Journal of Advanced Zoology

ISSN: 0253-7214

Volume ***44*** *Issue* ***S-3 Year 2023*** *Page* ***50:62***

A Study Comparing the Effectiveness of Hamstring Tendon Graft Versus Quadriceps Tendon Graft in Press Fit Anterior Cruciate Ligament Reconstruction

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Article History

Received: 06 June 2023
Revised: 05 September 2023
Accepted: 21 September 2023

Abstract

Background: *Press fit ACL reconstruction is a surgical procedure used to repair a torn anterior cruciate ligament (ACL) in the knee. During press fit ACL reconstruction, a graft is used to replace the torn ACL. The graft can be harvested from various sources, such as the patient's own hamstring tendons or patellar tendon, or from a donor. The graft is then inserted into tunnels created in the femur and tibia bone. The term "press fit" refers to the technique used to secure the graft within these bone tunnels. Instead of using screws or other fixation devices, press fit ACL reconstruction relies on tight fitting of the graft within the tunnels.* ***Objective:*** *This study aimed to compare the subjective, objective, and radiological results of press fit anterior cruciate ligament (ACL) reconstruction using hamstring tendon graft versus quadriceps tendon graft.* ***Methods:*** *A total of 50 patients with complete ACL tears underwent press fit ACL reconstruction between March 2016 and June 2019. Among them, 25 patients received a hamstring tendon graft, and another 25 patients received a quadriceps tendon graft.* ***Results:*** *The study demonstrated favorable outcomes of press fit ACL reconstruction, with improvements observed in all 50 patients when comparing postoperative to preoperative parameters. The results also showed comparable outcomes between the quadriceps and hamstring groups in terms of subjective, objective, and radiological measures.* ***Conclusion:*** *The press fit technique for ACL reconstruction is a successful method of graft fixation that offers advantages such as fewer complications, lower cost, and easier revision compared to other commonly used techniques.*

Keywords: *Press fit, Anterior cruciate ligament, Hamstring tendon, Quadriceps tendon.*

1. Introduction

The anterior cruciate ligament (ACL) is one of the major ligaments in the knee joint. It is located in the center of the knee and plays a crucial role in providing stability and preventing excessive forward movement of the tibia (shinbone) in relation to the femur (thighbone)[1,2]. The ACL also helps in controlling rotational movements of the knee. Injuries to the ACL are common, particularly in sports that involve sudden stops, changes in direction, or jumping. These injuries can occur due to direct trauma, such as a blow to the knee, or non-contact mechanisms, such as landing awkwardly or making sudden pivoting movements.

Press fit ACL reconstruction is a technique that has gained popularity due to its hardware-free method of graft fixation, which eliminates the need for screws or other fixation devices [3,4]. This method offers several advantages, including reduced risk of hardware-related complications, easier revision surgeries, and potentially lower costs. When it comes to choosing the appropriate graft for ACL reconstruction, two commonly used options are hamstring tendon graft and quadriceps tendon graft. The hamstring tendon graft involves harvesting a portion of the patient's own hamstring tendons, typically the semitendinosus and gracilis tendons. On the other hand, the quadriceps tendon graft involves using a portion of the patient's own quadriceps tendon, which is located above the patella [5,6].

Comparing the outcomes of press fit ACL reconstruction using hamstring tendon graft versus quadriceps tendon graft, several factors need to be considered. Subjective measures, such as patient-reported outcomes and satisfaction, play a crucial role in evaluating the success of the procedure. Objective measures, including range of motion, stability, and strength, are also important indicators of the graft's effectiveness. Additionally, radiological assessments, such as MRI scans, can provide valuable information about graft integration and healing [7,8].

Studies have shown that both hamstring tendon graft and quadriceps tendon graft can yield positive outcomes in press fit ACL reconstruction. The choice between the two graft options often depends on various factors, including surgeon preference, patient characteristics, and specific anatomical considerations [7].

Hamstring tendon grafts have been widely used for ACL reconstruction and have demonstrated good clinical outcomes. The hamstring tendons provide a strong and flexible graft option, allowing for successful reconstruction and restoration of knee stability. However, there are potential drawbacks associated with hamstring tendon grafts, such as donor site morbidity, postoperative pain, and the risk of hamstring weakness or tightness [9].

Quadriceps tendon grafts have gained increasing attention in recent years as an alternative to hamstring tendon grafts. The quadriceps tendon offers a larger graft size, which may be advantageous for patients with larger body sizes or those requiring revision surgeries. Additionally, the quadriceps tendon has a robust blood supply, which can promote graft healing and integration. However, there may be concerns regarding potential patellar tendonitis or patellofemoral pain syndrome after harvesting the quadriceps tendon [10].

In this study, we aim to compare the clinical outcomes of arthroscopic ACL reconstructions using the Press fit anterior cruciate ligament fixation technique with hamstring tendon grafts and quadriceps tendon grafts in terms of the subjective, objective, and radiological results of this technique, identify any limitations, and highlight potential complications.

2. Materials and Methods

This is a comparative study conducted at Kasr Al Ainy Hospital from March 2016 to June 2018, involving 50 patients. The aim is to evaluate the outcomes of arthroscopic ACL reconstruction without the use of hardware (using the Press-fit technique). The study compares the results of using hamstring tendons in 25 patients (group A) and quadriceps tendons in 25 patients (group B), all of whom had a torn ACL.

Inclusion criteria

- Age: 16 to 40 years old.
- Patients complaining of knee instability
- Active patients who wish to return to athletic activities.
- Patients working in heavy labor who need a stable knee.
- No other associated knee injuries except meniscal injuries.

Exclusion criteria

- Patients under 16 or over 40 years old.
- Multi ligamentous knee injury.
- Osteochondritis dissecans.
- Osteoarthritis.
- Knee stiffness.

Methods of evaluation:

Preoperative assessment: History taking included age, sex, mode of trauma, time interval, and level of activity. Complete general and local examination, including degree of swelling range of motion and thigh girth difference. Special tests (anterior drawer, Lachman, pivot shift test). Functional knee scoring (IKDC and Tegner Lysholm). Knee X.Ray and MRI.

Postoperative assessment

Subjective assessment

Using IKDC [11] and Tegner-Lysholm Knee Scoring system [12]. This has been graded and compared to the Knee status preoperative or graded as either normal, nearly normal, abnormal, and severely abnormal in relation to the patient expectations.

Objective assessment:

Objective assessment included postoperative assessment of thigh girth difference, postoperative assessment of ACL insufficiency using anterior drawer, Lachman and pivot shift test, as well as intraoperative and postoperative complications.

Anterior drawer test

- **Grade 1:** 1-5 mm displacement
- **Grade 2:** 6-10 mm displacement
- **Grade 3:** More than 10 mm displacement

Lachman test

- **Grade 1:** 1-5 mm displacement
- **Grade 2:** 6-10 mm displacement
- **Grade 3:** More than 10 mm displacement

Pivot shift test

- **Grade 1:** glide
- **Grade 2:** clunk
- **Grade 3:** gross displacement

Radiological

A CT scan was done for all patients at 3 and 6 months postoperatively to assess the integrity of the bone plugs, measuring the diameter of tibial and femoral tunnels at the aperture and mid-tunnel measurement to compare intra-operative tunnel diameter to the diameter 6 months postoperatively.

Surgical technique and steps

All patients were admitted to the hospital either on the day of surgery or the day prior. Prior to the operation, all patients received a preoperative dose of prophylactic IV antibiotic, which was continued throughout their hospital stay. During the procedure, patients were positioned supine with the affected knee flexed at the side of the table. Spinal anesthesia was administered to all patients, and they were examined under anesthesia to confirm the preoperative diagnosis, comparing it to the healthy side (as shown in Figure 1). A tourniquet was then applied to the upper thigh and inflated after recording the time. Following this, the knee and leg were sterilized and draped using standard procedures.

Fig. 1: Examination under anesthesia. (A-Lachman, B-anterior drawer, and C-pivot shift tests).

Graft harvesting

A-Hamstring tendon graft: Vertical or oblique skin incision 2 cm over the base of the semitendinosus and gracilis tendon at the pes anserinus was made. Both tendons are presented. These are mobilized and charged with the 90° Overholt or a similar clamp. At their whole length, the gracilis tendon and the semitendinosus tendon were extracted with the help of the tendon stripper **(Fig.2)**. They remained stemmed at the pes anserinus. After removing all the muscle remainders, both tendons were turned over with the help of two entry stitches, and they were held as double. A Kocher clamp holds the tendon double over the pes anserinus. In a distance of approx. 15 mm from the tendon turn-up, a marking suture was put on with resorbable material size 2-0. Proximally (depending on the size of the joint), another suture followed in approx. 30 to 35 mm distance.

Fig. 2: Harvesting hamstring tendon graft

B-Quadriceps tendon graft: To expose the quadriceps tendon, a standard incision of 4-6 cm was made along the midline, starting from the superior pole of the patella. The paratenon and prepatellar fascia were carefully incised for future repair. From the upper part of the patella, a segment of the quadriceps tendon measuring at least 7-8 cm in length and 10-11 mm in width (medial-to-lateral) was obtained. It was important to maintain this width to limit the extension of the tendon as it narrows towards the proximal end. To ensure proper positioning, we determined the location of the bone plug based on the projected portion of the harvested tendon. The adjacent bone plug had dimensions of 20-25 mm in length, 8-10 mm in width, and 6-10 mm in depth, and it was centered on the patella (as shown in Figure 3).

Fig. 3: Harvesting quadriceps tendon graft.

Finding out the diameter of the new pair of tendons with the 8 mm tendon template. **(Fig.4)** this was needed to determine the diameter of the bone cylinder that was necessary for the Press-Fit plugging.

Fig. 4: Sizing of the graft.

Fixing the target hook of the tibial target device at the original ACL insertion 7 mm ventral to the PCL **(Fig.5).** The target tube was pushed forward onto the medial tibial head in such a way that it was fitting tightly with both pins (make a distinction between right and left knee).

Fig. 5: Tibial guide insertion.

The target tube is firmly fixed at the tibia head and solidly with the clamping nut; the diamond core reamer is screwed onto the target tube, and the tibial channel is installed with the wet grinding method. The pre-grinded bone cylinder was taken out with the extractor, driven out with the push rod, and kept in a water bowl. **(Fig. 5).**

Fig. 5: Tibial tunnel drilling.

In order to pull the transplant into the tibial channel, a distal extension of the channel was absolutely necessary. In dependence on the distal diameter of the transplant this was done by taper milling up to a maximum depth of 14 mm, soft parts were protected with the soft tissue protector. **(Fig.6)**

Fig. 6: Extraction of tibial tunnel bone plug.

Through the medial portal the femoral target device was put into position at the dorsal turn-up edge in the quadrant positioning approx. 9:30/2:30 h in approx. 120° knee flexion. The femoral channel would be grinded out with the diamond core reamer into a depth of 30 mm. The extractor was put over the grinded bone cylinder and was hammered in up to the given depth of 30 mm. The handle was put into the opening of the extractor head. With a short 90° turn the bone cylinder was sheared off at the base and extracted. This cylinder was pushed out of the extractor with the help of the push rod and then put into saline. **(Fig.7)**

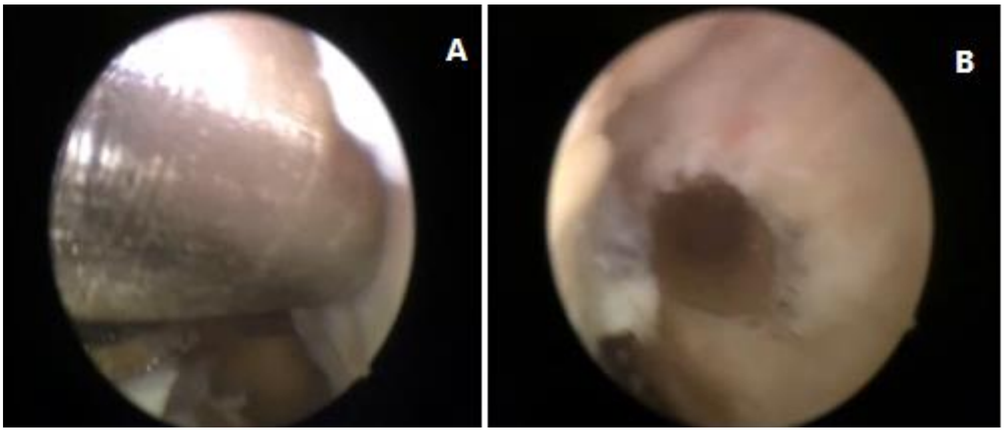

Fig. 7: A, B: Femoral tunnel drilling using anterolateral portal as the viewing portal and anteromedial portal as the working portal.

The tendon transplant was held on the table at the pull-in stitches. Each overholt took one end of the proximal tendon transplant at a time. The tendon ends were spread. The spongious end of the bone cylinder out of the tibial head was pushed firmly into the spread tendons up to the suture. The tendon thighs were put together and closed with a sack suture using absorbable suture material size 2-0. This bone cylinder, positioned in such a way, would be axially stabilized by a transosseous suture. Paying attention to the fact that a bone window had to remain open for later primary healing of the bone. Basically, even as a short model the cortical cylinder part was sufficient for anchoring in the under-dimensioned tibial implantation channel. **(Fig.8)**

Fig. 8: Graft preparation, note the bone window.

After putting the pull-out pins from distal to proximal, the transplant was wrapped and pulled into the tibia channel. While pulling to the proximal the distal end of the transplant with the inserted bone cylinder was pushed with mallet blows on the impactor into the tibial channel until it was under the tibial plateau. The length of the push rod in the tibial channel served as guideline for the depth. If necessary, the depth could be measured with the help of the length of the bone cylinder that came out of the tibial channel minus the transplanted cylinder. The marking stitch at the proximal end of the transplant must have disappeared in the femoral channel during 90°-120° knee flexion. **(Fig.9).**

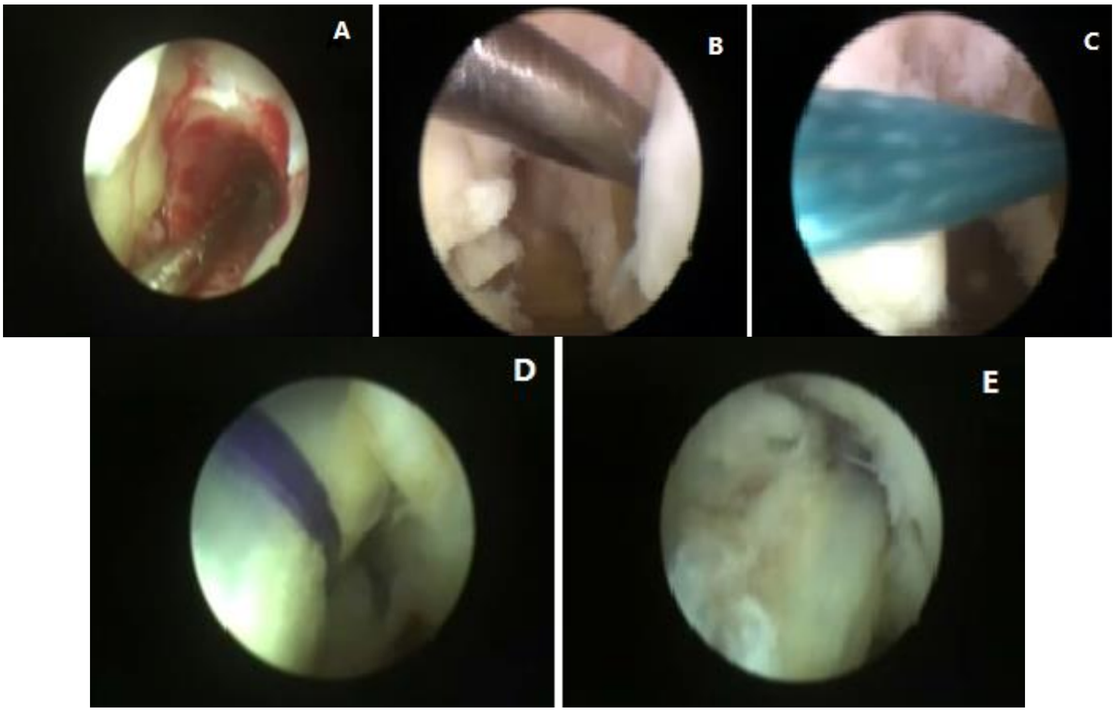

Fig. 9: A, B, C, D, E: Steps of graft passage.

The bone cylinder from the femoral channel was now divided in half. The spongious end was pushed into the applicator. At 120° knee flexion and with tightened ligament, the bone cylinder was firmly driven into the femoral channel parallel to the transplant. This was done through the medial access with the applicator and with visual control also through the control window of the applicator. The channel was deepened with the 4 mm impactor. Now for the first time, the ligament could be checked regarding correct fitting. In the same way, the second cortico-spongious cylinder was driven in with the applicator with the spongiosa in front so that the cortical end closed up. The cortical cover was deepened with the 4 mm impactor so that it closed up behind the cortex of the bone. **(Fig.10).**

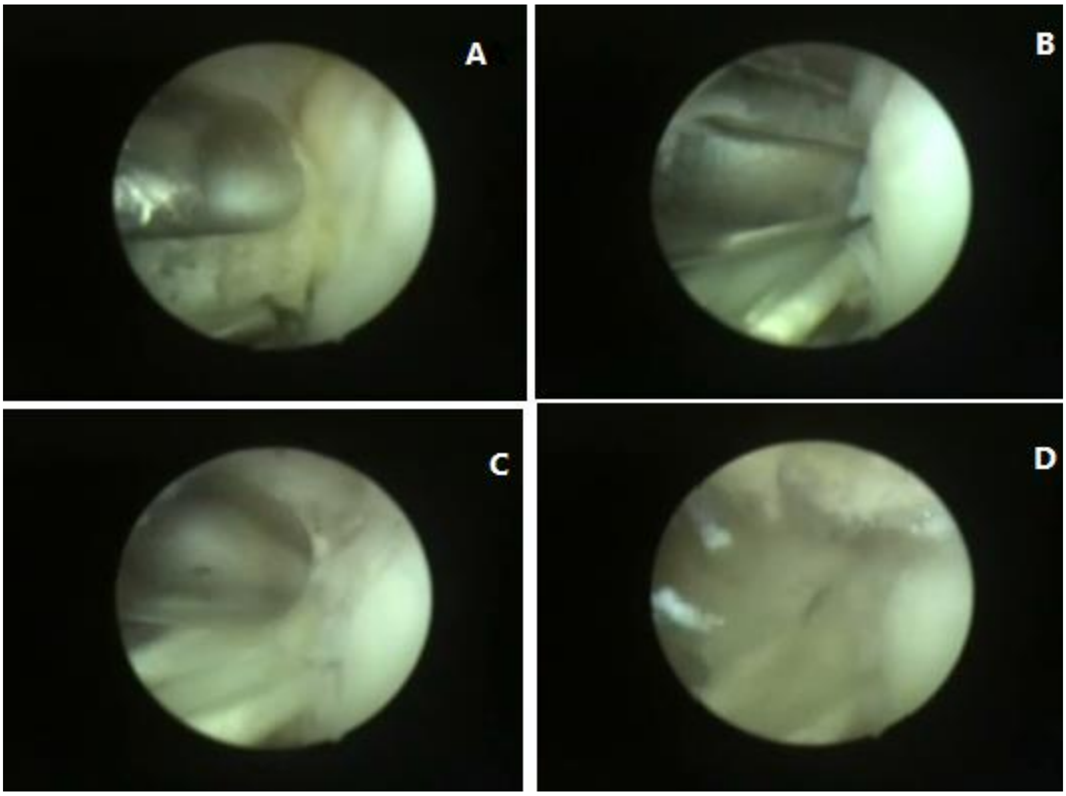

Fig. 10: A, B, C, D: Femoral fixation of the graft by inserting the femoral bone plug.

The ligament was implanted BOTTOM-TO-TOP; it was fixed near the joint and tightened. Physiologically the ACL was not tightened in a 90°-120° flexion. If we now lead the transplant, which we had tightened in flexion into the knee extension, the transplant would tighten further. Perhaps it slided a little bit further at the point of less resistance (usually distal) and stands upright in its operational length. The result we had got a replacement for the ACL, which was solid for exercises and fixed near the joint. If the femoral cylinder you had got was very small and short because the bone quality was soft, a Press-fit anchoring with the cortical cylinder part was sufficient in most cases. Alternatively, the tibial bone cylinder could also be used for proximal anchoring. Another cortico-spongious cylinder taken out of the tibial head served as an additional drawback.

A long lavage follows. The extraction defect of the tibia channel was filled up with the remaining bone cylinder. To do this, the cylinder was cut in half and then inserted into two pieces with the help of the push rod. The periosteal flap would be adapted above the defect. Closing of the wound in layers, intracutaneous suture, drainage, then a long intra-articular lavage followed, setting of suction drainage, sterile wound bandage, and elasto-compressive bandage was done.

Discharge: All patients were kept in the hospital for 1-2 days and discharged on the 2nd or 3rd day using a knee immobilizer in full extension during walking unless signs of infection were developed.

Follow-up: The follow-up period ranged from 6 months to 2 years after surgery. All patients were followed up at the 1st, 2nd, and 6th week postoperative, then at 3 months, then every 6 months for signs of infection, range of motion, thigh girth difference, anterior drawer, Lachman, pivot shift, and follow-up CT scan.

Postoperative Rehabilitation Program

A program of accelerated rehabilitation was employed to help patients achieve full knee extension soon after surgery. This rehabilitation program focused on restoring range of motion, allowing weight bearing, reducing swelling early on, and protecting the ACL replacement graft through closed kinetic chain exercises. It also aimed to restore dynamic joint stability through early strengthening of the quadriceps and hamstring muscles, as well as providing proprioceptive functional training and neuromuscular rehabilitation. Additionally, muscle strength training and agility training were included. Ideally, this accelerated rehabilitation program was tailored to each patient's condition. **Table one**

Table one shows the postoperative rehabilitation program.

7-10 day	The rehabilitation exercises included activities to improve the range of motion, such as terminal extension, prone hangs with a 2-pound weight if full extension was not achieved, towel extensions, wall slides, heel slides, and active-assisted flexion. Strengthening exercises for the knee involved knee bends, step-ups, and calf raises. Weight-bearing was gradually increased from partial to full weight bearing. Additionally, the use of a knee immobilizer was gradually reduced and eventually eliminated.
2-3 weeks	The range of motion exercises focused on achieving a range of 0° to 110°. Strengthening exercises included unilateral knee bends, step-ups, calf raises, and using the Stair Master 4000. Activities in the weight room involved leg press, quarter squats, calf raises in the squat rack, as well as stationary bicycling and swimming. Additionally, a custom-made functional knee brace without preset limits was prescribed to be worn at all times outside of the home for the next four weeks.
5-6 weeks	The range of motion exercises aimed to achieve a range of 0° to 130°. An isokinetic evaluation was conducted with a 20° block at speeds of 180 and 240 degrees per second. Once the strength of the operated knee reached 70% or more compared to the un-operated knee, the patient could start engaging in lateral shuttles, cariocas, light jogging, jumping rope, agility drills, weight room activities, stationary bicycling, and swimming. It is important to note that the functional brace would no longer be needed, except for sports activities, once the muscle tone and strength reached an adequate level.
10 weeks	Full ROM; isokinetic evaluation at 60,180, and 240 deg/sec, KT 1000, increased agility workouts, sport-specific activities
16 weeks	Isokinetic evaluation, KT 1000, increased agility workouts
4-6 months	Return to full sports participation (if patient has met, criteria of full ROM, no effusion, good knee stability, and completed the running program)

3. Results and Discussion

Demographic characteristics

The sample consisted of 50 individuals, with 46 males (92%) and 4 females (8%). Among them, 32 patients (64%) had sustained an injury to their right knee, while 18 patients (36%) had injured their left knee. The time elapsed between the knee injury and the operation ranged from 1 to 15 months, with an average of 4 months. The age of the patients ranged from 18 to 39 years old, with a mean age of 28 years. Out of the total participants, 38 patients (76%) had an additional meniscal injury along with their ACL injury. Among these, 20 individuals were in the quadriceps group and underwent meniscal repair, while the remaining 18 were in the hamstrings group and also received meniscal repair. Additionally, partial meniscectomy was performed on 13 patients in the quadriceps group and on 11 patients in the hamstrings group.

Preoperative parameters

The mean preoperative IKDC was 61.78 $\pm$ 8.426 in group A and 60.492 $\pm$ 11.049 in group B without any significant difference P value = 0.32. The hamstrings group had a preoperative Lysholm score ranging from 48 to 75, with an average score of 62.6 + 7.892. In comparison, the quadriceps group had a preoperative Lysholm score ranging from 42 to 81, with an average score of 65.52 + 10.5. However, these differences between the two groups were not statistically significant. The preoperative measurement of the anterior drawer test showed mostly grade 3 results, with grade 2 being less frequent. The average value for the hamstrings group was 2.88 + 0.332, while the quadriceps group had an average of 2.84 + 0.374. The mean preoperative Lachman test was similar between both groups, with a mean of 2.72 $\pm$ 0.458. Most of the pivot shift test results were grade 3, with grade 2 being less common, and the average value for both groups was 2.76 + 0.436. Table two

Table 2. shows the preoperative parameters.

Preoperative parameters of both groups			P value
IKDC	61.78 ± 8.426	60.492 ±11.049	0.32
Tegner Lysholm	62.6 ±7.892	65.52 ±10.5	0.27
Anterior drawer test	2.88 ±0.332	2.84 ±0.374	0.3
Lachman	2.72 ±0.458	2.72 ±0.458	1
Pivot shift test	2.76 ±0.436	2.76 ±0.436	1

Data were represented as mean and standard deviation (SD).

Intraoperative measurements and complications

Intraoperative measurement of the tibial tunnel ranged between 9 to 11 mm, with a mean value of 9.92 ± 0.572 for the hamstrings group and 9.76 ± 0.723 for the quadriceps group. At the same time, the measurement of the femoral tunnel during surgery varied from 8 to 10 mm, with an average value of 8.88 ± 0.526 for the hamstrings group and 8.96 ± 0.539 for the quadriceps group. Intraoperative incomplete graft laceration was observed in one patient (4%) from the quadriceps group intraoperatively.

Postoperative parameters of both groups

The mean postoperative IKDC ranged from a minimum of 60.6 to a maximum of 92.8, with an average value of 81.832 ± 7.495 for the hamstrings group. The quadriceps group had a minimum IKDC score of 62 and a maximum of 92, with an average value of 82.5 + 8.586. The mean postoperative Tegner Lysholm was 84.64 ± 6.903, and for the quadriceps group and 83.32 ± 7.37 for the hamstrings group. The postoperative difference in thigh girth was measured for both groups. In the hamstrings group, 6 patients had a range of thigh girth inequality from 0 to -5 for the operated leg, with an average value of -0.56 + 1.193. Similarly, in the quadriceps group, 6 patients had a range of thigh girth inequality from 0 to -6 for the operated leg, with an average value of -0.88 + 1.787. The anterior drawer was mostly grade 1 and less frequently grade 2, with a mean value of 1.20 ± 0.408 for either the hamstring or the quadriceps groups. The mean Lachman test value was 1.24 ± 0.436 for the hamstring and 1.16 ± 0.374 for the quadriceps group. The Pivot shift test of both groups was mostly grade 1 and less frequently grade 2, with a mean value of 1.04 ± 0.2 for the hamstring and 1.08 ± 0.277 for the quadriceps group. Mean postoperative femoral mid-tunnel measurements in the hamstring and quadriceps groups were 9.03 ± 0.536 and 9.27 ± 0.632, respectively. The mean postoperative mid-tunnel measurement of tibial was 10.184 ± 0.766 in the hamstring group and 10.292 ± 1.225 in the quadriceps group. **Table three.**

Table 3. shows postoperative parameters.

Postoperative parameters of both groups			P value
IKDC	81.832 ± 7.495	82.5 ± 8.586	0.38
Tegner Lysholm	84.64 ± 6.903	83.32 ± 7.37	0.25
Thigh girth	-0.56 ± 1.193	-0.88 ± 1.787	0.23
Anterior drawer	1.20 ± 0.408	1.20 ± 0.408	1
Lachman test	1.24 ± 0.436	1.16 ± 0.374	0.48
Pivot shift test	1.04 ± 0.2	1.08 ± 0.277	0.56
Femoral mid-tunnel measurement	9.03 ± 0.536	9.27 ± 0.632	0.15
Aperture measurement of femoral tunnel	9.212 ± 0.565	9.252 ± 0.588	0.8
Mid-tunnel measurement of the tibial tunnel	10.184 ± 0.766	10.292 ± 1.225	0.71
Aperture measurement of the tibial tunnel	10.384 ± 0.818	10.48 ±1.2	0.74

Data were represented as mean and standard deviation (SD).

Postoperative complications

Postoperative difficult knee extension has been encountered only in one patient (4%) from the quadriceps group mostly due to quadriceps tendon postoperative fibrosis. Her functional parameters postoperatively were less satisfactory than usual, with a 5 cm loss of thigh girth. 6 months postoperative CT scan showed significant tibial tunnel dilatation.

Postoperative wound infection was observed in Two patients **(8%)** from the quadriceps group, and another two patients **(8%)** from the hamstrings group suffered postoperative wound infection despite of routine Preoperative and postoperative antibiotics.

Choices for ACL reconstruction include autografts and allografts. The commonly used autografts include bone-patellar tendon-bone (BPTB), quadrupled bundle hamstring tendons, and quadriceps tendons with or without bone. Meanwhile, the allografts used mainly are Achilles tendon BPTB. Secure graft fixation is an important factor, especially in the early postoperative period. There are many different fixation methods, such as metal and biodegradable interference screws, staples, buttons, and press-fit fixation.

In this study, we found that Press fit technique is a successful graft fixation method with fewer complications, less cost, and easier revision than other commonly used fixation methods. Shanmugaraj et al. [13] conducted a comprehensive analysis of randomized controlled trials (RCTs) focused on the effectiveness of press-fit fixation in primary ACL reconstruction. The key finding from this systematic review revealed no notable disparities in complication rates between femoral press-fit and femoral interference screw fixation. However, the use of press-fit fixation for ACLR patients resulted in lower rates of graft failure and revision compared to other systematic reviews and meta-analyses that assessed similar populations and follow-up durations using alternative fixation techniques.

Xerogeanes et al. [14] estimated the efficacy of quadriceps grafts for ACLR. They found that this graft can be tailored for both primary and revision surgeries, and it had minimal complications at the harvest site. With an incision of less than 2 cm in an area without major nerves and without harvesting any patella bone, there was no significant pain, numbness, or visible defect at the harvest site. The clinical outcomes using this graft were excellent. According to this study, which involved almost 1,000 grafts and patients with an average age of 20, the failure rate for all soft tissue quadriceps grafts was only 4.2%.

A clinical trial by Horstmann et al. [5], Out of forty-four patients, 86% successfully completed the 2-year follow-up. Throughout the entire duration, there was a notable enhancement in knee stability, and no significant distinction was observed between the two groups being studied.

The conventional press-fit technique for ACLR involves drilling the femoral bone tunnel and manually shaping the patellar bone plug. However, this technique has drawbacks such as inconsistent bone plug size, which affects the strength of the fixation, bone loss with debris spreading in the knee joint, potential heat damage, and metal wear debris from guide wire abrasion. Therefore, Häberli et al. [15] aimed to compare the fixation strength and apparent stiffness of this new technique to the gold-standard interference screw fixation method in three different flexion angle configurations (0°/45°/90°) using a porcine model. They found that in a porcine model, the initial strength of femoral press-fit graft fixation using punched femoral tunnels and standardized bone plug compression was comparable to that of interference screw fixation. Hence, this procedure proved to be an effective approach for ACL reconstruction using autografts from the patellar or quadriceps tendon, which included a patellar bone plug.

In 2012, Ralph Akoto and Juergen Hoeher [1] performed a prospective study on 30 patients with complete ACL tears using the quadriceps tendon. The patients were followed up for 12 months and stated that quadriceps tendon grafts had been shown to provide good strength and low donor site morbidity, therefore being an alternative to hamstring grafts even in primary ACL reconstruction. The technique achieved 96.7% normal or nearly normal results for the objective IKDC. The mean subjective IKDC score was 86.1 ± 15.8, while in our study, there was an IKDC score of 82.5 ± 8.586 for the quadriceps group.

Full ROM has been achieved in 92.3%; one patient had a mild lack of extension, and one had a mild lack of extension and flexion. In our study, postoperative difficult knee extension occurred in one patient of the quadriceps group (4%), and Postoperative wound infection occurred in 2 patients of the quadriceps group (8%).

In 2013, Felmet [16] performed a prospective study that included 152 patients subjected to press fit ACL reconstruction using a hamstring tendon graft. They followed up for about 6.9 years and showed that

89% of the hamstring group achieved a good IKDC score, and the pivot shift was negative in 90% of the cases.

4. Conclusion

The results of our study demonstrated favorable outcomes in press fit ACL reconstruction, as evidenced by subjective, objective, and radiological improvements in all 50 patients. Furthermore, our study revealed similar outcomes between the quadriceps group and the hamstring group, both subjectively, objectively, and radiologically.

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