# Arthroscopic Technique to Reduce Suture Button Migration During Anterior Cruciate Ligament Reconstruction Procedure

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**Abstract:** Suture button–based femoral cortical suspension constructs of anterior cruciate ligament grafts can facilitate a fast and secure fixation. However, there are several case reports showing button malpositioning resulting from the inability to visualize the "flipped" button. Many current surgical techniques do not allow direct visualization of EndoButtons (Smith & Nephew, Andover, MA) in their final position, making it difficult to ensure that both buttons are fully flipped and that there is no soft-tissue interposition between the button and femur. We describe an arthroscopic technique for making femoral tunnels through the outside-in method that reduces the migration of the EndoButton through a lateral femoral portal. This technique may assist surgeons in understanding how to deal with and potentially avoid EndoButton migration during anterior cruciate ligament reconstruction.

Suture button–based femoral cortical suspension fixation of anterior cruciate ligament (ACL) grafts can facilitate a fast and secure graft fixation for ACL reconstruction.[1] A systematic review by Saccomanno et al.[2] reported similar excellent clinical and functional outcomes with femoral cortical suspension fixation when compared with suspensory transfemoral fixation, such as Bone Mulch screws (Biomet, Warsaw, IN) or interference screws. Among femoral cortical suspension devices, the EndoButton CL (Smith & Nephew, Andover, MA) is significantly stronger than other adjustable-loop femoral cortical fixation constructs, such as the TightRope RT (Arthrex, Naples, FL) or ToggleLoc with ZipLoop (Biomet).[3,4] Thus, it has been recognized that the EndoButton CL is the most reliable and suitable for femoral-side graft fixation.

However, there are several case reports documenting the potential complications of using EndoButtons (Smith & Nephew), such as malpositioning and interposition of the soft tissue during fixation.[5,6] Muneta et al.[7] reported a case in which the EndoButton moved away from the lateral aspect of the femoral cortex and deposited into the popliteal space. Fortunately, the patient had no ACL instability. Simonian et al.[6] reported a case in which the EndoButton was fixed approximately 10 mm away from the lateral aspect of the femoral cortex with soft-tissue interposition between the EndoButton and femoral cortex. Although they suggested that an increased angle of knee flexion was more likely to result in soft-tissue interposition before flipping, they did not describe any complications resulting from the failure of flipping. Postoperative clinical examination before revision showed range of motion without increased resistance. Moreover, Mae et al.[8] showed that soft-tissue interposition was found in 25.8% of EndoButtons (51 of 202) and migration was observed in 35.1% (71 of 202). They determined that migration of the EndoButton was

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**Table 1.** Tips, Pearls, and Pitfalls

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| Tips and pearls |
| Remove soft-tissue interposition and confirm the accurate reduction of the migrated EndoButton. |
| Make an LF portal by longitudinally extending the guide pin incision. |
| Confirm the migration of the EndoButton to the lateral cortex of the knee through the LF portal. |
| Introduce a shaver through another LF portal to clean up the soft tissue around the EndoButton. Switch the shaver to a Vulcan probe to remove any interposed soft tissue beneath the EndoButton. |
| Reduce the migrated EndoButton to the proper position, and fit the EndoButton to the lateral cortex of the knee by pulling the graft on the tibial side. |
| Pitfalls |
| Caution is need when removing the soft tissue over the lateral aspect of the femoral cortex. |
| Injury to arteries, such as the lateral superior genicular artery, is possible. |

LF, lateral femoral.

more common with the presence of soft-tissue interposition and clinical outcomes were unaffected by migration and soft-tissue interposition. Current surgical techniques do not allow adequate visualization of the button in its final position to confirm that it is correctly flipped over without soft-tissue interposition between the EndoButton and the iliotibial band (ITB) or vastus lateralis.

Several techniques have been proposed to ensure accurate placement of the EndoButton and lessen the probability of malpositioning. Some surgeons have recommended the use of intraoperative fluoroscopy to assess the position of the button and its relation to the femoral cortex.[8,9] Other surgeons have proposed the use of a guide pin to assist and provide a controlled force for a more accurate passage of the construct through the femoral tunnel.[10] Even with the aforementioned well-described techniques, we continue to experience EndoButton malpositioning and EndoButton migration with or without interposition of the soft tissue in our practice.

Mistovich et al.[11] reported endoscopic direct visualization is achievable through the ITB portal to facilitate the exact flipping and placement of the EndoButton on the lateral aspect of the femoral cortex. However, this technique requires a longer intraoperative time and a relatively higher level of surgical skills that may limit its use to more experienced surgeons.

This Technical Note describes an arthroscopic technique to prevent migration of the EndoButton using a femoral guide pin incision on the lateral aspect of the femur as an endoscopic portal. Our portal allows direct visualization of the migrated button, thereby fitting the migrated EndoButton to the femoral cortex and correcting the malpositioned button to be properly positioned (Table 1).

## Surgical Technique

The described ACL reconstruction technique was arthroscopically performed by the senior surgeon. A standard arthroscopic examination is performed through anteromedial and anterolateral portals. Other injuries, including osteochondral lesions and meniscal tears, are managed concomitantly depending on their severity. An outside-in technique is used to create both the femoral and tibial tunnels with a FlipCutter device (Arthrex) as described by Lubowitz et al.[12] and a commercially available tibial guide, respectively. Care is taken to ensure that the femoral and tibial tunnels are created anatomically in every patient. An ipsilateral semitendinosus and gracilis autograft is used in every case. A fixed-loop cortical suspension device, the EndoButton CL, is used for femoral fixation. The position of the EndoButton is confirmed with fluoroscopy after manual assessment to ensure that the

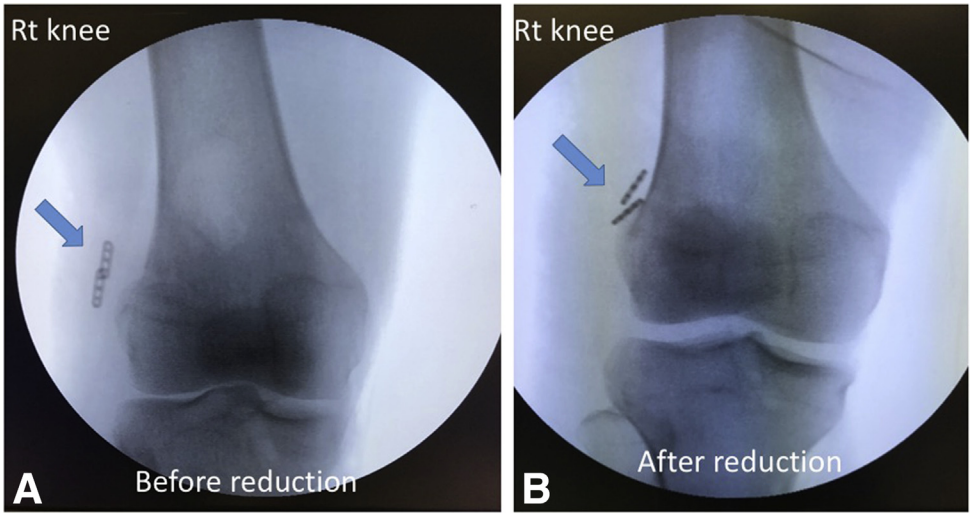


**Fig 1.** (A) Anteroposterior radiograph of a right (Rt) knee during operation showing migrated EndoButtons of anteromedial and posterolateral graft (arrow). (B) Anteroposterior radiograph of a right (Rt) knee showing reduced position of migrated EndoButtons after arthroscopic reduction. The arrow indicates the EndoButtons of the anteromedial and posterolateral graft.

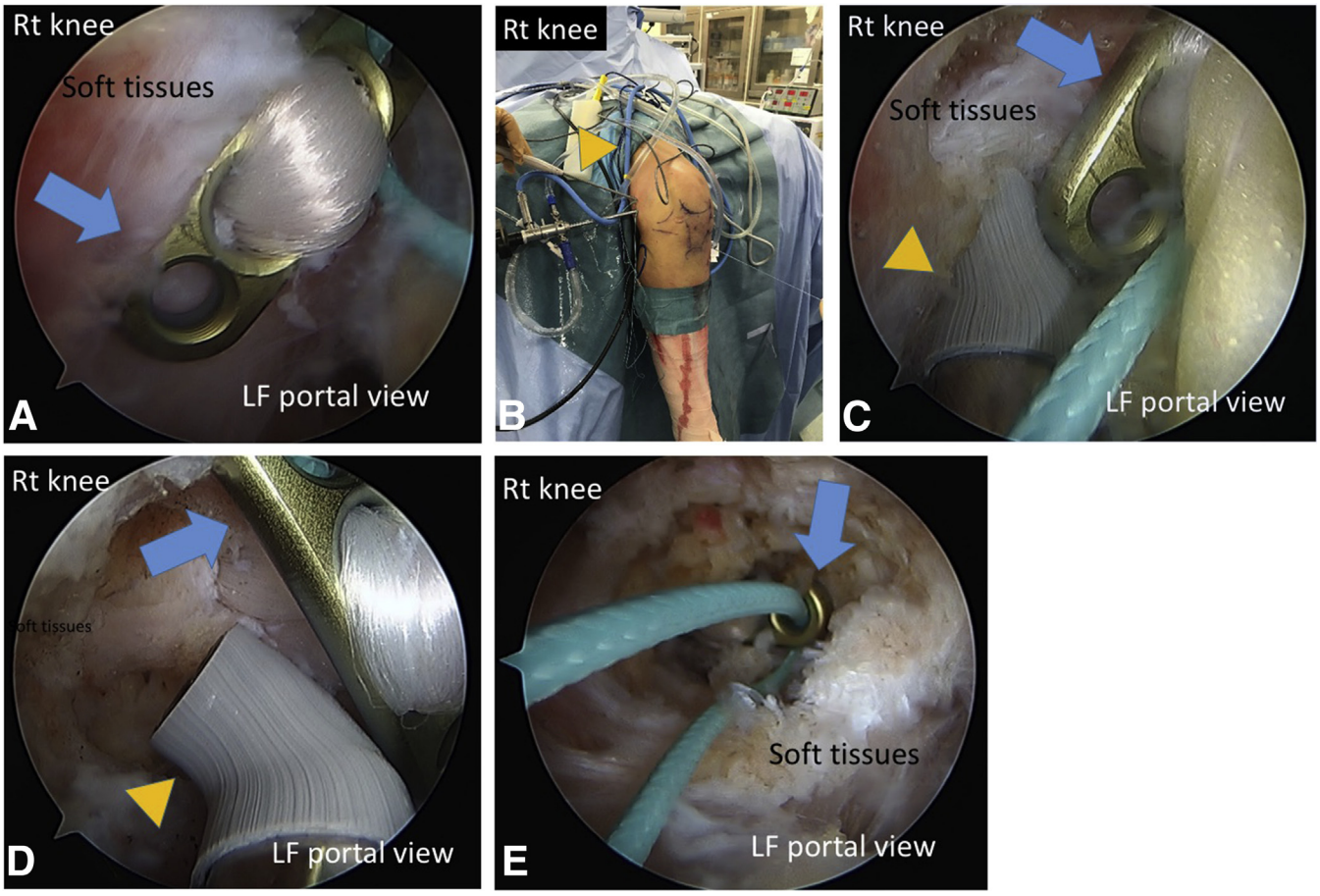


**Fig 2.** Right (Rt) knee with endoscopic visualization from lateral femoral (LF) portal. (A) Migrated EndoButton (arrow) in LF compartment. (B) The arthroscope is inserted through an LF portal, and a Vulcan probe (arrowhead) is inserted through another LF portal. (C) The Vulcan probe (arrowhead), introduced through the second LF portal, can remove the interposed soft tissue surrounding the EndoButton (arrow). (D) Removed soft tissue beneath migrated EndoButton (arrow). The arrowhead indicates the Vulcan probe. (E) The position of the EndoButton (arrow) is fixed to the lateral aspect of the femoral cortex.

button has been flipped. In the case in which the EndoButton migrates from the lateral aspect of the femoral cortex (Fig 1A), a lateral femoral (LF) portal is created through the femoral guide pin incision on the lateral aspect of the femur. An arthroscope is inserted into the LF portal to evaluate for EndoButton migration from the lateral aspect of the femoral cortex (Fig 2 A and B). If soft tissue is found interposed beneath the EndoButton, a Vulcan probe (Smith & Nephew) is introduced through a second LF portal to remove the soft tissue (Fig 2C). A Vulcan probe can also be inserted through the same portal to help manipulate and fit the EndoButton into the proper position at the lateral cortex of the femur by pulling the graft on the tibial side (Fig 2 D and E). After confirmation of the proper position of the EndoButton by fluoroscopy, the graft is manually tensioned and tibial fixation with a spiked plate is applied in every patient (Fig 1B, Video 1). Postoperative radiographs are obtained to confirm the position of the EndoButton after ACL reconstruction (Fig 3).

## Postoperative Rehabilitation

A standardized postoperative protocol is implemented for each patient. Physical therapy, consisting of exercise without resistance, to improve range of motion is initiated immediately after surgery. Weight-bearing exercise as tolerated with crutches is also initiated immediately. Patients are provided a hinged knee brace and instructed to wear it until they are able to perform a straight-leg raise without a quadriceps lag, which takes approximately 2 or 3 months. Return to sport is patient specific but is generally permitted at 9 months postoperatively at the earliest, according to physical therapy and functional assessments, as well as specific sporting demands (Table 1).

## Discussion

This Technical Note presents an arthroscopic technique that successfully removes interposed soft tissue between the EndoButton and the lateral aspect of the femoral cortex and reduces EndoButton migration from the lateral aspect of the femoral cortex of the knee. This

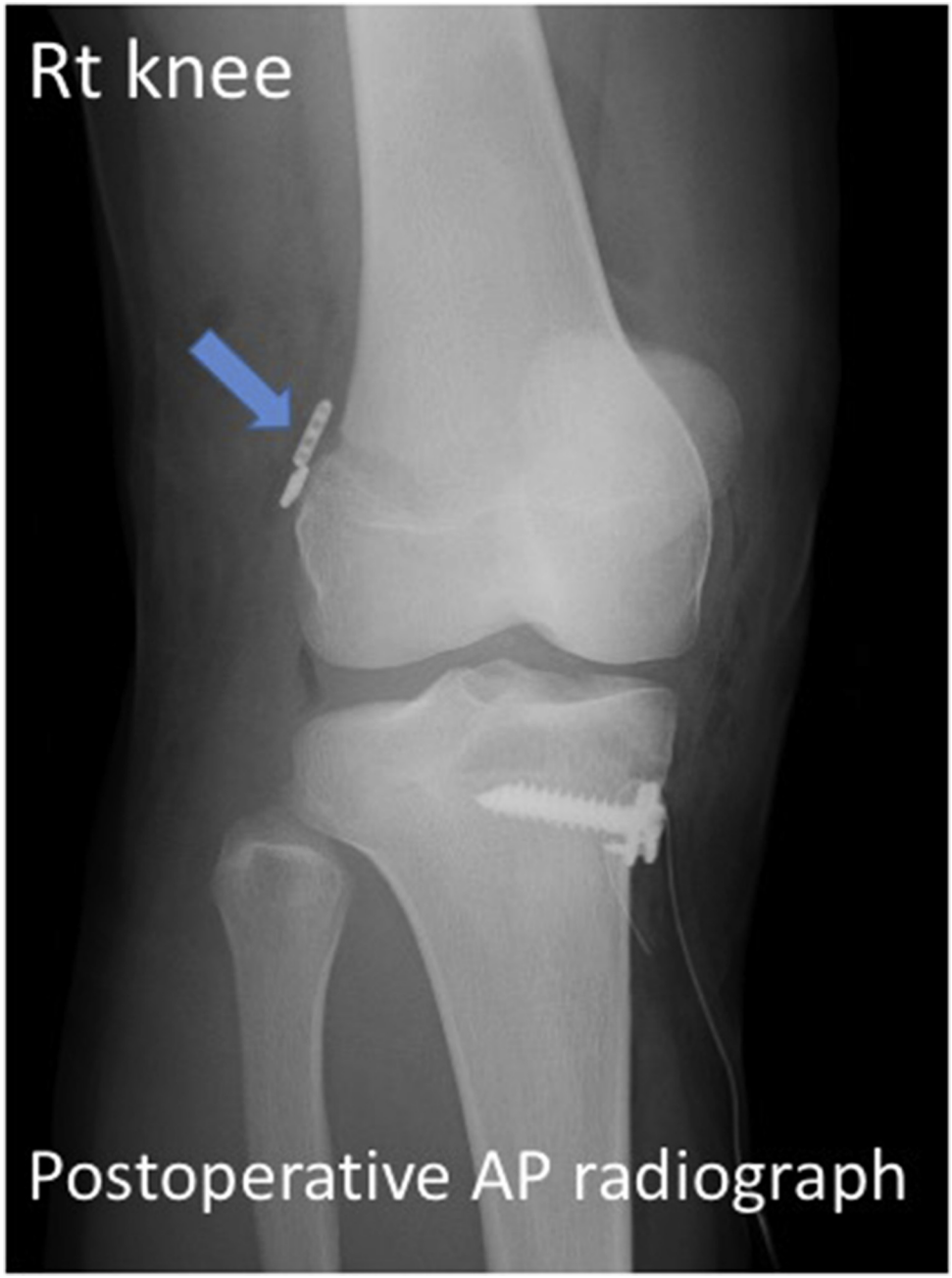


**Fig 3.** Postoperative anteroposterior radiograph of a right (Rt) knee showing reduced EndoButton to lateral aspect of femoral cortex. The arrow shows the EndoButtons of the anteromedial and posterolateral graft.

minimally invasive approach assists in the correction of the migrated EndoButton to the femoral cortex to the proper position.

Several studies have shown that EndoButton malpositioning over the soft tissue around the knee induces either tissue irritation or migration of the button.[6-8,13] These complications might require second-look surgery for removal or repositioning of the malpositioned EndoButton. Mae et al.[8] described a rate of soft-tissue interposition between the EndoButton and the lateral cortex of the femur of up to 25% on postoperative radiographs after ACL reconstruction. The previous studies showed a positive correlation between a malpositioned EndoButton and a higher rate of button migration. In general, suspension of the EndoButton over soft tissue, such as the ITB, was weaker than that on the femoral cortex. Weakening of femoral fixation before graft integration might cause loosening of the reconstructed ACL and failure of the ACL reconstruction.[8] It has been reported that a migrated EndoButton outside the extensor mechanism or the vastus lateralis might induce pain and restricted range of motion of the knee.[6]

When it is unclear whether soft tissue is interposed between the EndoButton and the lateral cortex of the femur, confirmation of the button position by radiographs is recommended.[6] If more than 1 mm of tissue

**Table 2.** Advantages and Disadvantages

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| Advantages |
| Our minimally invasive procedure can facilitate a quicker recovery. |
| The techniques allows direct visualization of the reduction of the migrated EndoButton. |
| Disadvantages, risks, and limitations |
| Excessive introduction of fluid may increase the risk of compartment syndrome. |
| There is a risk of damage to the EndoButton loop by using the Vulcan. |
| Our technique cannot be applied in the case of a migrated EndoButton resulting from malpositioning of the femoral bone tunnel. |

interposition is found on radiographs, the interposed soft tissue between the EndoButton and the lateral aspect of the femoral cortex should be removed.[8] Although the soft-tissue irrigation can be removed by an open technique, it is a more invasive procedure than arthroscopic ACL reconstruction. However, arthroscopic ACL reconstruction is more technically complex, and inexperienced surgeons may have difficulty identifying the interposed soft tissue and EndoButton. There is a paucity of available literature regarding how to best remove interposed soft tissue and reduce the position of the EndoButton. Our arthroscopic reduction technique allows the surgeon to assess for malpositioning and migration of the EndoButton directly through the LF portal and remove any soft tissue interposed between the EndoButton and the lateral cortex of the femur. This more accurate technique not only allows for better visualization but also leads to a decrease in the rate of failure of the ACL reconstruction.

Our technique has several pearls and pitfalls, as well as advantages and disadvantages (Table 2). The advantages of this arthroscopic technique include small incisions and direct visualization that can help remove any soft-tissue interposition and reduce a migrated EndoButton. There appears to be a short recovery time, which is especially beneficial for athletes who must quickly recover back to their preinjury activity level. A disadvantage of using our arthroscopic technique is the potential risk of compartment syndrome after excessive introduction of fluid in the LF portal. In addition, there is a small possibility of injury to the lateral superior genicular artery. Another potential complication is lateral extravasation because this technique is performed in the extra-articular space. There is also a risk of damage to the EndoButton loop by using the Vulcan. This technique requires careful cleaning of the soft tissue over the lateral cortex of the femur. The limitation of our technique is that it cannot be applied in the case of a migrated EndoButton resulting from malpositioning of the femoral bone tunnel (Table 2).

The proposed procedure is routinely used in our practice and continues to show promise. We believe this arthroscopic reduction technique could be beneficial in the case of a migrated EndoButton during ACL reconstruction of the knee; however, studies on long-term clinical outcomes with a larger cohort will be necessary to determine its efficacy.

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