SHORT COMMUNICATION

The PUTRA Press-fit System as An Alternative Femoral Fixation Technique for Posterior Cruciate Ligament Reconstruction – *A Technical Note and Outcome Evaluation*

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ABSTRACT

We describe our technique of single-bundle PCL reconstruction using a bony femoral press-fit system. 9 patients underwent PCL reconstruction using our pressfit system. The surgical procedure is described in detail. Post-operatively, 5 patients were available for assessment and review. Four patients gave a final Lysholm score of 92 – 100%. Three patients gave a Hospital for Special Surgery (HSS) score of excellent, one fair and one poor. Two patients gave a reduced Tegner activity score post-operatively while the other three gave a similar score post-operatively. Assessment using KT-1000 revealed four patients with a side-to-side difference of less than 3 mm (average side-to-side difference, 1.87 mm), while one patient exhibited a side-to-side difference of 5.8 mm. We believe that our technique enhances tunnel healing through usage of a bone-plug fixation and provides a cheap alternative for graft fixation on the femoral side in PCL reconstruction.

Keywords: PCL reconstruction, Graft fixation, Press-fit, Treatment outcome, Technical note

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INTRODUCTION

Over the years, there are variation in graft choices and techniques of fixation in posterior cruciate ligament (PCL) reconstruction. To date, no technique of PCL graft fixation has been proven to be superior to others with regards to initial fixation strength and long-term outcome. Hence, development and usage of new and enhanced technique of fixation on both sides of the knee joint have continued to evolve. Graft fixations in PCL reconstruction have been performed using biointereference screws (1), fixed button-loops (2), adjustable loops (3), aperture fixation device (4), hybrid fixation (5) and femoral cross-pins (6). Press-fit graft fixation on the femoral side for anterior cruciate ligament reconstruction has been described by Malek et al. in 1996 (7). Chuang et al. in 2011 published their technique and results in PCL reconstruction using periosteum-enhanced tendon-knot/pressfit method (8). Ettinger et al. biomechanically tested a tibial PCL press-fit (both the knot and bony variants) construct and found out that the press-fit method is a good alternative to fixation of the PCL graft on the tibial side (9). Press-fit technique for PCL reconstruction was published by Malek and Fanelli in 1993 but the technique was not described in detail (10).

We describe our surgical technique of single-bundle PCL reconstruction using a bony femoral press-fit system. We believe that this technique, named as the 'PUTRA Pressfit System', may enhance tunnel healing through usage of a bone-plug fixation and provide a cheap alternative for graft fixation on the femoral side in PCL reconstruction.

MATERIALS AND METHODS

Consent was obtained from patients for the purpose of this study. Medical records of 9 patients with Grade 3 PCL tear operated using this technique in Serdang Hospital from December 2013 to March 2015 were reviewed. Five patients were available for further postoperative assessment and included in the study. All of these patients were involved in multiligament reconstruction surgeries where more than one ligaments were replaced. Post-operative evaluation ranged from 15 to 30 months (mean, 22). All the patients were male and the mean age was 32 years old (range, 20 to 48 years). All were involved in motor-vehicle accidents. The diagnosis was confirmed by clinical examination and magnetic resonance imaging. Outcome assessments were done by Lysholm (11), Tegner (12) and Hospital for Special Surgery (HSS) (13) scores.

Surgical Technique

We utilized either an Achilles tendon allograft (usually in multi-ligament reconstruction) or a harvested quadriceps tendon autograft with an attached patellar bone plug (for isolated PCL reconstruction). The tendinous portion of the graft was fashioned to a minimum of size 10 mm in diameter with its end stitched to a pull-through suture (non- absorbable; No. 2 or 5) while the bone plug was trimmed to an 11 mm diameter and 25 mm in length (Figure 1). Standard arthroscopic (anterolateral, anteromedial and an accessory posteromedial) portals were utilized. While viewing through the anterolateral portal, the remnant of the native PCL is removed from its femoral attachment sparingly using a shaver or ablator. The remaining fibres of the PCL was elevated from its tibial attachment using a right-angled liberator inserted through the anteromedial portal, with the arthroscope inserted through an accessory posteromedial portal to better visualise the proximal part of the posterior tibia. The remaining PCL fibres which was elevated (not removed) would act as a cushion or buffer to protect the posterior capsule and the vessels behind it against over-insertion of guide-wires or against reaming effects of the PCL tibial tunnel. The tibial tunnel was created first. After insertion of the guide wire over the footprint area of the PCL on the proximal tibia at 60 degrees angle to the horizontal plane of the tibia (with the tip of the guide wire placed 14 mm from the level of the tibial plateau), the tibial tunnel was reamed using a 10 mm cannulated reamer. Care was taken to maintain the knee in 90-degrees flexion and to protect the posterior capsule against over-reaming using the right-angled liberator throughout this process. Next, the femoral tunnel was reamed from outside-in to size 10 mm at 11 o'clock position (left knee) or 1 o'clock position (right knee), with the guide wire placed 6 mm from the chondral margin of the medial femoral condyle. With the guide wire still held within the femoral tunnel using a straight Kocher's forceps, the outer 20 mm length of the femoral tunnel was then over-reamed to 11 mm, leaving a bottle-neck of about 10 mm or more at the inner portion of the femoral tunnel (Figure 2). A relaying suture (Ethibond

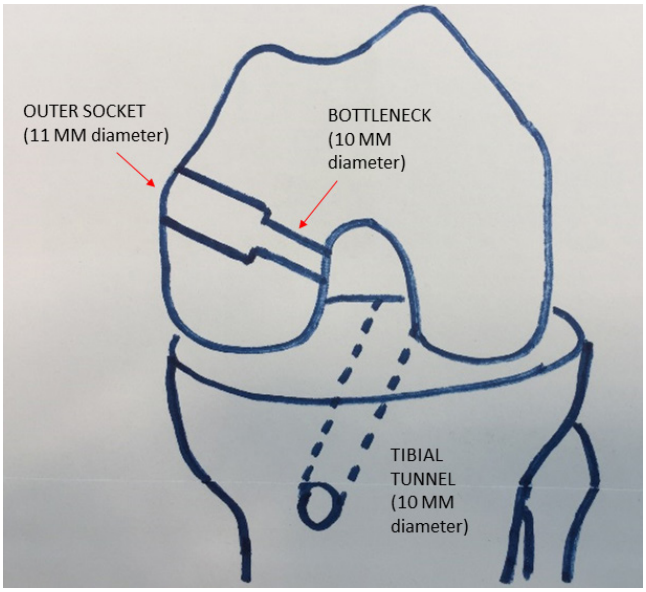

Figure 2: Schematic illustration of the tunnel preparation and creation of the bottleneck

No 5) was then passed through the tibial tunnel using a beath-pin and its loop-end pulled into the knee joint aided by viewing through the posteromedial portal. The loop-end was then retrieved through the femoral tunnel and pulled out of the skin incision on the anteromedial aspect of the knee. Using this relay suture, the pull-through suture on the PCL graft's tendinous end was then passed into the femoral tunnel, the knee joint and subsequently through the tibial tunnel and out of the distal opening of the tibial tunnel. The PCL graft was then passed from proximal to distal, with the tendon portion leading the passage until the 11-mm sized bony end is press-fitted into the 11-mm-reamed femoral tunnel, and gently impacted into the tunnel until the bone plug is seated nicely in the socket against the bottleneck area (Figure 3). After checking for graft impingement, the tibial side of the graft (tendinous portion) was fixed using a bio-interference screw, which was inserted far up as close as possible to the tibial tunnel's proximal opening (with an anterior drawer force applied to the knee, in 70 degrees flexion) and supplementary tibial fixation was

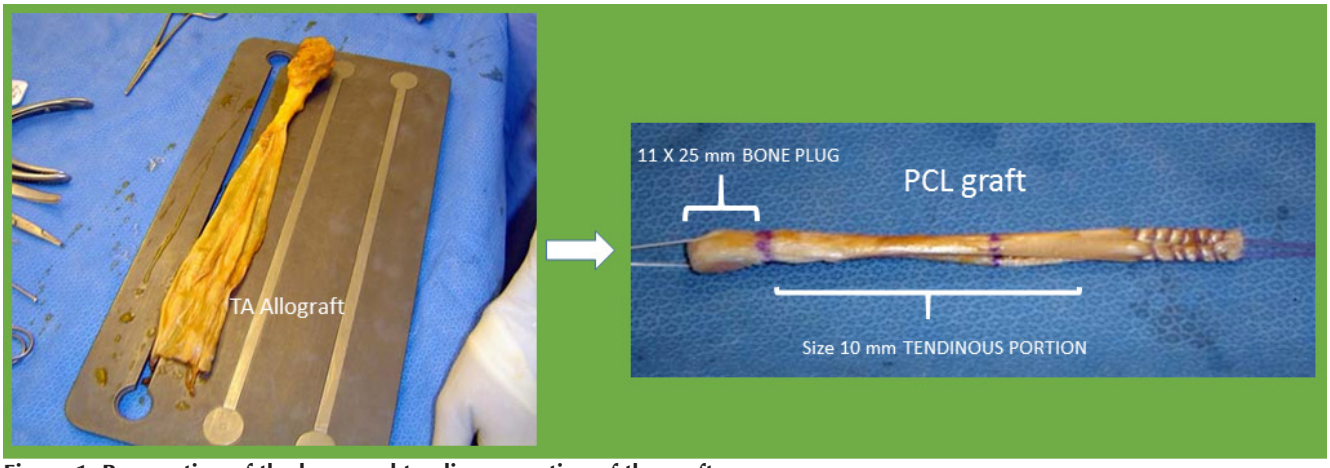

Figure 1: Preparation of the bony and tendinous portion of the graft

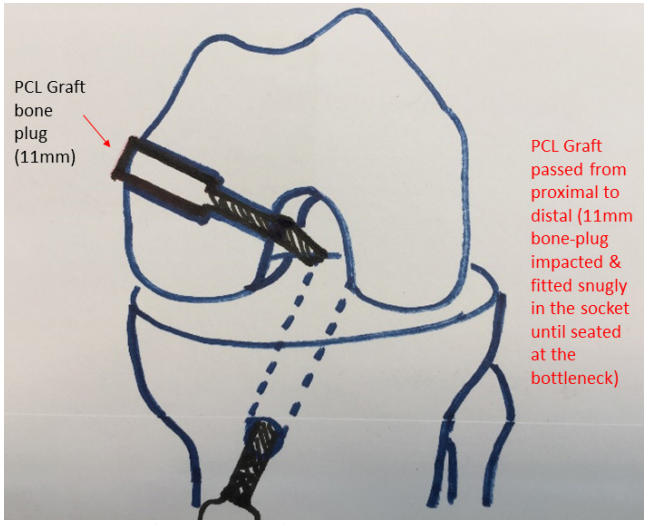

Figure 3: Final seating of the impacted graft

done using a ligament staple inserted below the tibial tunnel's distal opening.

Post-operatively the knee was put in a plaster backslab at 30 degrees flexion, with a folded blanket attached posteriorly to provide support for the proximal tibia against gravity pull and minimise the strain on the PCL graft. At 3 days post-operative period, after the wounds had been inspected and dressed, the knee was put in a cylinder cast which was allowed to set while applying anterior drawer force to the knee. A home-based, individually-tailored rehabilitation program was initiated at this point under the supervision of a sports physician at our centre. The cast was removed at 2 weeks post-operative period after which the sutures were taken off. At this point, the knee was further protected using a Donjoy® Legend brace (DJO UK Ltd). Partial weight-bearing and motion exercises were allowed at 6 weeks post-operative period. Full sports and unrestricted activities were employed at nine to twelve months post-operatively, depending on the patient's progress.

RESULTS AND DISCUSSION

Table I summarized the results of the 5 patients included in this study. Only for patient #3 the PCL was reconstructed using a quadriceps autograft, the rest were all operated using Tendo Achilles (TA) allografts. Four patients gave a final Lysholm score of 92 – 100%. Three patients gave a Hospital for Special Surgery (HSS) score of excellent, one fair and one poor. The patient who scored poorly had surgery done to three ligaments in his knee (anterior cruciate ligament, ACL; PCL and posterolateral corner, PLC). Assessment using KT-1000 revealed four patients with a side-to-side difference of less than 3 mm (average side-to-side difference, 1.87 mm), while one patient exhibited a side-to-side difference of 5.8 mm. Two patients gave a reduced Tegner activity score post-operatively while the other three gave a similar score post-operatively.

Table I : Post-operative Lysholm, Tegner and HSS scores including KT-1000 readings

Patient (Injured Ligaments)	Lysholm score	Tegner score (pre-/ post-)	HSS score	KT 1000 (PCL) Side-to-side difference (mm)
#1 (PCL/PLC)	92	7/7	68 (Fair)	1.5
#2 (PCL/PLC)	100	6/6	100 (Excellent)	3
#3 (ACL/PCL	99	4/4	85.75 (Excellent)	2.2
#4 (ACL/PCL)	100	7/5	100 (Excellent)	0.8
#5 (ACL/PCL/ PLC)	66	4/1	59 (Poor)	5.8

Out of the 5 patients operated, one patient was observed to have a complication postoperatively. This patient presented at one-year post-operative period with a subcutaneous swelling overlying the outer femoral tunnel aperture which caused minor discomfort during his daily activities. It was initially thought to be related to a prominent bone plug end. Subsequent surgery performed to trim the 'prominent plug' however revealed that the swelling was in fact a benign cyst which was resected without any further sequalae.

PCL reconstructive surgery continues to pose challenges to surgeons as the ideal procedure that fully and sustainably restores posterior stability in the knee is still lacking (8). Although femoral fixation is only a part of this procedure, the search for the most ideal femoral fixation system is essential to maximise the initial fixation strength and help prevent residual laxity. Other authors have described and reported variable outcome with their femoral fixation techniques (1-6). Chuang et al. reported their outcome in 29 patients who underwent PCL reconstruction using a periosteal-enveloped tendon knot femoral pressfit system (8). At a minimum 2-year follow-up, 89.7% of their patients gave an International Knee Documentation Criteria (IKDC) score of normal to near-normal. Only one (3.5%) of their patients was reported to have graft failure presenting with persistent pain and instability during daily activity and confirmed by MRI examination. However, it was not mentioned if the failure occurred at the femoral fixation site (8). Ettinger et al. investigated the strength of pressfit system on the tibial side, comparing quadriceps tendon bony pressfit, hamstring tendon-knot pressfit and hamstring interference screw fixation systems (9). They found out that both bony and soft-tissue pressfit systems were comparable to the interference hardware system with regards to maximum failure loads in their biomechanical tests. Niedwietzki et al. found out that hybrid fixation (suspensory extra-cortical system plus interference screw near the femoral tunnel aperture) was superior structurally to extra-cortical fixation alone

(5). Our method, mimicking aperture fixation through bone-plug pressfitted within the femoral tunnel, offers the same superior construct and advantage.

Our results showed an almost similar outcome with other studies, with post-operative Lysholm score of excellent in 80% and post-operative Tegner activity level of 4 or more also in 80% of our patients (14,15). Objective outcome assessment using the KT-1000 is also encouraging with 80% of knees exhibiting side-to-side difference of normal to near normal (14). Our surgical technique using the bony pressfit femoral fixation system may offer some advantages. Firstly, the bone plug can provide bone-to-bone healing which is desirable to enhance graft healing in ligament reconstruction. Secondly, this technique of femoral graft fixation can avoid utilization of biointeference screw or other types of femoral implant to fix the femoral side, thereby reducing the cost of surgery. It is therefore useful especially in those cases where the PCL reconstruction is part of a multiligament surgery where the cost can be exuberant. The pressfit system can also provide a 'waterproofing' of bone tunnels, resulting in less post-operative bleeding and swelling (16). Our surgical technique mimicked an aperture fixation of the PCL graft through bone-plug pressfitted within the femoral tunnel. Previous study has shown that the addition of an aperture femoral fixation of the graft was superior structurally compared to extra-cortical fixation alone (5).

The pressfit surgical technique is not without complications and limitations as illustrated in our study by the development of a pseudo-cyst at the femoral fixation. The size of the outer tunnel for the plug may also pose a problem especially if a double-bundle PCL reconstruction is to be performed. This 'overcrowding' in the medial femoral condyle can be overcome by diverging the tunnels and also by using a smaller bone plug for double-bundle reconstruction. Another limitation in this series is the small number of patients available for post-operative evaluation, with around 44% drop-out rate (4/9). Further evaluation of the outcome using bigger sample size is therefore required. The fact that these cases were heterogeneous in terms of the number of ligaments reconstructed also limits the value of this series. Nevertheless, the technique described would be of significant benefit to others.

CONCLUSION

We believe the PUTRA Pressfit System is a good alternative for femoral fixation technique in PCL reconstructive surgery by enhancing tunnel healing and also providing a cheap alternative for graft fixation.

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