Comparative study between peroneus longus, semitendinosus tendon, and quadriceps tendon graft for anterior cruciate ligament reconstruction: short-term results

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Background
Several graft options exist for ACL. The traditional options are patellar tendon (PT), hamstring tendons (HT) and quadriceps tendon (QT). Nevertheless, they have some disadvantages. In recent decades, several efforts were exerted to find more graft sources for ACL reconstruction. One of these grafts is the peroneus longus tendon (PLT) autograft. This study was done to compare the results of soft tissue grafts; HT, PLT and QT for ACLR.
Patients and Methods
This is a prospective comparative study over 75 patients with deficient anterior cruciate ligament. Patients were admitted to El Hadra University Hospital between June 2019 till September 2020. Patients were classified randomly into 3 groups. The first group (Group A) were treated with ACLR using hamstring tendon (*n*=25). The second group (Group B) were treated using peroneus longus autograft (*n*=25). The third group (Group C) were treated using quadriceps tendon graft. All groups were matched for age, gender and duration from injury to surgery. Functional evaluation was done using Lysholm score, modified Cincinnati scale, IKDC score and VAS. The functional score of the ankle was assessed with the American Orthopedic Foot and Ankle Score and the Foot and Ankle Disability Index score at the end of follow up.
Results
There was no statistically significant difference between the 2 groups regarding the Lysholm, Tegner, IKDC, VAS, Kujala scores. However, there was a statistically significant difference regarding the SCAR score.
Conclusion
Peroneus longus tendon is a reliable alternative for ACL reconstruction especially in patients with inadequate or prematurely amputated hamstring autograft.

Keywords:
anterior cruciate ligament reconstruction, peroneus longus tendon, pivot shift, semitendinosus tendon

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Introduction

Anterior cruciate ligament (ACL) is the main static stabilizer for anterior knee stability. With the prevalence of sports and the improvement of competitive sports level, the incidence rate of ACL injury has been rising rapidly. Damage to the ACL is one of the most common knee sports injuries. Furthermore, patients with ruptured ACL have unstable knee, cartilage injury, and meniscal damage that may lead to the occurrence of osteoarthritis and adversely affect the quality of life [1].

The standard procedure for ACL tear is surgical reconstruction. Approximately 100 000 cases of ACL reconstruction are performed in the United States annually [2]. The efficacy of ACL reconstruction is mainly attributed to the type of graft [3]. An ideal graft has always been a dream. It should have easy accessibility, little donor site morbidity, immediate rigid fixation, and rapid wound healing, which may maximally reproduce those of native ACL [4].

Several graft options exist for ACL reconstruction: the patellar tendon, the quadriceps tendon, and the hamstring tendons (HTs). These are the traditional choices. Nevertheless, they have some disadvantages, such as postoperative anterior knee pain, donor site morbidity, and quadriceps weakness in peroneus longus autograft and decreased HT strength, delayed graft incorporation, and increased joint laxity in HT autograft [5–8]. In recent decades, several efforts were exerted to find more graft sources for ACL reconstruction. One of these grafts is the peroneus longus autograft [9].

HT, however, has an unpredictable size and thus can be problematic in smaller tendon sizes. Another graft is the peroneus longus tendon (PLT), which is still debatable owing to the donor site morbidity despite its strength and stiffness; its use as an augmentation graft was a good option owing to the easy access and lesser infection risk. Female HTs are shorter in length and smaller in diameter compared with male patient HTs. The tensile strength of the HT is also weaker in female as laxity is more common, which also plays as contributing factor for the injury itself [10].

The PLT has an important function for the ankle and foot. Its main role is to strengthen first ray plantar flexion and to evert the foot. There is some concern about the deterioration of ankle eversion and first ray plantar flexion strength after PLT harvest. For stability, the PLT works in combination with the peroneus brevis tendon to distribute pressure on the forefoot. The PLT has a synergistic mechanism with the peroneus brevis tendon. The same force levels on the peroneus longus and peroneus brevis tendons showed equal strength [11].

The prerequisites for a donor site to be an ideal source of autografts should be that the autograft has an acceptable amount of strength and that it can be safely and easily harvested with no obvious functional impairment after its removal from the donor site. The PLT may represent a good choice as a potential autograft, as it has good biomechanical properties of high failure loading and stiffness [12].

This prospective study was done to compare the short-term functional results of ACL reconstruction using three different soft tissue grafts (peroneus longus autograft, the semitendinosus hamstring autograft, and quadriceps tendon autograft) over a 12-month follow-up. Our null hypothesis was that there will be no difference in the mean Lysholm score (primary outcome measure used) among the three groups. Our alternate hypothesis was that mean Lysholm score would be inferior to the other two groups.

Patients and methods

This is a prospective comparative study conducted on 75 patients with deficient ACL. Patients were admitted to El Hadra University Hospital between June 2019 and September 2020. All cases were followed up for a maximum of 1 year postoperatively. Only cases with isolated ACL injury with no other knee ligamentous injuries who were planned for single bundle ACL reconstruction were included in the study.

The exclusion criteria were as follows:

(1) Other knee ligamentous injuries.
(2) Skeletally immature patients less than 16 years.
(3) Patients more than 45 years.
(4) Knee arthritis more than GII Kellgren-Lawrence grading [13].
(5) Obvious knee varus deformity more than 6°.
(6) Bilateral ACL injury.
(7) Previous knee surgery in the ipsilateral knee.
(8) Ipsilateral ankle instability.

Patients were classified randomly into three groups. The first group (group A) was treated with ACL reconstruction using HT (n=25). The second group (group B) was treated using peroneus longus autograft (n=25). The third group (group C) was treated using quadriceps tendon graft. All groups were matched for age, sex, and duration from injury to surgery.

Patients were assessed preoperatively using radiograph and MRI films. A clinical evaluation was made using ROM and apprehension test. Functional evaluation was done using Lysholm score [14], modified Cincinnati scale [15], International Knee Documentation Committee (IKDC) score [16], and visual analog scale (VAS) score [17,18] preoperatively and postoperatively at 6 and 12 months. The functional score of the ankle was assessed with the American Orthopedic Foot and Ankle Score (AOFAS) [18] and the Foot and Ankle Disability Index (FADI) score [19] at the end of follow-up.

Statistical evaluation was done using SPSS version 25 (IBM, Chicago, Illinois, USA). One-way analysis of variance (ANOVA) test was used to compare among the three groups if data were parametric. χ^2 test was used for qualitative data. The outcomes of continuous measurements (IKDC, modified Cincinnati, and Lysholm scores) were compared among the three groups. Statistical significance was accepted at P value less than 0.05.

The study was approved by the local ethical committee of Alexandria University Faculty of Medicine. An informed consent was taken from every patient subjected to the study.

Surgical technique

All patients were operated supine under general anesthesia with a high thigh tourniquet. A side support was used, and patients were positioned to allow free knee motion between 0° and 120°. First, knee arthroscopy was done to deal with any intra-articular pathologies and to assess ACL rupture. Standard anterolateral and anteromedial portals were used. Graft harvesting of either the ipsilateral peroneus longus or the HT was then performed.

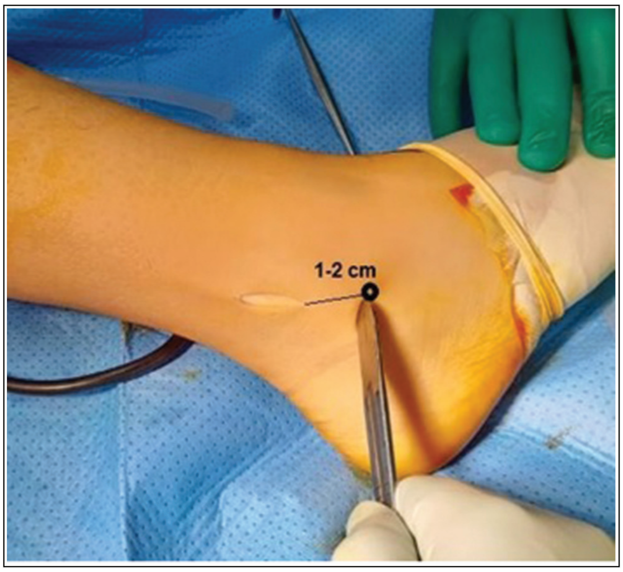
Group A: hamstring harvest

With the knee flexed to 90°, a 2-cm incision is used 3 cm medial and distal to the tibial tuberosity, parallel to the lines of the skin, to avoid damage to the inferior branch of the saphenous nerve, and for cosmesis. The bursa of the pes is incised and split proximally. Both the tendons are visualized and mobilized. First the gracilis tendon is grasped using a curved clamp. Maximal traction is applied, which releases the 'web-like' fascia slips. The gracilis tendon is inserted into an open stripper, which is advanced proximally about 25 cm. The tendon remains attached to the periosteum, and the semitendinosus is harvested in a similar manner. Finally, the tendons are stripped off the tibia with their periosteal insertion. On the workstation, the tendons are gently dissected free of muscle tissue. The ends are whipstitched under tension for later graft fixation.

Group B: peroneus longus graft

For the PLT, the location of the skin incision was marked, 2–3 cm above and 1 cm behind the lateral malleolus (Figs 1–8). The incision was made through the skin, subcutaneous tissue, and superficial fascia. The peroneus longus and peroneus brevis tendons were identified. The location of the tendon division was marked, 2–3 cm above the level of the lateral malleolus [20].

Figure 1



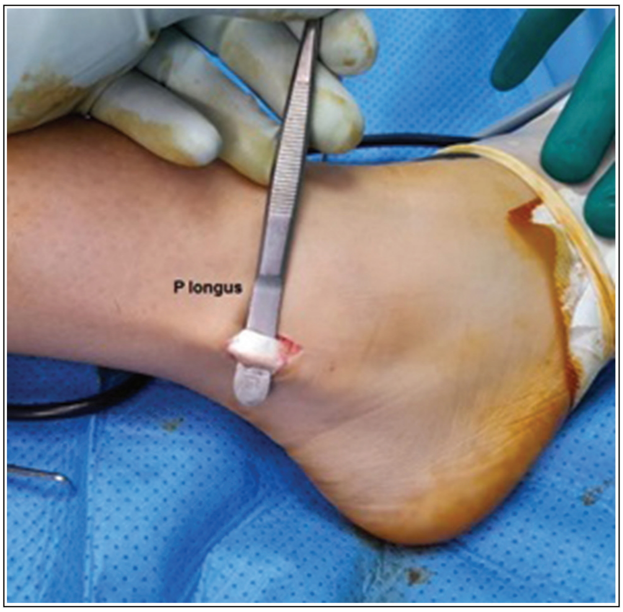
Incision for PLT harvest 2 cm above tip of lateral malleolus and 1 cm posterior to the fibula. PLT, peroneus longus tendon.

The distal part of the PLT to the peroneus brevis tendon was sutured with end-to-side sutures with nonabsorbable suture. The PLT was stripped proximally with a closed tendon stripper to about 4–5 cm from the fibular head to prevent peroneal nerve injury.

Group B: quadriceps tendon graft

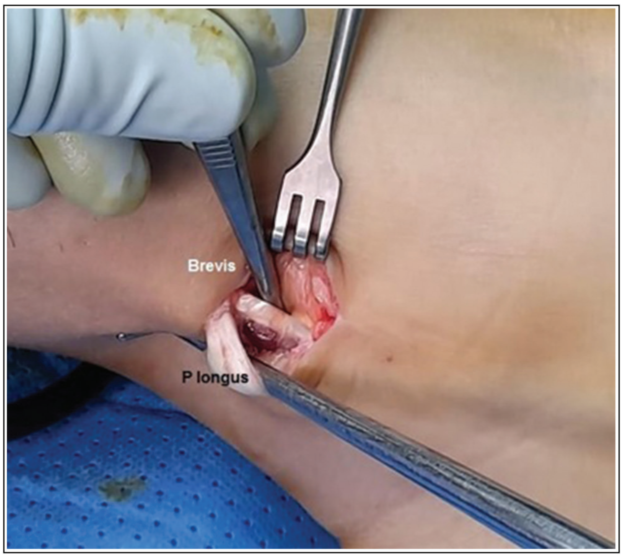
With the leg flexed at 90°, the superior pole and the medial and lateral borders of the patella were marked. A #15 blade was used to make an 8-cm vertical incision centered over the quadriceps tendon. The underlying subcutaneous fat and paratenon were widely excised for

Figure 2



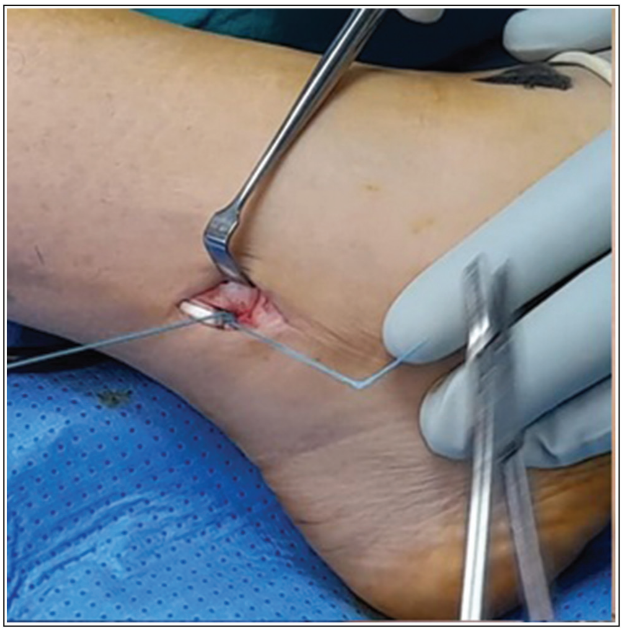
Exposure of the PLT. PLT, peroneus longus tendon.

Figure 3



Difference between PLT and PBT. PLT is less fleshy and ore posterior. PLT, peroneus longus tendon.

Figure 4



Tenodesis between PLT and PBT using no. 2 nonabsorbable suture. PLT, peroneus longus tendon.

Figure 5

Cutting the PLT above tenodesis site. PLT, peroneus longus tendon.

adequate visualization. A sponge was used to bluntly dissect the soft tissue from the quadriceps tendon and anterior patella. After mobilization, one should be able to feel ~8 cm proximally from the superior pole of the patella and distally to the mid portion of the patella.

Two longitudinal cuts in the quadriceps tendon were then made to create a 10-mm wide and 6-mm deep longitudinal cut. With a #15 blade, the two vertical incisions made by the harvesting device just off the superior pole of the patella were connect. With a scalpel or a scissors, careful dissection was done proximally

Figure6

Advancing the closed stripper for PLT harvest. PLT, peroneus longus tendon.

Figure 7

The PLT after harvest on the graft table. PLT, peroneus longus tendon.

while controlling the graft end with an Allis clamp. The tendon was whipstitched with a nonabsorbable suture.

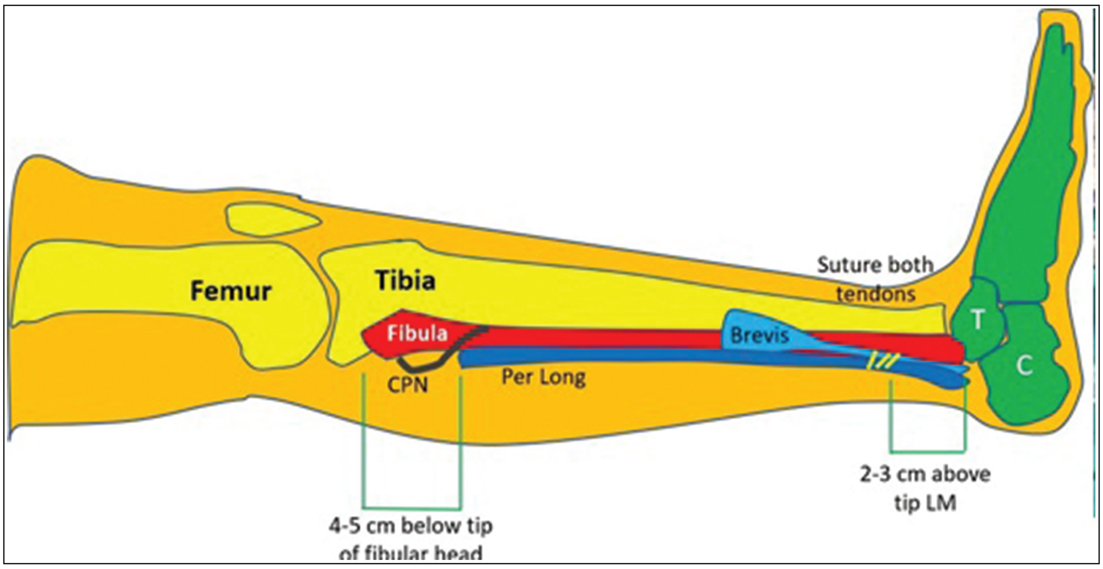
In all groups

The intercondylar notch was then cleared of fibrous tissue to ease visualization during preparation of the tunnels, but some remaining ACL fibers were preserved at the tibial footprint as a reference for tunnel placement and for proprioception. The femoral tunnel and the tibial tunnel were then prepared independently. The graft was fixed on the femoral side with an adjustable button (Tightrope; Arthrex, Naples, Florida, USA) in groups A and B; however, in group C, the graft was fixed with an absorbable interference screw. On the tibial side, fixation was done using a bioabsorbable screw (Arthrex) after appropriate tensioning of the graft in all groups.

Postoperative treatment

Patients were discharged without bracing after a one-day hospitalization period. All groups were treated with the same accelerated rehabilitation program, which was partial weight bearing 3 weeks after surgery, followed by full weight bearing. Knee extension was begun immediately after surgery, together with gradual knee flexion from 0 to 90° until 3 weeks after surgery, with subsequent full flexion. The patient was allowed to jog after 2 months and return to sports after passing a functional outcome test after an average of 6–9 months.

Figure 8



Surgical technique for PL harvest and proximity of CPN to proximal part of the tendon. PL, peroneus longus.

Table 1 Patients' demographic data

	Group A: HT (25)	Group B: PLT (25)	Group C: QT (25)	Test of significance	*P* value
Age (years)	31.5 ± 3.9	33.3 ± 6.4	32.3 ± 1.4	F=0.25	0.96
Sex					
Male	17	19	21	χ^2=0.516	0.472
Female	8	6	4		
Side affected					
Right	10	12	17	χ^2=0.045	0.832
Left	15	13	8		
BMI	22.6 ± 3.9	24.1 ± 2.5	24.1 ± 2.5	F=0.93	0.32
Time before surgery (weeks)	23.6 ± 3.9	19.6 ± 9.9	24.1 ± 6.2	F=1.46	0.07

χ^2, χ^2 test; F, one-way analysis of variance test, HT, hamstring tendon; PLT, peroneus longus tendon.

Patients' postoperative evaluation

Postoperative functional outcome and donor site morbidity were recorded 1 year after surgery with a direct patient examination. The IKDC, modified Cincinnati, and Lysholm scores were recorded. Range of motion and thigh circumference were measured and compared with the healthy side. The functional score of the ankle was assessed with the AOFAS and the FADI score.

Results

The study included 75 patients who were admitted to El Hadra University Hospital with isolated torn ACL. Group A was subjected to ACL reconstruction using HTs (n=25). Their mean age was 31.5 ± 3.9 years. Group B was subjected to ACL reconstruction using the peroneus longus graft (n=25). Their mean age was 33.3 ± 6.4 years. Group C was subjected to ACL reconstruction using the quadriceps tendon graft (n=25). Their mean age was 32.3 ± 1.4 years. The difference among the three groups was statistically insignificant denoting adequate matching of the groups. Patients' demographic data are included in Table 1.

Regarding ROM, there was no statistically significant difference between all groups (P>0.05).

Regarding the Lysholm score (primary outcome measure), one-way ANOVA was calculated to compare means among the three groups. No significant difference was found, with F value of 0.503, degree of freedom of 2, and P value of 0.60. The scores of three groups did not differ significantly at the end of follow-up. The mean Lysholm score for group A was 88.6 ± 5.5, for group B was 90.1 ± 3.8, and for group C was 89.9 ± 6.8 (Table 2, Fig. 9).

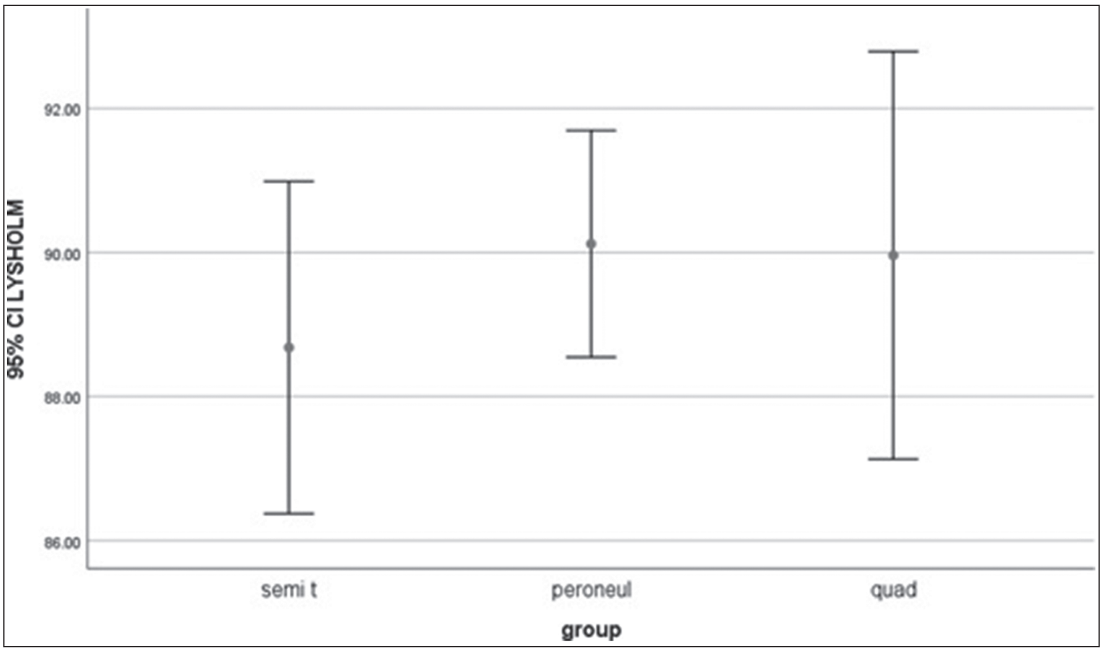
Regarding the IKDC score, one-way ANOVA was calculated to compare means between the three groups. No significant difference was found, with F value of 1.03, degree of freedom of 2, and P value of 0.36. The scores of the three groups did not differ significantly

Table2 Patients' clinical data and functional scores

	Group A: semi T (*n*=25)	Group B: peroneus T (*n*=25)	Group C: quadriceps (*n*=25)	DF	*F* (ANOVA)	*P*
Lysholm	88.6±5.5	90.1±3.8	89.9±6.8	2	0.503	0.60
IKDC	90.7±5.1	90±4.6	88.9±5.1	2	1.03	0.36
Cincinnati	86.9±3.5	88.5±4.2	88±2.6	2	1.41	0.24
VAS	0.92±0.7	0.64±0.6	0.28±0.4	2	6.95	0.002*
AOFAS	95±3.5	94.1±2.8	96±1.7	2	1.43	0.24
FADI	97.6±1.2	93.3±17.6	97.5±1.7	2	1.43	0.24
Thigh circumference	5.4±1.3	1.9±0.6	6.3±2.2	2	90.7	0.000*
Graft size	8±0.6	7.6±0.7	9.6±0.5	2	67	0.000*

AOFAS, American Orthopedic Foot and Ankle Score; DF, degree of freedom; *F*, one-way analysis of variance test; FADI, Foot and Ankle Disability Index; IKDC, International Knee Documentation Committee; VAS, visual analog scale. **P* value significant if less than 0.05.

Figure 9



An error bar showing the difference in Lysholm score at the end of follow up.

at the end of follow-up. The mean IKDC score for group A was 90.7±5.1, for group B was 90±4.6, and for group C was 88.9±5.1 (Table 2, Fig. 10).

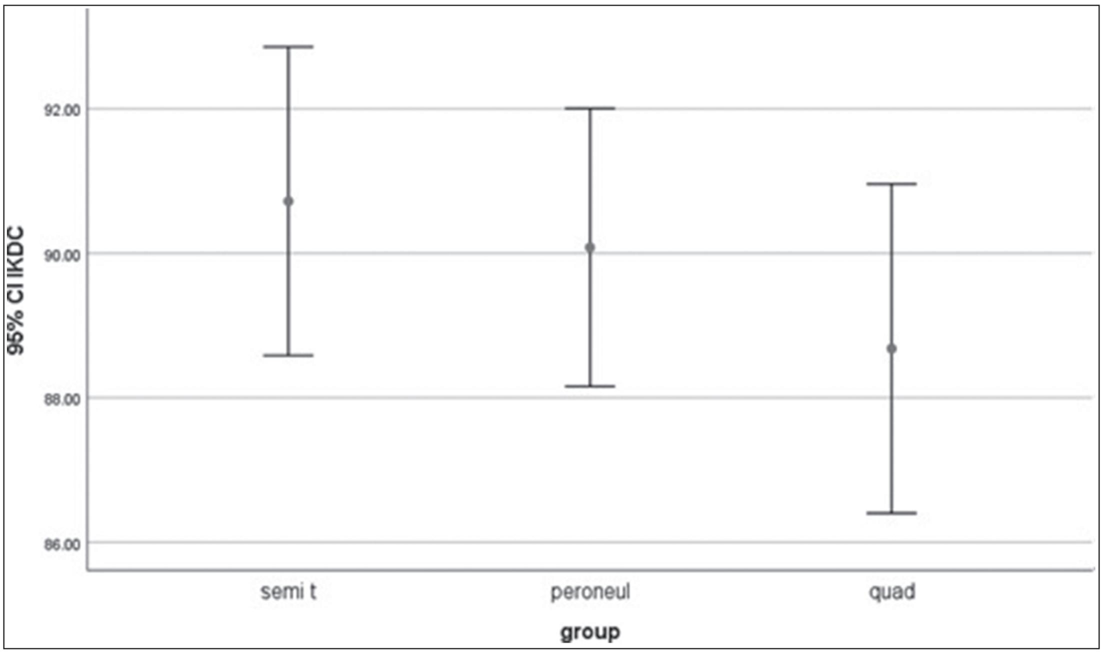
Regarding the modified Cincinnati score, one-way ANOVA was calculated to compare means among the three groups. No significant difference was found, with *F* value of 1.41, degree of freedom of 2, and *P* value of 0.24 The scores of the three groups did not differ significantly at the end of follow-up. The mean modified Cincinnati score for group A was 86.9±3.5, for group B was 88.5±4.2, and for group C was 88±2.6 (Table 2, Fig. 11).

Regarding the VAS score for residual pain, we computed a one-way ANOVA comparing the outcomes among the three groups. A significant difference was found among the groups, with *F* value of 6.95, degree of freedom of 2, and *P* value of 0.002. Tukey's HSD post-hoc comparison test was used to determine the source the differences among the groups. This analysis revealed that group A (semitendinosus) scored higher pain (0.92±0.7) than group C (quadriceps) (0.28±0.4). However, the difference between semitendinosus group and peroneus group was not significant (Table 2, Fig. 12).

Regarding the AOFAS score, one-way ANOVA was calculated to compare means among the three groups. No significant difference was found, with *F* value of 1.43, degree of freedom of 2, and *P* value of 0.24. The scores of three groups did not differ significantly at the end of follow up. The mean modified Cincinnati score for group A was 95±3.5, for group B was 94.1±2.8, and for group C was 96±1.7 (Table 2, Fig. 13).

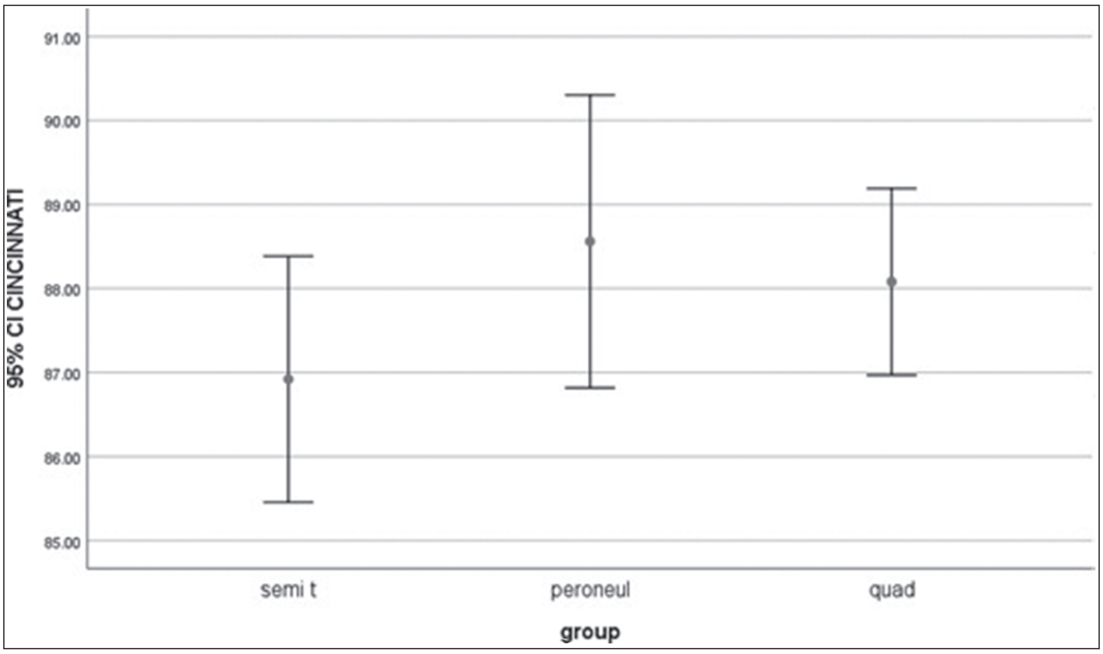
Regarding the FADI score, one-way ANOVA was calculated to compare means among the three groups. No significant difference was found, with *F* value of 1.43, degree of freedom of 2, and *P* value of 0.24. The scores

Figure 10



An error bar showing the difference in IKDC score at the end of follow up. IKDC, International Knee Documentation Committee.

Figure 11

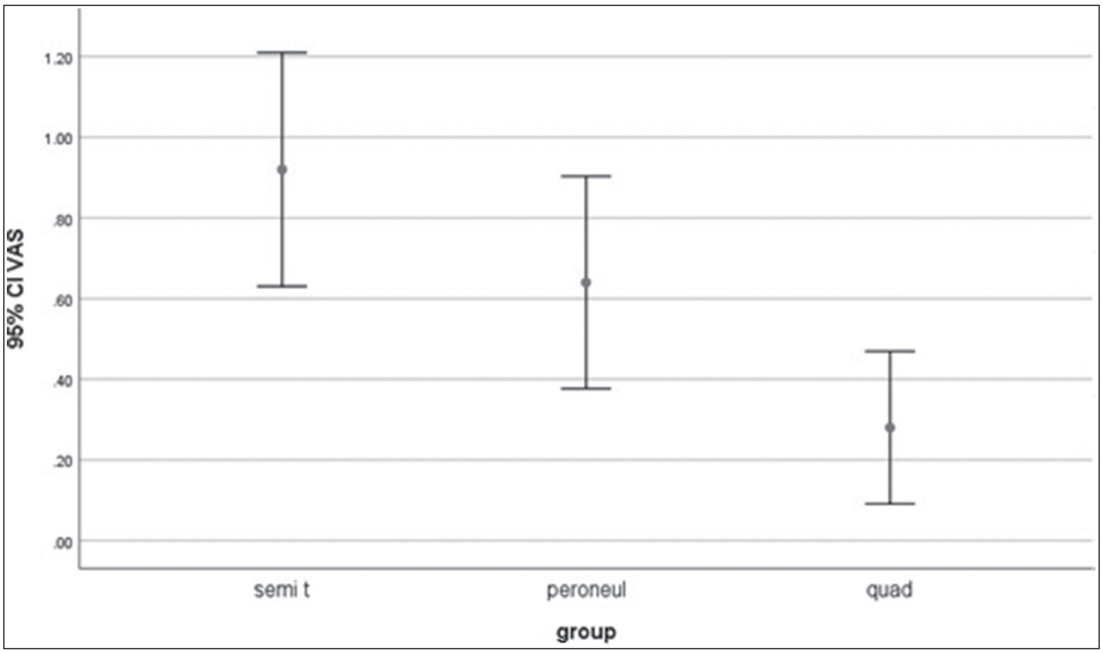


An error bar showing the difference in modified Cincinnati score at the end of follow up.

of the three groups did not differ significantly at the end of follow-up. The mean modified Cincinnati score for group A was 97.6 ± 1.2, for group B was 93.3 ± 17.6, and for group C was 97.5 ± 1.7 (Table 2, Fig. 14).

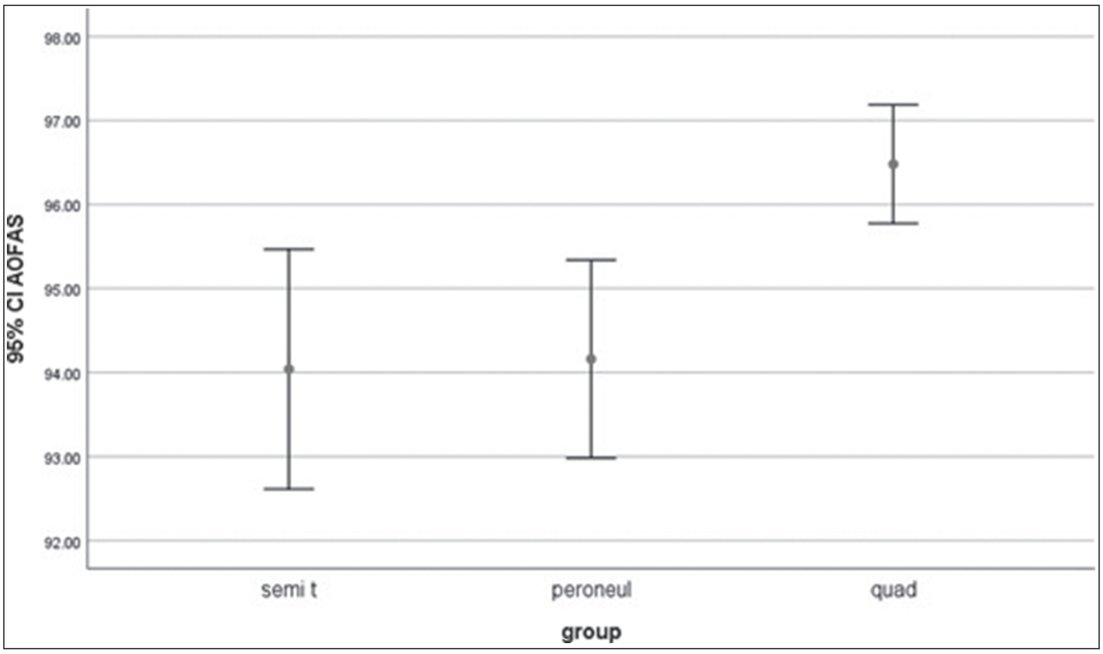
Regarding the difference in the thigh circumference in comparison with the normal side, we computed a one-way ANOVA comparing the mean differences among the three groups. A significant difference was found among the groups, with F value of 90.7, degree of freedom 2, and P value of 0.000. Tukey's HSD post-hoc comparison test was used to determine the source of the differences among the groups. This analysis revealed that group C (quadriceps group) had the highest thigh circumference difference among the three groups (6.3 ± 1.4 cm) than groups A and B. Moreover, the peroneus group had the least effect on thigh circumference (Table 2, Fig. 15).

Figure 12



An error bar showing the difference in VAS score at the end of follow up. VAS, visual analog scale.

Figure 13

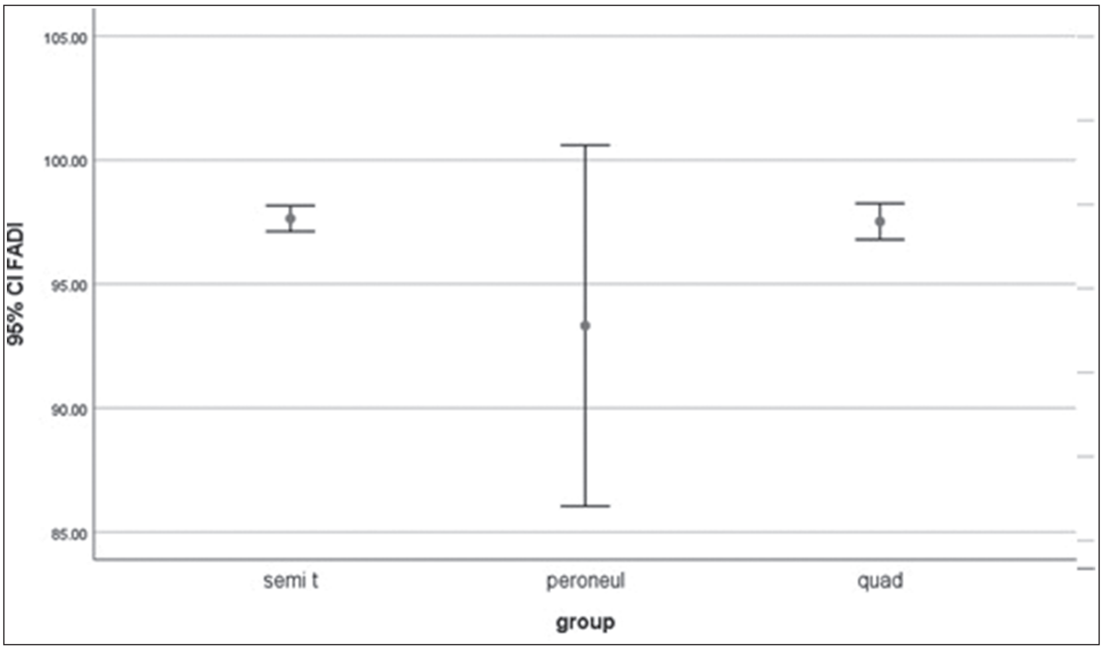


An error bar showing the difference in AOFAS score at the end of follow up. AOFAS, American Orthopedic Foot and Ankle Score.

Regarding the graft size, we computed a one-way ANOVA comparing the mean differences in graft sizes among the three groups. A significant difference was found among the groups, with F value of 67, degree of freedom of 2, and P value of 0.000. Tukey's HSD post-hoc comparison test was used to determine the source of the differences among the groups. This analysis revealed that group B (peroneus group) had the smallest graft size among the three groups (7.6 ± 0.7 mm), where the quadriceps group had 9.6 ± 0.5 mm and the semitendinosus group had 8 ± 0.6 (Table 2, Fig. 16).

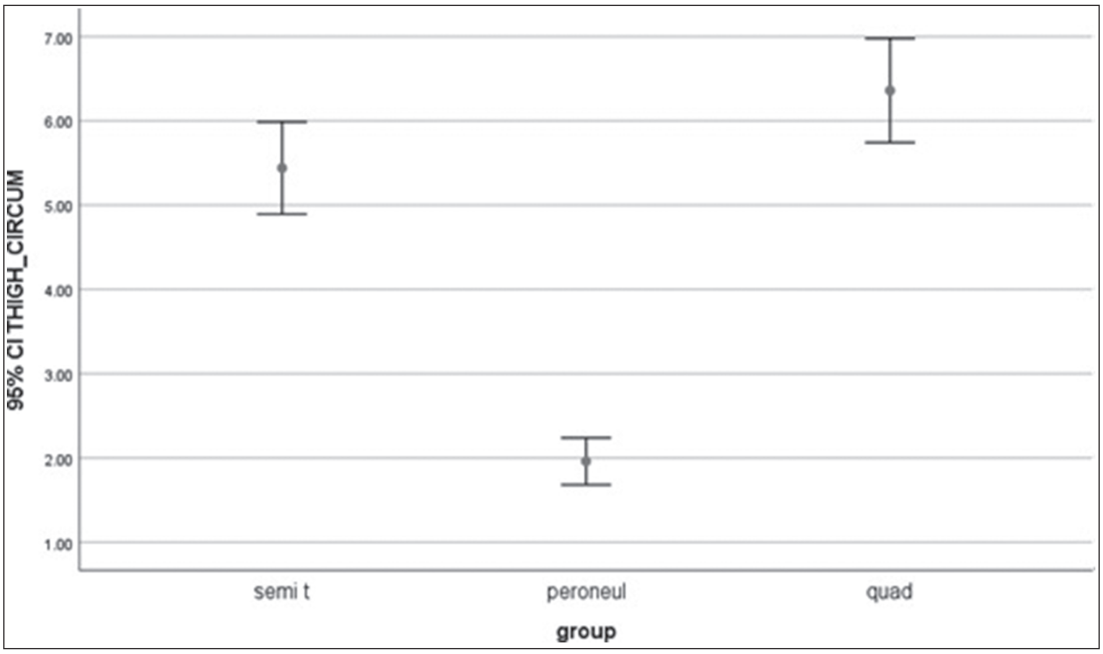
Regarding complications, there was no significant difference among the three groups regarding the incidence of complications. Two patients in group A had some flexion deformity for 6 weeks, which was later improved by physical therapy. Two cases in group A and the other in group B had graft site infection

Figure 14



An error bar showing the difference in FADI score at the end of follow up. FADI, Foot and Ankle Disability Index.

Figure 15



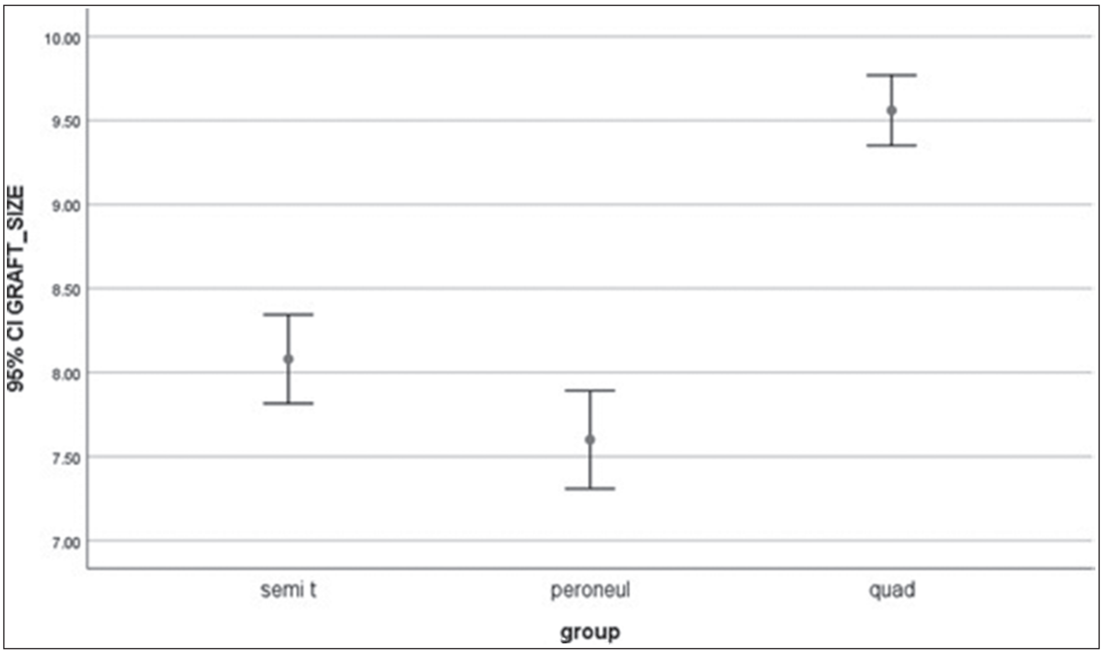
An error bar showing the difference in thigh circumference in comparison with normal side.

that necessitated superficial debridement. One case in group B had calf tenderness and ecchymosis that lasted for 3 weeks (Fig. 17).

Discussion

Which is the best graft for ACL reconstruction? Some systematic reviews and direct meta-analyses have been published to evaluate the effectiveness of graft options. None of them confirm the superiority of one graft over the other and recommended one graft as the perfect graft for ACL reconstruction [9]. PLT has emerged as an alternative autograft for reconstruction in kneeling populations and in simultaneous ACL and medial collateral ligament injuries. It has been reported for either anterior or posterior cruciate ligament reconstruction and with posterolateral reconstruction [21–23].

Figure 16



An error bar showing the difference in graft size between the three groups.

Figure 17

Calf edema and ecchymosis on one patient of peroneus longus group.

The strength and stiffness of the graft are important considerations for choosing the kind of graft and reconstruction technique. It is widely accepted that a four-strand HT autograft represents a reliable option for ACL reconstruction [24]. However, a disadvantage is the unpredictable size of both the diameter and length. Female patients have statistically significantly shorter length and smaller diameter hamstring grafts compared with male patients. The hamstring graft size has been also shown to be correlated to the anthropometric parameters of the patient. However, the diameter of tendon grafts for knee cruciate ligament reconstruction must be at least 7 mm [25,26]. A reinforcing additional graft source must be sought to obtain a functional ACL graft.

Biomechanical evaluations of the properties of PLT grafts have been done recently and revealed that both the strength and stiffness of PLT grafts are suitable for knee ACL reconstruction [27,28]. In addition, this graft is easy to harvest with minimal complications of the donor site in short-term and mid-term reports [29,30]. However, the PLT is an important stabilizing structure of the foot and ankle. The safety of its harvest on ankle stability over long-term periods has not been confirmed yet. Fermín *et al.* [31] found that the clinical and stability outcomes of ACL reconstruction with peroneus longus autograft are comparable with those of HT during short-term follow-up; however, there is insufficient evidence to support its implementation.

Rhatomy *et al.* [32] found that patients' physical characteristics can influence the peroneus longus graft size in ACL reconstruction. They found significant correlation between peroneus longus graft diameter and patient's sex, height, body weight, and BMI. Song *et al.* [33] explained that weight, height, and duration of injury were variables which could determine the diameter of peroneus longus graft and could be used as important information before ACL reconstruction.

Liu *et al.* [34] used the half?peroneus?longus?tendon graft augmentation for unqualified HT graft in eight cases. The average diameter of hamstring grafts after half-PLT augmentation was 9.6 mm. The average IKDC score was 86.0 (range, 83–89), and the average Lysholm score was 84.4 (range, 80–90). The average FADI score for the donor sites of half-PLT was 135.8

(range, 134–136). They concluded that additional half-PLT can successfully and safely reinforce unqualified HT grafts for ACL reconstruction.

Kerimoglu *et al.* [29] evaluated the results of ACL reconstruction with complete PLT grafts. The results were assessed after at least 5 years of follow-up and showed a mean Lysholm score of 83.7, with excellent or good results in 79.3% of the patients. In addition, no patients experienced ankle joint donor site dysfunction or difficulty in sports activities because of the complete PLT graft transfer.

Lubis *et al.* [35] used combined hamstrings and PLT for undersized graft in ACL reconstruction in two female patients. One year after surgery, the IKDC score for both cases was improved and there was no ankle-donor site morbidity with good motoric power and 100% AOFAS. They concluded that additional PLT can be considered as an alternative in undersized HT graft without significant donor site morbidity.

Wiradiputra and Aryana [36] reported a case of ACL reconstruction using PLT graft in a patient with a confirmed ACL rupture. The follow-up results revealed favorable recovery and improvement in all objective parameters. They found that the use of PLT in ACL reconstruction established an excellent potential for its satisfactory result and comparable to other graft modalities.

Comparative studies on the use of HT and PLT grafts showed no significant differences between the pre-year and 1-year postsurgery results, based on the IKDC, modified Cincinnati, and Lysholm Knee Scoring Scale. The PLT graft was considered more superior because it provided larger graft diameter and less thigh hypotrophy with excellent ankle function based on AOFAS and FADI [37,38].

Bi *et al.* [39,40] compared the use of single-bundle anterior half of PLT versus semitendinosus tendon on 62 cases. At the 2-year follow-up, the study found no differences between both groups in the VAS scale, IKDC score, pivot shift test, and KT-1000. Besides, the AOFAS score in the PLT group was more excellent than the semitendinosus tendon group. This finding concluded that PLT graft provides greater strength and is relatively safe for reconstruction. The assessment on ankle plantar flexion and foot eversion muscle strengths showed normal function.

Another reports on ACL reconstruction using anterior half-PLT graft showed no complications in ankle and foot after surgery [41,42].

Another study revealed enhancement on knee functionality based on the Lysholm and KT-3000 arthrometer scores, leaving no ankle functionality differences based on the AOFAS score [30].

A comparative study of the ankle eversion and first ray plantar flexion strength on the donor site versus contralateral site at 6-month after surgery over 31 cases revealed no significant differences. Furthermore, the FADI and AOFAS scores at the donor site were excellent. There was no significant difference in ankle eversion strength at the donor site compared with the contralateral site, with means of 65.87 ± 7.63 and 66.96 ± 8.38 N, respectively. Moreover, there was no significant difference in ankle first ray plantar flexion strength at the donor site compared with the contralateral site, with means of 150.64 ± 11.67 and 152.10 ± 12.16 N, respectively. The mean FADI score of 99.71 ± 0.57 and mean AOFAS score of 98.71 ± 3.03 at the donor site were considered excellent results [43].

He *et al.* [11] concluded that the PLT graft is suitable as an autograft harvested outside the knee to avoid the complication of quadriceps-hamstring imbalance that may occur after harvesting the graft from the knee.

The aforementioned studies show that the PLT can be an appropriate autograft source for ACL reconstruction. However, the PLT is an important supporting structure of the ankle. Cadaver research has revealed that the PLT creates an eversion locking effect on the first ray of the foot, which stabilizes the medial column [44]. Sonography studies of asymptomatic cases have revealed that the peroneal tendons also control frontal plane motion of the rear foot [45]. In addition, peroneal tendons are known as active stabilizers in acute ankle sprains, and intact lateral ligaments are required for passive stability of the ankle joint [46]. Many case reports have discussed the association between rupture of peroneal tendons and instability of the ankle joint [47,48]. Chronic lateral ankle pain has also been reported with PLT rupture in long-term follow-up studies [49–51]. This should be taken into consideration before generalizing the peroneus longus graft as a substitution for hamstring grafts with negligible donor site morbidity. To date, no long-term studies have addressed the function of the foot after complete PLT harvesting.

Regarding proximity and incidence of nerve injury during stripping of the PLT, He *et al.* [52] found that the average distance from the PLT to the sural nerve increased significantly from 0 to 2 cm proximal to LM. The average distance to the sural nerve at the LM was 4.9 ± 1.5 mm and increased to 10.8 ± 2.4 mm (2 cm proximal to LM). The average distance from the tendon stripper to the deep peroneal nerve was 52.9 ± 11.4 mm. The average distance to the PLT branch of peroneal nerve was 29.3 ± 4.2 mm. The superficial peroneal nerve, which coursed parallel and deep to the tendon stripper, was on average 5.2 ± 0.7 mm from the end of the stripper. No transection injuries of the nerves were observed in any of the ten legs after harvesting. They recommended the distances between the tendon stripper and the nerves to be greater than 5 mm with an initial incision at 2 cm proximal to LM [52].

The study has some limitations: first is the lack of randomization and blinding, which exposed the data to selection bias, and second, the short-term follow-up of only 1 year, so a longer follow-up period is needed to assess survival of the peroneus graft in front of the two other standard grafts.

Conclusion

The use of peroneus longus autograft in primary ACL reconstruction is a safe procedure with an excellent outcome. PLT autograft can be recommended as an alternative graft in single-bundle ACL reconstruction. Moreover, PLT can successfully and safely reinforce unqualified HT grafts for ACL reconstructions. No significant complications of the ankle-donor site were noted. Stronger evidence is recommended with multicentric, network meta-analysis of randomized trials to support the peroneus longus autograft use for ACL reconstruction.

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Conflicts of interest

There are no conflicts of interest.

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