Preservation of the Anterior Cruciate Ligament: Surgical Techniques

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Abstract

In the first part of this series, we (I) discussed the history of anterior cruciate ligament (ACL) preservation, (II) discussed how modern advances altered the risk-benefit ratio for ACL preservation, and (III) proposed our treatment algorithm for ACL injuries, which is based on tear location and tissue quality. In the second part of this series, we discuss (I) our proposed modification of the Sherman classification of the different tear types and (II) the surgical techniques and variations that can be used to treat these different tear types.

In the first part of this series, "Preservation of the Anterior Cruciate Ligament: A Treatment Algorithm Based on Tear Location and Tissue Quality" we discussed the history of anterior cruciate ligament (ACL) preservation, and the historical outcomes of both open primary repair and augmented repair. We also presented our surgical treatment algorithm for ACL preservation, which is based on the tear location and tissue quality of the ligament remnant. In this article, we propose a modification of the Sherman classification[1] to identify the different tear types, and we will discuss the different surgical techniques that can be used for each one. Furthermore, we aim to provide an overview of the variations of these techniques that are seen in the literature. It is important to emphasize that these tear types and corresponding surgical techniques are to be seen as guidelines, rather than strict criteria, and that significant overlap between these tear types and surgical indications exist.

Assessment of Tear Type and Tissue Quality

The first assessment of the tear location and tissue quality is made using magnetic resonance imaging (MRI). Although MRI can give you an idea of where the tear is located, the final assessment for eligibility of each specific preservation technique is made during arthroscopy. Therefore, the routine preoperative discussion and informed consent process with the patient should encompass the gamut of surgical possibilities ranging from repair to reconstruction.

The **Table** shows our tear type classification, along with the corresponding preservation surgical techniques. The location of the tear is described as the length of the distal remnant compared to the total ligament length (in percentage). The tissue quality indicates the minimum tissue quality that is generally necessary to perform a certain surgical technique. If the tissue quality is less than what is necessary for a specific ACL preservation technique, it may still be possible to perform another technique. For example, if a type II tear is found to have poor tissue quality in the upper half of the ligament, but good tissue quality in the lower half of the ligament, the remnant with poor quality is debrided and then the surgical procedure that corresponds to the length of good tissue quality can be performed (in this case remnant tensioning or remnant preservation with soft tissue graft reconstruction).

Surgical Preparation

In the operating room, the patient is placed in supine position on a standard operative table, such that the knee can be moved freely through

Authors' Disclosure Statement: Dr. DiFelice reports that he is a paid consultant for Arthrex. Dr. van der List reports no actual or potential conflict of interest in relation to this article.

Table. **Treatment Algorithm for Anterior Cruciate Ligament Preservation Based on the Different Tear Types**

Tear Type	Description	Tear Location	Tissue Quality	Technique
Type I	Proximal avulsion	>90%	Good to excellent	Repair (two bundles/anchors) ± internal brace
One bundle Type I[a]	One bundle proximal avulsion[a]	>90%	Good to excellent	Repair (one bundle) + augmentation (other bundle)
Type II	Proximal	75%-90%	Good to excellent	Repair (two bundles) + augmentation
Type III	Midsubstance	25%-75%	Fair to good	Reconstruction + remnant tensioning
Type IV	Distal	10%-25%	Fair to good	Reconstruction + remnant preservation
Type V	Distal (bony) avulsion	<10%	Good to excellent	Distal repair (anchors/tunnels/screws)
Complex/multiple	--	--	Poor	Reconstruction

[a]With these tear types, one bundle (either anteromedial or posterolateral bundle) has a Type I tear that is amendable for repair while the other bundle is not repairable.

its range of motion (ROM). The operative leg is then prepped and draped in standard fashion for knee arthroscopy. Standard knee arthroscopy equipment and implants are used, although some instruments from the standard shoulder set are also utilized. Anteromedial and anterolateral portals are created, and a general inspection of the knee is performed. By pulling the remnant ligament proximally using a broad tissue gasper, the available length of the remnant can be assessed. It is important to reduce possible anterior tibial subluxation in the sagittal plane in order to prevent "false" shortening of the distal ligament remnant. Once the length of the remnant tissue is assessed and the tissue quality is determined, the surgical preservation technique can be chosen (Table).

Type I Tears: Primary Repair

In order to be a candidate for arthroscopic primary repair, sufficient tissue length and tissue quality are necessary (**Figures 1A and 1B**, Table). Sufficient length is seen if the distal remnant can be approximated to the femoral wall. Sufficient tissue quality is noted if sutures can be passed through the ligament and achieve good purchase. Once the ligament is deemed suitable for repair, a malleable Passport cannula (Arthrex) is placed in the anteromedial portal to facilitate suture passage and management of the repair.

Sutures are then passed through the anteromedial bundle using the Scorpion Suture Passer (Arthrex) with a No. 2 FiberWire suture (Arthrex) (**Figure 1C**). Suturing is commenced at the intact distal end of the anteromedial bundle and is advanced in an alternating, interlocking Bunnell-type pattern towards the avulsed proximal end with approximately 4 mm to 5 mm between each pass. In general, 3 to 4 passes can be made before the final pass exits via the avulsed end of the ligament towards the femur (**Figure 1D**). The same process is then repeated for the posterolateral bundle of the ACL remnant with a No. 2 TigerWire suture (Arthrex) to optimize suture management. With each subsequent pass of the sutures, it is important to assess tissue resistance to prevent perforation of a previous stitch. Mild resistance is normal, but the suture-passing device should be repositioned when notably increased resistance is encountered. In addition, placing all of the bites in the same plane should be avoided since this can allow the sutures to "cheese cut" along the collagen fibers of the ligament remnant rather than holding firm.

After passing the sutures through both bundles, the sutures are guided outside the knee using an accessory stab incision situated just above the medial portal. Using this portal, the ligament can be retracted away from the femoral footprint for optimal visibility. The femoral footprint is then roughed using a shaver or burr, and bleeding is induced to stimulate a local healing response,[2] while the sutures and the ACL are protected via the portal. With the knee in flexion, an accessory inferomedial portal is then created under direct visualization using a spinal needle for localization. Care should be taken to enable the appropriate trajectory for anchor placement to be achieved.

Many different techniques can be used to

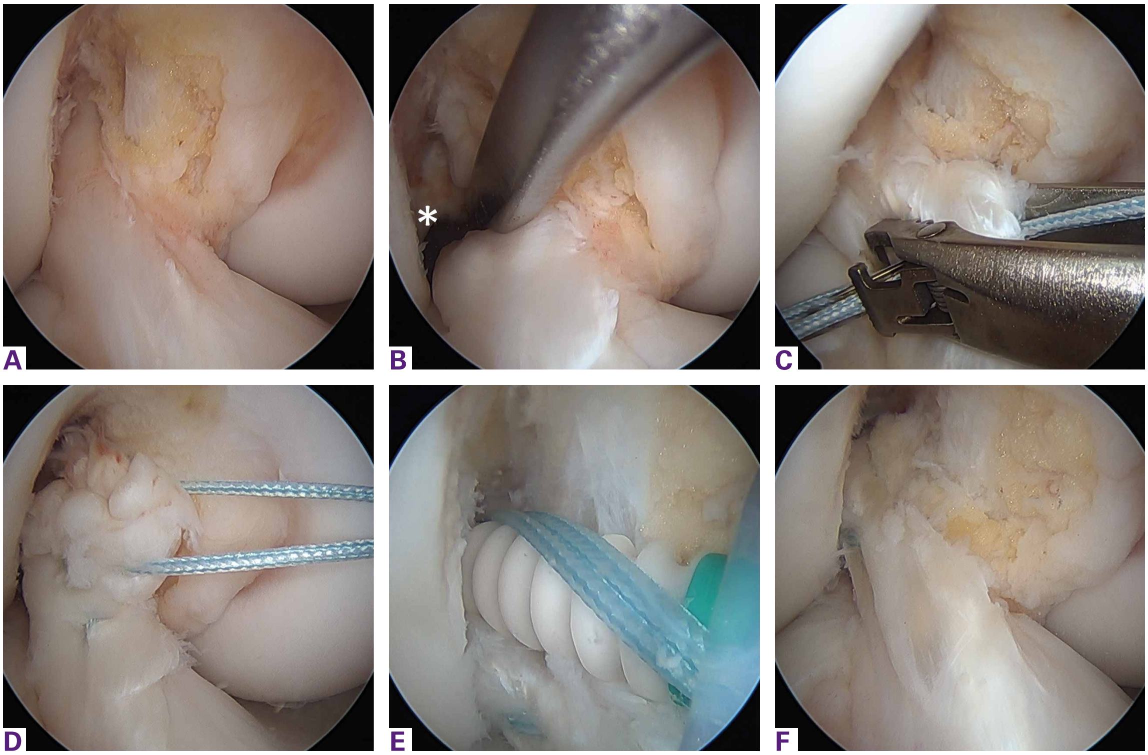

Figure 1. Type I tears: primary repair. (A) The ligament is shown with excellent tissue quality. (B) After probing of the ligament, a proximal soft tissue avulsion tear (type I) is confirmed (asterisk). (C) Sutures are passed through the anteromedial bundle using a suture passer. (D) The sutures exit at the proximal end of the avulsed ligament and are channeled through an accessory portal in order to retract the ligament. (E) The suture anchor of the anteromedial bundle is placed in the anteromedial femoral footprint. (F) The primary repair is completed.

provide fixation of the ACL repair to the femoral footprint; the 2 most straightforward techniques are presented here. The first technique provides fixation with knotless suture anchors,[3,4] whereas in the second technique the sutures are transosseously passed, and tied over a bone bridge, as was performed in the 1970s and 1980s.

Suture Anchor Fixation

With the suture anchor fixation technique, the knee is flexed in 90°, the anteromedial bundle origin within the femoral footprint is identified, and a 4.5-mm x 20-mm hole is drilled, punched, or tapped, in the case of high bone density. The FiberWire sutures are then retrieved through the accessory portal and passed through a 4.75-mm Vented BioComposite SwiveLock suture anchor (Arthrex). The suture anchor for the anteromedial bundle is then deployed into the hole within the anteromedial footprint, while tensioning the ACL remnant to the wall with a visual gap of <1 mm (**Figure 1E**).[5] The procedure is then repeated using another suture anchor with TigerWire sutures for the posterolateral bundle with the knee flexed at 110° to 115°. This ensures an optimal angle of approach and avoids perforating the posterior condyle with the anchor. The drill hole and anchor are placed into the origin of the posterolateral bundle within the femoral footprint. The order of bundle tensioning and repair may be varied depending on the particulars of each case.

Once the anchors are fully deployed and flush with the femoral footprint, the handle is removed and the additional core stitches are unloaded. Occasionally, the core stitches can be passed from lateral to medial through the proximal ligament remnant and tied down with an arthroscopic knot pusher to add extra compression of the remnant to the origin. The free ends of the repair sutures are cut with an Open Ended Suture Cutter (Arthrex) so that they are flush with the notch. The repair is now complete (**Figure 1F**). Using a probe, the ACL remnant is tested for tension and stiffness. Finally, cycling of the knee through the full ROM confirms anatomic positioning without impingement of the graft. Manual laxity testing should reveal minimal

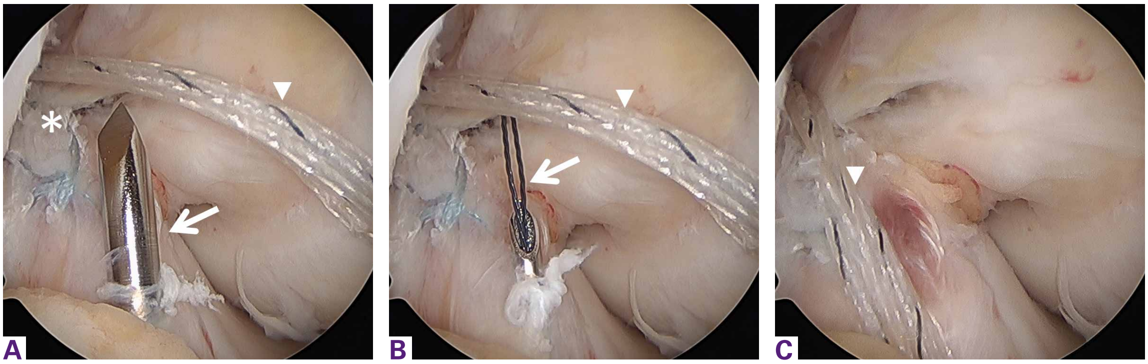

Figure 2. Type I tears: primary repair with internal brace. (A) The primary repair has been completed (asterix) and a tibial tunnel is drilled (arrow) to guide the FiberTape (Arthrex) internal brace (arrowhead) down the tibia. (B) The ninitol wire is guided through the tibial tunnel (arrow) to retrieve the internal brace (arrowhead). (C) The internal brace is guided down through the tibia (arrowhead) and fixed, and the primary repair with internal brace is completed.

anteroposterior translation with a firm endpoint on Lachman examination intraoperatively.

Bone Bridge Fixation

With this technique, parallel drill holes are created exiting at each bundle origin. The repair stitches can then be retrieved and tensioned proximally. One way to accomplish this is by using an ACL femoral guide (Arthrex) that is placed via the anterolateral portal and is centered on the anteromedial bundle insertion. This device guides a cannulated RetroDrill (Arthrex) to drill through the lateral femoral condyle towards the anteromedial footprint. A passing wire can then be delivered through the cannulation and used to retrieve that anteromedial bundle repair stitches. This process can then be repeated for the posterolateral bundle and the associated repair stitches. Drill holes can also be made retrograde from a low anteromedial accessory portal using a slotted pit that can be used to shuttle the repair stitches. When all the repair sutures are passed, the ligament is tensioned while being visualized arthroscopically. The knee is held at 20° of flexion and a posterior drawer force can be applied, if necessary, to reduce the tibia to its anatomic position. The suture limbs are then tensioned and can be fixated using any of a multitude of techniques, including tying over a bony bridge, tying over a 4-hole ligament button, and tying to a post.

One disadvantage of the bone bridge fixation technique, however, is the suspensory fixation that is not as stiff as tensioning and fixating with suture anchors. Despite this disadvantage, however, the senior author (GSD) has achieved excellent results with this technique at longer-term follow-up in a small group of patients. One advantage of the bone bridge fixation technique is that the procedure has lower costs than fixation with suture anchors.

One Anchor Repair Fixation

Achtnich and colleagues[6] recently published a slightly different technique for repairing type I tears. The authors passed a No. 2 FiberWire suture through the midsubstance of both bundles of the ACL remnant to create a modified Mason-Allen stitch configuration. Subsequently, they tensioned the remnant towards the middle of the ACL footprint (between the anteromedial and posterolateral footprint) using one PushLock suture anchor (Arthrex). They hypothesized that using 1 anchor would be enough fixation for tears amenable to repair, and that doing so would minimize the invasion of the bone.

The preference of the senior author (GSD) is, however, to use 2 suture anchors for each bundle in order to more anatomically and biomechanically repair the remnant, since both bundles have different biomechanical characteristics.[7] Similarly, the preference of the senior author is to commence the suturing as distal as possible and pass multiple sutures towards the proximal end. This ensures that the last suture pass is exited very proximally, and ensures that the proximal end is approximated towards the femoral wall. One suture passed at the midsubstance portion of the remnant might cause a different tension pattern and prevent optimal re-approximation of the most proximal part towards the femoral wall. Future studies are necessary to assess the efficacy of different suture and fixation techniques as these are currently lacking.

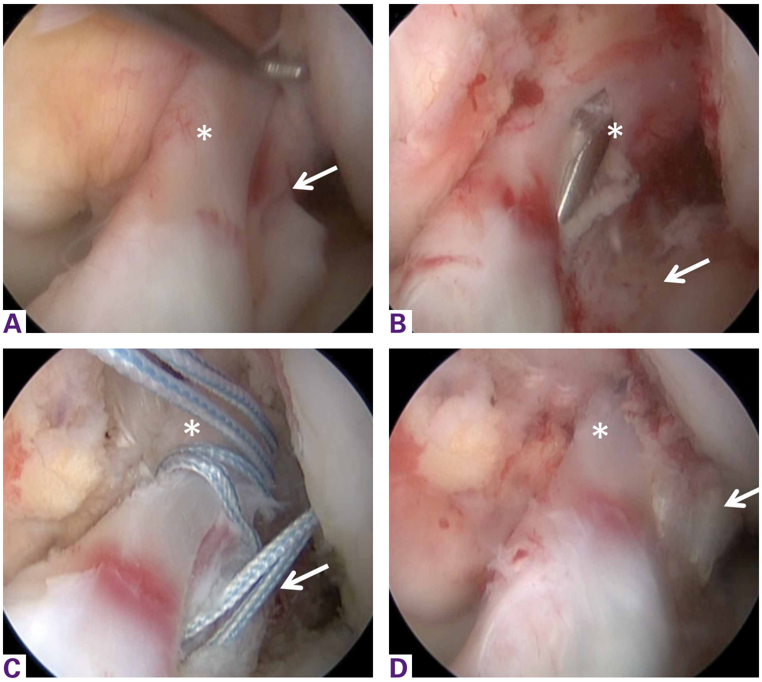

Figure 3. One bundle type I tears: single bundle augmented repair. (A) The anterior cruciate ligament is shown with a type I anteromedial bundle tear (asterisk) and a midsubstance tear of the posterolateral bundle tear with suboptimal tissue quality (arrow). (B) The posterolateral bundle has been debrided (arrow) and the tibial tunnel for the posterolateral reconstruction is drilled (asterisk). (C) Sutures are passed through the midsubstance and proximal part of the anteromedial bundle (asterisk) and the passing sutures of the posterolateral bundle reconstruction are shown (arrow). (D) The augmented repair is complete with an anteromedial bundle repair (asterisk) and a posterolateral bundle reconstruction (arrow).

Addition of Internal Brace

Over the last few years, the senior author has added an internal brace (FiberTape, Arthrex) to the repair technique, which was first performed by MacKay and colleagues.[8] The added internal brace protects the repair and the healing process in the first few weeks and enables early ROM.

With this technique, the previously described arthroscopic primary repair technique is performed with suturing of both bundles. However, after punching, tapping, or drilling a hole in the anteromedial origin of the femoral footprint, the anteromedial anchor is first loaded with the FiberTape in addition to the repair stitches. After placing the anteromedial suture anchor in the femoral footprint, the internal brace is fixated proximally with the suture anchor into the femoral wall. After the normal placement of the posterolateral suture anchors and completion of the repair, the internal brace has to be fixed distally. An ACL guide is used to drill a 2.4-mm drill pin up through the tibia from the anteromedial cortex (**Figure 2A**) and into the anterior half of the ACL tibial insertion. This is then switched for a Straight Microsuture Lasso (Arthrex) (**Figure 2B**), and the nitinol wire is retrieved out of the anteromedial portal with the 2 ends of the FiberTape. The FiberTape is then shuttled along the ACL substance anteriorly and down through the tibia (**Figure 2C**) where it fixed with a vented suture anchor near full extension after cycling the knee.

Others, however, have advocated fixing the internal brace independently of the repaired ligament and suture anchors.[9] With this technique, tunnels are drilled in the femur and tibia and the internal brace construct is fixed proximally using a RetroButton (Arthrex) and fixed distally in the tibial metaphysis using a suture anchor. A disadvantage of this technique is that an extra femoral tunnel needs to be drilled, which is especially important in pediatric patients with the increased risk for growth disturbances.[10]

One Bundle Type I Tears: Single Bundle Augmented Repair

In some cases, the anteromedial or posterolateral bundle is a type I tear with good or excellent tissue quality, whereas the other bundle is not a type I tear or has poor tissue quality (**Figure 3A**). In these cases, a primary repair of one bundle is performed with a hamstring reconstruction of the other bundle.

First, a No. 2 FiberWire is used to make 4 to 5 passes from distal to proximal, as previously described. Then, the remnants of the irreparable bundle are debrided (**Figure 3B**). Subsequently, the semitendinosus tendon is harvested in standard fashion, or soft tissue allografts can be used. Tunnels are then drilled for the reconstruction of the second bundle. The femoral tunnel, really a socket, is drilled at the femoral origin of the irreparable bundle using a FlipCutter (Arthrex) (Figure 3B). The tibial tunnel is localized using standard ACL guides, and drilled retrograde bicortically over a guide wire up into the ACL footprint of the bundle that is going to be reconstructed. Care must be taken to avoid damaging of the remnant that is being preserved. The sutures of the repaired remnant are then pulled back through the tibial tunnel and the repair stitches are passed through the TightRope RT (Arthrex) button. Once this is completed, all sutures and the button are passed up through the tibial tunnel and into the femoral socket. The proximal button is then flipped to engage the lateral femoral cortex in standard fashion (**Figure 3C**). Care should be taken to not tension the repairable remnant during the passage of the sutures through the femoral socket, as too much tension can cause tears in the remnant. Once the doubled hamstring graft has been advanced up into the femoral tunnel using the cinch stitches, the remnant bundle can then be tensioned towards the femoral wall (**Figure 3D**), and the sutures are tied over the TightRope RT button. Finally, the knee is cycled and held near full extension, while a BioComposite interference screw (Arthrex) is placed in the tibial tunnel for distal fixation.

Type II Tears: Augmented Repair

In patients with type II tears, primary repair is not possible as the length of the remnant is too short to firmly approximate the remnant towards the femoral wall (75%-90% of native tissue length) (**Figure 4A**). In these patients, an augmented repair of the entire ACL is performed using hamstring autograft or soft tissue allograft.

With this technique, repair stitches are passed into the anteromedial bundle of the remnant as previously described (**Figure 4B**). Keeping the repair stitches anteriorly in the anteromedial bundle tends to prevent entanglement during graft passage later in the case. In some cases, it can be noted that the remnant has scarred to the femoral wall or the femoral notch. Crain and colleagues[11] previously described that in 20% of the cases, the remnant was reattached to the notch or the lateral wall of the notch. Because the reattachment is not at an anatomical position, the ligament should be detached from the femoral wall to allow the repair to be placed anatomically. In these cases, the senior author leaves the bundle initially attached to the femoral wall in order to make the passage of sutures through the ligament easier, and then he detaches the ligament to restore the anatomy.

Once the repair stitches are in place, a small accessory stab incision is made just above the medial portal. The repair stitches are parked here to keep them out of harms way. Traction on the repair stitches will retract the ACL away from the lateral wall of the notch and allow work to be performed here. A small opening notchplasty is generally performed to enhance visualization and to add a bleeding surface for enhanced healing. Next, the arthroscope is placed into the medial portal, which allows the

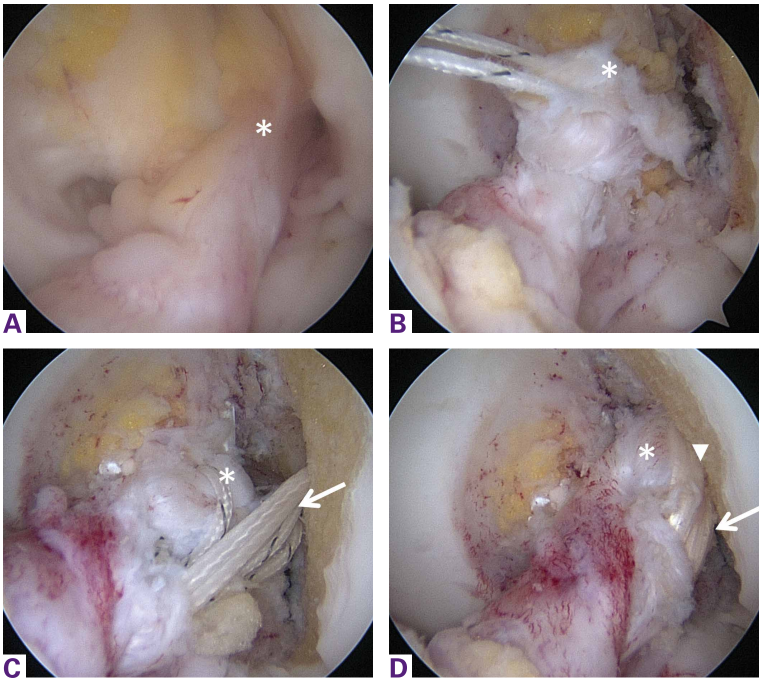

Figure 4. Type II tears: augmented repair. (A) The anterior cruciate ligament remnant is shown with a complete tear and good tissue quality (asterisk). (B) As the first sutures are passed through the ligament, the tissue quality of the proximal portion is found to be suboptimal (asterisk), and a decision is made to proceed with augmented repair. (C) The graft is advanced through the remnant (asterisk) and the passing sutures of the graft are visible (arrow). (D) The graft has been passed through the remnant and fixed (arrowhead) and the remnant has been pulled up to the femoral wall. Note that the anteromedial bundle is in close approximation to the femoral wall (asterisk), but there is a gap between the posterolateral bundle remnant and the femoral wall (arrow) that is augmented with the graft.

femoral guide to be placed into the lateral portal. The femoral guide is positioned to optimize the femoral tunnel location in the center of the footprint. A small incision is made laterally over the condyle and through the iliotibial band to allow access to the lateral cortex of the lateral femoral condyle. The FlipCutter is then used to back-cut the femoral socket as described above. A FiberStick (Arthrex) passing suture is then placed in the femoral tunnel and brought out through the anteromedial portal.

Next, the tibial tunnel is drilled with a tibial guide at 55° inclination. The pin is drilled up into the center of the tibial footprint and this is overreamed with a reamer. The reaming is stopped precisely upon breaking to proximal tibial cortex so as to minimize soft tissue damage of the ACL insertion fibers that are typically pristine. Then, a grasper is passed up and through the tunnel to retrieve the repair stitches and bring them out distally for later use. At the same time, the passing suture in the femoral is also retrieved distally. The soft tissue graft is proximally

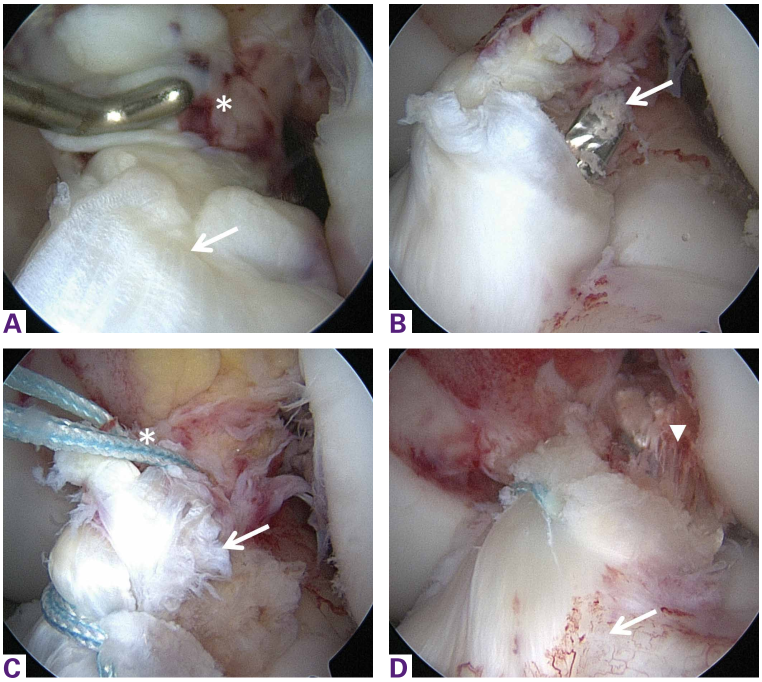

Figure 5. Reconstruction with remnant tensioning. (A) The tissue quality of the remnant is assessed with a probe and the tissue quality of the proximal part of the ligament is found to be poor (asterisk) while the distal part is good (arrow). (B) The tibial tunnel is drilled through the center of the distal part remnant (arrow). (C) Tensioning sutures are passed through the remnant (asterisk) to minimize the risk of a cyclops lesion (arrow). (D) The reconstruction with remnant tensioning is complete with a soft tissue graft (arrowhead). Vascularization of the distal remnant is visible (arrow).

prepared with a TightRope RT button, and the repair stitches are passed through the button. The passing suture from the femoral socket is then used to shuttle the draw sutures and repair stitches up through the tibia, through the ACL remnant, and out the femoral socket (**Figure 4C**). The TightRope RT button is then engaged on the lateral femoral cortex in standard fashion. Using the cinch stitches, the graft is delivered through the tibia, up and through the center of the ACL remnant, and into the femoral socket. The knee is then cycled and the graft is tensioned distally in standard fashion, and fixed using a BioComposite interference screw. Finally, the repair stitches can be tensioned pulling the ligament remnant up as a sleeve around the hamstring graft (**Figure 4D**). They are then tied over the TightRope RT button using alternating half hitches tied with a knot pusher from laterally.

Type III Tears: Reconstruction With Remnant Tensioning

The previously discussed techniques have the goals of preserving as much native ligament remnant as possible, approximating the ligament remnant towards the femoral wall, and promoting healing of the ligament. In some cases, however, the ligament remnant is too short for healing (**Figure 5A**). Although the ligament cannot be approximated to the femoral wall in these cases, there is still an argument for ACL preservation, as was discussed in the first article of this series.

If the ligament length is between 25% and 75% of the native tissue length, the senior author performs a remnant tensioning technique. The main goal of tensioning the remnant here is to prevent fluid egress into the tibial tunnel and avoid cyclops lesions, while theoretically improving graft vascularization and proprioception. With this technique, 1 or 2 passes are made through the most proximal part of the remnant and the sutures are then parked in an accessory portal as described above. The technique is very similar to that of an augmented repair; however, the graft dimensions here tend to be significantly larger due to the diminished contribution of the remnant. No strength can be expected of this small remnant since it will not be approximated close to the wall. The tibial tunnel is then drilled in standard fashion through the center of the tibial remnant (**Figure 5B**). After passing the repair sutures through the TightRope RT button of the soft tissue graft, the sutures of the graft and remnant are passed through the center of the distal remnant (**Figure 5C**). After the passage of the soft tissue graft sutures and button through the femoral socket, the button is flipped, and the graft is delivered. The knee is then cycled and the graft is fixated distally using a BioComposite interference screw. Finally, the remnant is then tensioned as a partial sleeve around the graft (**Figure 5D**) and tied over the TightRope RT button using alternating half hitches tied with a knot pusher from laterally.

Type IV Tears: Reconstruction With Remnant Preservation

Finally, in some cases, the distal remnant is small or the tissue quality in the largest part of the remnant is poor, and after debriding back to good tissue quality, only 10% to 25% of the native tissue length is left (**Figure 6A**). In these cases, the remnant is preserved, however, tensioning of the remnant with sutures is usually not necessary for the prevention of cyclops lesions. Nonetheless, it is important to debride the parts of the remnant ligament with poor tissue quality as mop-end patterns of the remnant may increase the chance of these lesions (**Figure 6B**).

In this situation, any of the standard ACL reconstruction techniques can be performed with simple attention being paid to preserving what is left of the tibial insertion site. At the very least, the small insertion remnant guides the anatomic placement of the graft, and prevents egress of joint fluid into the tibial tunnel and could minimize tunnel widening. Theoretical benefits also include improved vascularity and proprioception. The tunnels are prepared, the grafts passed, and fixation placed per the surgeon's preference (**Figure 6C**). The remnant is then arthroscopically checked to confirm that there is no impingement or risk of cyclops lesions (**Figure 6D**).

Type V Tears: Primary Repair

Finally, in some patients a soft tissue avulsion (**Figure 7A**) or bony avulsion of the distal attachment of the ACL can be seen. Both injuries are relatively rare, although bony avulsions are frequently seen in children, especially those younger than 12 years old. In these cases, the same techniques and theory that are applied to proximal avulsion type tears can be used and applied to distal avulsion type tears. However, they must be applied in an upside down manner by working from proximal to distal in this case.

First, No. 2 FiberWire sutures are passed from proximal towards the distal end of the ligament in the anteromedial bundle, and the same process is then repeated for No. 2 TigerWire sutures for the posterolateral bundle. Then both sutures are exited at the distal avulsed end at the locations of the anteromedial and posterolateral footprints (**Figure 7B**). A 2.4-mm ACL guide wire and a Ninitol wire are used to drill 2 tunnels from the tibia towards the tibial footprint. The repair sutures are then retrieved through both tunnels (**Figure 7C**) and the sutures are tied distally over a ligament button after cycling of the knee (**Figure 7D**). This technique is very useful for soft tissue avulsions, or when there are only small flecks of bone or when the avulsed bone is significantly comminuted. If a large bony avulsion fragment is present, this technique can also be applied with some modification, although there have been multiple other techniques described in the literature that work well

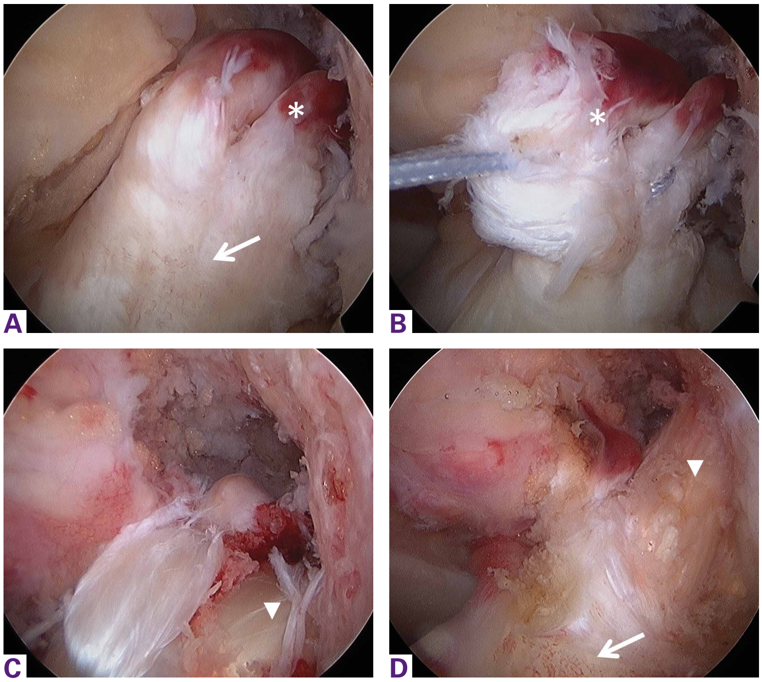

Figure 6. Reconstruction with remnant preservation. (A) Anterior cruciate ligament tear is seen with excellent distal tissue quality (arrow) and fair midsubstance tissue quality (asterisk). (B) However, when sutures are passed to tension the ligament, it becomes clear that the midsubstance tissue is of poor quality (asterisk). (C) A graft has been passed through the ligament (arrowhead). (D) The soft tissue graft is visible (arrowhead), along with the preserved remnant (arrow).

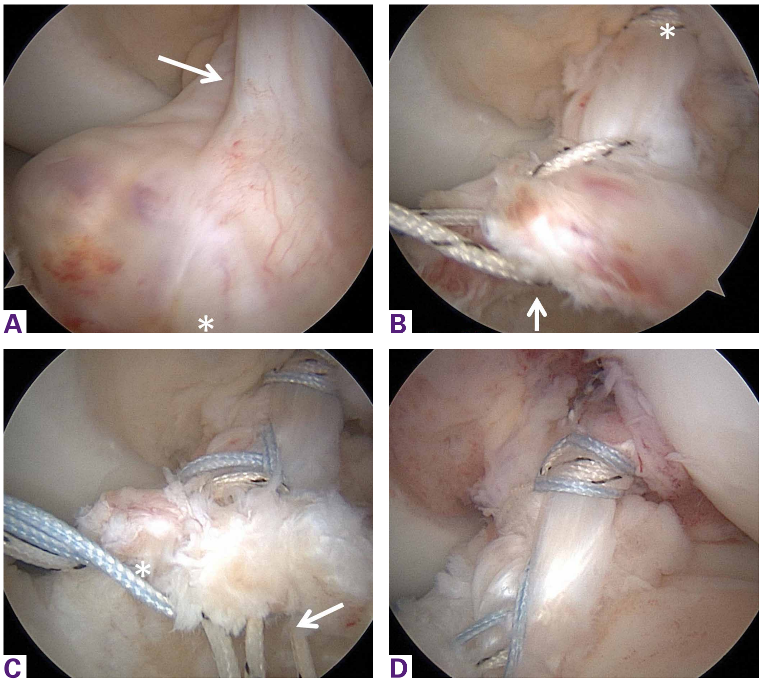

Figure 7. Type V tears: primary distal repair. (A) Distal soft tissue avulsion tear of the anterior cruciate ligament is seen (asterisk) with excellent tissue quality of both bundles (arrow). (B) Sutures are passed through the anteromedial bundle (asterisk) and exit at the distal part of the remnant (arrow). (C) Sutures of both the anteromedial bundle (arrow) and posterolateral bundle (asterisk) exiting at the distal end of the remnant. (D) Both bundles have been guided through drill holes and tensioned over a bony bridge to complete the primary repair.

in this situation including fixation with screw and washer, or with suture anchors.

Complex Tear or Poor Tissue Quality: Reconstruction

In some cases, the tissue quality is poor, or the ligament has complex or multiple tears. Essentially, in these cases, there is nothing to preserve and a standard reconstruction approach is performed in these cases.

Conclusion

The uniform gold standard for all ACL tear types is currently primary reconstruction. However, several disadvantages of ACL reconstruction exist, while there are multiple advantages to the concept of ACL preservation. In this surgical technique article, we have discussed our tear type classification and the recommended surgical techniques for each. With this treatment algorithm, which is based on tear location and tissue quality, an optimal and minimally invasive treatment can be chosen for each individual patient. Future studies are needed to compare and contrast these treatments with the current gold standard of ACL reconstruction.

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