

# Alternate Method of Arthroscopically Confirming Femoral Button Deployment for Knee Anterior Cruciate Ligament Graft Suspensory Cortical Fixation



Rajamani Perumal, M.S.Orth., Chandrasekaran Gunasekaran, M.S.Orth.,  
Miriam Jacob, D.Orth., Dip.N.B., and Thilak Samuel Jepegnanam, M.S.Orth.

**Abstract:** Accurate deployment of the femoral button on the lateral aspect of the lateral femoral condyle when using a suspensory fixation device for anterior cruciate ligament reconstruction is ideal. Direct visualization would be the most appropriate method of visualization in the lateral gutter. A previously described technique is performed with the knee in flexion. In this position, maneuverability of the arthroscope in the lateral gutter may be difficult in small knees because of tight lateral structures. We describe a simple technique in which visualization is performed with the knee in extension, which is especially useful in small knees.

Modern techniques used for anterior cruciate ligament (ACL) reconstruction aim toward increasing the success rate of this commonly performed procedure. The all-inside TightRope RT (Arthrex, Naples, FL) technique used for ACL reconstruction can reduce postoperative pain and promote early rehabilitation and return to activity.<sup>1,2</sup> The advantages of the TightRope RT are its optimal graft-to-socket filling, decreased longitudinal graft motion within the tunnel, and optimal graft-to-bone healing.<sup>3</sup>

The all-inside TightRope RT technique presents a risk of the button being pulled too far laterally, leading to the interposition of the soft tissue between the button and cortex or the button being deployed inside the femoral tunnel.<sup>4</sup> Both eventualities may lead to the failure of button deployment. Thus, an essential step for achieving success is the accurate deployment of the femoral button on the lateral cortex of the lateral

femoral condyle. Sonnery-Cottet et al.<sup>3</sup> described a technique that involved arthroscopically visualizing the button deployment and seating, which was direct and confirmatory. However, this visualization was performed with the knee in a flexed position and the arthroscope in the anterolateral portal, and the shaver was introduced through a lateral incision in the knee to remove the synovial tissue in the lateral gutter.

In our practice, most ACL reconstruction surgical procedures are performed in patients with a height of less than 170 cm. These patients have small knees in which it is difficult to maneuver the arthroscope in the lateral gutter with the knee in flexion because of the tight iliotibial band. Therefore, we established a technique wherein the shaving of the synovial tissue and the visualization of the femoral button for deployment in the lateral femoral gutter may be performed with the knee in extension when the lateral soft tissues are relaxed, affording better maneuverability of the arthroscope in this region; this technique is especially useful in small knees.

## Surgical Technique

In our technique, the semitendinosus graft is harvested through a posterior incision<sup>5,6</sup> and quadrupled by using TightRope RT at both ends of the graft. After routine arthroscopy, the femoral footprint of the ACL is visualized and marked. The knee is then extended. Subsequently, the arthroscope is introduced through the anteromedial portal of the knee and moved across the patellofemoral joint to visualize the lateral gutter

*From the Department of Orthopaedics Unit 3, Christian Medical College, Vellore, India.*

*The authors report that they have no conflicts of interest in the authorship and publication of this article. Full ICMJE author disclosure forms are available for this article online, as [supplementary material](#).*

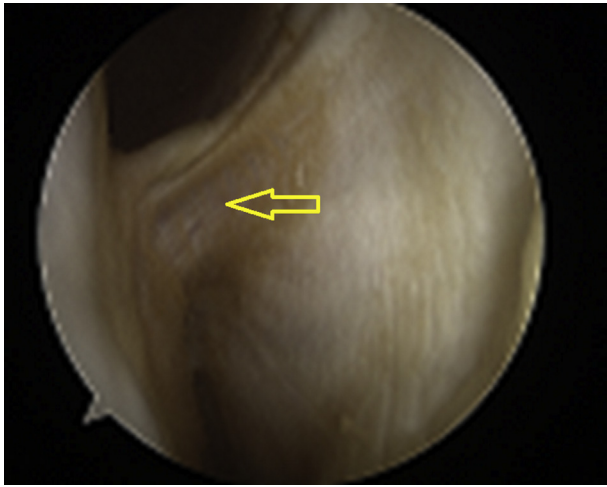
*Received July 13, 2018; accepted August 8, 2018.*

*Address correspondence to Thilak Samuel Jepegnanam, M.S.Orth., Department of Orthopaedics Unit 3, Christian Medical College, Vellore 632004, Tamilnadu, India. E-mail: [thilakjepegnanam@yahoo.com](mailto:thilakjepegnanam@yahoo.com)*

*© 2018 by the Arthroscopy Association of North America. Published by Elsevier. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).*

*2212-6287/18870*

*<https://doi.org/10.1016/j.eats.2018.08.019>*



**Fig 1.** Arthroscopic view of the left knee in extension viewing from the anteromedial portal showing the synovial recess (arrow) in the lateral gutter.

(Fig 1). The lateral synovial recess<sup>7</sup> is debrided (Fig 2) from the lateral cortex with a shaver introduced through the anterolateral portal.

The knee is then flexed, and the lateral epicondyle is marked. The femoral guide is introduced through the anterolateral portal, and the drill sleeve is introduced through a small lateral incision anterior and proximal to the previously marked epicondyle by using a drill guide handle. We have observed that the button always becomes deployed in the region of the previously debrided synovial recess.

An appropriate tibial socket is then created by placing the tibial drill guide in the center of the ACL stump. The total length of the femoral socket, intra-articular graft, and tibial socket is maintained at 10 mm more than the graft length to allow for appropriate tensioning.

With the knee at 90° of flexion, the graft is inserted into the femoral socket through the anteromedial portal by using a flexible silicone cannula (PassPort; Arthrex). When the mark on the TightRope loop denoting the interosseous length nears the mouth of the femoral socket, the knee is brought into extension and the arthroscope is inserted into the patellofemoral joint and

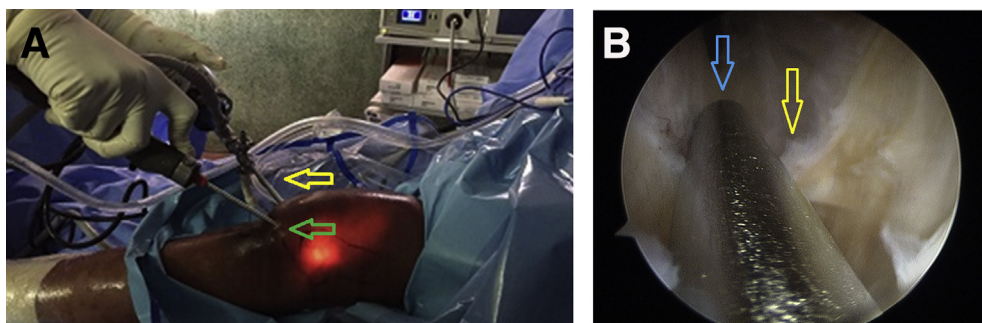
slid into the lateral gutter from the anterolateral portal. With an assistant controlling the entire graft construct by using both his or her hands, gentle traction is applied to bring the button into the lateral gutter under direct visualization (Video 1). After the button is completely seated against the lateral cortex, the knee is flexed and the graft is completely seated inside the socket while gentle traction is applied at the tibial end of the graft to prevent button displacement. The remaining procedure is performed in a routine manner. After cycling of the knee and further final tensioning of the graft on the femoral and tibial sides, the button is visualized in the lateral gutter through the anterolateral portal before a knot is tied and the sutures are cut under direct visualization (Fig 3).

## Discussion

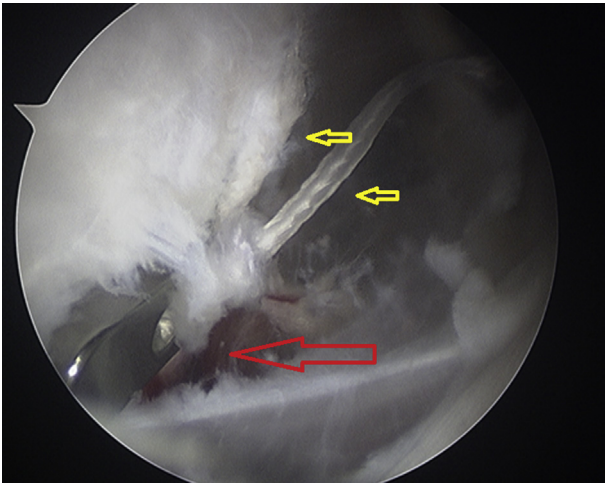
TightRope RT is a fixation device that has the purported advantages of the graft filling the entire socket and construct, allowing for repeated tensioning of the graft. However, correct seating of the button on the lateral cortex is an integral part of the procedure. Postoperative radiographic evaluation revealed soft-tissue interposition between the EndoButton (Smith & Nephew Endoscopy, Andover, MA) and the lateral femoral cortex in up to 25.2% cases.<sup>8</sup> Furthermore, iliotibial band irritation due to the button deployed in the vicinity of the lateral epicondyle was observed.<sup>9</sup> However, first marking the lateral epicondyle and then placing the drill guide and sleeve anterior and proximal to it through an outside-in drilling technique can prevent the aforementioned eventualities.

To prevent malpositioning, indirect techniques were described to view the femoral tunnel from inside the joint.<sup>4</sup> However, proper button deployment and seating can be directly confirmed through arthroscopic visualization of the lateral gutter.

Sonnery-Cottet et al.<sup>3</sup> popularized the direct visualization of the deployed button in the lateral gutter. However, this technique is performed with the knee in flexion, where maneuverability of the arthroscope is difficult in smaller knees. Our technique, which involves prior viewing of the lateral gutter from the



**Fig 2.** (A) Left knee in extension with the arthroscope in the anteromedial portal (yellow arrow) and shaver in the anterolateral portal (green arrow). (B) Arthroscopic view of the left knee in extension with the arthroscope in the anteromedial portal and the shaver in the anterolateral portal (blue arrow) showing synovial tissue (yellow arrow) being debrided.



**Fig 3.** Arthroscopic view of the lateral gutter of the left knee in extension with the arthroscope in the anterolateral portal showing the button seated on the lateral cortex of the lateral femoral condyle (red arrow) and the cut ends of the suture (yellow arrows).

anteromedial portal and shaving the synovial recess from the anterolateral portal with the knee in extension, is technically easier to perform in a small knee. Thereafter, progression of the button into the lateral gutter and its seating on the lateral cortex of the femur can be viewed from the anterolateral portal with the knee maintained in extension.

This technique has pearls and pitfalls (Table 1). Viewing the shuttling suture at the end of outside-in drilling ensures that the button can be viewed without difficulty later. Uncontrolled traction during passage through the femoral socket can lead to the button migrating into the lateral soft tissues and should

**Table 1.** Pearls and Pitfalls

Viewing the lateral gutter in extension is easier when the arthroscope is slid from the patellofemoral joint onto the lateral gutter.
It is important to view and ensure that the shaver is in the lateral gutter before commencement of debriding the synovial recess because the shaver can easily slip to an extracapsular location with the knee in extension.
Marking the lateral femoral condyle with a marking pen with the knee in flexion enables the outside-in drilling to be anterior and in the desired location.
Viewing the shuttling suture in the lateral gutter at the end of outside-in drilling ensures that the button exits in the desired location without being entangled in the remnant of synovial tissue.
The same person should hold the sutures at both the proximal and distal ends of the graft during femoral graft passage because unrestrained and uncontrolled traction can still lead to button migration into the soft tissues.
Gentle countertraction should be applied while the graft is being seated because there is a chance of button migration.
Marking the interosseous length with a pen on the suture helps indicate when the knee should be extended. Extension of the knee is performed when this mark nears the mouth of the femoral socket.

**Table 2.** Advantages and Disadvantages

**Advantages**

- Direct visualization of the button being seated on the lateral wall of the lateral femoral cortex would be confirmatory.
- The technique can be performed with ease in all patients regardless of their size.
- The technique can be applied to most other methods of reconstruction in which outside-in drilling is performed.
- Additional portals are not required.

**Disadvantages**

- It may not be possible to perform this method using the transtibial technique in which the button exits more proximally.
- The knee should be extended whenever the lateral gutter requires visualization and again flexed for the rest of the procedure.

be avoided. For this reason, if the same person holds both ends of the graft construct during passage, the tactile feedback leads to a more controlled pull on the graft construct.

The main advantage (Table 2) is that direct viewing of the button being seated on the lateral cortex would be an ideal method of confirmation. This method can be used for most other methods of outside-in drilling.

In addition to the risk of the button being pulled into the lateral soft tissues, there is a risk of the button exiting posteriorly. This can be avoided by first marking



**Fig 4.** Postoperative (Post op) anteroposterior radiograph in 20° of external rotation showing the seated TightRope RT button on the lateral cortex of the condyle without soft-tissue interposition. (L, left knee.)

the lateral femoral condyle and making sure the tip of the femoral jig sleeve remains anterior. The limitation of this method is that it may not be applicable for the transtibial technique in which the button exits more proximally.

We obtained postoperative radiographs of the extended leg in slight external rotation to observe the true anteroposterior view of the lateral femoral cortex to reconfirm button positioning on the cortex without soft-tissue interposition (Fig 4). Our technique is safe and reproducible and is especially useful in small knees.

### References

1. Lubowitz JH. No-tunnel anterior cruciate ligament reconstruction: The transtibial all-inside technique. *Arthroscopy* 2006;22:900.e1-900.e11.
2. Lubowitz JH, Ahmad CS, Anderson K. All-inside anterior cruciate ligament graft-link technique: Second-generation, no-incision anterior cruciate ligament reconstruction. *Arthroscopy* 2011;27:717-727.
3. Sonnery-Cottet B, Rezende FC, Martins Neto A, Fayard JM, Thaumat M, Kader DF. Arthroscopically confirmed femoral button deployment. *Arthrosc Tech* 2014;3:e309-e312.
4. Nag HL, Gupta H. Seating of TightRope RT button under direct arthroscopic visualization in anterior cruciate ligament reconstruction to prevent potential complications. *Arthrosc Tech* 2012;1:e83-e85.
5. Prodromos CC, Han YS, Keller BL, Bolyard RJ. Posterior mini-incision technique for hamstring anterior cruciate ligament reconstruction graft harvest. *Arthroscopy* 2005;21:130-137.
6. Wilson TJ, Lubowitz JH. Minimally invasive posterior hamstring harvest. *Arthrosc Tech* 2013;2:e299-e301.
7. Nemeth WC, Sanders BL. The lateral synovial recess of the knee: Anatomy and role in chronic Iliotibial band friction syndrome. *Arthroscopy* 1996;12:574-580.
8. Uchida R, Mae T, Matsumoto N, Kuroda S, Toritsuka Y, Shino K. The effect of cortical button location on its postoperative migration in anatomical double-bundle anterior cruciate ligament reconstruction. *Knee Surg Sports Traumatol Arthrosc* 2014;22:1047-1054.
9. Taketomi S, Inui H, Hirota J, et al. Iliotibial band irritation caused by the EndoButton after anatomic double-bundle anterior cruciate ligament reconstruction: Report of two cases. *Knee* 2013;20:291-294.