



Posterior Lateral Meniscus Root Reattachment With Suture Anchors: An Arthroscopic Technique

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Abstract: The posterior lateral meniscus root (PLMR) provides the circumferential tension required to stabilize the lateral meniscus. Thus, preservation of the PLMR is important to prevent an increase in tibiofemoral contact pressure, which could result in osteoarthritis. We describe an all-arthroscopic approach to the fixation of PLMR using suture anchors through associated posterolateral arthroscopic portals that result in a more favorable inclination of the anchors. Initially, the anatomical insertion site of the root on the tibial plateau is debrided, 1 to 2 anchors are placed through the posterolateral portals into the root's footprint area, and the meniscus is finally sutured from the posterolateral portals. Compression of the meniscus is achieved with bone contact. This technique achieves lateral meniscus root fixation, reducing the risk of subluxation of the meniscus and subsequent osteoarthritis.

The anterior and posterior roots are the only parts of the meniscus with direct attachment to bone; the rest is attached to the joint capsule and collateral ligaments.¹⁻⁵ The fibers that attach the roots to the tibia are the main restrictors against meniscal extrusion and are vital for the functional integrity of the menisci.⁶⁻⁸

Lateral meniscal root tears are often concomitant with anterior cruciate ligament (ACL) ruptures and have been reported in 7% to 12% of patients with a tear of the ACL.⁹⁻¹¹ Complete meniscal rupture or detachment of the posterior root of the lateral meniscus can result in loss of meniscal hoop stresses, similar to that caused by total meniscectomy.¹²⁻¹⁴ A decreased tibiofemoral contact area and increased contact pressures may consequently lead to premature degenerative

osteoarthritis.^{8,15-17} Long-term clinical studies have proven repair, as opposed to meniscectomy, a valid strategy to prevent osteoarthritis. For that reason, preservation of the meniscus is the best option,¹⁵ and refixation is often a reasonable way of restoring meniscal function.^{18,19} Meniscal root tear repair is indicated chiefly in patients without osteoarthritis who have sustained an acute traumatic root tear associated or not with an ACL rupture. It is also indicated in chronic symptomatic root tears in young or middle-aged patients with normal or nearly normal cartilage.²⁰ Surgery is contraindicated in cases of osteoarthritis.

The technique proposed consists of debridement of the tissue at the root's attachment footprint and subsequent fixation of the meniscus through bone contact using 2 posterolateral portals. The advantage of this procedure is that it permits easy and strong fixation and obviates the need of a tibial hole. Posterior lateral meniscus root (PLMR) fixation has been indicated for the treatment of a detachment where meniscal removal would result in a poor outcome. Performing the fixation technique with an all-arthroscopic technique minimizes the risk of cartilage damage and reduces operative time. In this report, an all-arthroscopic technique is presented where a PLMR tear is fixed using 2 suture anchors at the anatomic insertion site.

The pullout suture technique is often used to repair lateral meniscal root tears, but it is associated with some technical difficulties. This article introduces a simple surgical technique for repairing lateral meniscus root tears that allows optimal visualization.

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Table 1. Key Aspects of Lateral Meniscal Root Reattachment

1. The patient is positioned with the knee flexed at 90° on the operating table.
2. The 30° scope is introduced through the anterolateral portal, and a complete arthroscopic examination of the knee is performed. The 70° scope is then introduced into the posterolateral compartment through the anteromedial portal.
3. Two posterolateral working portals are used. These are established under arthroscopic control to provide a direct route to the anatomical attachment site and the meniscus root.
4. The anatomical footprint on the tibial plateau is debrided with a shaver to allow bone contact of the root.
5. The anchor drill guide is inserted through a superior posterolateral portal ensuring proper orientation to the anatomical insertion site.
6. Two anchors are placed in a double-row arrangement: the posterolateral anchor reduces the meniscus, and the anteromedial one compresses it against the footprint.
7. The root is punctured from the posterolateral portals.
8. The sutures are tied through the posterolateral portals, and the posterior lateral meniscus root is shifted to its reduced position.
9. An arthroscopic assessment of the attachment of the meniscus root into the footprint is performed.
10. Knee flexion is restricted for 4 weeks to protect the fixation.

Technique

Surgical Approach

The patient is positioned on the operating table with the knee flexed at 90°. After performing an overall arthroscopic examination through the standard anterolateral portal, a 70° scope is inserted through an anteromedial portal located just medial to the medial border of the patellar tendon (Video 1). The scope is introduced into the posterolateral compartment of the joint between the ACL and the posterior cruciate ligament (Table 1).²¹⁻²⁵

Two working portals are used: a superior posterolateral one located 3 cm proximal to the joint line and 2 cm posterior to the lateral posterior condyle and an inferior posterolateral one placed 1 cm proximal to the joint line and 2 cm posterior to the posterior condyle (Fig 1). The superior portal is placed over the short head of the biceps tendon, and the inferior portal is created between the long and the short heads of the biceps tendon. These 2 posterolateral portals must be placed under arthroscopic control to allow easy access to the anatomical insertion site and the meniscal root (Table 2). Appropriate orientation is established using 2 arthroscopy needles from the Disposable Hip Pac (Smith and Nephew, Andover, MA). Subsequently, the portals are created with 2 cannulated switching sticks (Smith and Nephew) following the direction of 2 nitinol guide wires that were previously introduced through the arthroscopy needles (Table 1). Two slotted cannulas from the Fast-Fix Meniscal Repair System (Smith and Nephew) are introduced consecutively after each maneuver of the technique in order to maintain portal access and prevent the loss of those portals.

Preparing the Anatomical Insertion Site

Inserting suturing devices through the posterior rather than the standard anterior portals makes it easier to avoid cartilage damage when reattaching the meniscal root (Video 1).

The anatomical insertion of the PLMR must be identified at the correct site of the lateral tibial plateau. The anatomical insertion is identified just posterior to the intercondylar eminence, between the tibial attachments of the posterior cruciate ligament and the ACL but more lateral to them. It must be ascertained that the meniscus can be reduced to the chosen anatomical insertion site without tension (Table 2); otherwise, the suture may be detached when stretching the knee. After choosing the correct anatomical insertion point, the site must be debrided to allow contact between the meniscus and the bone (Table 2). A 4.5-mm full-radius disposable blade (Smith and Nephew) on a motorized shaver is inserted through the posterolateral portals and used to debride the fibrous tissue from the selected anatomical insertion site to expose the subchondral bone (Fig 2, Video 1).

Posterior Root Fixation Technique

The next step involves choosing the position of the anchors at the anatomical insertion site and placing them at a 45° inclination with respect to the tibial plateau (Fig 3). The anchors should be introduced through the superior posterolateral portal, which provides easy access to the anatomical insertion site and allows correct anchor inclination (Fig 4, Table 1). The kind of anchor used for this technique is the 1.7 mm Suturefix Ultra S all-suture anchor (Smith and Nephew; Table 2, Video 1). The use of all-suture anchors avoids the need to drive a tibial tunnel.

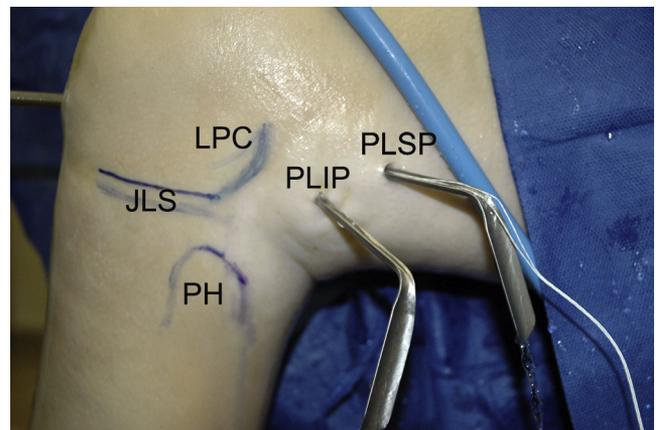


Fig 1. Image of a left knee with posterolateral superior (PLSP) and inferior portals (PLIP). Two slotted cannulas were used to maintain those portals. The following anatomical structures are represented: FH, fibular head; JLS, joint line space; LPC, lateral posterior condyle.

Table 2. Technical Pearls and Pitfalls

Pearls	Pitfalls	Risks
Devote adequate time to performing the posterolateral portals.	Saves time when it comes to puncturing the meniscus and placing the anchors, getting the correct angle for the suture anchors.	Peroneal nerve injury if the anatomical landmarks are overlooked. Popliteal artery injury if the direction of the portal is too medial.
Expose the subchondral bone at the footprint.	Avoids nonhealing of the meniscus.	Anchor detachment if the subchondral bone is removed.
Select the correct anatomical insertion site and make sure that the meniscus is reducible to the chosen attachment site.	Prevents overtensioning the meniscus and consequent detachment of the sutures.	Difficulty mobilizing the meniscus in chronic cases with a retracted meniscus.
Use suture anchors.	Suture anchors being soft, there is no risk of loose body release if an anchor comes loose.	

Reduction and compression of the root are performed with 2 anchors separated by 5 to 10 mm from each other: one is placed at the far posterolateral end of the anatomical footprint and the other at the far anteromedial end of the anatomical footprint (Table 1). The anchors are arranged in 2 rows: the posterolateral anchor reduces the meniscus, and the anteromedial one compresses it against the anatomical footprint (Video 1). An Accu-Pass Direct Crescent XL suture shuttle (Smith and Nephew) is used to pass the suture through the PLMR (Fig 5 A and B). It is important to make sure that enough tissue is available between the sutures and the meniscal margin so that the sutures do not pull through the meniscus tissue. The Accu-Pass device is introduced from either of the posterolateral portals. Portal selection depends on whether the meniscus is dislocated or not: if the meniscus is completely dislocated, the device can easily be passed through the PLMR from the inferior posterolateral portal; if the meniscus has already been reduced or if the goal is to pass through the periphery of the meniscus, the superior posterolateral portal must be used (Table 1). We suggest applying the lasso-loop stitch when the quality of the root is not optimal (Fig 5C). The sutures are tied through the posterolateral portals, and the PLMR is shifted into its reduced position (Video 1). An arthroscopic assessment must be performed to assess the degree of reduction and compression achieved (Table 1).

Stability of the PLMR repair is assessed with flexion/extension and slight rotational movements and by pulling at it with a blunt-tipped device. In this way, a complete and anatomic reattachment of the root is achieved.

Postoperative Rehabilitation

Patients are advised to protect the fixation by limiting knee flexion to 45° for 4 weeks. Crutches are used for partial weight bearing for 6 weeks. Stationary bicycle exercises with minimal resistance are initiated at 8 weeks postop.

Discussion

Use of suture anchors allows simple and safe reattachment of the PLMR. The arthroscopic all-inside technique includes debridement of the tissue at the

anatomical attachment site on the tibial plateau, repair of the root to the meniscal footprint on the tibial plateau, and compression of the meniscus against the tibial plateau with 2 soft suture anchors.

The proposed advantages of the technique described are avoidance of a transosseous tibial tunnel, which could converge with the ACL tunnel when a concurrent reconstruction is performed; performance of an extensive exposure; achievement of an anatomic reconstruction and attachment of the PLMR without overtensioning the meniscus, which is essential for lateral meniscus stability²⁶; reduction of surgical time; access to the footprint at a 45° inclination with respect

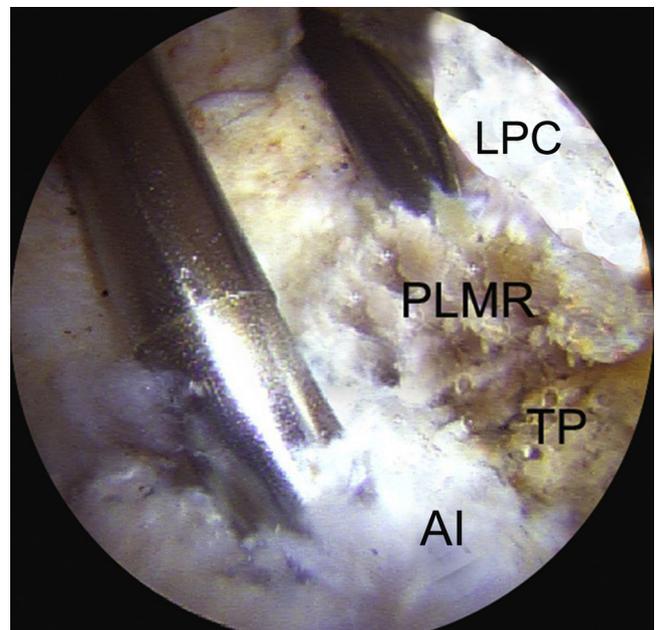


Fig 2. View of left knee flexed at 90° with the 70° scope into the posterolateral compartment through the anteromedial portal. The fibrous tissue from the selected root's footprint is debrided to expose the subchondral bone. To achieve good access, the blade is inserted through the posterolateral portal and the 70° arthroscope through the anteromedial portal and placed in the intercondylar space. (IR, anatomical insertion site of the root; LPC, lateral posterior condyle; PLMR, posterior lateral meniscus root; TP, tibial plateau.)

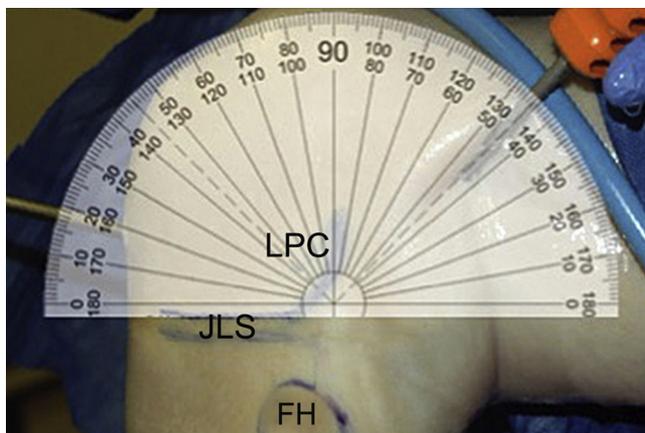


Fig 3. Image of a left knee with an anchor drill guide introduced through the superior posterolateral portal at 45° with respect to the tibial plateau. The following anatomical structures are represented: FH, fibular head; JLS, joint line space; LPC, lateral posterior condyle. A protractor is added to measure the tilt of the anchor drill guide.

to the tibia, which increases anchor placement accuracy; and avoidance of the chondral damage that may result from use of the pullout suture technique (Table 3).

Some investigators prefer not to establish posterior portals and often resort to the transosseous tibial tunnel technique. However, PLMR tears may be difficult to detect from anterior portals, increasing the likelihood that the surgeon may overlook them.²¹⁻²³ We believe that the use of posterior portals is safe if they are carried out as indicated using the technique described in this study. Moreover, such portals allow easy access to the posterolateral compartment and, if necessary, a transeptal portal may be added to permit visualization through a posteromedial portal.²¹⁻²⁵

Reattachment of the PLMR is important to restore the biomechanical function of the lateral meniscus. Like the medial meniscus, the lateral meniscus absorbs forces and generates circumferential hoop stresses, so detachment or removal of the meniscus results in an increase in tibiofemoral contact pressure.^{27,28} In addition, Starke et al. report a conversion of tibiofemoral loads into circumferential tension when the posterior root is not attached to its footprint.²⁹

There is a continued debate about the best posterior lateral root repair techniques. Most techniques for meniscus root repair are performed using the transtibial pullout suture technique.^{10,30} According to the literature, repair of posterior root tears in the lateral or medial meniscus using pullout sutures results in satisfactory return to previous activity.^{9,31} However, in a study on porcine knees, Feucht et al. found that suture anchor repair provides a more stable fixation of a meniscus root tear.³² It should be added that soft anchors provide a mean pullout strength of 239.1 N,³³ so this technique can be said to provide satisfactory

primary fixation until the root has healed. Some investigators have reported that although transtibial fixation and anchor-based repair provide similar biomechanical results, neither of them restores the elongation and load to failure of the native meniscus.³⁴ In this respect, it would be interesting to study the biomechanical properties when the meniscus root has healed following the different repair techniques.

Several techniques for repairing the posterior root of the medial meniscus with anchors have been described,^{8,35,36} but few descriptions exist of lateral meniscus root fixation. Prasathaporn et al. describe an arthroscopic technique to reattach the PLMR with soft suture anchors using a high accessory anteromedial portal.³⁷ However, it is not easy to prepare the anatomical attachment site and pass the sutures through the meniscus from anterior portals. Use of anterior portals entails the risk of failing to restore the PLMR footprint and injuring the cartilage with the suture devices. Also if no posterior portals are used, it is not easy to create accessory working portals. In addition, in this kind of technique it is very important for suture anchors to be inserted at an angle, which means that the footprint area must be approached from a portal that allows comfortable maneuvering. For these reasons, we believe that the posterolateral approach is the most suitable approach for PLMR reattachment.

Some of the techniques reported in the literature are performed with metal anchors.⁶ We personally prefer

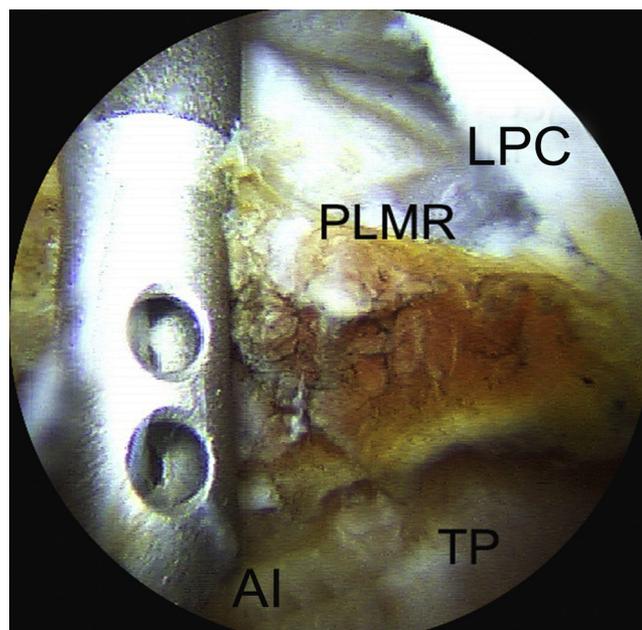


Fig 4. Anchor drill guide introduced through the superior posterolateral portal and positioned at the root insertion site. View of the left knee through a 70° scope in the intercondylar space. (AI, anatomical insertion site of the root; LPC, lateral posterior condyle; PLMR, posterior lateral meniscus root; TP, tibial plateau.)

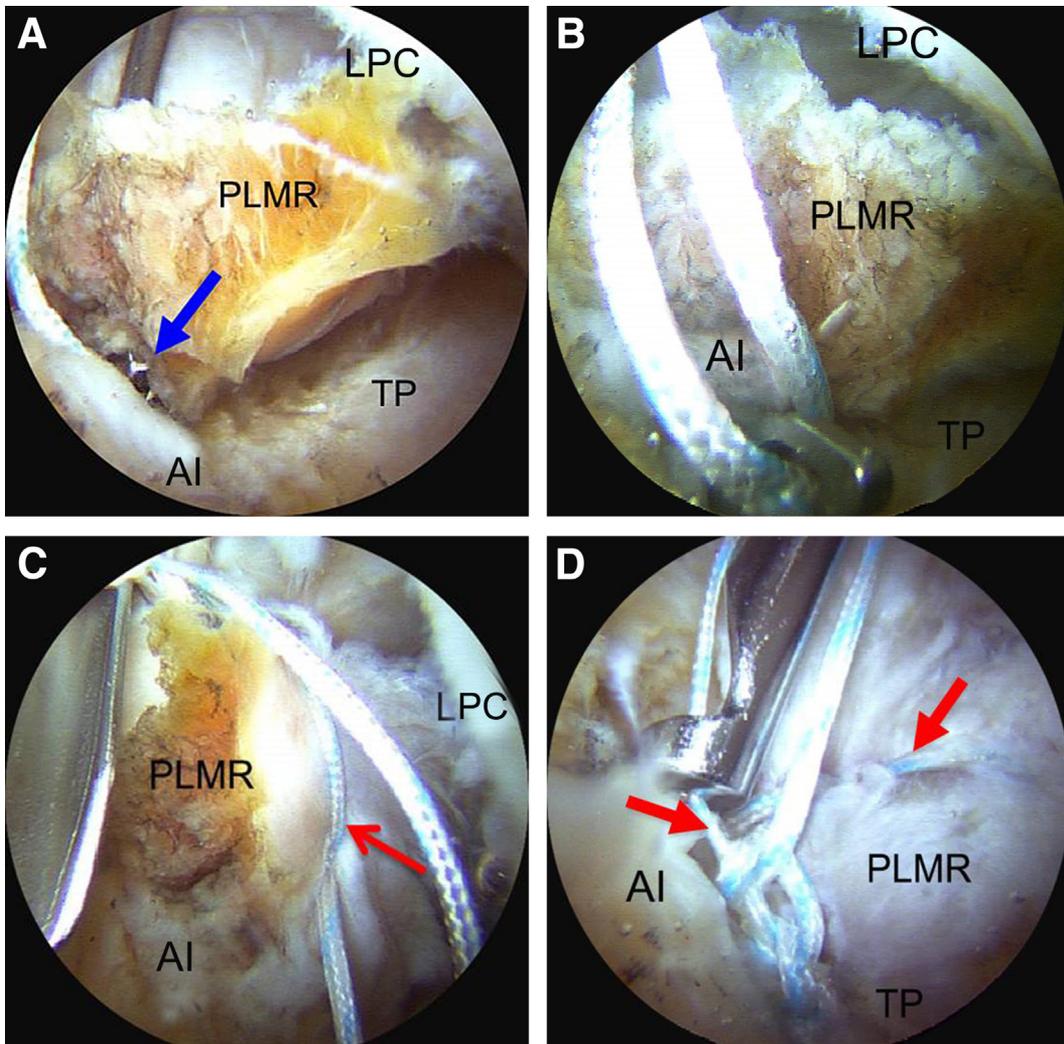


Fig 5. PLMR reduction and compression with 2 suture anchors. View of the left knee through a 70° scope in the intercondylar space. The fixation instruments are inserted through the accessory posterolateral portals. (A) The Accu-Pass Direct Crescent XL (blue arrow) suture shuttle penetrates the PLMR and (B) grasps the suture of the anchor. (C) A lasso-loop stitch (red arrow) is used for reduction, (D) the sutures are tied (red arrow), and the root is reduced under arthroscopic control. (IR, anatomical insertion site of the root; LPC, lateral posterior condyle; PLMR, posterior lateral meniscus root; TP, tibial plateau.)

soft suture anchors as the use of metal anchors may result in bigger holes if they are detached.

Although most of reported studies are case series with short-term follow-ups, all of them show better clinical outcome scores and knee function after medial or lateral meniscus root repair.^{9,10,34,38-40} Nevertheless,

some reports found incomplete healing of the PLMR on magnetic resonance imaging.^{31,36,38,41} In spite of this, the clinical outcomes are much better than those of partial meniscectomy.³⁵ For that reason, we believe that PLMR reattachment should be performed.

Table 3. Advantages and Disadvantages of This Technique

Advantages	Disadvantages
Avoidance of a transosseous tibial tunnel.	Higher cost.
Extensive exposure allows optimal performance of the technique.	Infrequent indication.
Achievement of an anatomic reconstruction of the posterior lateral meniscus root footprint, which is essential for lateral meniscus stability.	Less resistant than the transtibial pullout suture technique.
Decrease in operative time.	
Placement of anchors at a 45° inclination with respect to the tibial plateau.	
Avoidance of chondral damage with posterior portals.	
Avoidance of tunnel convergence when a concurrent anterior cruciate ligament reconstruction is performed	

Disadvantages of the procedure include a higher cost than the transtibial pullout suture technique (Table 3). In addition, PLMR reattachment with anchors can result in anchors coming loose and subsequent redislocation of the lateral meniscus.

As far as risks are concerned, the posterior portals could be created too distally and result in peroneal nerve injury. To avoid this, it is suggested that the portals be created with a guide wire under arthroscopic control, using the fibular head as a reference. Other pitfalls include the difficulty to maintain arthroscopic portal holes on the knee capsule. To avoid this, slotted cannulas should be introduced after each step.

In summary, while the results of long-term studies on the arthroscopic fixation of PLMR are still becoming available, it seems reasonable to vouch for an easier and less aggressive technique that uses an all-inside arthroscopic approach. In this respect, a PLMR tear can be treated by the technique described above in a simple and safe manner using 2 anchors. This precludes the need for tibial perforation and allows adequate debridement of the fibrous tissue at the root's fingerprint.

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