Double Bundle ACL Reconstruction using the Smith & Nephew Outside-In Anatomic ACL Guide System

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Introduction

The anterior cruciate ligament (ACL) consists of two functional bundles, each with a different function. The anteromedial (AM) bundle appears more tensed in flexion, while the posterolateral (PL) bundle appears more tensed in extension. Single bundle ACL reconstruction techniques do not exactly reproduce these two functional units, since their aim is to restore only the AM bundle.

This technique describes an anatomic ACL reconstruction that uses two totally independent bundles, through two femoral and two tibial tunnels. The double-stranded semitendinosus and the double- or triple-stranded gracilis are fixed using four Smith & Nephew Interference Screws.

The two tunnels are prepared using the Smith & Nephew Outside-In Anatomic ACL Guide System, which enables the femoral and tibial tunnels to be placed and drilled concurrently. The resulting anatomic ACL reconstruction should provide a repair that more accurately recreates the biomechanical properties of the native ACL.
Patient Preparation
Place the patient supine on the operating room table. Apply a pneumatic tourniquet to the operative leg after the limb has been exsanguinated. Hang the lower extremity at 90° and block it with a leg holder. Abduct and flex the contralateral limb with the leg holder. Prepare the surgical field in accordance with the recommended aseptic guidelines for knee surgery.

Graft Harvesting
Make a 2 cm vertical incision on the anteromedial side of the tibia. The bony landmark is the midline between the tibial tubercle and the posteromedial margin of the tibia. This incision is used to harvest the grafts and to prepare tibial tunnels.

A minimal graft length of 20 cm for the gracilis tendon and 24 cm for the semitendinosus tendon are recommended for double or triple preparation.

Portal Establishment
Establish standard anterolateral (AL) and anteromedial (AM) portals. The AL portal should be established as close as possible to the external margin of the inferior pole of the patella.

Perform a complete diagnostic arthroscopy and address any intra-articular pathologies.
Intercondylar Notch and Tibial Plateau Preparation

Use a radiofrequency device to perform an extremely limited notchplasty to the femoral insertion site. Leave the tibial footprint of the ACL intact and identify the PL and AM bundles of the ACL on the lateral wall of the intercondylar notch.

Drill the PL and AM Tibial Tunnels

Position the outside-in anatomic tibial guide at 55° (Figure 4). The outside-in anatomic tibial guide is specifically designed to produce two outside-in convergent tunnels. Placed correctly, the tip of the aimer will be 3 to 5 mm anterior to the posterior cruciate ligament (PCL), resulting in a PL pin emerging interarticularly behind the aimer tip and the AM pin emerging in front of the aimer tip.

Figure 4
Use the outside bullet to drill the PL tunnel first at 75° on the coronal plane. Then use the center bullet to drill the AM tunnel at 40° on the coronal plane. This provides a distance of 1.5 cm between the tunnels on the external anteromedial cortex (Figure 5).

Advance the appropriately-sized cannulated drill bit into the joint space to create the tunnels. Alternatively, undersize the tunnels by 1 mm less than the graft diameter and use serial dilators to expand the tunnel to the desired diameter.

*Optional:* Place two different-color, plastic cannulas inside the tunnels to visualize the direction of the new grafts (Figure 6).
Place the Smith & Nephew Outside-In Femoral Aimer

Use the outside-in femoral guide in conjunction with the Smith & Nephew ACUFEX® Director PCL Femoral Aimer. With the PCL aimer in place, the Smith & Nephew Outside-In Femoral Aimer is now set up to produce two convergent tunnels while maintaining 1.2 cm in between the pins at their intra-articular emergence point.

Before securing the femoral aimer, mark the lateral collateral ligament (LCL). Position the aimer just superior to the femoral insertion site of the LCL.

Use the AL portal to position the aimer at 6–7 mm from the anterior cartilage of the femoral condyle and 4–5 mm from the inferior cartilage of the femoral condyle. This position ensures that the femoral tunnels emerge at the anatomic insertion points of the ACL bundles at the 9 and 11 o’clock positions (Figures 7 and 8).

Use the outside-in femoral guide to determine the position of the lateral incisions needed for drilling the femoral tunnels. Two lateral incisions 4–5 mm long and posterior to the lateral collateral ligament are needed.

Figure 7

Figure 8
Drill the Femoral Tunnels

With the outside-in guide in place, drill the PL guide wire first to further secure the outside-in guide (Figure 9). Drill the AM guide wire. The notchplasty performed earlier, allows for easier control and visualization of the guide wires as they emerge from the femoral condyle (Figure 10).

Use the appropriately-sized endoscopic drill to drill the PL tunnel. Lock the guide wire in place with a grasper before retrieving the drill.

**CAUTION:** Insert a plastic cannula over each guide wire as each tunnel is finished. The soft tissue, particularly for the AM tunnel, makes it easy for the guide wires to shift, resulting in a misdirected tunnel.

Use a Smith & Nephew ENDOBUTTON™ Depth Probe to measure the length of the tunnels to determine graft and interference screw lengths (Figure 11). Insert the arthroscope into the lateral incision used to drill the femoral tunnels and read the length indicator measurement off the depth probe.
PL and AM Graft Preparation

Posterolateral Bundle
Use the harvested gracilis to form the PL bundle. Fashion either a double- or triple-stranded graft 6–7 mm in diameter with a minimum length of 24 cm. Use a double “roman sandal” suture to obtain two threads at either end of the graft (Figure 12).

Anteromedial Bundle
Use the harvested semitendinosus to form the AM bundle. Fashion a double-stranded bundle 7–8 mm diameter with a minimum length of 24 cm. Use a double “roman sandal” suture to obtain two threads at either end of the graft (Figure 12).

Final Graft Passage and Fixation
While maintaining the wire against the anterior wall of the tunnel, use a suture carrier to pass the graft. Pass the PL bundle first, followed by the AM bundle. There should be 4–5 cm of tendon length in the AM tunnel and 3–4 cm of tendon length in the PL tunnel. This large amount of tissue in each tunnel increases the bone incorporation of the graft.

Femoral Fixation
Tension the PL graft from both ends. Use a Smith & Nephew Interference Screw 1 mm greater than the PL tunnel diameter to affix the PL bundle (Figure 13).
Tension the AM graft from both ends. Use an interference screw 1 mm greater than the AM tunnel diameter to affix the AM bundle (Figure 13).
Tibial Fixation

Flex the knee to 0–10° of flexion while maintaining tension on both grafts. Secure the PL bundle first using an interference screw 1 mm greater than the PL tunnel diameter (Figure 14).

Continue to maintain tension and flex the knee to 30–50° to affix the AM bundle. Use an interference screw 1 mm greater than the AM tunnel diameter (Figure 15).

Postoperative Care

Brace is kept in full extension for 1 days. Partial weight bearing is allowed as tolerated. Full weight bearing is allowed after 1 days. Rehab program is started at 5 days post-op. Back to sports at 5–6 months post-op.

This technique requires the following Smith & Nephew instrumentation:

Outside-In Anatomic Tibial Guide (REF 72200870)
Outside-In Anatomic Femoral Guide (REF 72200611)
Four Point Bullet, Extended Length (REF 72200608)
ACUFEX® Director PCL Femoral Aimer (REF 7207283)
ACUFEX Director Drill Guide (REF 7205517)
ACUFEX Director ACL Elbow Aimer (REF 7205518)
ACUFEX Director Angled Bullet (REF 7205524)
Additional Instruction

Prior to performing this technique, consult the Instructions for Use provided with individual components — including indications, contraindications, warnings, cautions, and instructions.

Courtesy of Smith & Nephew, Inc.,
Endoscopy Division

Caution: U.S. Federal law restricts this device to sale by or on the order of a physician.

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