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Original Research Article

Functional outcome of arthroscopic reconstruction of anterior cruciate ligament tear using peroneus longus tendon autograft

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ABSTRACT

Background: The objective of the study was to evaluate the functional outcome of arthroscopic reconstruction of ACL tear using triple layered PLT autograft and to study its effect on ankle stability.
Methods: The study included 25 patients. The range of age was 18-42 years. Pre-op clinical tests and MRI was done to confirm tear. Reconstruction was done arthroscopically. Physiotheraphy protocol was fixed for all patients. Final outcome was assessed at 6 months using IKDC score and ankle stability was assessed by grading muscle power (MRC grading) with the normal side as control.
Results: IKDC score was normal or near normal in 21 patients and only 4 patients were rated as abnormal or severely abnormal. Mean IKDC Score was 83.53. Stability of the ACL was assessed using the Lachman test: normal in 18 cases (72%), 1+ laxity in 5 cases (20%), 2+ and 3+ in 1 case (4%) each. Pivot shift was negative in 15 cases (60%), Pivot glide was seen in 9 cases (36%) and gross pivot shift was seen in 1 patient. Partial meniscectomy of the medial meniscus was performed in 5 patients. No patient experienced ankle dysfunction however 2 patients had pressure pain in the region of the graft harvest.
Conclusions: PLT graft is similar to the native ACL both in terms of thickness and strength. It can be an appropriate autograft option for ACL reconstruction without compromising ankle function and avoiding potential complications of hamstring and BPTB autograft obtained from the knee region.

Keywords: ACL, PLT, Arthroscopy, Autograft

INTRODUCTION

Anterior cruciate ligament (ACL) reconstruction is performed using different grafts. Allografts, autografts and synthetic grafts have been used with variable success rates.[1] The autografts have been time tested and consistently associated with good clinical results. The hamstring and the bone patella bone tendon grafts are the forerunners among the autografts with wide acceptability. The other autografts being quadriceps, patellar tendon, fascia lata etc. Although, these grafts are used commonly, disagreements regarding suitable graft choice still persist because of some disadvantages.

Use of peroneus longus tendon (PLT) autograft as an alternative to the conventional autograft is a recent development in the field of ACL reconstruction.The advantages are that its strength and mean thickness is nearly same as that of the native ACL.[2,3] Removing the PLT has no effect on stability of the ankle.[4,5] The aim of our study was to assess the functional outcome of arthroscopically reconstructed ACL in which triple layered PLT autograft was used.

METHODS

This study was conducted in the department of orthopaedics Sardar Patel Medical College, Bikaner between December 2016 to December 2017. Patients attending OPD were randomly chosen for the study. Thorough clinical testing was done (Lachman test, anterior drawer test and pivot shift test). Tests were also done to exclude tear of the posterior cruciate ligament (PCL) and the postero-lateral corner (PLC). Patients were then subjected to x-ray of the knee joint and MRI to confirm tear. The inclusion criteria were: age 18-50 years, complete ACL tear (both acute and chronic) with or without meniscal tear and functional instability. All routine investigations were done before surgery. In this study, 25 patients were considered (24 males, 1female; mean age 26.72 years; range 18 to 42 years).

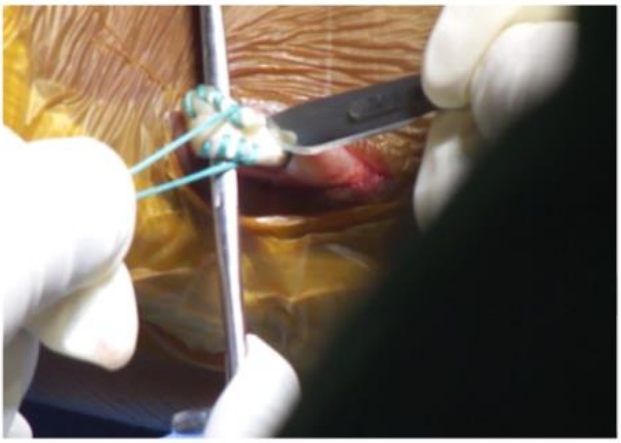

Figure 1: Tenodesis of PL to PB.

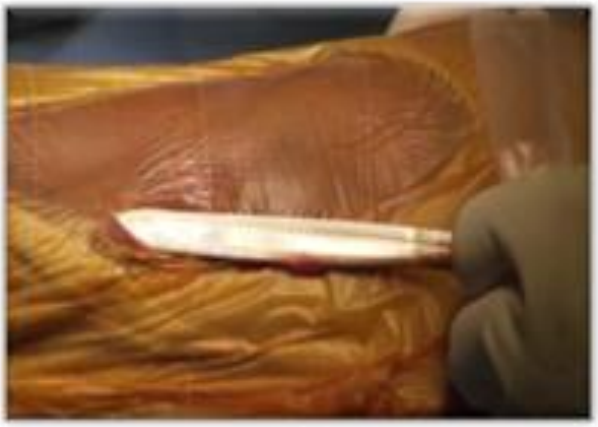

Figure 2: Stripping of PLT.

Surgical technique

Surgery was performed under spinal anaesthesia. Pneumatic tourniquet was used in all cases. The PLT was harvested through a 2 cm incision given above and behind the lateral malleoli of the ipsilateral limb. Peroneal muscle tendon (longus and brevis) were identified and tenodesis of longus to brevis was done (Figure 1). PLT was harvested using a long tendon stripper (Figure 2). Incision was closed using non absorbable sutures. Pre-tensioning of the harvested graft was done on a tendon board. The graft was then looped to constitute a triple graft. Femoral fixation device (Tight rope RT) was attached to one end of the graft. Graft was passed through cylindrical sizers to determine the exact size of the triple graft to be matched with the needed femoral and tibial tunnel (Figure 3). Standard arthroscopic portals were established and thorough arthroscopic survey was done.

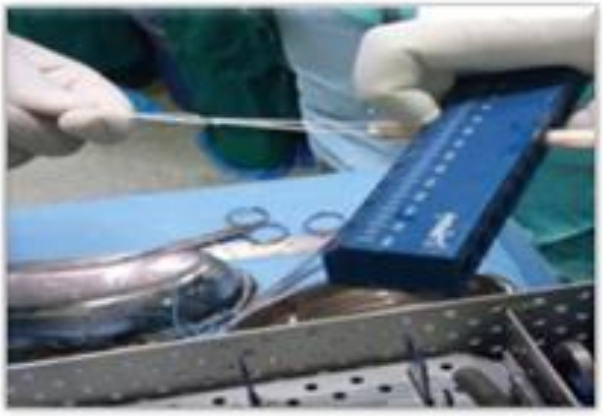

Figure 3: Measuring PLT.

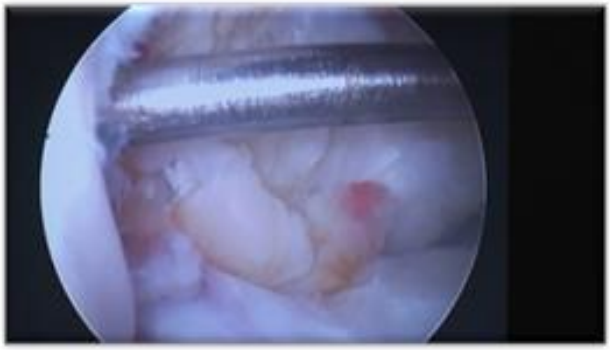

Figure 4: Femoral tunnel preparation.

Figure 5: Tibial tunnel preparation.

With the help of femoral offset aimer, a guide wire was placed into the posteromedial corner of the lateral femoral condyle at approximately 10:30 position for the right knee and 1:30 position for the left knee. Using an appropriate sized reamer (same size as that of the graft), femoral tunnel was made (Figure 4). The knee was flexed 70-90º, and then the tip of the tibial drill guide was placed into position through the anteromedial portal with the angle of drill guide set to 45 to 55 degrees. The drill sleeve was placed against the medial tibial cortex, and a guide wire was drilled into place emerging at the tibial plateau (Figure 5). A cannulated tibial reamer of the size as determined by the thickness of the harvested graft was used to make the tibial tunnel.

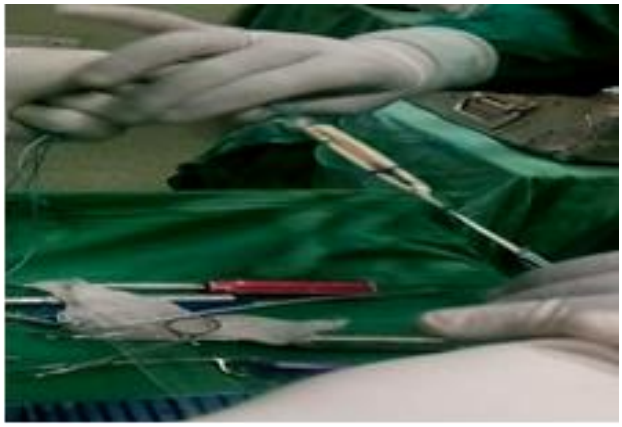

Figure 6: Marking on PLT graft.

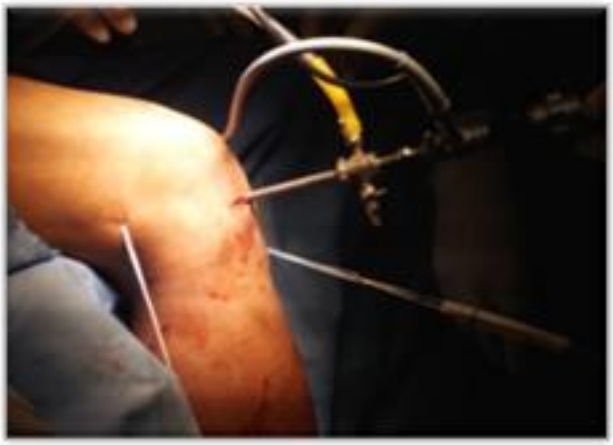

Figure 7: Railroading of PLT.

Appropriate markings were made on the triple layered graft (Figure 6) and was rail-roaded into the femoral tunnel through the tibial tunnel under arthroscopic guidance (Figure 7). The knee joint was taken though the full range of flexion and extension (cycling of the knee joint up to 20 times) to remove any kinks in the graft. Maximal traction was applied on the graft and guide wire was passed into the tibial tunnel over which biodegradable screw was tightened until achieving satisfactory purchase. Post-operative x-ray was done to ensure proper placement of the tunnels and the position of the trans-fixation device (Figure 8).

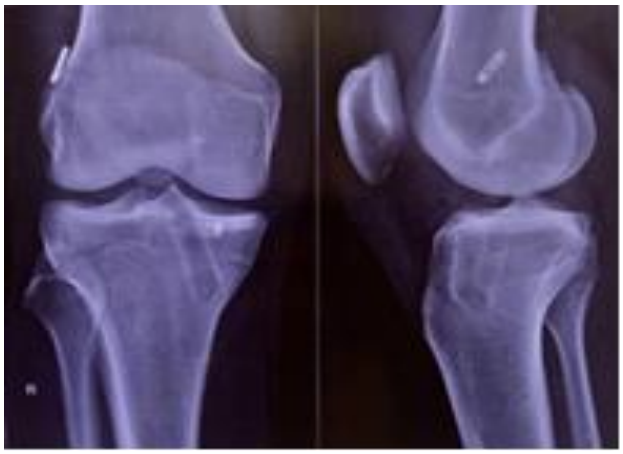

Figure 8: Post-op x-ray.

Follow up and assessment

Dressing was done on the fourth and eighth post-operative day. Patients were discharged after removal of sutures on the twelfth post-operative day. The following parameters were looked for: Suture line, swelling or effusion if any, surrounding skin and range of movement of knee and ankle. Knee brace was used till one month post operatively. Continuous passive motion was initiated on the first day itself. Extension exercises (passive extensions, heel props, prone hangs and active assisted extension), flexion exercises (passive flexion and wall slides), quadriceps exercise (isometric contractions and straight leg raises), hamstrings exercise (curls), ankle exercises (dorsiflexion and plantar flexion, passive toe movements, inversion and eversion movement), hip abduction, adduction and extension were also advised. The patient was discharged and asked to attend sports injury clinic at 1 month, 2 month, 3 month and 6 month postoperatively.

The following exercises were advised after discharge: partial squats, toe raises, stationary bicycling, wall slides, hand assisted heel drags and inclined leg-press machine. In the period between 1st and 3rd post-operative month, brace was discontinued. Tread mill was introduced (flat only). Leg curls, leg presses and outdoor bike riding on flat road was advised to the patient. After the third postoperative month, the following exercises were introduced: jogging, light running, leg raising with application of sand bags as counter weights, one and two leg jumping, swimming etc. Patient was allowed to return to sports only after 6 months of follow up.

RESULTS

Road traffic accident was the most common mode of injury in 44% (11 cases)in our case series followed by sport injury in 32% (8 cases) and fall from height in 24%

(6 cases). Knee effusion was present in 3 cases (12%) only and 40% cases had some wasting of the thigh at presentation.

We operated on 16 right and 9 left knee. Intra-operatively, only 10 patients had partial tear of the medial menisci of whom only 5 patients required partial meniscectomy. 20 patients had mid substance tear of ACL, 4 patients had ACL avulsion from tibial attachment site and 1 patient had avulsion from the femoral attachment site. The length of the peroneus longus graft harvested in our study ranged from 270-300 mm. The minimum length was 270 mm and maximum length was 300 mm. The mean length was 281 mm. The mean thickness of the tripled peroneus longus graft obtained in our study was 8.24 mm (Table 1). The maximum thickness of the graft was 9. 5 mm and minimum thickness was 7.5 mm. In 44% (11 cases) graft of 8 mm thickness was harvested. Only one patient required bony notchplasty. Microfracture was done in 1 patient due to osteochondritis dessicans. Tight rope RT was used as femoral graft fixation device and biodegradable screw was used on the tibial side.

Table 1: Thickness of PLT graft.

Thickness of graft (mm)	Number of patient	Percentage (%)
7.5	03	12
8.0	11	44
8.5	08	32
9.0	02	08
9.5	01	04

Table 2: Lachman test pre-op vs post-op.

Lachman test grade	Preoperative	Postoperative
Negative	03	18
1+	11	05
2+	10	01
3+	01	01

Table 3: Pivot shift test pre-op vs post-op.

Pivot shift	Preoperative	Postoperative
Negative	08	15
Positive	10	09
Gross	07	01

Stability of the knee was assessed using Lachman test which showed normal finding in 18 cases (72%), while 5 patients (20%) had 1+ laxity, 1 case had 2+ laxity and 1 patients had 3+ laxity (Table 2). Pivot shift was reported negative in 15 (60%) cases, positive glide in 9 cases (36%) and gross pivot shift was reported in 1 patient (Table 3). The results in our study was assessed by IKDC criteria at the end of 6 months.[6] According to the IKDC, 21 cases were rated as normal or nearly normal (84%) and 4 cases (16%) cases were rated as abnormal or severely abnormal (Figure 9). The mean IKDC score was 83.53.

There was no flexion or extension loss at the end of 6 months of follow up. In our study we found that the ankle functions were grossly preserved in almost all the patients which was elucidated by grading the power of the muscles of the foot particularly the eversion movement on a scale of five and comparing it with the normal ankle.

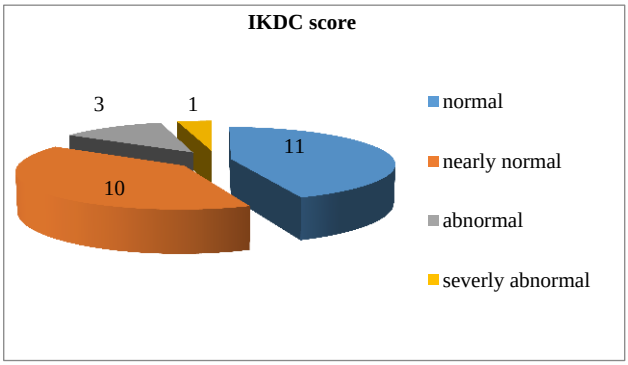

Figure 9: IKDC at 6 months of follow up.

Complications

One patient developed stiffness of the knee joint which was mobilized under general anesthesia 10 days post-operatively. Haemarthosis was reported in one patient who underwent arthroscopic lavage at 3 weeks after reconstruction of ACL. Blood investigation revealed factor X deficiency but was managed conservatively. Re-rupture occurred in one patient probably due to re-injury which was confirmed both clinically and on MRI.

DISCUSSION

ACL has been realized to have an important role in maintaining the stability of the knee along with the other ligaments. Its rupture most commonly occurs during sports injuries or during road traffic accidents.[7] Forceful valgus-external rotation is the most common mechanism of injury.

ACL reconstruction is a commonly performed procedure. However, bone-patellar tendon-bone complex, hamstring tendon autografts, and allografts are commonly used as the graft sources, which graft is the most suitable has still been controversial. The BPTB graft is considered as a gold standard for ACL reconstruction because of its strength, consistency of the size of the graft, ease of harvesting and most importantly because of bone to bone healing within the tibial and femoral tunnel.[8] Complications of bone patella tendon bone graft include patellar tendon rupture, patellar/tibial fracture, quadriceps weakness, loss of full extension, anterior knee pain, difficulty in kneeling and numbness due to injury to the infra-patellar branch of saphenous nerve. Hence it is to be

avoided in patients whose occupation or lifestyle requires frequent kneeling.[9]

The hamstring tendon grafts have greater mechanical strength than a bone-patellar tendon-bone graft.[10] Patients treated with hamstring tendon grafts are less likely to suffer patella-femoral pain and extension loss. Using the hamstring tendon can cause a significant change in hamstring muscle strength. Hamstring function is very important after ACL reconstruction in order to protect the reconstructed ACL from anterior drawer force, which is exerted by quadriceps contraction.[11]

The advantages of the allograft are shorter operation and anaesthetic time and good cosmetic results, however high costs, delayed corporation, disease transmission and immunological reaction have limited their use.[12] The enthusiasm surrounding the introduction of synthetic graft materials stemmed from their lack of donor morbidity, their abundant supply and significant strength of these devices.[13] Several artificial biomaterials are available like Carbon, Dacron, polyester and polypropylene etc. Disadvantages are early breakage and tendency to elongate (wear and tear), deposition of carbon, inflammatory synovitis, cross-infections, immunological responses, tunnels osteolysis, femural and tibial fractures, foreign-body synovitis and knee osteoarthritis.

For these reasons we used the peroneus longus (PLT) in ACL reconstruction in our patients. Biomechanically, PLT is as strong as native ACL. The maximum tensile load of the native ACL is 1725N and the maximum tensile load of single strand PLT in the study by Kerimoglu et al was 1950N. The mean thickness of the graft obtained in our study was 8.24 mm which was way far satisfactory than the thickness obtained in most of the hamstring grafts. There was no extension or flexion loss in our patients. Furthermore, no patella-femoral pain was reported by our patients. The results of our study was better than that done by Kerimoglu et al and Angthong et al with better IKDC score. There was no ankle dysfunction related to graft harvest, pressure pain could be elicited in only 2 patients. Cao also found the peroneus longus a good substitute of anterior cruciate ligament reconstruction and its resection has no major influence for ankle joint.[14]

The limitation of our study was that the assessment of the ankle function was done by grading of muscle power. Newer devices (arthrometres) which measure ankle functions objectively were not used. Single bundle reconstruction was done but now the focus is shifting towards anatomical double bundle reconstruction which is thought to be more physiologic and stable.[15] Although the results are very encouraging, a longer follow up are required to further establish these observation and results conclusively.

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Conflict of interest: None declared
Ethical approval: The study was approved by the institutional ethics committee

REFERENCES

1. Freeman JW, Kwansa AL. Recent Advancements in Ligament Tissue Engineering: The Use of Various Techniques and Materials for ACL Repair. Recent Patents Biomed Engineering. 2008;1:18-23.
2. Kerimoğlu S, Aynaci O, Saraçoğlu M, Aydin H, Turhan AU. Anterior cruciate ligament reconstruction with the peroneus longustendon. Actaorthoptraumatol Turc. 2008;42(1):38-43.
3. Nazem K, Barzegar M, Hosseini A, Karimi M. can we use peroneus longus tendon in addition to hamstring tendons for anterior cruciate ligament reconstruction. Adv Biomed Res. 2014;3:115.
4. Angthong C, Chernchujit B, Apivatgaroon A, Chaijenkit K, Nualon P, Suchao-in K. ACL reconstruction with peronuslongustendon: Abiomechanical and clinical evaluation of donor ankle morbidity. J Med Assoc Thai. 2015;98:6.
5. Zhao J, Huangfu X. The biomechanical and clinical application of using the anterior half of the peroneus longus tendon as an autograft source. Am J Sports Med. 2012;40(3):662-71.
6. Hefti F, Muller W, Jakob RP, Staubli HU. Evaluation of knee ligament injuries with the IKDC form. Knee Surg Sports TraumatolArthrosc 1993;34(1):226-34.
7. Gordon MD, Steiner ME: Anterior cruciate ligament injuries: Orthopaedic Knowledge Update Sports Medicine III, Garrick JG (Ed), American Academy of Orthopaedic Surgeons, Rosemont; 2004: 169.
8. Hospodar SJ, Miller MD: Controversies in ACL reconstruction: bone patellar tendon-bone anterior cruciate ligament reconstruction remains gold standard. Sports Med Arthrosc. 2009;17(4):242-6.
9. Poehling-Monaghan KL, Salem H, Ross KE, Secrist E, Ciccotti MC, et al. Long-Term Outcomes in Anterior Cruciate Ligament Reconstruction: A Systematic Review of Patellar Tendon Versus Hamstring Autografts. Orthop J Sports Med. 2017;5(6):2325967117709735.
10. Chee MY, Chen Y, Pearce CJ, Murphy DP, Krishna L, Hui JH, et al. Outcome of Patellar Tendon Versus 4-Strand Hamstring Tendon Autografts for Anterior Cruciate Ligament Reconstruction: A Systematic Review and Meta-analysis of Prospective Randomized Trials. Arthroscopy. 2017;33(2):450-63.
11. Kartus J, Movin T, Karlsson J. Donor-site morbidity and anterior knee problems after anterior cruciate ligament reconstruction using autografts. Arthroscopy. 2001;17:971-80.
12. Shelton WR, Papendick L, Dukes AD. Autograft versus allograft anterior cruciate ligament reconstruction. Arthroscopy. 1997;13:446-9.

13. Batty LM, Norsworthy CJ, Lash NJ, Wasiak J, Richmond AK, Feller JA. Synthetic devices for reconstructive surgery of the cruciate ligaments: a systematic review. Arthroscopy. 2015;31(5):957-68.
14. Cao HB, Liang J, Xin JY. Treatment of anterior cruciate ligament injury with peroneus longus tendon. Zhonghua Yi Xue Za Zhi. 2012;92(35):2460-2.
15. Mayr HO, Benecke P, Hoell A, Schmitt-Sody M, Bernstein A, Suedkamp NP, et al. Single-Bundle Versus Double-Bundle Anterior Cruciate Ligament Reconstruction: A Comparative 2-Year Follow-up. Arthroscopy. 2016;32(1):34-42.

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