

Anterior Cruciate Ligament Reconstruction Using a Two-Incision Arthroscopy-Assisted Technique With Patellar Tendon Autograft

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Summary: While a single-incision arthroscopy-assisted reconstruction of the ACL is our preferred technique for primary ACL reconstructions, under certain circumstances the two-incision approach is recommended. All ACL surgeons should be familiar with this technique. In revision cases or in the case of posterior wall blow-out, the two-incision technique provides an excellent alternative. Advantages of this technique are numerous. The problem of graft-tunnel mismatch is minimized, and the problem of screw divergence or screw laceration of the graft is eliminated. The disadvantage rests only in the additional incision required. The technical aspects of this procedure are similar to those described in the single-incision technique. Overall, results using the two incision technique compare favorably with those of a single-incision. **Key Words:** Two-incision—Reconstruction—Patellar tendon—ACL.

Before the advances in arthroscopic techniques made over the past 10 to 15 years, the two-incision technique was the gold standard operation for anterior cruciate ligament (ACL) reconstruction.³ It is still a technique that should be mastered by all ACL surgeons because it is useful in the event of revision ACL surgery or in circumstances when posterior wall blowout occurs during the endoscopic technique.⁴ Many published reports have concluded that there is no statistically significant difference in subjective, objective, functional, or radiographic outcomes between the endoscopic and the two-incision techniques.^{1,2,5,7–9,11,12,15,16} In fact, complications with respect to femoral tunnel placement are fewer with the two-incision technique.^{1,10,14}

The two-incision technique for ACL reconstruction allows for more flexibility and accuracy during the placement of the femoral tunnel when compared with the previously described endoscopic technique.^{9,10} Aside

from the creation of the femoral tunnel and the subsequent passage of the graft, the two-incision technique is nearly identical to that described in the previous chapter. Preparation of the graft requires the placement of sutures through both bone plugs for control of the graft during passage.

Advantages of the two-incision technique are numerous. There is consistent femoral tunnel placement with less concern of posterior wall violation. This technique minimized the problem of graft-tunnel mismatch, and escapes of the problem of screw divergence or screw laceration of the graft. Finally, the two-incision techniques allows for the placement of the ACL graft at a more anatomic angle.⁹ An obvious disadvantage of the two-incision technique is the second incision and subsequent dissection on the lateral aspect of the femur. Additionally, because there is no bone plug flush with the posterior wall of the femoral socket, there may be stresses on the tendinous portion of the graft that are not present in the endoscopic technique.

GRAFT HARVEST AND PREPARATION

The technique used to harvest the bone-patellar tendon-bone (BPTB) autograft is identical to that described

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in the previous chapter. (For further details, please see the chapter on BPTB graft harvest pearls and pitfalls.) Once the graft is obtained, the preparation of the graft is the same as for the “pull-through” technique of a single incision operation. Specifically, both femoral and tibial bone plugs require drill holes and number 5 Ticron passing sutures in the bone plugs for control of the graft during passage through the knee. Additionally, because the graft is passed from the femur through the knee and into the tibia, the bone plug diameters should either be equal or the trailing femoral plug slightly larger. This is in contrast to the single incision situation where the tibial bone plug is equal to or larger than the femoral plug because the graft is passed in the opposite direction. To make passage of the graft easier, the tibial bone plug can be made slightly shorter (approximately 20–22 mm) so that it can more easily make the turn as it comes down the femoral tunnel into the joint.

TIBIAL TUNNEL CREATION

Previously, we have advocated creation of the tibial tunnel after completing the femoral tunnel.⁶ This was

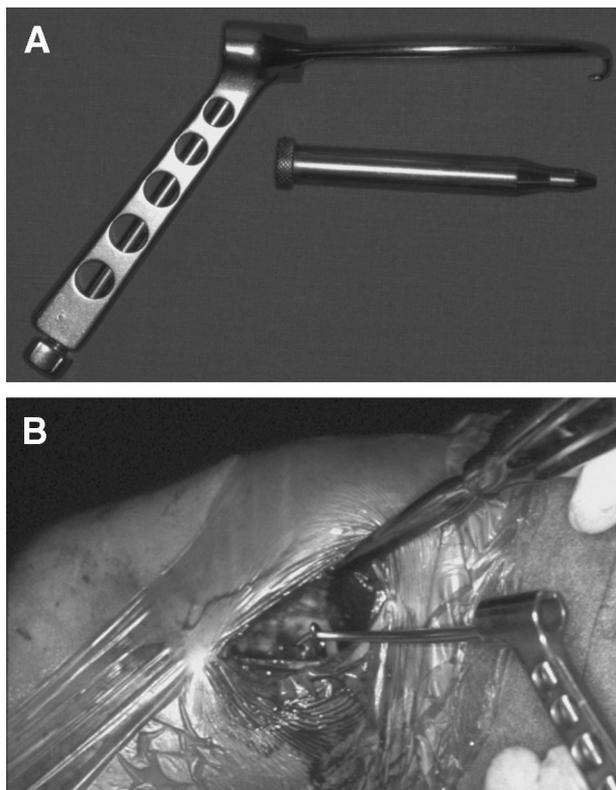


FIG. 1. (A) Photograph of the side-specific aiming guide. (B) Photograph of the side-specific aiming stylet being pulled into the joint by the J-passer.

suggested so that the visualization of femoral tunnel placement would not be disrupted by loss of joint distension after the tibial tunnel was created. However, we now routinely create the tibial tunnel first as this allows us to place our ACL femoral offset guide in an ideal position through the tibial tunnel.

The steps taken to make the tibial tunnel are similar to those described in the previous chapter. However, the exact angle of the tibial tunnel, which is determined in part to prevent graft tunnel mismatch in the single incision technique, does not play an important role in the two-incision technique. Place a 7 mm femoral offset ACL guide in the appropriate position as one would for the endoscopic technique. Drill a guide pin a few millimeters into the bone to identify where the femoral tunnel will enter the joint. Plug the tibial tunnel to prevent fluid extravasation during the creation of the femoral tunnel.

FEMORAL TUNNEL CREATION

Make a skin incision on the lateral knee over the midportion of the iliotibial band (ITB) extending from the lateral epicondyle distally and continuing 4 cm proximally. Split the ITB in its middle third along the length of the incision. Elevate the vastus lateralis from posterior to anterior off the lateral intermuscular septum and place a Chandler or Z retractor over the femur to retract the extensor mechanism and expose the anterolateral distal femur. Keep the exposure of the femur proximal to the metaphyseal flare to avoid disruption of the lateral collateral ligament.

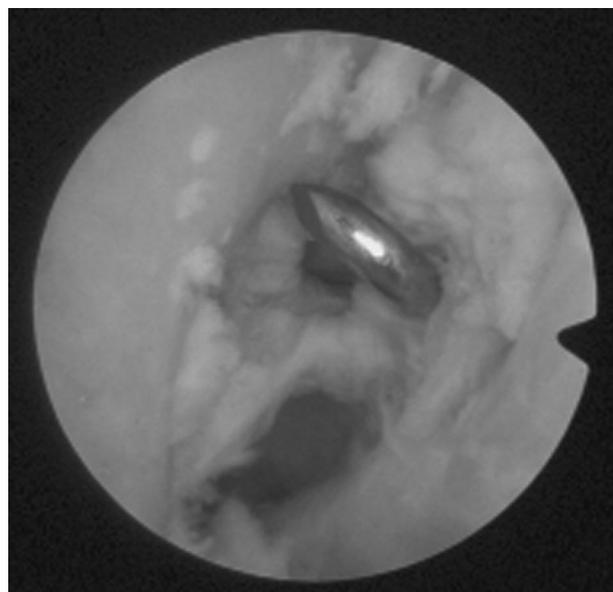


FIG. 2. Aiming guide stylet in position.



FIG. 3. Sawbones model depicting the proper position of the aiming guide with stylet around the over the top position.

At this point, palpate the posterior intercondylar notch with a finger, and use an elevator to dissect subperiosteally to expose the over-the-top position where a J passer will be passed through the inferomedial portal. The J passer can alternatively be passed through a mid-patellar rent into the knee and to the over-the-top position and out the posterior capsule. Always visualize the J passer arthroscopically as it hugs the lateral wall. Visualize the J passer from the lateral incision anterior to the intermuscular septum and attach the side-specific rear-entry guide (Fig. 1a,b). Bring the guide into the joint via the over-the-top position and visualize the guide in the knee (Fig. 2). Push the bullet tip of the guide flush against the lateral femoral condyle (Fig. 3). The stylet position is crucial to tunnel placement, and should be placed in the starting hole previously created with the guide pin placed with the help of the 7 mm ACL offset guide. Confirm that the stylet is in the proper position to

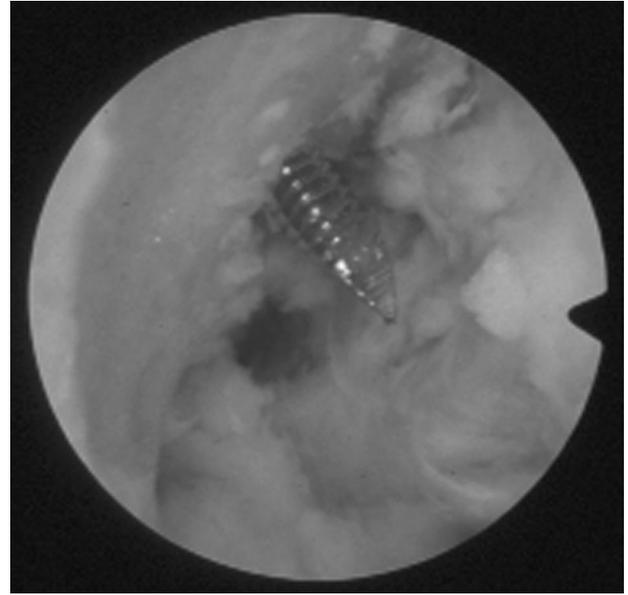


FIG. 4. Arthroscopic view of the guide pin in position.

achieve a tunnel with an intact posterior cortex that is 1 to 2 mm thick and located at the 10 o'clock position for a right knee or 2 o'clock position for left knee.

Starting at or just proximal to the flare of the metaphysis, drill the guide pin from outside to inside. The entry point of the femoral tunnel should not be placed any farther distal than the metaphyseal flare, otherwise the angle into the intercondylar notch will be too acute, which may place excessive bending stresses on the tendon as it enters the notch. Observe arthroscopically as the pin is drilled intra-articularly (Fig. 4). Confirm proper position, remove the guide system, and over-ream the pin with the appropriate sized reamer (Fig. 5).

The Adapter Guide Marking Hook (Arthrex, Inc., Naples, FL) is a two-incision femoral tunnel guide that allows placement of the stylet through the inferomedial portal rather than through the over-the-top position. This eliminates the need to dissect around the posterior capsule to retrieve the J passer from the over-the-top position. The lateral incision to place the guide pin and drill the femoral tunnel is still required.

An advantage of the two-incision technique over the endoscopic technique is that the concern of "blowing out the back wall" is significantly reduced because the femoral condyle houses the femoral bone block in the two-incision technique. However, in the endoscopic technique, the 2 mm "back wall" is crucial for bone block stability and fixation. Because of the concern about disrupting this posterior cortex, it is feasible that some surgeons place their endoscopic femoral tunnels more anterior than what is truly optimal.

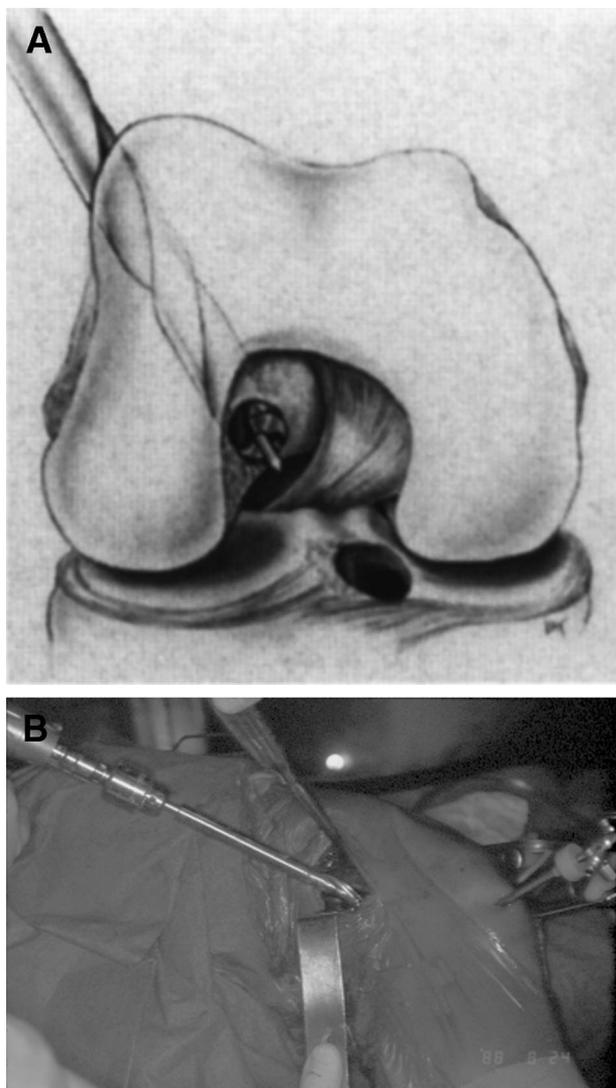


FIG. 5. (A) Photograph of the intra-articular guide pin in position being over-reamed with cannulated reamer. (B) Artist depiction showing the femoral tunnel drill reaming over the guide pin. (Reprinted with permission from Bach BR, Jr. Arthroscopy-assisted patellar tendon substitution for anterior cruciate ligament insufficiency: surgical technique. *Am J Knee Surg* 1989;2:3–20.).

GRAFT PASSAGE

Flex the knee to 60 degrees. The graft will be passed through the femur, into the knee, and to the tibia. Two 22-gauge wire loops can be used to pass the graft. First place a Yankauer suction tube retrograde through the tibial tunnel and into the femoral tunnel opening to create a conduit to pass the wires. Place 2 wires retrograde through the suction tube. Loop the sutures from the tibial bone block separately through the wire loops and withdraw the wires out the tibial tunnel. Clamp the sutures

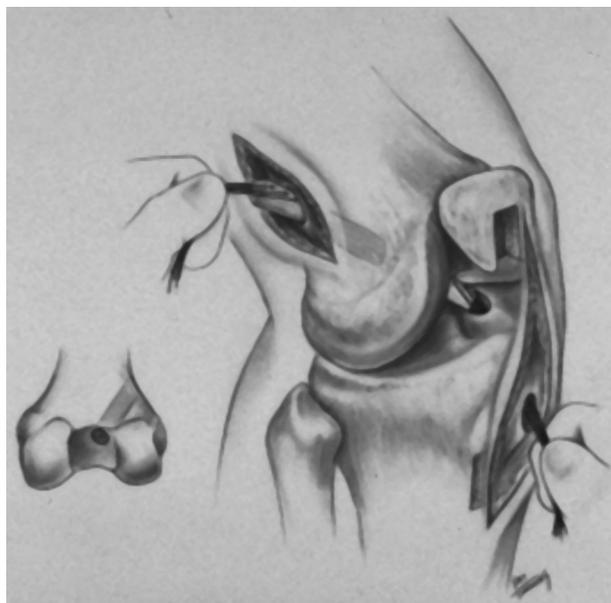


FIG. 6. Artist drawing of the graft in position with tension being held on both sides. (Reprinted with permission from Bach BR, Jr. Arthroscopy-assisted patellar tendon substitution for anterior cruciate ligament insufficiency: surgical technique. *Am J Knee Surg* 1989;2:3–20.).

outside the tibia and pull the graft into the femoral tunnel. Use a probe arthroscopically to manipulate the tibial bone plug into the tibial tunnel. It may be necessary to retract the PCL that may obstruct the passage of the tibial bone plug. Once both bone plugs are seated in their respective tunnels, it is important to place tension on both sets of sutures to assess for laxity, because a bone plug may be stuck within a tunnel preventing the graft from being fully tensioned (Fig. 6). Although seating both tibial and femoral bone plugs within their respective tunnels eliminates the problem of graft tunnel mismatch, true aperture fixation at the femur is also lost.

GRAFT FIXATION

Secure the femoral side before the tibial side. Use a cannulated screw of the same length as the bone plug and 9 mm in diameter. Place the screw against the cortical surface of the bone plug, which should be oriented to face laterally. Keep tension on the sutures as the screw is advanced to avoid pushing the graft with the screw. If the femoral bone block is recessed in the tunnel, then a longer interference screw should be used so that the screw head remains near the opening of the tunnel on the outer cortex of the femur, in case future removal is needed. Turn attention to the tibial bone plug. Rotate the tibial plug 90 degrees externally to place the cortical

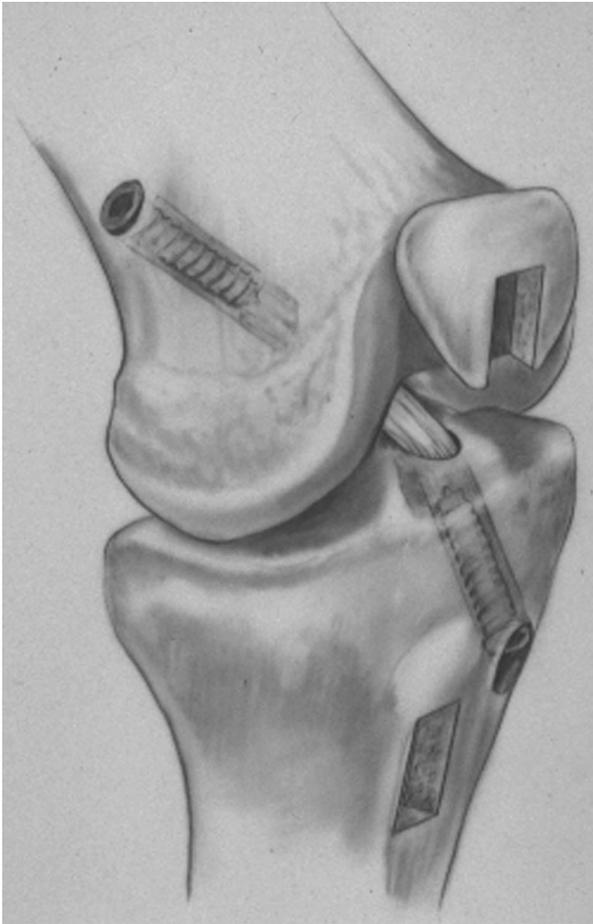


FIG. 7. Artist rendering of completed reconstruction with appropriate screw fixation. (Reprinted with permission from Bach BR, Jr. Arthroscopy-assisted patellar tendon substitution for anterior cruciate ligament insufficiency: surgical technique. *Am J Knee Surg* 1989;2:3–20.).

surface of the plug anteriorly. Cycle the knee while maintaining tension on the sutures. Extend the knee. Place a 9 mm screw anteriorly while pulling the sutures and applying an axial load on the joint. Placing the knee in extension while securing the bone plugs will help avoid overconstraining the knee (Fig. 7).

An advantage of the two-incision technique over the endoscopic technique is that interference screw placement in the femur is performed under direct visualization. Studies have shown that endoscopic placement of the a cannulated screw over a guide wire is not as accurate as in a two-incision technique.¹³

CLOSURE

The lateral wound is closed using a number 1 Vicryl suture in the ITB in a running fashion followed by 2-0

Vicryl sutures in the subcutaneous tissue and a running 3-0 Prolene suture in the skin. The anterior incision and arthroscopic portals are closed as described for the single incision technique. Postoperative management and rehabilitation is the same as for a single incision technique.

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