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# Original Research

## To determine the Posterior Cruciate Ligament restoration utilising a peroneus longus tendon graft

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***ABSTRACT:***
**Aim:** The purpose of this research is to determine the Posterior Cruciate Ligament restoration utilising a peroneus longus tendon graft. **Methods:** This research comprised 20 individuals with chronic injury (> 6 months) and the presence of a 'isolated' PCL. Clinical examination and imaging were used to confirm the diagnosis of chronic ligament rupture (Magnetic resonance imaging, MRI). Two years following surgery, post-operative functional outcomes (IKDC, Modified Cincinnati, and Lysholm) were documented by direct patient examination and a guided interview by a single orthopaedic specialist outside the surgical team. **Results:** Intra operatively, graft diameter was measured and documented, yielding a mean diameter of 8.77± 0.88 mm. The pre-operative IKDC score was 48.75±11.69, while the post-operative score was 79.98±5.63. After a two-year follow-up. The mean Modified Cincinnati score was 49.86±9.58 before surgery and 81.69±2.36 after 2 years of follow-up. The pre-operative Lysholm score was 51.638.69, and the 2-year follow-up score was 82.44±5.22. There were significant differences in pre-operative and 2 years post-operative IKDC, Modified Cincinnati, and Lysholm scores (p 0.05), with the majority of patients with PCL damage rebuilt with peroneus longus tendon showing improvement. After 24 months, the single hop test and triple hop test showed 97.02± 3.21 and 93.12±3.06, respectively. Table 3 shows how ankle functional score, AOFAS, and FADI score are used to assess donor site morbidity. The average AOFAS score of the donor ankle was 95.61±1.97, while the FADI score was 95.89±1.78. **Conclusion:** At two years, single bundle PCL repair with peroneus longus tendon autograft improved functional outcome (IKDC, Modified Cincinnati, Lysholm) and demonstrated good ankle function and serial hop test results.
**Keywords:** Posterior Cruciate Ligament graft, peroneus longus tendon graft

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### INTRODUCTION

In situations of knee injury, solitary posterior cruciate ligament (PCL) rupture is uncommon. In the absence of the PCL, however, the knee will have aberrant kinematics, leading in damage to other knee ligaments. [1] There are several graft choices for PCL reconstruction, including autografts and allografts. The optimal graft has anatomical qualities such as adequate size, geometric form, tensile strength, and graft length. Graft fxation, quick graft integration, simple graft flow, and no harvest site morbidity are critical components of a perfect graft for PCL reconstruction[2]; yet, these traits also render an optimal graft for PCL restoration unattainable. As a result, when examining prospective grafts, surgeons have numerous alternatives, including the bone–patellar tendon–bone (BPTB), quadriceps tendon, and hamstring tendon (HT) grafts[3,4], each of which has its own drawbacks. BPTB allows for bone-to-bone mending, which may take [4–6] weeks. This allows for a quicker recovery to physical activity than other grafts; nevertheless, BPTB may induce anterior knee discomfort, kneeling pain, soreness around bone abnormalities, patellar fractures, a weaker extensor mechanism, and a short graft length for PCL replacement. These BPTB flaws are addressed by the HT autograft. It has high tensile strength, is simple to harvest, has adequate graft length, and a wide surface

area that promotes revascularization following graft implantation.[5] It has become one of the most often utilised grafts in ACL and PCL restoration. However, there are several disadvantages to using HT autografts, including saphenous nerve injury, less stiffness than the native ACL, a risk of residual muscle tearing (biceps femoris and semimembranosus), decreased fexion strength, decreased internal rotation strength, thigh hypotrophy, and an unpredictable graft size diameter. Because of the drawbacks of HT autografts, the peroneus longus tendon (PLT) is being evaluated as a novel graft for PCL repair. [6]

## METHODS AND MATERIALS

This prospective research was conducted at the Department of Orthopaedics on patients who had PCL injuries and had PCL repair. Clinical examination and imaging were used to confirm the diagnosis of chronic ligament rupture (Magnetic resonance imaging, MRI).

## CRITERIA FOR INCLUSION

- Long-term injury (more than 6 months)
- The presence of a'single' PCL
- No prior ligament surgery

## CRITERIA FOR EXCLUSION

A posterolateral and/or posteromedial lesion is present.

This research involved 20 participants. The patient's functional score was examined before and after surgery using the International Knee Documentation Committee (IKDC) score, Modified Cincinnati Rating System, Lysholm scale, and serial hop test. The American Orthopaedic Foot Ankle Society score and the Foot Ankle Disability Index were used to measure donor site morbidity. Thigh circumference was measured 10 cm and 20 cm superior to the top pole of the patellar bone at the injury site and contralateral healthy site, respectively.

## METHODOLOGY

All PCL rebuilding surgeries were carried out by a single senior knee surgeon. The surgery was carried out while the patient was supine and under general anaesthetic. After a short clinical evaluation under anaesthesia, a padded tourniquet was placed to the affected knee's proximal thigh. Diagnostic arthroscopy was performed using anterolateral and anteromedial arthroscopic portals. PLT autograft was obtained from the ipsilateral ankle after the diagnosis of PCL rupture was confirmed arthroscopically. With the knee fully extended, a 3-cm longitudinal incision was made about 2–3 cm above and 1 cm behind the lateral malleolus. The incision was made in the skin and subcutaneous tissue. The peroneus longus and peroneus brevis tendons were discovered in the operative field after the superficial fascia was incised. The peroneus longus tendon was divided 2–3 cm proximal to the lateral malleolus, and the distal section of the tendon was sutured to the peroneus brevis tendon using a side-to-side suture. The peroneus longus tendon was then peeled proximally using a tendon stripper and halted 4–5 cm from the fibular head to avoid peroneal nerve damage.

The synovial and fat-like tissue on the PCL remnant's femoral connection was carefully removed to reveal the fibres of PCL bundles. The PCL fragments were saved. The femoral tunnel was put on a continuous line with the junction of the roof and medial wall of the intercondylar notch, 8–10 mm from the anterior or distal medial femoral articular edge. As a guide wire, a 2.0 mm Kirschner wire was placed through the reamer. The anterolateral portal was used for over drilling with a 5 mm diameter drill (ConMed, USA). A 2.4-mm pin was pushed through the femoral tunnel and reamed with a cannulated drill in accordance with the graft diameter at the distal part until the tunnel was 30 mm deep.

Under direct observation, a posteromedial gateway was established. The tibial attachment point of the PCL was entirely revealed. Through the anteromedial incision, a guiding pin was placed into the distal centre region of the tibial insertion of the PCL, which comes into touch with the posterior border of the retrospinal surface. The tibial hole was drilled to accommodate the graft diameter. Through this hole, a 2.4-mm (blunt leading end) pin was inserted. In a retrograde approach, a pullout suture was threaded. The 4-strand hamstring graft was pushed through the femoral hole using this technique. A button was used to provide proximal femoral fixation. The button was flipped outside the femur's medial cortex. The graft was then gripped and firmly pulled out of the anterior tibial hole, and a 25–35 mm bioabsorbable screw was introduced at 90° knee flexion while preserving anterior drawer pull of the tibia.

The knee was immobilised for four weeks with the brace fully extended. On the second postoperative day, the non-weight bearing regimen was commenced. After two weeks, the quadriceps isometric exercise and straightleg raising exercise were started. Beginning in the fourth week, protected ROM was progressively raised from 0 to 90° flexion. After 8 weeks, incremental knee flexion from 90° to full ROM was progressively exercised. After 4 weeks, partial weight bearing was authorised. After 8 weeks, full weight bearing with hamstring-strengthening activities was allowed, and active knee ROM should improve to complete flexion and extension. Patients were typically able to resume their regular daily activities and begin exercising on a stationary bike or standing on one leg 5 months after surgery. Light athletic activities begin at the age of six months. After 12 months, the patient is examined with a serial hop test (single and triple hop tests) and approved for athletic activities if the results are satisfactory.

**THE FUNCTIONAL RESULT**

Two years following surgery, post-operative functional outcomes (IKDC, Modified Cincinnati, and Lysholm) were documented by direct patient examination and a guided interview by a single orthopaedic specialist outside the surgical team. Donor site morbidity was assessed by measuring ankle functional score using the AOFAS and FADI scores. The serial hop test was performed two years following surgery.

**STATISTICAL INVESTIGATION**

The paired t-test was performed to compare IKDC, Modified Cincinnati, and Lysholm scores from preoperative to 2-year follow-up. A p-value of 0.05 was considered statistically significant. FADI, AOFAS, and the serial hop test were shown descriptively.

**RESULTS**

This research involved 20 participants. The group was made up of 14 males and 6 women. All of the patients had chronic injuries, and the average period from injury to reconstruction was 9 months. Eight patients were injured during a sporting activity, while twelve were injured in a car accident. 1. Table

**Table 1: Basis parameter**

| Basic parameter | Number | % |
|---|---|---|
| Age | | |
| Below 25 | 3 | 15 |
| 25-35 | 11 | 55 |
| Above 35 | 6 | 30 |
| Gender | | |
| Male | 14 | 70 |
| Female | 6 | 30 |
| Site of injury dextra | 10 | 50 |
| Sinistra | 10 | 50 |
| Injury mechanism | | |
| Traffic injury | 12 | 60 |
| Sport | 8 | 40 |
| Graft diameter | 8.77 ± 0.88 mm | |

During the research period, 22 patients had single bundle PCL repair. Two individuals were eliminated due to concurrent meniscal damage. Twenty patients met the inclusion criteria and had single bundle PCL repair using a peroneus longus autograft. At the 2-year follow-up, there were 20 patients, 14 men and 6 girls. Intraoperatively, graft diameter was measured and documented, yielding a mean diameter of 8.77± 0.88 mm (range 7.5–10 mm). 1. Table

**THE FUNCTIONAL RESULT**

Table 2 shows that there were significant differences in preoperative and 2-year postoperative IKDC, Modified Cincinnati, and Lysholm scores (p 0.05). The pre-operative IKDC score was 48.75±11.69, while the post-operative score was 79.98±5.63. After a two-year follow-up. The mean Modified Cincinnati score was 49.86±9.58 before surgery and 81.69±2.36 after 2 years of follow-up. The pre-operative Lysholm score was 51.638.69, and the 2-year follow-up score was 82.44±5.22. There were significant differences in pre-operative and 2 years post-operative IKDC, Modified Cincinnati, and Lysholm scores (p 0.05), with the majority of patients with PCL damage rebuilt with peroneus longus tendon showing improvement. 2nd table

**Table 2: Functional outcome**

| Functional outcome | Pre-operative | Post-operative | P-value |
|---|---|---|---|
| | Mean±Sd | Mean±Sd | |
| IKDC | 48.75±11.69 | 79.98±5.63 | 0.000 |
| MODIFIED CINCINNATI | 49.86±9.58 | 81.69±2..36 | 0.001 |
| TEGNER-LYSHOLM | 51.63±8.69 | 82.44±5.22 | 0.000 |

**Table 3: Serial hop test**

| Serial hop test | MEAN±SD |
|---|---|
| SINGLE HOP | 97.02 ± 3.21 |
| TRIPLE HOP | 93.12 ± 3.06 |

After 24 months, the single hop test and triple hop test showed 97.02± 3.21 and 93.12±3.06, respectively. Table 3 shows how ankle functional score, AOFAS, and FADI score are used to assess

donor site morbidity. The average AOFAS score of the donor ankle was 95.61±1.97, while the FADI score was 95.89±1.78.

**CIRCUMFERENCE OF THE THIGHS**

Thigh circumference measurements indicated no change between the injured location and the contralateral healthy region (p>0.05). The mean circumference in 10 cm proximal to the upper patellar bone at the damage site was 43.77±5.88 and 44.69±3.77 at the contralateral healthy location. The mean circumference in 20 cm proximal to the upper patellar bone at the damage site was 50.87±3.72 and 51.98±4.52 at the contralateral healthy location.

**Table 4**: **Thigh circumference**

| | **Injury site** | **Contralateral site** | |
|---|---|---|---|
| | MEAN±SD | MEAN±SD | P value |
| 10CM THIGH DIAMETER | 43.77±5.88 | 44.69±3.77 | 0.38 |
| 20CM THIGH DIAMETER | 50.87±3.72 | 51.98±4.52 | 0.58 |

**DISCUSSION**

Following nonoperative therapy for a high-grade PCL injury, knee function may deteriorate. As a result, PCL repair is required in cases of severe PCL damage. PLT has been utilised in several orthopaedic procedures and may be considered an autograft for PCL rebuilding. PLT autografts show tensile strength equivalent to HT autografts. Longer grafts are required for PCL reconstruction. We now employ HT autograft, however it causes more morbidity in the patient, such as degradation of adductor hip strength, reduced isokinetic knee flexion, and decreased extensor and fexor knee strength. Because of the drawbacks of HT, the PLT was employed as the autograft outside of the knee area. [7,8]

BPTB autograft and hamstring tendon autograft are two of the most often utilised grafts in PCL restoration. Because of its bone-to-bone tunnel healing, BPTB have a speedier return to sport than other types of grafts. The occurrence of tendon growth and fat pad fibrosis, which might result in infrapatellar contracture syndrome, is a drawback of BPTB. Harvesting BPTB also involves a significant risk of anterior knee discomfort, kneeling pain, loss of mobility, and patellar fracture. [9]

The presence of kneeling discomfort or anterior knee pain may be more distressing in some patients than others. This is particularly true for patients who routinely kneel as part of their everyday activities, whether for religious or cultural reasons. Corry et al.[10] examined the clinical result and donor site morbidity of patients who had solitary ACL ruptures and had ACL repair using hamstring and patellar tendon. In the patellar tendon group, around 55% of patients reported anterior kneeling discomfort in the first year, which improved to approximately 30% in the second year, compared to just 5% in the hamstring group in both the first and second years. A 2015 meta-analysis by Xie et al.[9] examined the use of BPTB and hamstring tendon autograft, and found that the risk ratio for anterior kneeling discomfort was 1.71 in favour of hamstring tendon, while the risk ratio for kneeling pain was 2.05. While the proportion of kneeling discomfort in the hamstring group is lower than in the BPTB group, it may be disastrous if it occurs in a patient who cannot tolerate any kneeling pain.

Hamstring tendon autograft offers various benefits over BPTB and is becoming more used in PCL restoration. The use of hamstring tendon in PCL reconstruction also yielded positive clinical results. During a 3- to 5-year follow-up period, Chan et al.[11] discovered a significant increase in knee function, activity level, IKDC classification, Lysholm scores, and muscular strength after PCL restoration using hamstring tendon. Some drawbacks of hamstring tendon autograft harvesting include saphenous nerve damage, thigh hypotrophy, and decreased hamstring muscular power. Some studies also found inconsistencies in graft diameter following hamstring tendon harvesting, with the diameter being too small most of the time. The short diameter of the hamstring tendon may lead to a higher risk of rerupture and revision following PCL repair. A recent biomechanical research found that hamstring grafts with diameters of 6 mm or 7 mm had much lower load to failure than grafts with larger diameters. This study also noted the potential that hamstring grafts are not as robust as previously perceived in earlier studies.[12] These drawbacks prompted several authors to investigate the use of autograft from other sources as an alternative to hamstring graft in cruciate ligament reconstruction.

Previous biomechanical research comparing the tensile strength of the peroneus longus tendon, hamstring tendon, patellar tendon, and quadriceps tendon found that the peroneus longus tendon was equivalent to the hamstring tendon and much stronger than the patellar and quadriceps tendon.[13] The mean diameter of the peroneus longus graft was 8.77±0.88 mm in this research. Previous research found that graft diameters greater than 8 mm had a decreased failure rate in ACL repair, with the chance of revision decreasing by 0.82 mm for every 0.5 mm increase in the 7.0–9.0 graft diameter range. [14] Based on IKDC, Modified Cincinnati, and Lysholm scores, this research found that PCL reconstruction with PLT resulted in significant improvement and an excellent clinical outcome after a 2-year follow-up. This finding indicates that PLT autograft may be utilised in single bundle PCL reconstruction with a

favourable functional outcome for the patient after 2 years. The single hop test and triple hop test for measuring knee function both provide excellent results (more than 85%). According to Angthong et al.[15], there was some donor site morbidity with peroneus longus tendon harvesting. Potential donor site morbidity includes ankle function decline and ankle instability concerns. Ankle function is assessed in this research using the AOFAS and FADI scores.

## CONCLUSION

At two years, single bundle PCL repair with peroneus longus tendon autograft improved functional outcome (IKDC, Modified Cincinnati, Lysholm) and demonstrated good ankle function and serial hop test results.

## REFERENCES


1. Owesen C, Sandven-Thrane S, Lind M, Forssblad M, Granan L-P, Aroen A. Epidemiology of surgically treated posterior cruciate ligament injuries in Scandinavia. Knee Surg Sports Traumatol Arthrosc.2017; 25(8):2384–2391
2. Höher J, Schefer S, Weiler A . Graft choice and graft fxation in PCL reconstruction. Knee Surg Sports Traumatol Arthrosc.2003; 11(5):297–306
3. Johnson P, Mitchell SM, Görtz S . Graft considerations in posterior cruciate ligament reconstruction. Curr Rev Musculoskelet Med.2018; 11(3):521–527
4. Chan Y-S, Yang S-C, Chang C-H, Chen AC-Y, Yuan L-J, Hsu K-Y, Wang C-J . Arthroscopic reconstruction of the posterior cruciate ligament with use of a quadruple hamstring tendon graft with 3- to 5-year follow-up. Arthrosc - J Arthrosc Relat Surg.2006; 22(7):762–770
5. Pinczewski LA, Clingeleffer AJ, Otto DD, Bonar SF, Corry IS . Integration of hamstring tendon graft with bone in reconstruction of the anterior cruciate ligament. Arthroscopy.1997; 13(5):641–643
6. Vinagre G, Kennedy NI, Chahla J, Cinque ME, Hussain ZB, Olesen ML, LaPrade RF . Hamstring graft preparation techniques for anterior cruciate ligament reconstruction. Arthrosc Tech.2017; 6(6):e2079–e2084
7. Hiemstra LA, Gofton WT, Kriellaars DJ . Hip strength following hamstring tendon anterior cruciate ligament reconstruction. Clin J Sport Med.2005; 15(3):180–182
8. Hiemstra LA, Webber S, MacDonald PB, Kriellaars DJ . Knee strength defcits after hamstring tendon and patellar tendon anterior cruciate ligament reconstruction. Med Sci Sports Exerc.2000; 32(8):1472–1479
9. Xie X, LiuX , Chen Z, Yu Y, Peng S, Li Q, A meta-analysis of bone-patellar tendon-bone autograft versus four-strand hamstring tendon autograft for anterior cruciate ligament reconstruction, The Knee.2015; 22 (2) : 100–110.
10. Corry IS, Webb JM, Clingeleffer AJ, Pinczewski LA, Arthroscopic reconstruc- tion of the anterior cruciate ligament. A comparison of patellar tendon autograft and four-strand hamstring tendon autograft, Am. J. Sports Med.1999;27 (4) : 444–454.
11. Chan YS, Yang SC, Chang CH, Chen ACY, Yuan LJ, Hsu KY, et al., Arthroscopic reconstruction of the posterior cruciate ligament with use of a quad- ruple hamstring tendon graft with 3- to 5-year follow-up, Arthrosc. J. Arthrosc. Relat. Surg.2006; 22 (7) :762–770.
12. Boniello MR, Schwingler PM, Bonner JM, Robinson SP, Cotter A, Bonner KF,Impact of hamstring graft diameter on tendon strength: a biomechanical study, Arthrosc. J. Arthrosc. Relat. Surg.2015; 31 (6) :1084–1090.
13. Phatama KY, Hidayat M, Mustamsir E, Pradana AS, Dhananjaya B, Muhammad SI, Tensile Strength Comparison between Hamstring Tendon, Patellar Tendon, Quadriceps Tendon and Peroneus Longus Tendon: A Cadaver Research, J Arthrosc Jt Surg [Internet] (2018);10–2.
14. Spragg L., Chen J., Mirzayan R., Love R., Maletis G, The effect of autologous hamstring graft diameter on the likelihood for revision of anterior cruciate ligament reconstruction, Am. J. Sports Med.2016; 44 (6) :1475–1481.
15. Angthong C., Chernchujit B, Apivatgaroon A, Chaijenkit K, Nualon P, Suchao- in K, The anterior cruciate ligament reconstruction with the peroneus longus tendon: a biomechanical and clinical evaluation of the donor ankle morbidity, J. Med. Assoc. Thail.2015; 98 (6) :555–560.