

# ACL Reconstruction with Bone-Tendon-Bone Transplants Using the ENDOBUTTON<sup>◇</sup> CL BTB Fixation System

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# ACL Reconstruction with Bone-Tendon-Bone Transplants Using the ENDOBUTTON<sup>®</sup> CL BTB Fixation System

## Introduction

The ENDOBUTTON CL BTB Fixation System was developed by Smith & Nephew to assist surgeons performing bone-tendon-bone (BTB) ACL reconstructions. This revised technique, which demonstrates the preferred method of attaching the ENDOBUTTON CL BTB Fixation Device (ENDOBUTTON CL BTB) through a longitudinal hole, offers the surgeon many advantages:

- Bone blocks are fully appositioned in the femoral tunnel. Neither bone block, particularly the tibial bone block, protrudes.
- The tibial bone block lies flush with the opening of the tibial tunnel, eliminating the need for long grafts.
- Perforation of the posterior femoral cortex does not compromise fixation.
- Easier revisions because bone blocks fit existing tunnels, reducing the number of steps required.
- The ability to “hide” the continuous loop within the femoral bone block allows the bone block to be easily guided and pulled into position, without added bulk or cumbersome sutures.
- Directly obtaining the length of the needed construct using the ENDOBUTTON Depth Probe eliminates all calculations and minimizes the potential for error.

This technique delivers strong fixation without the drawbacks of interference fixation such as screw divergence, posterior blow-out, laceration of the graft, the need for long grafts, and screw breakage. In addition, this technique makes it easier for surgeons to apply powerful fixation for interference fixation of the tibial bone block, namely between cortical bone on the tibia and the tibial bone block. These advantages translate into a technique for BTB ACL reconstruction and ACL revisions that is simple, reproducible, and dependable.



Figure 1. Measuring the overall length of the graft



Figure 2. Drilling a longitudinal hole through the femoral block

## Graft Harvesting and Preparation

If necessary, perform appropriate notchplasty using the Smith & Nephew NOTCHMASTER<sup>®</sup> Curette or a DYONICS<sup>®</sup> resection device, such as the BONECUTTER<sup>®</sup> Blade or NOTCHBLASTER<sup>®</sup> Burr.

Harvest the bone-patella-bone tendon graft in the preferred manner. Recommended bone block lengths are 20 mm.

1. Measure the overall length of the graft (Figure 1).
2. Use the Smith & Nephew COMPACTION<sup>®</sup> Pliers to crimp the bone block to 1 mm less than the diameter of the tunnel (for example, crimp bone block to 9 mm for a 10 mm tunnel). This will allow the construct to slide easily through the tunnels.

**Note:** The bone block will expand slightly prior to being pulled through the tunnels, but it will still slide through easily.

3. Drill a 2 mm hole longitudinally through the femoral bone block using the COMPACTION Pliers (Figure 2) or drilling freehand.

For additional options on attaching the continuous loop to the femoral bone block, see Appendix A.

## Drilling the Tunnels

1. Ream the tibial tunnel in the usual manner using the Smith & Nephew ACUFEX<sup>®</sup> Director Drill Guide.
2. Use the desired offset guide to drill the passing pin until the passing pin breaks through the femoral cortex (Figure 3). “Posterior blow out” will not compromise fixation with this technique as it would with interference fixation. Reaming the femoral tunnel at varying degrees of flexion will effectively lengthen or shorten the tunnel as desired.
3. Use an acorn reamer (endoscopic drill bit) to ream the femoral tunnel over the passing pin. The reamer markings allow measurements to be read directly from the reamer. Ream the femoral tunnel to a depth that matches the total length of the graft as read from the reamer at the tibial tunnel entrance (Figure 4). For example, if the graft is 90 mm in length, insert the reamer 90 mm. Advance the reamer an extra 10 mm to allow room to flip the ENDOBUTTON<sup>®</sup> CL BTB outside the lateral femoral cortex.
4. Take care not to ream through the lateral femoral cortex. This will compromise fixation with the ENDOBUTTON CL BTB. Should the reamer break through the lateral femoral cortex, adding the XTENDOBUTTON Fixation Device provides an easy solution (see Appendix B for details).
5. Remove the acorn reamer, leaving the guide pin in place. Finish by drilling over the guide pin with the 4.5 mm drill bit through the femoral cortex (Figure 5). This drill bit allows the ENDOBUTTON CL BTB to be passed outside the lateral femoral cortex.
6. Remove the passing pin.



Figure 3. Reaming femoral tunnel, knee flexed less than 90°

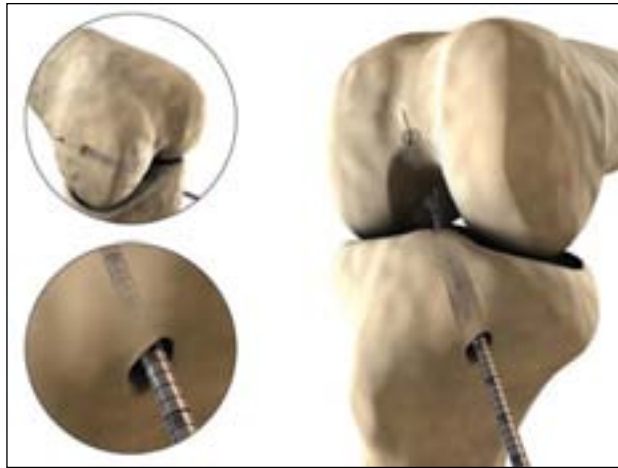


Figure 4. Femoral socket drilling

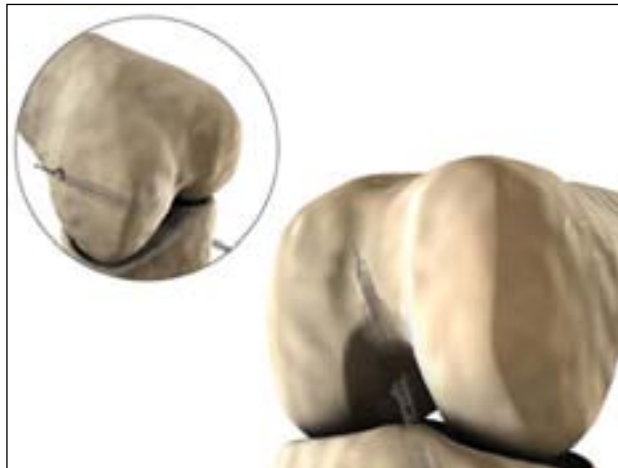


Figure 5. Drilling through the femoral cortex

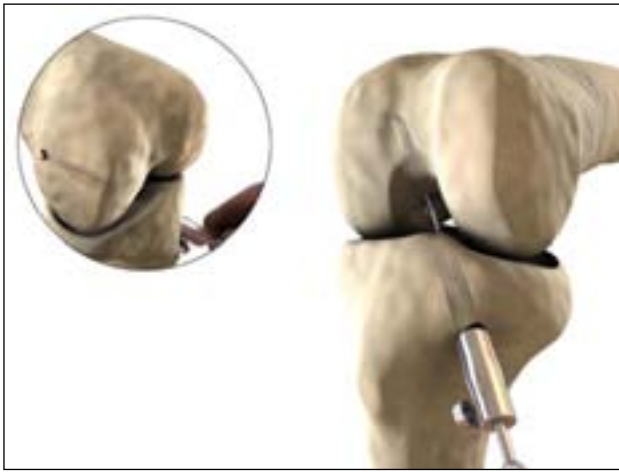


Figure 6. Measuring the femoral channel



Figure 7. Determination of continuous loop length

## Determining the Continuous Loop Length

1. Measure the total length of the tunnel from the lateral femoral cortex to the opening of the tibial tunnel using the ENDOBUTTON<sup>®</sup> Depth Probe's adjustable stop.
2. With the tibial stop at the opening of the tibial tunnel, tighten the knob on the depth probe (Figure 6).
3. Remove the depth probe from the knee to mark the total tunnel length.
4. Lay the graft directly against the depth probe with the tibial bone block flush against the tibial stop. This will determine the size of the ENDOBUTTON CL BTB that is required (Figure 7).
5. Read the length of the required continuous loop from the depth probe. If the continuous loop will be attached at the bone-tendon junction, read the distance that correlates to the bone-tendon junction from the depth probe.
6. Mark the graft 10 mm below the bone-tendon junction to signify the flipping distance needed to pass the ENDOBUTTON CL BTB.

## Attaching the ENDOBUTTON® CL BTB to the Femoral Bone Block

1. Pass a suture passer through the small loop of the ENDOBUTTON CL BTB, then through the bone block, and then through the tendon as pictured (Figure 8).
2. Place a passing suture through the long loop of the ENDOBUTTON® CL BTB and through the suture passer (Figure 9).
3. Pull the passing suture back through the tendon, bone block, and small loop. This is the path that the long loop of the ENDOBUTTON CL BTB will need to follow (Figure 10).



Figure 8. Suture passer passing through small continuous loop, bone block, and tendon

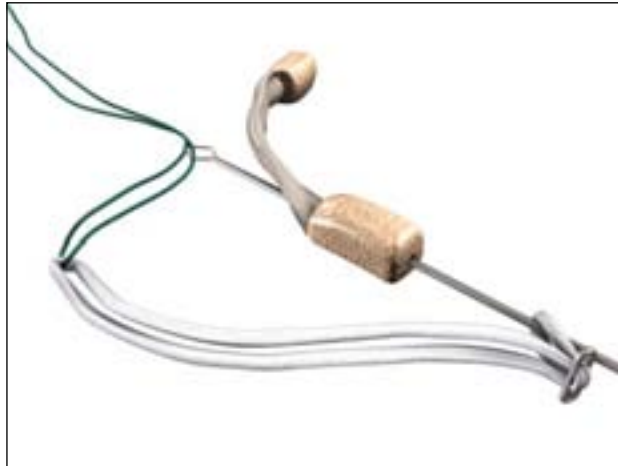


Figure 9. Place a passing suture around the long loop of the ENDOBUTTON CL BTB



Figure 10. Pull passing suture through tendon, bone block, and small loop



Figure 11. Pulling long loop through construct



Figure 12. Confirming that the total length of the construct correlates with the length from the depth probe.

4. Pull the long loop of the ENDOBUTTON® CL BTB through the tendon, bone block, small loop, and over the top of the ENDOBUTTON® CL BTB (Figure 11).

**Note:** The long loop of the ENDOBUTTON CL BTB must pass around the cortical side of the bone block – not the cancellous side. Passing the long loop around the cancellous side of the bone block may compromise fixation.

5. Pull on the button to tighten the construct.
6. Place the construct against the depth probe to assure the total length of the construct still correlates with the total length of the tunnel. The tibial bone block must lay flush with the depth stop while the ENDOBUTTON CL BTB will be at the top of the depth probe (Figure 12).



## Graft Passage

1. Place the passing pin into position through the tunnels in the usual manner.
2. Attach a #5 polyester braided suture to one outside hole of the ENDOBUTTON® CL BTB to lead and pass the graft.
3. Attach a trailing #2 polyester ULTRABRAID® Suture to the opposite outside hole of the ENDOBUTTON CL BTB to flip the ENDOBUTTON as it exits the anterolateral femoral cortex. Alternatively, #2 ULTRABRAID sutures of differing colors may be used.
4. If desired, add a free suture to the bone block to allow for graft tensioning on the tibial end.
5. Pass both sutures through the eyelet of the passing pin (Figure 13).
6. Pull the passing pin preloaded with sutures through the tibial and femoral tunnel and outside the lateral femoral cortex.
7. With the ENDOBUTTON® CL BTB horizontal to the plane of the tunnels, pull on the leading suture, guiding the graft into position (Figure 14). Pull up slack on the trailing suture as you go.
8. Once the graft is in position, flip the ENDOBUTTON CL BTB outside of the lateral femoral cortex so it rests perpendicular to the tunnels (Figure 15).
9. Pull back on the graft to lock it into position. Secure fixation should be felt at the point where the bone-tendon-bone tissue markings retreat 6 mm.

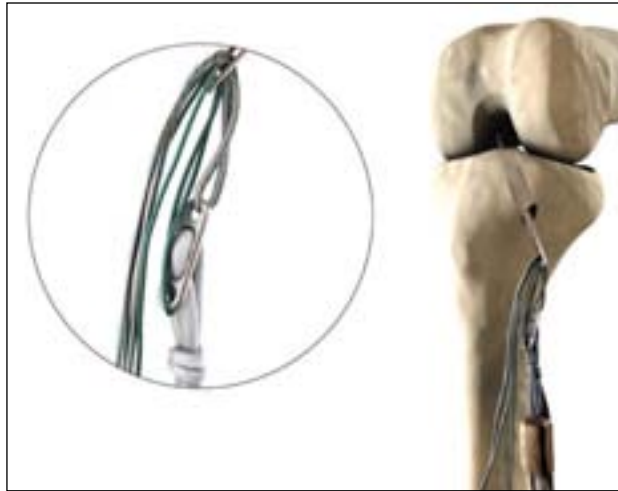


Figure 13. Leading and trailing sutures attached to ENDOBUTTON CL BTB

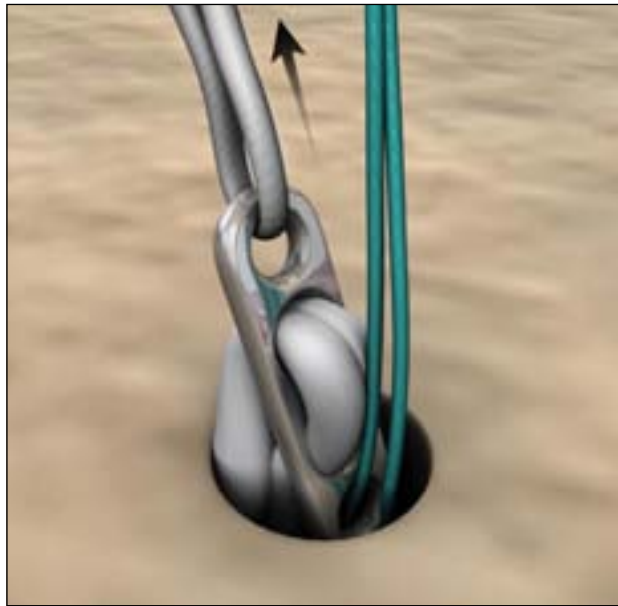


Figure 14. Pulling the ENDOBUTTON CL BTB through the femoral tunnel

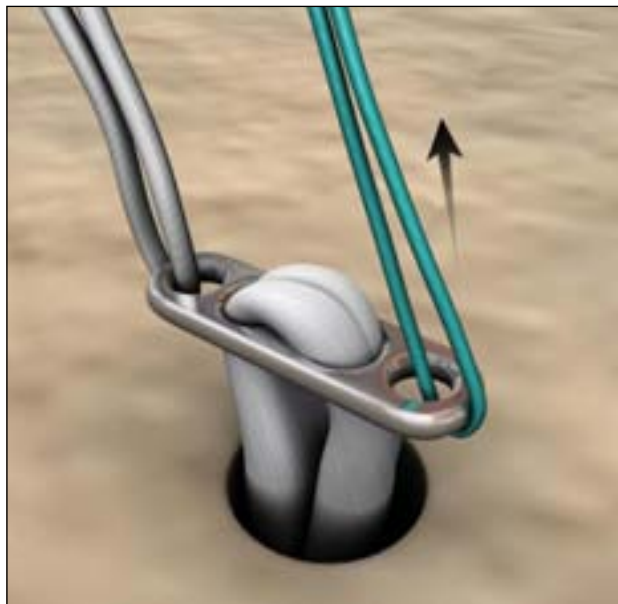


Figure 15. Flip the ENDOBUTTON CL BTB device perpendicular to tunnels

## Tibial Fixation

Tension the graft. The tibial bone block should rest flush with the end of the tibial tunnel, allowing for the desired fixation method (for example, with a Smith & Nephew interference screw, tying over a screw and washer, or both) (Figure 16).

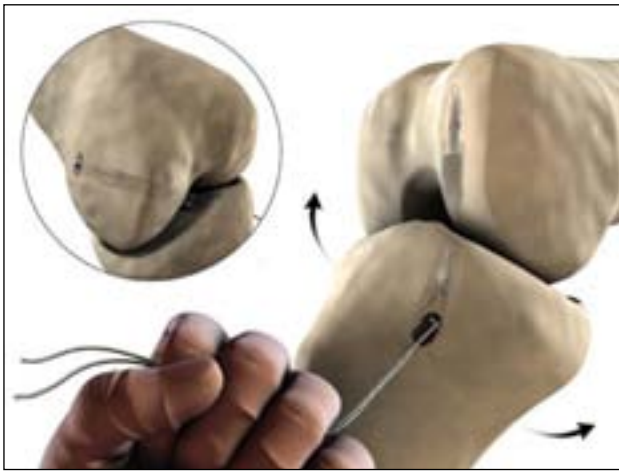


Figure 16. Tensioning the graft

## Appendix A

### Attaching the continuous loop through the bone block

1. Drill a 2 mm hole transversely through the bone block.
2. Pass the long loop of the ENDOBUTTON CL BTB through the drilled hole, through the short loop, and around the ENDOBUTTON CL BTB as shown in Figure 17.

**Note:** Be sure to measure the length of the ENDOBUTTON CL BTB from this attachment point and not the bone-tendon junction.

### Attaching the continuous loop at the bone-tendon junction

1. Pass the long loop of the ENDOBUTTON CL BTB at this attachment point, through the short loop, and over the ENDOBUTTON CL BTB in a manner as described above.

**Note:** Attaching the continuous loop in this manner may allow the femoral bone block to toggle in the femoral canal when pulling it into position. Therefore, place a guiding suture through a 2 mm drill hole placed transversely through the bone block to help pull the graft into position (Figure 18).

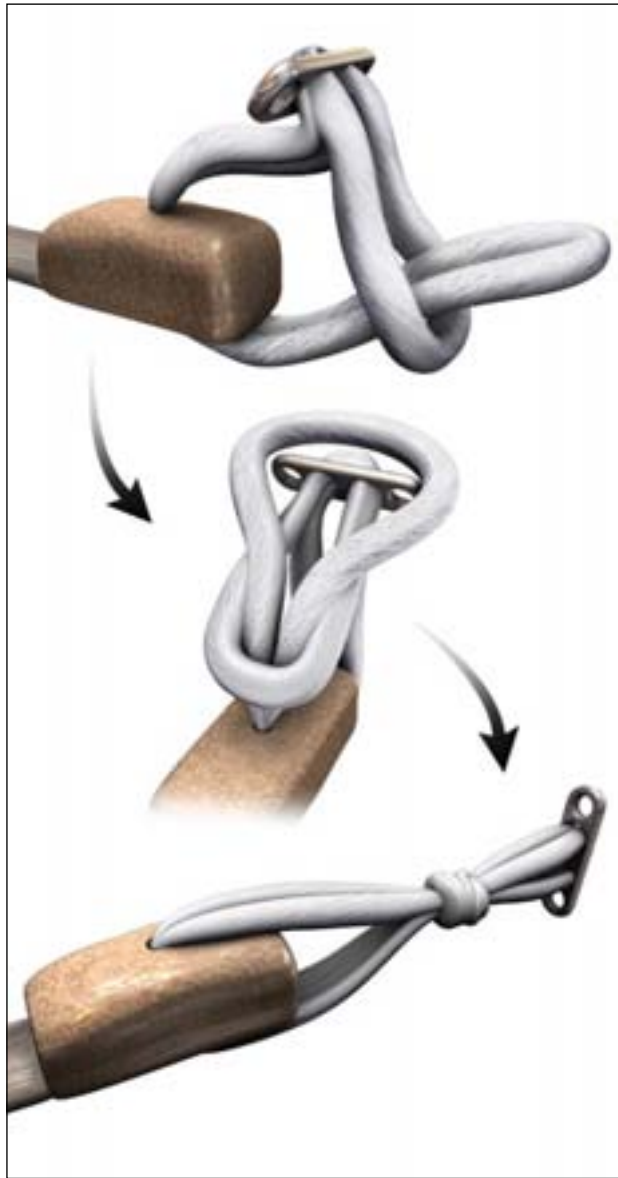


Figure 17. Attaching the ENDOBUTTON CL BTB through a transversely drilled hole in the bone block



Figure 18. Attaching the ENDOBUTTON CL BTB at the bone-tendon junction

## Appendix B

### XTENDOBUTTON Fixation Device

The XTENDOBUTTON allows the ENDOBUTTON<sup>®</sup> CL BTB to be converted into a larger ENDOBUTTON that toggles and holds over a 6–10 mm hole. This works well, for example, when the lateral femoral cortex is inadvertently breached by the acorn reamer, leaving a hole greater than 6 mm in the lateral femoral cortex. This hole is too large for the ENDOBUTTON CL BTB to obtain fixation. Simply attach the XTENDOBUTTON as described below.



Figure 19. ENDOBUTTON CL BTB pulled through the XTENDOBUTTON



Figure 20. ENDOBUTTON CL BTB seated within the XTENDOBUTTON

1. Drill a 6 mm or greater hole through the lateral femoral cortex. This eliminates the step of drilling over a guide pin with a 4.5 mm drill bit for the ENDOBUTTON CL BTB.
2. From the bottom of the XTENDOBUTTON, insert the ENDOBUTTON CL BTB through center hole.
3. Pull the ENDOBUTTON CL BTB all the way through (Figure 19).
4. Pull back on the graft or loop to seat the ENDOBUTTON CL BTB within the XTENDOBUTTON (Figure 20).
5. Pull the graft into position.
6. Flip the XTENDOBUTTON outside of the lateral femoral cortex.
7. Tension and secure the graft.







## Additional Instruction

Prior to performing this technique, consult the Instructions for Use documentation 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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