



Anatomic Repair of Posteromedial Meniscocapsular Separation Using an All-Inside Technique

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Abstract: Separation of the posteromedial meniscocapsular junction (PMC) is a unique injury seen in patients with disruption of the anterior cruciate ligament. PMC tears may go unrecognized despite preoperative magnetic resonance imaging and diagnostic arthroscopy of the medial compartment. Unrepaired lesions may lead to persistent laxity of the knee after anterior cruciate ligament reconstruction. Inside-out repair techniques risk iatrogenic injury to the articular cartilage during needle passage and require dissection of the posteromedial knee for suture retrieval. Previous all-inside techniques have required specialized implants and repaired PMC lesions with direct visualization of the tear. The presented all-inside technique is an easily reproducible, cost-effective means to anatomically repair separation of the PMC. The technique provides the surgeon direct visualization and full arthroscopic access to the lesion, making repair technically easy and efficient.

Various intra-articular injuries can be sustained with disruption of the anterior cruciate ligament (ACL). As many as 43% of patients with ACL injuries may also have traumatic meniscal pathology.¹ A particular variant of the medial meniscal tear is separation of the posteromedial meniscocapsular junction (PMC). PMC lesions may be present in 9% to 23% of patients with ACL rupture.^{1,2} These injuries are often difficult to visualize with magnetic resonance imaging (MRI) because of low sensitivity and poor radiologic markers for identification.^{3,4} Furthermore, PMC tears can be missed even with arthroscopic exploration because lesions are located in the posteromedial “blind spot.”⁵ Biomechanical testing has indicated that

missed PMC tears may lead to persistent joint laxity after anterior cruciate ligament reconstruction (ACLR).⁶

Multiple techniques have been described for PMC tear repair. Meniscal needles can be used through the inside-out technique.² All-inside repair with use of specialized implants, such as the Fast-Fix (Smith & Nephew, Andover, MA), has also been reported.⁷ We present a modified technique for all-inside anatomic repair of the PMC. In our opinion, the following technique is easily reproducible, cost-effective, and not technically demanding.

Surgical Technique

We use an all-inside technique with direct visualization of the meniscocapsular separation to complete an anatomic repair (Video 1). The repair is performed using a No. 2 Orthocord suture (DePuy Synthes, West Chester, PA), No. 0 polydioxanone sulfate (PDS) suture, 90° shoulder Spectrum hook (ConMed, Utica, NY), 8-mm × 25-mm cannula, ball-tip rasp (Arthrex, Naples, FL), and 30° and 70° arthroscopes.

Preoperative Imaging

All patients with suspected ACL disruption undergo preoperative MRI. PMC tears are suspected when MRI T2 sagittal sequences show the peripheral posterior horn medial meniscus outlined by a continuous fluid line in a superior-to-inferior direction. Bony contusion

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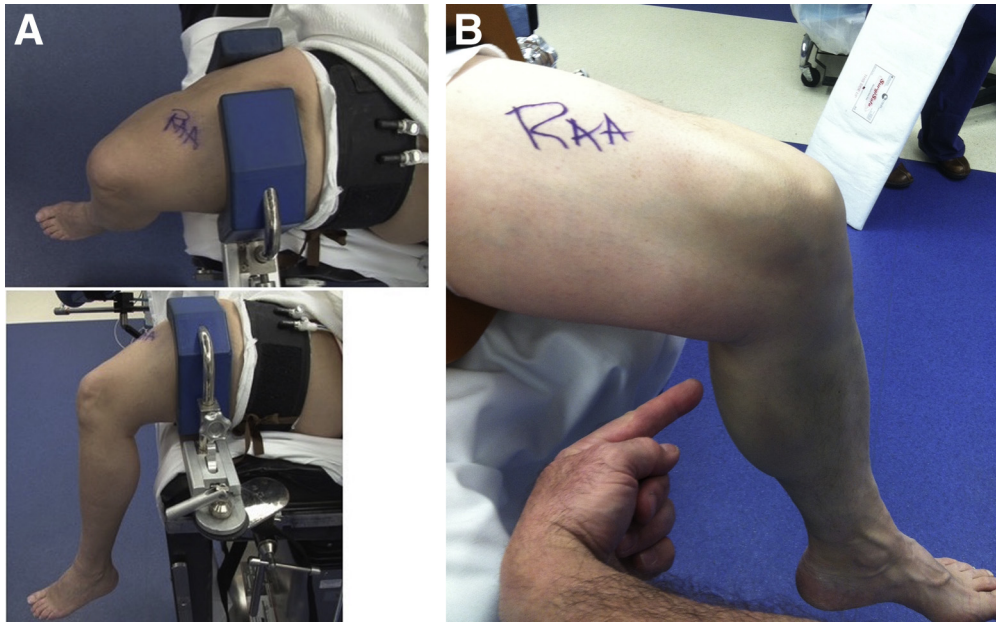


Fig 1. (A) The patient is supine on the operative table with the left leg in a leg holder distal to the tourniquet. (B) Placing the patient distally on the table allows easy access to the posteromedial knee.

to the posterior medial tibial plateau may also indicate PMC injury.

Patient Positioning

The patient is placed in the supine position distally on the operative table. The leg is positioned within a leg holder that is placed distal to the thigh tourniquet and raised approximately 5 cm above the table. This technique ensures easy access to the posteromedial knee during portal placement and instrument passage (Fig 1).

Diagnostic Arthroscopy

A standard anterolateral viewing portal is created for diagnostic arthroscopy of the patellofemoral joint, medial and lateral gutters, medial and lateral compartments, and intercondylar notch using the 30° arthroscope. A working anteromedial portal is created under direct visualization.

Evaluation of PMC

Visualization. In our practice, the posteromedial compartment is evaluated in all patients undergoing ACLR. Meniscocapsular lesions are difficult to identify from the standard anterolateral portal and often require direct posteromedial viewing (Fig 2). With the knee at 90° of flexion, the arthroscope is placed between the posterior cruciate ligament and the lateral aspect of the medial femoral condyle (MFC). Once resistance from the MFC is met, the arthroscope is exchanged for a smooth trocar. The trocar is directed posterolaterally, which allows the cannula to slide past the MFC into the posteromedial compartment,

and the arthroscope is reinserted into the knee. This technique is similar to the maneuver described by Gillquist et al.⁸ At this point, the full extent of the lesion is better identified with the 70° arthroscope (Fig 3).

Tear Stability. A posteromedial (PM) portal is created under direct visualization, ensuring instrument access to the tear site (Fig 4). An 8-mm × 25-mm cannula is placed to ease passage of instruments and prevent soft-tissue interference during suture repair. A blunt

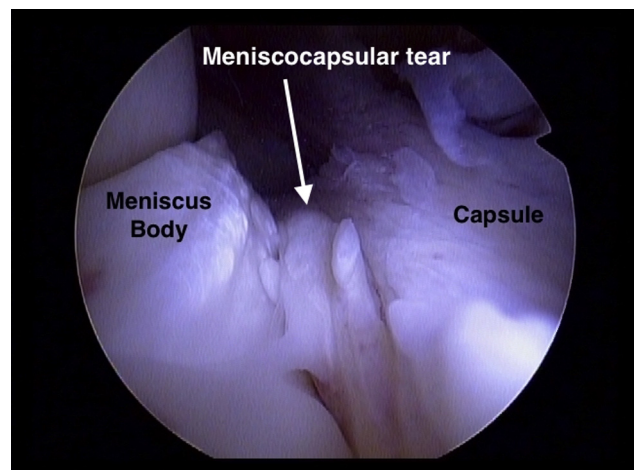


Fig 2. The arthroscope is placed in the posteromedial compartment in a left knee by the Gillquist maneuver. The viewing portal is the anterolateral portal, and the knee is in 90° of flexion. Identification of meniscocapsular lesions is better appreciated with this technique.

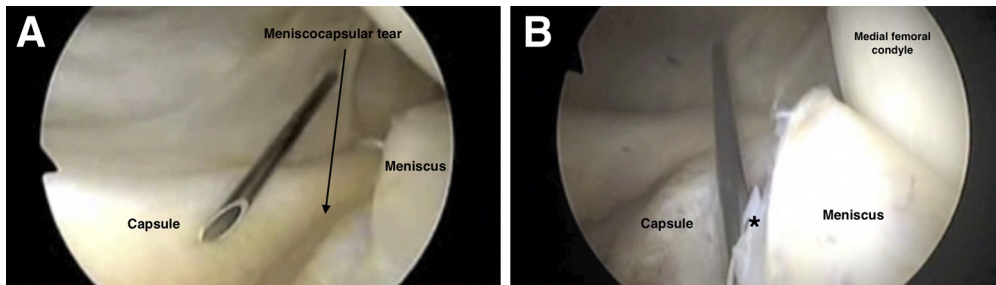


Fig 3. Visualization of the posteromedial compartment from the anterolateral portal in a right knee in 90° of flexion. (A) A 30° arthroscope achieves initial visualization of the lesion. (B) A 70° arthroscope from the anterolateral portal aids in complete visualization of the tear. An 18-gauge spinal needle probes the meniscocapsular tear (asterisk).

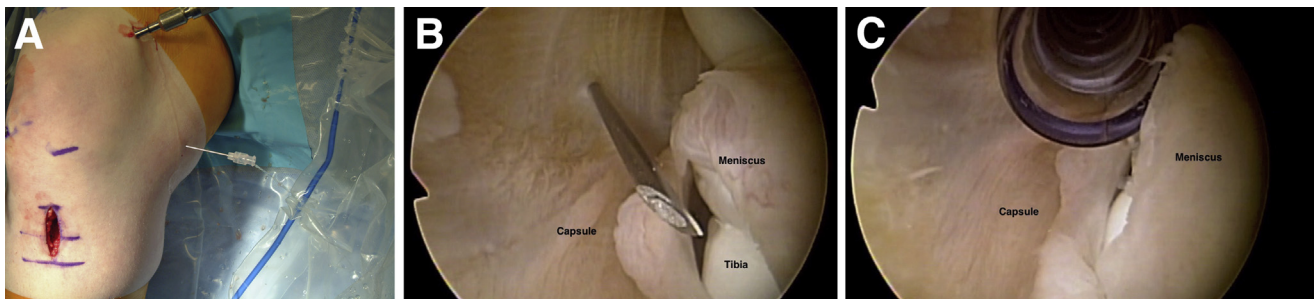


Fig 4. (A) An 18-gauge spinal needle is placed in the posteromedial compartment in a right knee in 90° of flexion. (B) The needle localizes the posteromedial portal. Visualization of the posteromedial compartment is from the anterolateral portal. (C) A cannula is placed in the posteromedial compartment to serve as a working portal.

probe is inserted through the portal to examine the lesion for instability of the medial meniscus (Fig 5).

All-Inside Repair Technique

Repair Site Preparation. By use of the PM portal, a ball-tip rasp is used to roughen the meniscocapsular

junction at the lesion site. A shaver is introduced into the knee with the suction turned off, and the remaining fibrous scar tissue is debrided (Fig 6).

Tear Approximation. The Spectrum hook is entered into the joint through the PM portal (Fig 7A). The

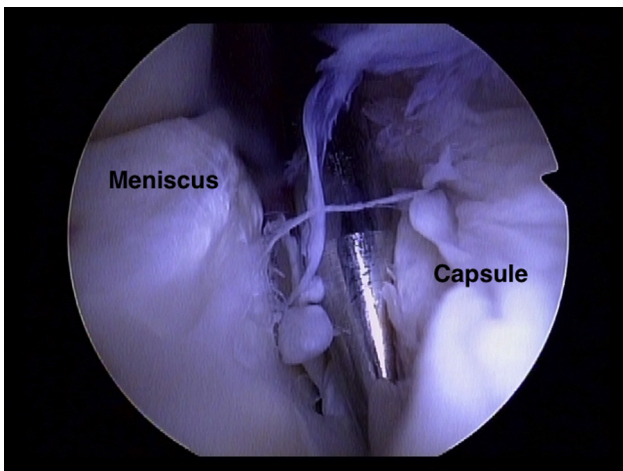


Fig 5. Visualization of the posteromedial compartment from the anterolateral portal in a left knee in 90° of flexion. From the posteromedial portal, a blunt probe is introduced into the meniscocapsular tear to examine the stability of the meniscus.

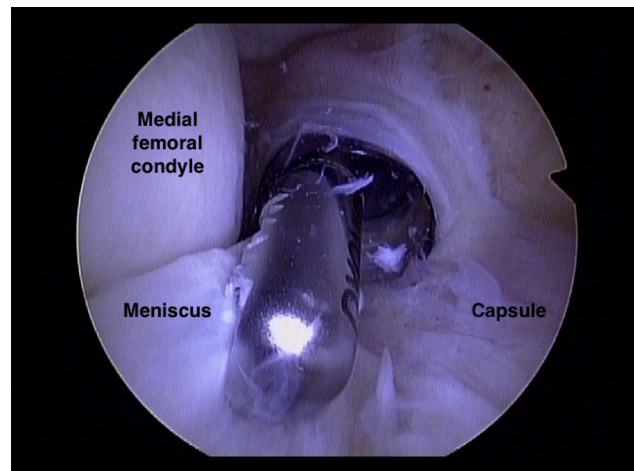


Fig 6. Visualization of the posteromedial compartment from the anterolateral portal in a left knee in 90° of flexion. From the posteromedial portal, a shaver debrides fibrous scar tissue and improves visualization of the entire lesion.

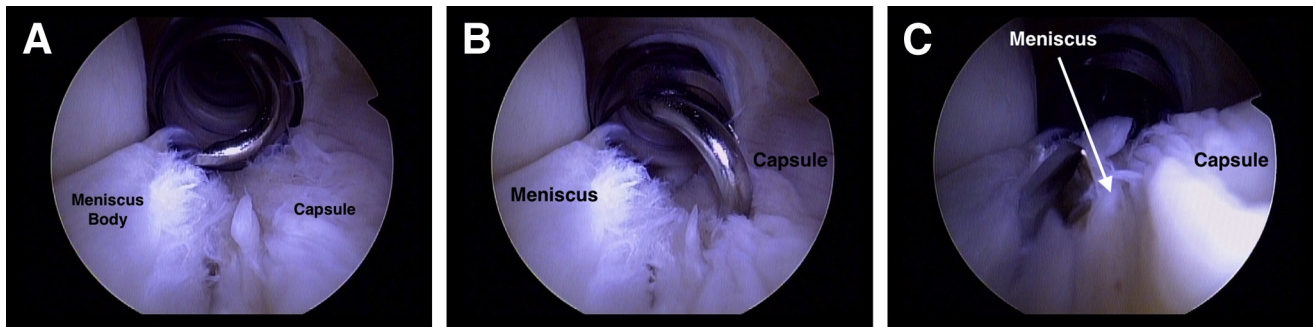


Fig 7. Visualization of the posteromedial compartment from the anterolateral portal in a left knee in 90° of flexion. (A) The suture hook enters the knee from the posteromedial portal. The hook first pierces the capsular tissue (B) and then the posterior meniscus (C). The repair is visualized from the anterolateral portal.

capsular tissue is pierced first, followed by the posterior meniscus (Fig 7 B and C). It is critical to ensure the hook does not enter the tibiofemoral articulation during capture of the meniscal tissue. At this point, slight tension on the hook will elevate the displaced capsular tissue to the height of the meniscus.

Suture Passage. A No. 0 PDS suture is deployed through the hook, and an arthroscopic grasper retrieves the suture through the PM portal (Fig 8). The PDS suture is used as a shuttle to pass the No. 2 Orthocord suture through the meniscal and capsular tissue (Fig 9). The heavy nonabsorbable suture is slightly tensioned to verify an anatomic repair of the meniscocapsular junction.

Knot Tying. The No. 2 Orthocord suture is toggled gently to ensure the suture slides, with care taken to avoid sawing of the soft tissues. The posterior capsular limb is used as the post. We prefer using arthroscopic SMC knots for fixation; however, this can be altered to the surgeon's preference (Fig 10). Typically, 2 to 3 sutures placed 5 mm apart are needed for anatomic repair.

Repair Assessment. The arthroscopic probe is reintroduced through the PM portal, and meniscal stability is tested. Should the meniscus be displaced, additional sutures may be required. Once repair integrity is satisfactory, ACLR is completed.

Postoperative Rehabilitation

Patients are placed on a restricted weight-bearing protocol of 20 to 40 lb with crutch assistance for 4 weeks. Full extension with a locked hinged brace is maintained for 3 days and then progressed to 0° to 90°. At 6 weeks, motion is increased to 120° of flexion. Quadriceps rehabilitation is unchanged from a standard ACL rehabilitation protocol.

Discussion

Separation of the PMC can be difficult to diagnose. Preoperative MRI may miss a significant number of

injuries, and several radiologic parameters have poor positive predictive values for lesion identification.^{3,9} Standard diagnostic arthroscopic techniques may also miss up to 16.8% of lesions.^{5,10} Previous biomechanical studies have indicated that unrepaired PMC lesions result in persistent laxity after ACLR, possibly placing the graft at risk.⁶

We investigate the posterior compartment of the medial knee in each patient undergoing ACLR. The modified Gillquist maneuver consistently allows the surgeon to view the posterior compartment without placing the MFC articular cartilage at risk of iatrogenic injury. Using a 70° arthroscope can significantly improve visualization of the entire lesion, in particular inferior capsular displacement typical of these injuries.² Furthermore, spinal needle localization in conjunction with the 70° arthroscope ensures the PM portal allows access to the entire tear.

A significant advantage (Table 1) of the all-inside technique using a Spectrum hook through the PM portal is that it allows the surgeon to titrate the amount of tissue grasped for repair. Such a technique ensures a stable repair without overconstraining the

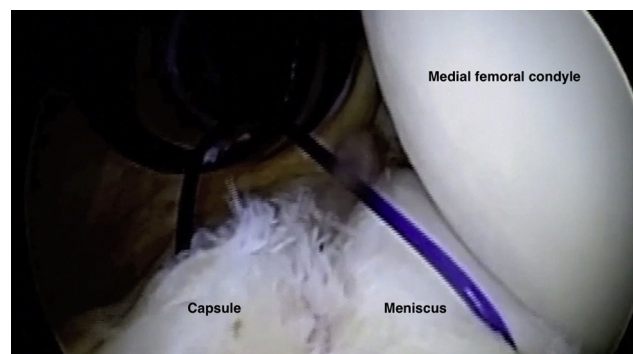


Fig 8. Visualization of the posteromedial compartment from the anterolateral portal in a right knee in 90° of flexion. A No. 0 polydioxanone sulfate suture is passed through the suture hook and retrieved with a grasper from the posteromedial portal.

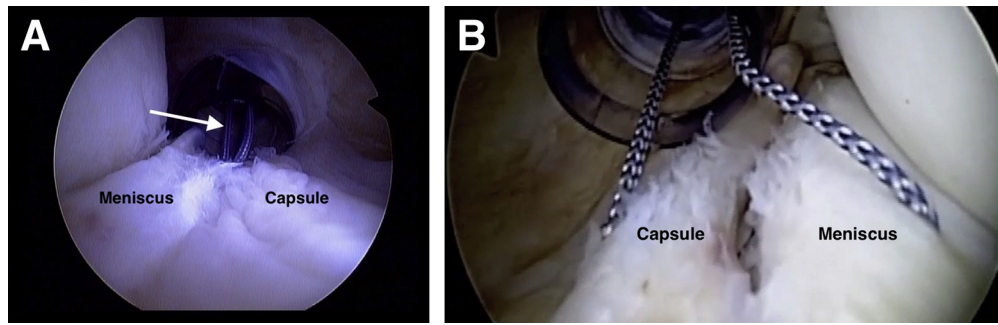


Fig 9. (A) Visualization of the posteromedial compartment from the anterolateral portal in a left knee in 90° of flexion. A No. 2 Orthocord suture (arrow) is passed through the meniscal and capsular tissue. (B) Visualization of the posteromedial compartment from the anterolateral portal in a right knee in 90° of flexion. Suture passage is visualized with the arthroscope in the anterolateral portal.

capsule. The capsular tissue is often displaced distally from the meniscocapsular junction. This technique allows for proximal advancement of the tissue for an anatomic repair, aiding in the reapproximation of the natural mechanics of the knee.⁶ Direct visualization of the tear with the 70° arthroscope enhances the ability to anatomically repair the PMC lesion. Furthermore, no special implants are required for this technique, which may improve cost-effectiveness compared with other methods.⁷ Inside-out techniques risk iatrogenic injury to the articular cartilage during needle passage and require open dissection of the posteromedial knee, as opposed to our minimally invasive method. Furthermore, such repairs are performed from an anterior portal, which does not allow the surgeon to visualize purchase of the displaced capsular tissue.

The main disadvantage of our technique is the establishment of the PM portal. The operative time may be greater if the surgeon is unfamiliar with

establishment of this portal (Table 2). The saphenous neurovascular structures are at risk of iatrogenic puncture injury during portal establishment¹¹ and during cannula placement, which may result in post-operative dysesthesia or hematoma. Use of the cannula improves the ease of instrument and suture passage, thus reducing operative time and injury to the surrounding soft tissues. The cannula also limits fluid extravasation into the posteromedial knee and prevents a soft-tissue bridge from interfering in the repair. Finally, the surgeon may have limited experience with the 70° arthroscope, and its use may increase the overall procedure cost.

In our opinion the presented all-inside technique is a reproducible, cost-effective means to achieve an anatomic repair of posteromedial meniscocapsular separation. The technique reduces the risk of articular injury during repair and avoids more extensive

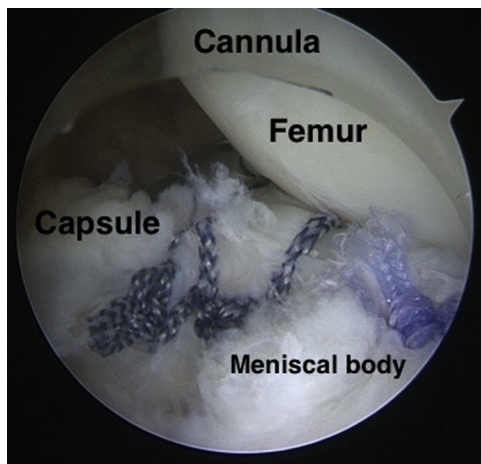


Fig 10. Visualization of the posteromedial compartment from the posteromedial portal in a right knee in 90° of flexion. Examination of the repair after arthroscopic knot tying.

Table 1. Advantages and Disadvantages of Anatomic Repair of Posteromedial Meniscocapsular Separation Using All-Inside Technique

Advantages	
Direct visualization of tear with modified Gillquist maneuver and 70° arthroscope	
Anatomic reduction of inferiorly displaced capsular tissue	
Titration of capsular tissue purchase prevents overconstraint	
Minimally invasive; no open dissection of posteromedial knee needed	
No special implants required, reducing procedure cost	
Reduces risk of chondral injury by eliminating needles passed anteriorly into medial compartment	
Disadvantages	
Increased operative time, especially if unfamiliar with posteromedial portal establishment	
Saphenous nerve at risk of injury, leading to dysesthesia postoperatively	
Saphenous vein at risk of injury, leading to hematoma postoperatively	
Fluid extravasation into posteromedial knee	
Use of 70° arthroscope may increase procedure cost	

Table 2. Pearls and Pitfalls of Anatomic Repair of Posteromedial Meniscocapsular Separation Using All-Inside Technique

Pearls

- The surgeon should ensure draping allows adequate exposure of the posteromedial knee.
- During the Gillquist maneuver, the tibia can be translated anteriorly to facilitate access to the posteromedial compartment.
- The posteromedial portal should be placed proximally and posteriorly within the compartment. This position eases use of the Spectrum hook to obtain purchase of the capsular and meniscal tissues.
- A rasp can help quickly debride fibrous scar tissue at the repair site.
- The capsular tissue is often displaced distally on the tibia.
- Capturing this tissue with the Spectrum hook and translating it anteriorly allow for anatomic repair.
- The surgeon should deploy most of the length of the PDS suture into the posteromedial compartment to ease capture with the grasper.
- We typically use 2 to 3 sutures placed 5 mm apart.

Pitfalls

- A distally placed leg holder may not allow the proper angle of entry into the posteromedial compartment.
- Performing the Gillquist maneuver with the 70° arthroscope is technically more difficult than with the 30° arthroscope.
- An anterior or inferior posteromedial portal increases the technical difficulty of capsular and meniscal tissue purchase with the Spectrum hook.
- The shaver should be used judiciously. The capsular tissue can be fragile and easily resected.
- Excessive purchase of the capsule risks overconstraint. Excessive purchase of the meniscus can result in entering the tibiofemoral articulation.
- Passing the Orthocord suture should be performed in line with the cannula to prevent PDS breakage.

PDS, polydioxanone sulfate.

soft-tissue dissection. The short- and long-term effects of this repair method have yet to be studied in the clinical setting.

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