Original Research Article

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Push back and pull down to socket manoeuvre – a simple and effective technique to engage graft into the tibial socket in all inside anterior cruciate ligament reconstruction

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ABSTRACT

Background: All-inside Anterior cruciate ligament Reconstruction technique is newer technique that has advantages of preservation of cortical bone. The potential for peripatellar soft tissue to become interposed between the bone and the graft has been a significant issue in the technique. Early necrosis of any interposed tissue can compromise the strength of fixation button. Our technique of pushback and pull down to socket manoeuvre avoids this interposition and entanglement. This study was done to know the efficacy of pushback and pull down to socket manoeuvre.
Methods: In our study, 298 cases fulfilling the criteria undergone All inside anterior cruciate ligament reconstruction with push back and pull down to socket manoeuvre and corresponding radiological and functional outcomes were assessed using International Knee Documentation Committee (IKDC) score.
Results: In our study, the mean IKDC score is 83 at 1 year follow-up. There is no radiological widening of both femoral and tibial tunnel during follow up. There is considerable reduction of time for passing graft into the tibial socket. No episodes of entanglement happened in any case during surgery and the success rate was 100 percent.
Conclusions: Push back and pull down to socket manoeuvre is a simple and fail proof technique to avoid peri patellar soft tissue entanglement while managing the engagement of graft into the tibial socket. This technique also helps to save time, improves surgeons comfort.

Keywords: All-inside anterior cruciate ligament reconstruction, Push back and pull down to socket manoeuvre, Soft tissue interposition, Entanglement, Tunnel widening

INTRODUCTION

Reconstruction of the anterior cruciate ligament is among the most frequently conducted operations in orthopaedic surgery. Through the years, various advancements in surgical techniques and equipment's have been introduced to merge anatomical anterior cruciate ligament reconstruction with minimally invasive methods, aiming to minimize bone loss, bleeding, and discomfort while promoting a quicker rehabilitation process. Among the various Anterior cruciate ligament reconstruction methods, the all-inside technique introduced by Morgan et al and later enhanced by Lubowitz et al is becoming increasingly popular due to its adherence to optimal anatomical socket positioning, reduced postoperative pain and swelling, minimal invasiveness of hardware, improved control of graft tension, and preservation of cortical bone.[1-4] All inside anterior cruciate ligament reconstruction technique involves the tensioning of semitendinosus graft or quadriceps or a peroneus longus tendon graft with optimal tightness, utilizing adjustable loop suspensory device with cortical button, which is secured into bone half-tunnels (femoral and tibial sockets) prepared using retrograde drills (Figure 1 a and b).[2,4]

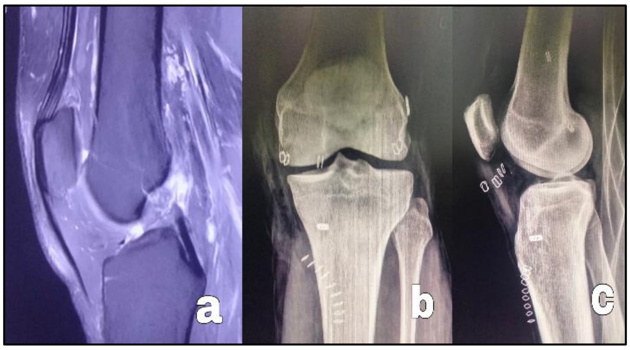

Figure 1: (a) Preoperative MRI of a patient showing anterior cruciate ligament tear, (b) postoperative anterioposterior view x ray after all inside anterior cruciate ligament reconstruction and (c) postoperative lateral view x ray after all inside anterior cruciate ligament reconstruction.

Since the advent of suspensory devices in anterior cruciate ligament reconstruction, the potential for soft tissue to become interposed between the bone and the graft has been a significant issue.[5] The soft tissues around the patella (peripatellar soft tissue) can get trapped while trying to manoeuvre the harvested tendon into the tibial socket after securing the femoral tunnel. Early necrosis of any interposed tissue can compromise the strength of the fixation button.[6] The ensuing loss of graft tension and persistent movement between the graft and tunnel can adversely affect the healing process, resulting in a failure of the reconstruction.[7-10] Suspensory devices feature an adjustable loop that accommodates all sizes of tunnels, making the creation of an additional socket (6-10 mm) for button flipping unnecessary.[2-11] Nevertheless, the chance of soft tissue interposition increases with the use of an Adjustable loop suspensory device because there is no side-trailing suture for flipping and it features a longer loop in comparison to a fixed-length loop device.[11,12] Another reason for soft tissue interposition is that suspensory device acquires a non-linear travel rather oblique travel. Numerous research efforts have warned about the negative effects that may arise from the interposition of soft tissue caused by suspensory devices, yet they do not propose any specific clinical results and therapeutic remedies.[6,11-13]

Our technique "push back and pull down to socket manoeuvre" of grasping and pushing the tip of the graft straight back into the posterior area of medial semilunar cartilage and pulling it into the tibial socket, avoided peri patellar soft tissues. It creates a linear path to tibial socket trajectory with no soft tissues.

The objective of our study is to know the efficiency of "push back and pull down to socket manoeuvre" technique to avoid unnecessary entanglement of peri patellar soft tissues while passing graft into the tibial socket. In this long-term study of 298 cases, we standardized and followed this technique in every case of All inside Anterior cruciate ligament reconstruction done.

METHODS

This single institution based Prospective study was conducted during the period June 2020 to June 2024 among the patients who underwent arthroscopic primary All inside Anterior cruciate ligament reconstruction in the Department of Orthopaedics, Starcare Hospital, Kozhikode, Kerala. The study was approved by Institutional ethical committee. Out of 298 cases studied, Semitendinosus Autografts were used in 269 cases, and ipsilateral Peroneus Longus autografts in the rest. Patients enrolled in this study followed up for at least 12 months. Patient aged less than 60 years, Mult ligamentous injury are included in this study. Patients with Kellgren-Lawrence stage >2 osteoarthritis, revision Anterior cruciate ligament reconstruction and reinjury after Anterior cruciate ligament reconstruction were excluded from this study. All patients studied after obtaining an informed consent form. We used an adjustable loop suspensory device with a cortical button for the surgery.

Surgical technique

Graft harvest and preparation

An incision measuring 5 cm is created 8 cm below the inferior pole of the patella on the medial aspect of the tibia. The semitendinosus tendon is located, held with a clamp, and secured using a non-absorbable suture. The tendon is then dissected sharply in the proximal direction and stripped using a tendon stripper instrument. The harvested graft is either quadrupled into 6.9 cm length with average thickness of 9-11 mm depending on the graft. The graft is subsequently attached to an adjustable loop suspensory device with a cortical button at both ends and made ready for use (Figure 2). Pretensioning was given in graft master board and wrapped with gauze soaked with antibiotic (Vancomycin).

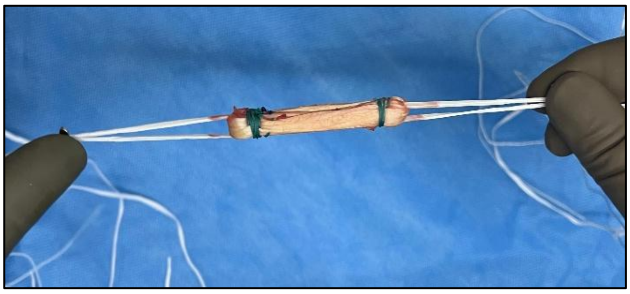

Figure 2: Graft preparation.

Arthroscopic tunnel preparation and graft passage

The surgeon carries out a routine diagnostic arthroscopy and prepares the knee joint using standard anteromedial, accessory anteromedial and anterolateral arthroscopic entry points. Both the femoral and tibial sockets were shaped in anatomical positions to ensure the postoperative isometric behaviour of the graft. The location for the femoral tunnel was identified at the resident's ridge. The femoral socket is drilled using a diamond-tipped guide wire in an antegrade manner and subsequently reamed in the same direction with the appropriately sized reamer. A non-absorbable thread is threaded through the socket and secured from the accessory anteromedial portal. The location for the tibial tunnel is marked with respect to the anterior horn of the lateral meniscus. The tibial socket is drilled in an antegrade manner with a guide wire using the tibial guide and reamed in a retrograde fashion using a retrograde cutting reamer of the suitable size (Figure 3 a).

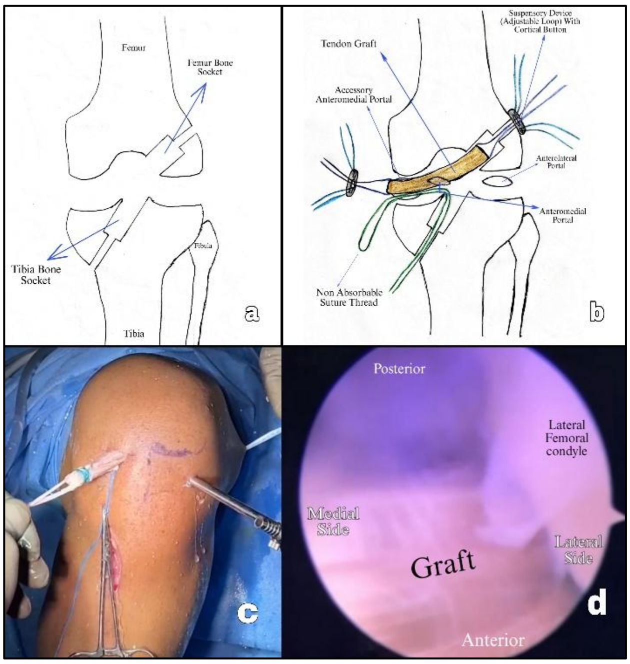

Figure 3: (a) Diagrammatic representation of front view of femur and tibial socket, (b) diagrammatic representation of front view of passing the graft into the femoral socket, (c) intraoperative clinical picture of front view of passing the graft into the femoral socket and(d) arthroscopic picture of passing graft into the femoral socket.

A non-absorbable thread is then passed through this socket, again docking out from the accessory anteromedial portal. Each socket is designed to be a length as per available graft length. Both non absorbable threads are retrieved and docked out of the accessory anteromedial portal, with the surgeon ensuring there is no soft-tissue bridge between the two sutures. The adjustable loop thread of the suspensory device is marked corresponding to femoral socket and endo-tunnel to confirm flipping and engagement of the graft. The graft's femoral side is passed into the Femoral socket utilizing the non-absorbable thread (Figure 3 b-d). While visually monitoring the process arthroscopically from the anteromedial portal, the cortical button is flipped. The view is then shifted back to the anterolateral portal to advance the graft further into the femoral socket.

Push back and pull down to socket manoeuvre

The sutures on the tibial side of the graft are passed using the non-absorbable thread (Figure 4 a and b). By our Push back and Pull down to socket manoeuvre, an artery forceps was the instrument used to grasp the tip of the graft and pushing the tip of the graft straight back into the posterior area of medial semilunar cartilage in posteromedial zone (Figure 5 a and b) (Figure 6 a-e). Attached fibre wires of the adjustable loop with cortical button managed to pull and engage the graft into the tibial socket (Figure 7 a-c) (Figure 8 a and b). The cortical button is flipped while the surgeon is viewing arthroscopically from the anteromedial portal.

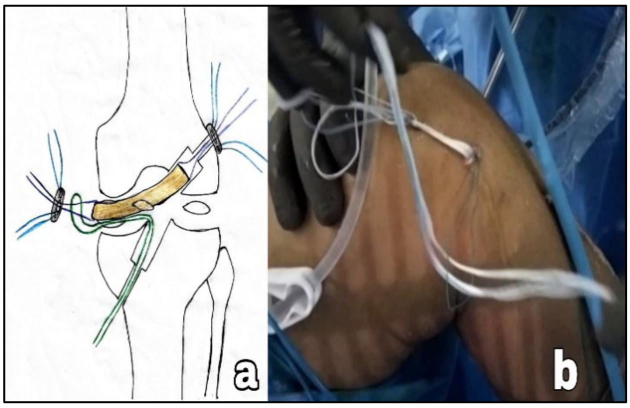

Figure 4: (a) Diagrammatic representation of front view of loading the graft into the loop of non-absorbable suture thread and (b) intraoperative clinical picture of side view of loading the graft into the loop of non-absorbable suture thread.

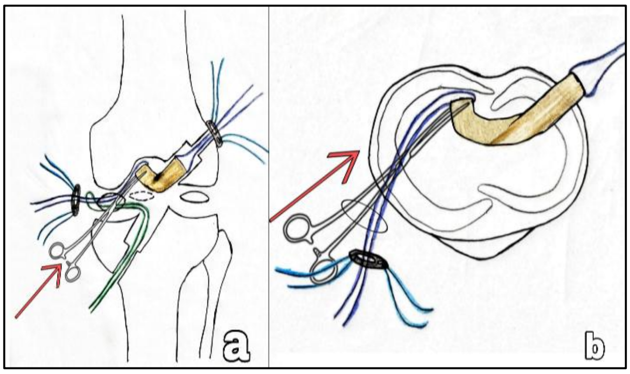

Figure 5: (a) Diagrammatic representation of front view of push back manoeuvre of the graft into the posteromedial zone of posterior area of medial semi lunar cartilage area (red arrow represents the direction of push back manoeuvre), b) diagrammatic representation of axial view of push back manoeuvre of the graft into the posteromedial zone of posterior area of medial semi lunar cartilage area (red arrow represents the direction of push back manoeuvre).

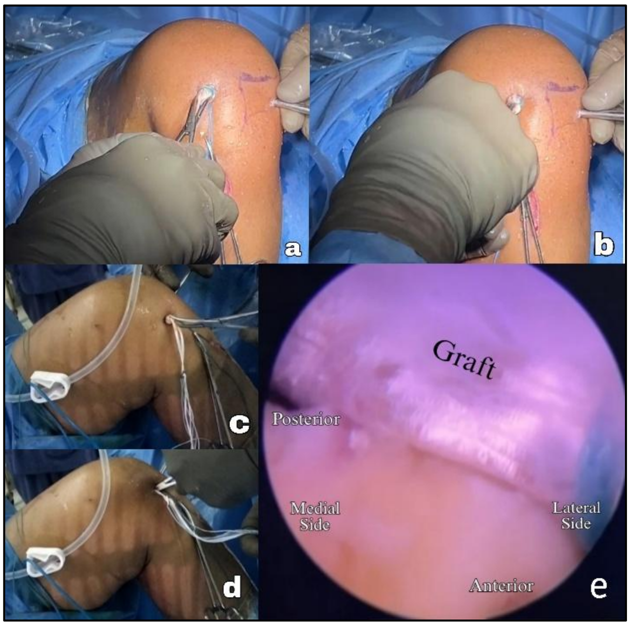

Figure 6: (a) Intraoperative clinical picture front view before push back manoeuvre, (b) intraoperative clinical picture front view after push back manoeuvre, c) intraoperative clinical picture side view before push back manoeuvre, d) intraoperative clinical picture side view area after push back manoeuvre and e) arthroscopic picture of push back manoeuvre of the graft into the posteromedial zone of posterior area of medial semi lunar cartilage area. Note the position of graft in posteromedial zone after push back manoeuvre.

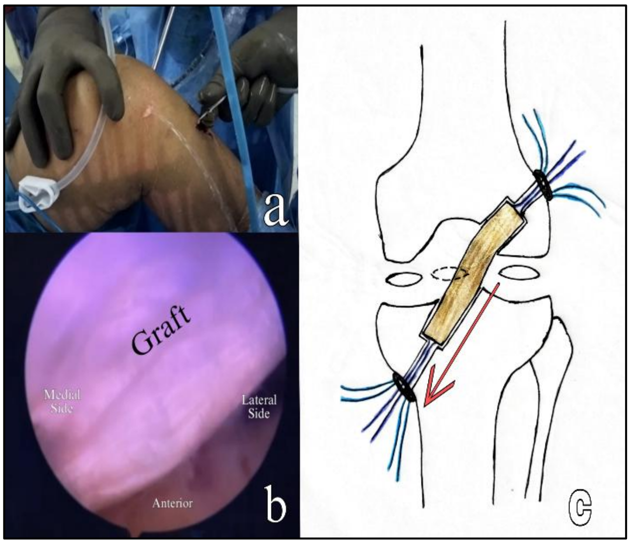

Figure 7: (a) Intraoperative clinical picture of side view of pull down to socket manoeuvre of the graft into the tibial tunnel, (b) arthroscopic picture of pull down to socket manoeuvre of the graft into the tibial tunnel, (c) diagrammatic representation of front view of pull down to socket manoeuvre of the graft into the tibial tunnel (red arrow represents the direction of pull down to socket manoeuvre).

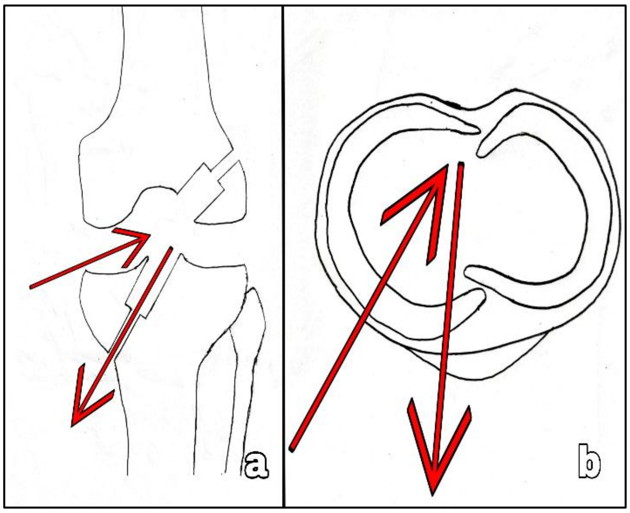

Figure 8: (a) Diagrammatic representation of trajectory of graft into the tibial socket in push back and pull down to socket manoeuvre of graft in frontal view and (b) diagrammatic representation of trajectory of graft into the tibial socket in push back and pull down to socket manoeuvre of graft in axial view (red arrow represents the trajectory).

Graft tensioning

The surgeon adjusts the graft tension in the knee while doing posterior drawer manoeuvre, observing arthroscopically to ensure that both ends of the graft are securely positioned and tensioned according to the previously marked points. The knee can be cycled, and the tension on the graft can be adjusted again if needed. The knee is then assessed. Intraoperative fluoroscopy may be utilized if there is uncertainty about the placement of the buttons on the bone. The passing sutures are trimmed and taken out and the suspensory device sutures are secured. The site of the incision is closed in layers.

Postoperative period and follow up

Post-operative X-rays were taken immediately to assess the placement of the cortical button and the alignment of the tunnel. Patients who had either isolated anterior cruciate ligament reconstruction or a procedure that included meniscectomy were allowed to perform a full range of motion exercises and bear full weight starting the day after surgery. "Patients who had either isolated anterior cruciate ligament reconstruction or a procedure that included meniscectomy were allowed to perform range of motion exercises and bear full weight starting the day after surgery. Patients who underwent meniscal repair were restricted to non-weight bearing activities until six weeks after surgery. Standard physiotherapy for anterior cruciate ligament reconstruction began gradually from the first day and continued until six months post-surgery. Each patient was followed up until 12 months after the operation. Functional outcomes were assessed using the International Knee Documentation Committee (IKDC) score. The demographic information collected and the study protocol received approval from the institutional review board. Data were collected using Excel 2007 (Microsoft), and the results were analysed with SPSS software.

RESULTS

In our study out of 298 individuals, 248 patients are male and the remaining is female. The average age of patients who underwent Anterior cruciate ligament reconstruction is 26 years. The average graft dimensions were 72 mm in length and 9.5 mm in diameter. Mean tibial socket length was 18 mm and Femoral was 24 mm. The mean IKDC score is 83 at 1 year follow-up. There is no widening of both femoral and tibial tunnel in AP and lateral radiograph during follow up. There is considerable reduction of time for passing graft into the tibial socket with more confidence. No episodes of entanglement happened in surgery during the study time and the success rate was 100 percent (Table 1).

Table 1: Study outcome.

Variable	Frequency	Percentage
Age (mean) in years	26	
Gender (number of people)		
Male	248	83.22
Female	50	16.77
Graft dimension		
Length	72 mm	
Diameter	9.5 mm	
Mean tibial socket length	18 mm	
Mean femoral socket length	24 mm	
Mean IKDC score	83	
Percentage of entanglement free passage of graft	-	100

DISCUSSION

This study highlights the practicality and usefulness of "Push back and Pull down to socket manoeuvre". This is a simple method developed by our team, preventing peri patellar soft tissue entanglement while passing graft into the tibial socket and thereby preventing tunnel widening by graft-tunnel motion due to loss of graft tension. There is also a considerable reduction of time for passing graft into the tibial socket. It has been suggested that any type of movement of the graft or graft construct within the bone tunnel could contribute to tunnel enlargement.[14-17] When using suspensory devices in all-inside anterior cruciate ligament reconstruction, tibial tunnel widening may arise due to the "bungee cord effect" during the postoperative period.[18] This bungee effect is a result of longitudinal motion of the graft (Figure 9 a). Such longitudinal movement occurs when the surrounding soft tissue becomes necrotic, creating a gap between the graft and the tibial tunnel. This leads to motion between the graft and the tunnel, resulting in widening of the tibial socket and a loss of graft tension. In this context, performing the push back and pull-down manoeuvre within anatomical placed sockets offers a clear advantage, as it eliminates the space between the bone and graft by preventing soft tissue entanglement and ensuring the tightening of the loop isometrically.

Further, due to necrosis of the interposed soft tissue and the bungee cord effect, there will be a significant dead space present in the tibial tunnel adjacent to the tendinous section of the graft. This space will permit transverse movement of the graft at the tibial tunnel during joint motion across its full range. This occurrence is commonly known as the windshield wiper effect (Figure 9 b and c).[15] This effect also further leads to widening of the tunnel and loss of graft tension. This effect can be eliminated by our Pushback and pull down to socket manoeuvre by avoiding dead space between graft and bone.

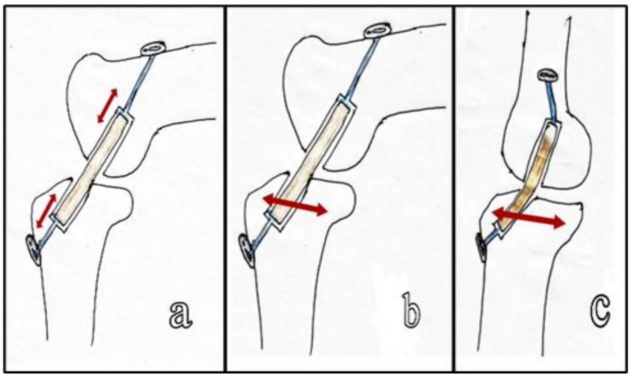

Figure 9: (a) Bungee cord effect, (b) Windshield wiper effect in flexion of the knee, (c) Windshield wiper effect in extension of the knee.

Considering the circumstances and assuming that the interposed soft tissue had either degenerated or shrunk, this would lead to graft-tunnel movement, resulting in osteolysis and an increase in the size of the bone tunnel. Our pushback and pull down to socket manoeuvre eliminate this concern. The limitations of this research are outlined as follows. Firstly, given that our investigation is a case series, it is necessary to conduct a comparative study between patients who have undergone All inside anterior cruciate ligament reconstruction using both regular graft passage and the push back and pull down to socket manoeuvre. Secondly, the sample size for this study was somewhat limited. We believe that further comparisons with a larger sample size in each group would yield more comprehensive insights and lower the chance of errors. Despite these limitations, this is the first research comparing the duration, knee stability, and clinical outcomes associated with the push back and pull down to socket manoeuvre in all inside anterior cruciate ligament reconstruction employing an adjustable loop suspensory device with cortical button.

CONCLUSION

Push back and pull down to socket manoeuvre is a simple, reproducible and fail proof technique to avoid the likely complication of peri patellar soft tissue entanglement while managing the engagement of graft into the tibial socket. This technique also helps to save time, improves the surgeons comfort, ergonomics and friendliness towards the otherwise very useful All inside Anterior cruciate ligament reconstruction surgery.

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Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

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