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KNEE TECHNIQUE GUIDE

Anatomic ACL Reconstruction Using the CLANCY™ Flexible Drill Guide System



Asheesh Bedi, MD, Answorth Allen, MD, and David W. Altchek, MD



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As described by:

Asheesh Bedi, MD
Sports Medicine & Shoulder Surgery Service
Hospital for Special Surgery
New York, NY

Sports Medicine & Shoulder Surgery
University of Michigan
Ann Arbor, MI

Answorth Allen, MD
Associate Attending Orthopaedic Surgeon
Hospital for Special Surgery
New York, NY

David W. Altchek, MD
Co-Chief
Sports Medicine & Shoulder Surgery Service
Hospital for Special Surgery
New York, NY



In order to address the limitations of the conventional transtibial technique and the technical issues associated with double-bundle ACL reconstruction, we have developed a "footprint" technique that reliably provides an anatomic, single-bundle ACL reconstruction with minimal technical complications. This technique merges the principles of footprint anatomy and anatomic ACL reconstruction with the modified anteromedial portal drilling technique by utilizing a flexible passing pin and drilling system, as first described by Clancy. This procedure offers several advantages, including:

- The position of the femoral tunnel on the lateral wall is determined entirely by the native anatomical footprint. Tunnel positioning based on the native anatomy ensures an anatomic graft position.
- The flexible passing pin and drill minimize the risk of iatrogenic injury to the medial femoral condyle during passage via the medial portal.
- The flexible drill system allows a superolateral trajectory of the femoral tunnel starting at the anatomic center of the femoral footprint. This trajectory provides sufficient tunnel length and avoids the risk of a "shallow socket," which can result from straight drilling via the anteromedial portal.
- Knee hyperflexion is not necessary. The hyperflexion that is required with straight drilling systems through the medial portal is associated with loss of visualization, fat pad ingress, poor arthroscopic inflow, inability to seat instrumentation, and bending of rigid guide wires.
- No endoscopic offset guides, which can be difficult to position via the anteromedial portal, are required.

Note: All internal images in this guide were recorded using a 30° arthroscope.

PORTAL PLACEMENT

Precise anterolateral and anteromedial portal placement are critical to the success of this procedure.

1. Place the anterolateral portal just below the inferior pole of the patella and directly adjacent to the patellar tendon (1–2 mm) **(Figure 1)**. This location is critical to visualizing the lateral wall and femoral ACL footprint **(Figure 2)** without an extensive notchplasty and allows direct visualization of the tibial ACL footprint.
2. After a brief diagnostic arthroscopy has been completed, position the anteromedial portal using direct visualization, inserting the needle directly above the anterior horn of the medial meniscus. Typically this is done with the knee in 70–90° of flexion.

   Note: *Be sure to position the needle sufficiently distant from the medial femoral condyle to avoid iatrogenic injury with drill passage* ***(Figures 3a and 3b)****, but still allow unencumbered access to the lateral wall and femoral footprint in as perpendicular an orientation as possible.*

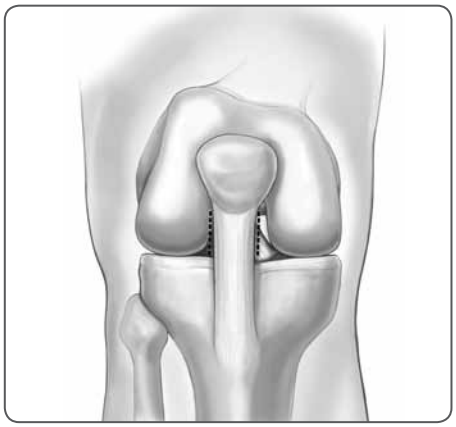


Figure 1



Figure 2



Figure 3a



Figure 3b

TIBIAL FOOTPRINT PREPARATION

Footprint preparation is critical to the success of this procedure, as it provides the primary references that are used for tunnel placement.

1. Using a Smith & Nephew DYONICS® RF-S WHIRLWIND 90° Probe, detach the tibial insertion of the ACL approximately 2 mm above its bony attachment site.
2. Clearly mark the center of the tibial footprint with the probe **(Figure 4)**. Do not reference the center of the footprint from any other intra-articular landmarks.
3. Progressively resect the ligament stump in a proximal direction using a 4.5 mm Smith & Nephew DYONICS INCISOR® Plus PLATINUM Blade with a Smith & Nephew DYONICS POWER II Control System (mode 2, RATE setting 9).

Once the ACL has been resected from the tibia and the excess tissue has been removed, the femoral footprint must also be carefully prepared.



Figure 4

FEMORAL FOOTPRINT PREPARATION

Confirm that the femoral ACL footprint is fully visualized, either by placing the arthroscope into the anteromedial portal and working through an accessory anteromedial portal, or by using a 70° arthroscope through the anterolateral portal.



Figure 5



Figure 6



Figure 7

1. If the femoral notch is stenotic, perform a gentle notchplasty anterior to the footprint only in order to provide complete visualization of the femoral ACL footprint **(Figure 5)**.

2. Debride the bulk of the femoral attachment using the DYONICS® RF-S WHIRLWIND 90° Probe, leaving only the residual 2 mm of the femoral footprint on the lateral wall of the femur to precisely define its margins **(Figure 6)**.

3. Mark the center of the femoral footprint with a microfracture awl to assist in passing pin placement and femoral tunnel drilling **(Figure 7)**.

TIBIAL TUNNEL DRILLING



Figure 8



Figure 9



Figure 10

1. Place the ACUFEX® Director ACL Tip Aimer through the anteromedial portal and fix it at the previously marked center of the tibial footprint **(Figure 8)**.

2. Externally place the guide through a periosteal window prepared at the proximal medial tibia. Both the starting point and guide angle can be adjusted by the surgeon to accommodate graft length, allowing tunnel length to be adjusted without concern for the altered trajectory of the femoral tunnel that can occur with a standard transtibial technique.

3. Advance the passing pin and confirm its position in the center of the tibial footprint **(Figure 9)**.

4. Over-drill the passing pin using the ACUFEX Cannulated Drill that matches the size of the prepared graft **(Figure 10)**.

5. Clear debris within the tunnel and at the tunnel apertures using the 4.5 mm DYONICS® INCISOR® Plus PLATINUM Blade.



Figure 11



Figure 12



Figure 13



Figure 14

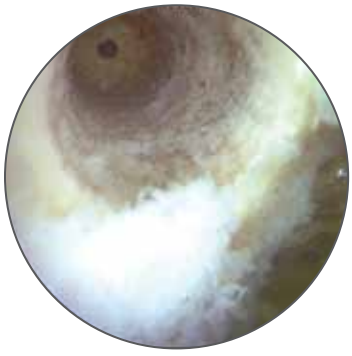


Figure 15

FEMORAL TUNNEL DRILLING

1. With the femoral footprint in clear view, introduce the curved endoscopic femoral guide through the anteromedial portal.

   Note: It is critical that the guide be positioned to achieve a superolateral trajectory of the flexible passing pin, at approximately a 45° angle relative to the tibial plateau. Despite a correct starting point on the wall, positioning the guide at an insufficient angle will decrease tunnel length and increase proximity to the common peroneal nerve (as with conventional straight drilling via the anteromedial portal).

2. With the guide in position, manually advance the flexible passing pin to the microfracture awl defect at the center of the femoral footprint **(Figure 11)**.

3. Gently flex the knee to 115° and advance the pin until it has passed out of the lateral skin of the distal thigh.

   Note: Appropriate tunnel position is confirmed by the pin exiting from the lateral skin of the distal thigh. Pin exit from the anterior thigh indicates too-vertical a trajectory, while exit directly lateral indicates too-horizontal a trajectory and risk of a short femoral socket.

4. Once the pin has been passed, and prior to drilling, decrease knee flexion to the resting position. Remove the guide and advance an appropriately-sized flexible cannulated drill over the pin to the footprint **(Figure 12)**. An appropriately-placed medial portal allows the drill to advance easily beyond the medial femoral condyle without iatrogenic injury.

5. Under direct visualization, advance the drill along the pin until the desired depth of femoral socket is achieved or contact is made with the lateral cortical wall **(Figure 13)**. Flexible drilling does NOT require the hyperflexed position of straight drilling through the anteromedial portal, avoiding injury to the fat pad as well as limited visualization during drilling.

   Note: Always be sure to drill with the drill set to "Forward." Drilling in reverse can unwind the drill bit, causing it to detach from the drill.

   Note: The presence of a back wall can be confirmed after drilling a short distance, but is not necessary if the pin position and drill size are appropriately selected to match the femoral footprint. With correct superolateral pin trajectory, it is possible to regularly achieve a femoral socket of 25 mm or greater **(Figure 14)**.

6. Remove the drill and pin, being sure not to drill in reverse. Clear bony debris from the socket using a shaver handpiece. Directly visualize and evaluate the tunnel position, depth, and walls **(Figure 15)**. The 70° arthroscope in the lateral portal provides complete visualization without adjustment or repositioning of the camera to the anteromedial portal.

GRAFT PASSAGE AND FIXATION

Bone-Patellar Tendon-Bone Graft Using Interference Screw Fixation

1. Place the free ends of a looped, nonabsorbable suture in the eyelet of the flexible passing pin. Advance the pin through the anteromedial portal into the femoral tunnel, exiting the superolateral thigh.
2. After clamping the free ends, visualize the suture loop within the notch and retrieve the loop through the tibial tunnel using a probe or arthroscopic grasper **(Figure 16)**.
3. Shuttle the passing sutures of the graft into the tunnels using the looped passing suture.
4. Ensure that the tibial tunnel exit is clear of debris and soft tissue that could impede graft passage.
5. Extend the leg while pulling the graft through the tibial tunnel, aligning the vector of pull with the tibial tunnel. Pull the femoral bone plug completely into the notch **(Figure 17)**.
6. Allow the knee to flex to a resting position of 90°. Orient and seat the plug in the femoral socket **(Figure 18)**. If the plug does not seat easily, confirm the depth of the femoral socket and ensure that the plug has been sized appropriately.
7. Fix the graft on the femoral side using interference screw fixation. Use standard arthroscopic technique to position the 1.2 mm guide wire through the anteromedial portal. Advance the 1.2 mm guide wire parallel to the femoral socket while protecting the graft. Using the BIOSURE® Flexible Driver, advance a BIOSURE PK or HA Interference Screw over the guide wire and secure the graft within the femoral tunnel. **(Figure 19)**.

   Note: The BIOSURE Flexible Driver is designed to work with BIOSURE Interference Screws up to 25 mm in length.

   Note: For BIOSURE HA Interference Screws and/or hard bone applications, use BIOSURE Flexible Taps to prepare the femoral socket prior to interference screw fixation.
8. After femoral-side fixation, fully extend the leg. Cycle, tension, and secure the graft on the tibial side using a BIOSURE HA Interference Screw, a BIOSURE PK Interference Screw, or a metal interference screw.



Figure 16



Figure 17



Figure 18



Figure 19



Figure 20



Figure 21

SOFT TISSUE GRAFT USING THE ENDOBUTTON® CL ULTRA FIXATION DEVICE

1. After drilling the femoral socket, remove the flexible passing pin from the anteromedial portal.
2. Introduce a 4.5 mm endoscopic cannulated drill through the medial portal and seat it centrally into the base of the femoral socket at the hole created by the flexible passing pin **(Figure 20)**. A parallel trajectory can be easily achieved with gentle hyperflexion of the knee to 110–115°.

   Note: Alternatively, the 4.5 mm CLANCY™ Flexible Drill can be used in place of the straight drill, which eliminates the need for hyperflexion.
3. Advance the 4.5 mm drill through the base of the femoral socket and lateral cortex of the femur. It is not necessary to penetrate the skin of the distal thigh.
4. Place the free ends of a looped, nonabsorbable suture in the eyelet of the flexible passing pin. Reintroduce the pin through the medial portal into the femoral tunnel **(Figure 21)**, exiting the superolateral thigh.
5. After clamping the free ends, visualize the suture loop within the notch and retrieve the loop through the tibial tunnel using a probe or arthroscopic grasper.
6. Shuttle the passing and flipping sutures of the ENDOBUTTON CL ULTRA Fixation Device into the tunnels using the looped passing suture.
7. Advance the graft using these sutures in a standard fashion. Flip and seat the fixation device on the lateral cortex of the femur. Toggle the sutures to confirm that the fixation device is properly seated.
8. Once femoral-side fixation is achieved, fully extend the leg. Cycle, tension, and secure the graft on the tibial side using a BIOSURE® HA Interference Screw, a BIOSURE PK Interference Screw, or a metal interference screw.

ALTERNATIVE TECHNIQUES FOR USING ENDOBUTTON® CL ULTRA FIXATION DEVICE WITH THE CLANCY™ FLEXIBLE DRILL GUIDE SYSTEM

1. After drilling the socket, place the scope in the anteromedial portal to view the inside of the tunnel. Alternatively, use a 70° scope through the lateral portal.

   Note: Ensure that the socket depth is equal to the desired graft insertion depth plus 10 mm to allow for flipping the ENDOBUTTON CL ULTRA Fixation Device.

   Example: For 20 mm of graft in the femoral tunnel, drill the socket to 30 mm.



Figure 22

2. Make a small incision at the exit point of the flexible passing pin on the distal thigh. Place the 4.5 mm endoscopic cannulated drill bit over the tip of the pin in order to drill the 4.5 mm tunnel from the outside-in **(Figure 22)**.
3. Advance the drill through the tissue until it makes contact with the femur. Reference the reading on the drill at the skin level prior to drilling.
4. Drill the 4.5 mm hole into the femoral socket. The 4.5 mm tunnel length can now be estimated.

   Place the distal end of the 4.5 mm drill at the junction of the 4.5 mm hole and the socket. Reference the reading on the drill at the skin.

(Reading on drill after drilling) – (Reading on drill prior to drilling) = Length of 4.5 mm tunnel	
Example:	• Reading on 4.5 mm drill after drilling = 20 mm • Reading on 4.5 mm drill before drilling = 10 mm 20 mm – 10 mm = 10 mm = Length of 4.5 mm tunnel

5. Add the depth of the socket to the length of the 4.5 mm tunnel to determine the total tunnel length and the corresponding ENDOBUTTON CL ULTRA device loop length.

(Socket depth) + (4.5 mm tunnel length) = Total tunnel length	
Example:	• Socket depth drilled = 30 mm (Step 1) • 4.5 mm tunnel length = 10 mm (Step 4) 30 mm + 10 mm = 40 mm

(ENDOBUTTON CL ULTRA device loop length) + (Length of graft in tunnel) = Total tunnel length	
Example:	ENDOBUTTON CL ULTRA device loop length + 20 mm (Step 1) = 40 mm ENDOBUTTON CL ULTRA device loop length = 20 mm

Note: *Select the next longest ENDOBUTTON CL ULTRA device's loop length when the total tunnel length falls between sizes.*

Note: *If outside-in drilling is not desirable, or the cortex is inadvertently breached:*

Drill all the way through the cortex and use the ENDOBUTTON CL ULTRA Fixation Device with an XTENDOBUTTON device to achieve femoral fixation,

or

Drill all the way through the cortex and use an ENDOBUTTON DIRECT Fixation Device.

ORDERING INFORMATION

To order the instruments used in this technique, call +1 800 343 5717 in the U.S. or contact an authorized Smith & Nephew representative.

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

Reference #	Description
72203086	CLANCY™ Anatomic Cruciate Guide Flexible Drill System A
72202971	CLANCY Flexible Drill, 4.5 mm
72202972	CLANCY Flexible Drill, 5.0 mm
72203161	CLANCY Flexible Drill, 5.5 mm
72202594	CLANCY Flexible Drill, 6.0 mm
72203162	CLANCY Flexible Drill, 6.5 mm
7209008	CLANCY Flexible Drill, 7.0 mm
72203163	CLANCY Flexible Drill, 7.5 mm
7209737	CLANCY Flexible Drill, 8.0 mm
72203164	CLANCY Flexible Drill, 8.5 mm
7209738	CLANCY Flexible Drill, 9.0 mm
72203165	CLANCY Flexible Drill, 9.5 mm
7209739	CLANCY Flexible Drill, 10.0 mm
72203166	CLANCY Flexible Drill, 10.5 mm
72203090	CLANCY Flexible Drill, 11.0 mm
72203167	CLANCY Flexible Drill, 11.5 mm
72203091	CLANCY Flexible Drill, 12.0 mm
72203170	CLANCY Curved Femoral Guide, 42°

Reference #	Description
72203168	BIOSURE° Flexible Driver
7207707	Ratcheting Handle with Hudson Adaptor
72203252	BIOSURE Flexible Tap, 6 mm
72203253	BIOSURE Flexible Tap, 7 mm
72203254	BIOSURE Flexible Tap, 8 mm
72203255	BIOSURE Flexible Tap, 9 mm
72203256	BIOSURE Flexible Tap, 10 mm
72203085	CLANCY Instrument Tray System
72201594	Flexible Passing Pins, 2.4 mm, sterile, package of five
72202139	DYONICS° RF-S WHIRLWIND 90° Probe
72203013	DYONICS INCISOR° Plus PLATINUM Blade, 4.5 mm
72203519	INCISOR Plus PLATINUM Blade, 5.5 mm
7205519	ACUFEX° Director ACL Tip Aimer
7207315	ENDOBUTTON° Drill, 4.5 mm
72203331	ENDOBUTTON CL ULTRA Fixation Device, 10 mm
72200146–72200155	ENDOBUTTON CL ULTRA Fixation Devices, 15 mm–60 mm (see Product Catalog)
72201768–72201791	BIOSURE HA Interference Screws, 6 mm x 20 mm–12 mm x 35 mm (see Product Catalog)
72202259–72202282	BIOSURE PK Interference Screws, 6 mm x 20 mm–12 mm x 35 mm (see Product Catalog)

CAUTION: *U.S. Federal law restricts these devices to sale by or on the order of a physician.*

References:

Bedi A and Altchek DW. The "Footprint" ACL Technique: An Anatomic Approach to ACL Reconstruction. *Arthroscopy: The Journal of Arthroscopic and Related Surgery* 2009; 25(10); 1128–1138.

Endoscopy
Smith & Nephew, Inc.
150 Minuteman Road
Andover, MA 01810
USA

www.smith-nephew.com
+1 978 749 1000
+1 978 749 1108 Fax
+1 800 343 5717 U.S. Customer Service

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