhatomy S et al. also reported an insignificant difference in context to the IKDC and Lysholm knee score between the two groups, that was similar to our results. Tang et al. reported a better Lysholm knee score among the PLT group. We agreed with the result of that comparative study by Wiradiputra et al. Knee laxity for peroneus longus tendon autograft was similar to hamstring tendon autograft, and no significant differences were found between the two groups in terms of functional scales and ROM of the knee joint after ACLR.(11, 12)

In the current study, AOFAS mean score in ACL with Peroneus longus tendon autograft group was 79.9±6.5 with range between 70-90, with no donor site morbidity.
In this study, regarding the post-operative complications of both groups, ACL with PLT autograft group had one patient with knee stiffness managed by physiotherapy, 2 patients with post-operative superficial wound infection at recipient site managed by medical treatment and 17 patients with no post-operative complications. ACL with HT autograft group had 2 patients with knee stiffness managed by physiotherapy, 2 patients with post-operative superficial wound infection at recipient site managed by medical treatment and 16 patients with no post-operative complications. No significant difference between both groups regarding post-operative complications (P- value of 0.834).

We disagreed with a previous study by Angthong et al. mentioned possible donor site morbidity using the peroneus longus tendon, including reduced peak torque eversion and inversion, decreased ankle function and concerns about ankle stability. In that study by Sohrab et al, they evaluated ankle function using the AOFAS-Hindfoot Scale. The mean for the AOFAS-Hindfoot Score in the peroneus longus group was 97.3 ± 4.2 (range 88–100), which was considered excellent result. The above result showed that the function of the donor ankle was excellent after harvesting the peroneus longus tendon. That was probably because the peroneus brevis was still intact in the donor ankle.(12, 13)

In the study by Hossein et al, the mean AOFAS score for the donor's ankle was 93.42± 1.7 (range 84-100; Excellent=90-100 points, Good=75-89 points, Fair=60-74 points, and Poor<60 points) at the last follow-up, and there was no difference

between both sides. No pain or complaint about the weakness of the ankle joint, vascular and neurological complications, or other discomforts over the donor site of the ankle was noted, that was similar to our results. No serious instability or complication was found in both groups. Thigh hypotrophy was considerably more significant in the hamstring tendon group compared to the peroneus longus group at a minimum of 2 years of follow-up (12.2±4.5 mm mean thigh hypotrophy in the hamstring group and 4.9±2.4 mm mean thigh hypotrophy in the peroneus longus group; P<0.001).(14, 15)

**Limitations of the study:**
The study was conducted over a relatively small number of patients. It was confined to a single center (Menoufia University Hospitals). The 12 months follow-up in this study is also a short-term.

**Recommendations:**
Further studies are needed to focus on a longer evaluation of ACL reconstruction using other methods and on a larger number of patients.

**Conclusion:**
Both techniques are valid options for ACL reconstruction with comparable results with no significant difference between both groups regarding clinical and functional results and also donor site morbidity.

**References**

1. Freedman KB, D'Amato MJ, Nedeff DD, et al. Arthroscopic anterior cruciate ligament reconstruction: a metaanalysis comparing patellar tendon and hamstring tendon autografts. The American journal of sports medicine. 2003;31 (1):2-11.
2. Ristanis S, Tsepis E, Giotis D, et al. Electromechanical delay of the knee flexor muscles is impaired after harvesting hamstring tendons for anterior cruciate ligament reconstruction. The American journal of sports medicine. 2009;37 (11):2179-86.
3. Samuelsson K, Andersson D, Karlsson J. Treatment of anterior cruciate ligament injuries with special reference to graft type and surgical technique: an assessment of randomized controlled trials. Arthroscopy : the journal of arthroscopic & related surgery : official publication of the Arthroscopy Association of North America and the International Arthroscopy Association. 2009;25 (10):1139-74.
4. Milenin O, Strafun S, Sergienko R, et al. Lateral meniscus replacement using peroneus longus tendon autograft. 2020;9 (8):1163-6.
5. Costa GG, Perelli S, Grassi A, et al. Minimizing the risk of graft failure after anterior cruciate ligament reconstruction in athletes. A narrative review of the current evidence. Journal of experimental orthopaedics. 2022;9 (1):26-8.
6. Nishio Y, Kondo E, Onodera J, et al. Double-bundle anterior cruciate ligament reconstruction using hamstring tendon hybrid grafts in patients over 40 years of age: comparisons between different age groups. 2018;6 (5):23-7.

7. Vijay C, Santosh MS, Avinash C, et al. Is Peroneus longus autograft a better alternative to the Hamstring autograft for anterior cruciate ligament reconstruction? – A randomised control study. 2022;29 (1):22-6.
8. Rhatomy S, Asikin AI, Wardani AE, Rukmoyo T, Lumban-Gaol I, Budhiparama NC. Peroneus longus autograft can be recommended as a superior graft to hamstring tendon in single-bundle ACL reconstruction. Knee Surgery, Sports Traumatology, Arthroscopy. 2019 Nov;27(2):3552-9.
9. Joshi S, Shetty UC, Salim MD, Meena N, Kumar S, Rao VK. Peroneus longus tendon autograft for anterior cruciate ligament reconstruction: a safe and effective alternative in nonathletic patients. Nigerian Journal of Surgery. 2021 Oct 15;27(1):42- 7.
10. Shi FD, Hess DE, Zuo JZ, Liu SJ, Wang XC, Zhang Y, Meng XG, Cui ZJ, Zhao SP, Li CJ, Hu WN. Peroneus longus tendon autograft is a safe and effective alternative for anterior cruciate ligament reconstruction. The journal of knee surgery. 2019 Aug;32(08):804-11.
11. Agarwal A, Singh S, Singh A, Tewari P. Comparison of functional outcomes of an anterior cruciate ligament (ACL) reconstruction using a peroneus longus graft as an alternative to the hamstring tendon graft. Cureus. 2023 Apr;15(4):3-5.
12. Keyhani S, Qoreishi M, Mousavi M, Ronaghi H, Soleymanha M. Peroneus longus tendon autograft versus hamstring tendon autograft in anterior cruciate ligament reconstruction: a comparative study with a mean follow-up of two years. Archives of Bone and Joint Surgery. 2022 Aug;10(8):695-7.
13. He J, Tang Q, Ernst S, Linde MA, Smolinski P, Wu S, Fu F. Peroneus longus tendon autograft has functional outcomes comparable to hamstring tendon autograft for anterior cruciate ligament reconstruction: a systematic review and meta-analysis. Knee Surgery, Sports Traumatology, Arthroscopy. 2021 Sep;29:2869-79.
14. Bi M, Zhao C, Zhang Q, Cao L, Chen X, Kong M, Bi Q. All-inside anterior cruciate ligament reconstruction using an anterior half of the peroneus longus tendon autograft. Orthopaedic Journal of Sports Medicine. 2021 Jun 15;9(6):23-8.
15. Kerimoglu S, Aynaci O, Saracoglu M, Aydin H, Turhan A. Anterior cruciate ligament reconstruction with the peroneus longus tendon. Acta orthopaedica et traumatologica turcica. 2008 Jan 1;42(1):38-43.