



Meniscal Ramp Lesion Repair Using an All-Inside Technique

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Abstract: Posteromedial meniscotibial ligament lesions, known as meniscal ramp lesions, are typically associated with ACL injuries, but frequently underdiagnosed. When correctly diagnosed, repair is mandatory in most cases. Retraction of the soft tissues makes it difficult to repair and leads to suture failure. Previously described techniques include all-inside and inside-out meniscal sutures, but do not ensure correct meniscotibial closure because of the soft tissue retraction. The purpose of this Technical Note is to describe a meniscal ramp lesion arthroscopic repair with an all-inside technique with the Fast-Fix 360 device, detailing the use of the accessory posteromedial portal, and the addition of an arthroscopic grasper that raises the retracted meniscotibial ligament, to allow correct fixation.

Meniscal tears can occur in isolation or in association with other knee injuries. The most common association is with anterior cruciate ligament (ACL) injuries in 47% to 61% of cases.^{1,2} Of these, 40% correspond to injuries of the posterior horn of the medial meniscus (PHMM). At the same time, PHMM injuries have a high temporal correlation to ACL tears, because the incidence of PHMM injuries increases in direct proportion to the time from ACL injury to repair. The incidence of PHMM or posteromedial meniscocapsular injuries is an estimated 9.3% to 16.9%.^{1,2}

In 1988, Strobel³ first described a longitudinal meniscal lesion involving the peripheral union of the PHMM, typically associated with ACL injuries, which

he termed *ramp lesion* to distinguish it from other types of posterior tears. The choice of the name reflects the ramp appearance of the posteromedial zone, which he named *ramp zone*, when seen from the intercondylar notch toward the posteromedial compartment (Fig 1A). This ramp zone corresponds to the peripheral union of the medial meniscus with the posteromedial meniscotibial ligament.⁴

Described risk factors include gender, with higher prevalence in males than females (18.56% vs 11.97%, $P = .017$); age, significantly higher incidence among patients younger than 30 years ($P < .01$); and time from injury, being more common in lesions more than 6 weeks old (18.8% vs 12.7%, $\chi^2 = 5.322$, $P < .05$). The prevalence increases significantly over time to 24 months and then stabilizes, with no differences found between 24 and 60 months of evolution.² In addition, a recently assessed risk factor is the medial meniscal slope, which is the angle formed by a tangent line between the superior meniscosynovial anterior and posterior borders, and a line perpendicular to the tibial longitudinal axis, measured in the sagittal section of magnetic resonance imaging. An increased medial meniscal slope is a risk factor for ramp lesions in knees with ACL injury, independent of age, gender, and time from injury.⁵

Sometimes, ramp lesions are underdiagnosed, owing to the incomplete preliminary study or an incomplete diagnostic arthroscopy during ACL reconstruction surgery. Before surgery, a magnetic resonance imaging has good sensibility, high negative predictive value, and low positive predictive values; therefore, it is easy to make a

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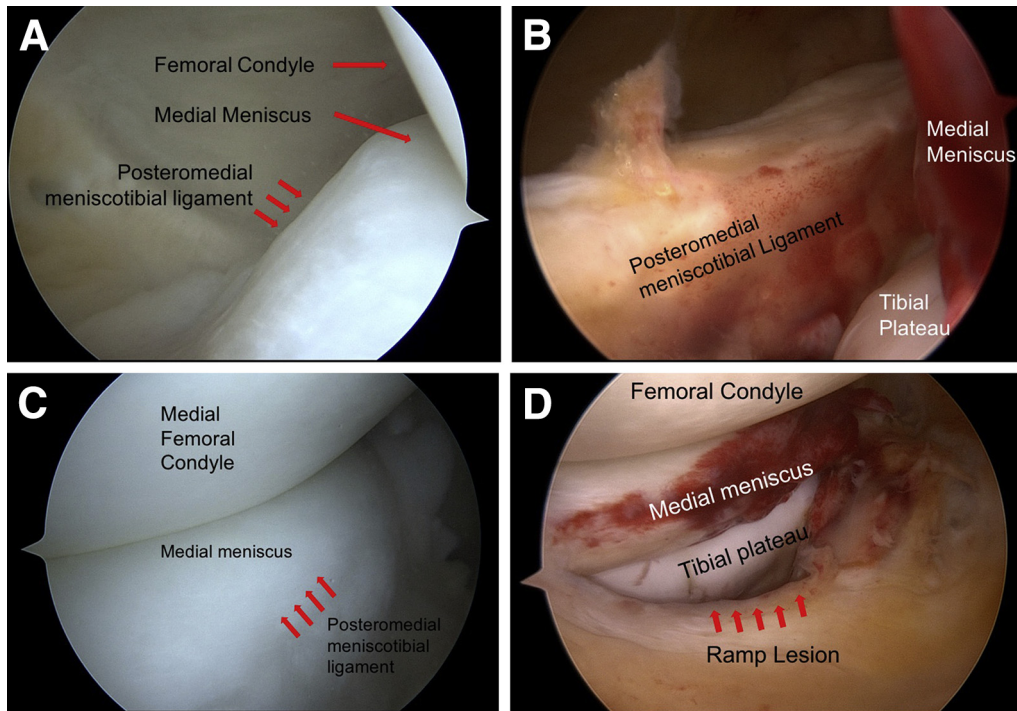


Fig 1. Diagnostic arthroscopy with knee flexed at 90°: (A) Notch view, with 30° optic, rotated at 4 o'clock. The “ramp zone” of the posteromedial meniscotibial ligament, attached to the posterior horn of the medial meniscus, is seen. (B) Notch view with 30° optic of an acute ramp lesion in a patient with ACL injury. Complete disinsertion of the meniscus and the posteromedial ligament is observed, revealing the medial plateau. (C) View through the posteromedial accessory portal with 30° optic. Posteromedial meniscotibial ligament is attached to the posterior horn of the medial meniscus. (D) Complete posteromedial meniscotibial ligament disruption and retraction.

diagnosis as well as safe to discard the diagnosis.⁶⁻⁸ That is why an accurate diagnosis is necessary during the arthroscopy, looking for the ramp lesion using an intercondylar notch view of the posteromedial compartment, and adding a posteromedial portal for direct vision.⁹⁻¹¹

Treatment is aimed at restoring stability, preventing progression, and protecting the reconstructed ACL,¹²⁻¹⁴ for which surgical treatment is necessary in most cases. Conservative management is reserved for partial¹⁵ or complete small and stable lesions of less than 1.5 cm and not excessively displaced (5 mm) when probed through the anteromedial portal.^{16,17}

If the posteromedial lesion, whether meniscal or meniscotibial, compromises the stability of the posterior

horn of the meniscus, and is complete and reparable, the treatment is meniscal suture. The most commonly used techniques are all-inside sutures, including the use of curved suture hooks through the posteromedial portal, which in practice presents various difficulties. Therefore, we prefer modern all-inside suture devices such as Fast-Fix 360 (Smith & Nephew Endoscopy, Andover, MA), from the technique described by Li et al. using the original FasT-Fix (Smith & Nephew Endoscopy). As described by the author, the technique has some limitations,¹⁸ including the possibility of underdiagnosing lesions with the lack of a posteromedial portal and the use of FasT-Fix without the advantages of the new implant “Fast-Fix 360,” such as its low profile, minimal disruption of meniscal tissue, and adjustable

Table 1. Pearls and Pitfalls

Pearls	Pitfalls
1. Perform diagnostic arthroscopy through 3 portals (anteromedial, anterolateral, and posteromedial).	1. All-inside suture with curved hooks may further damage the meniscal tissue.
2. The posteromedial portal must be made more proximally and slightly posteriorly than usual.	2. Not directly seeing the suture device may result in an incorrect technique.
3. Exchange medial and notch views without drawing the optics from the anterolateral portal.	3. Not elevating the meniscotibial ligament does not ensure correct fixation.
4. Move the Fast-Fix 360 device forward only after seeing through the notch through the posteromedial portal.	
5. Observe how it crosses the meniscotibial ligament.	
6. Observe how the second implant is released.	

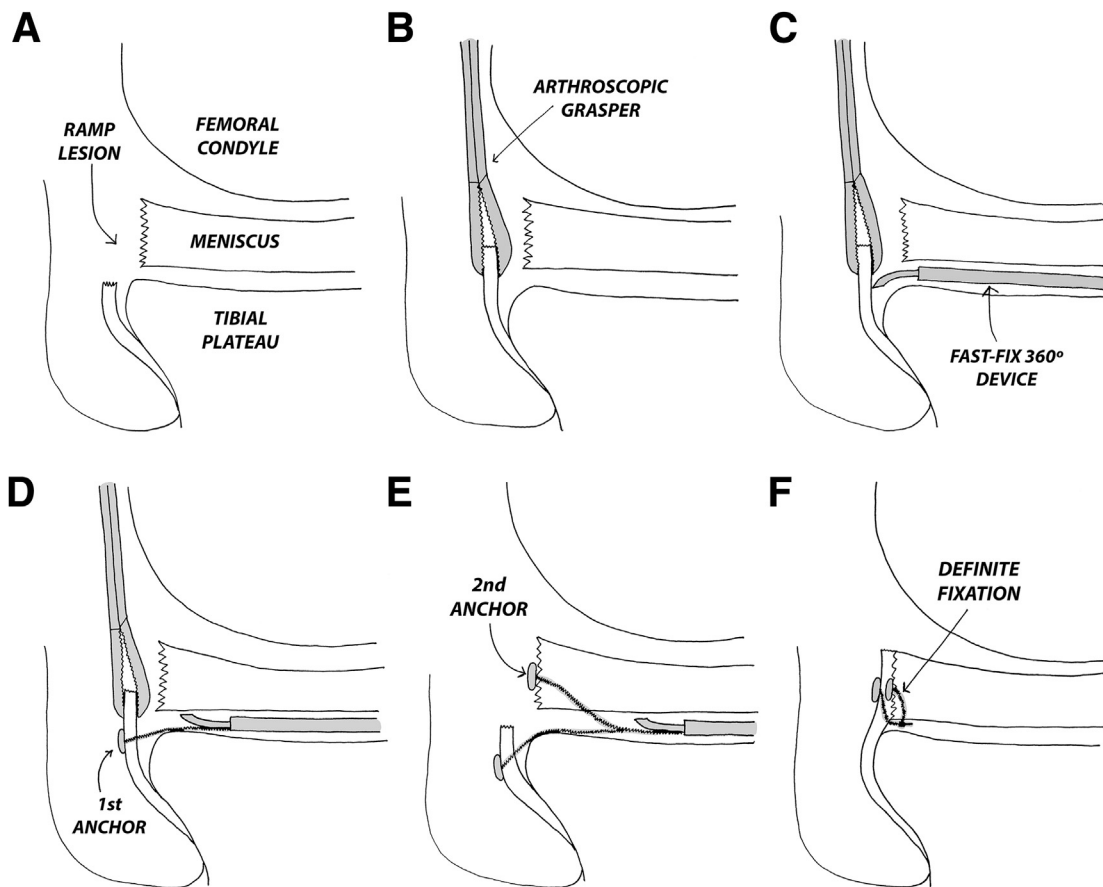


Fig 2. Step-by-step diagram of meniscal ramp lesion repair (A). Step 1 (B): Hold the meniscotibial ligament with an arthroscopic grasper through the posteromedial portal. Step 2 (C): Using a Fast-Fix 360 device, point the curve downward through the meniscotibial ligament and release the first anchor. Step 3 (D): Then pass the device pointing upward through the meniscus and release the second anchor (E). Then pull the suture and cut (F).

depth penetration. Furthermore, we have not found studies considering the displacement of the meniscotibial ligament and its technical consideration at the time of suturing.

Our objective is to present an arthroscopic technique, based on Li et al., for the treatment of ramp lesions, using the Fast-Fix 360 all-inside meniscal suture device, with support from the posteromedial portal to reach and grasp the meniscotibial ligament and ensure a correct and efficient suture.

Surgical Technique

The technique is shown in [Video 1](#), and its pearls and pitfalls are described in [Table 1](#).

Patient Positioning

The patient is in supine position on the operating table after spinal anesthesia is given, with both knees flexed to 90° and hanging toward the floor. A thigh tourniquet should be placed, and it is recommendable to place the knee to be operated on a special leg holder

for knee procedures, placed proximal enough to allow posterior arthroscopic portal placement.

Diagnostic Arthroscopy

Standard anteromedial and anterolateral portals are performed as usual, although ideally at medium height and adjacent to the patellar tendon. Considering that it is a patient with an ACL injury who will be repaired in this surgical procedure, a complete examination of the knee should be performed in all compartments, including patellofemoral, intercondylar notch, medial, and lateral. When examining the medial compartment, the stability of the posterior horn of the meniscus should be evaluated with a probe, especially in presence of a visible peripheral lesion.

A view is then obtained through the intercondylar notch (i.e., notch view), in the triangular space between the tibial spine, the medial femoral condyle, and the posterior cruciate ligament. It is usually possible to perform this passage without modifying the anatomy; otherwise, it is recommended to perform a reverse-plasty of the sulcus by shaving the lateral wall of the

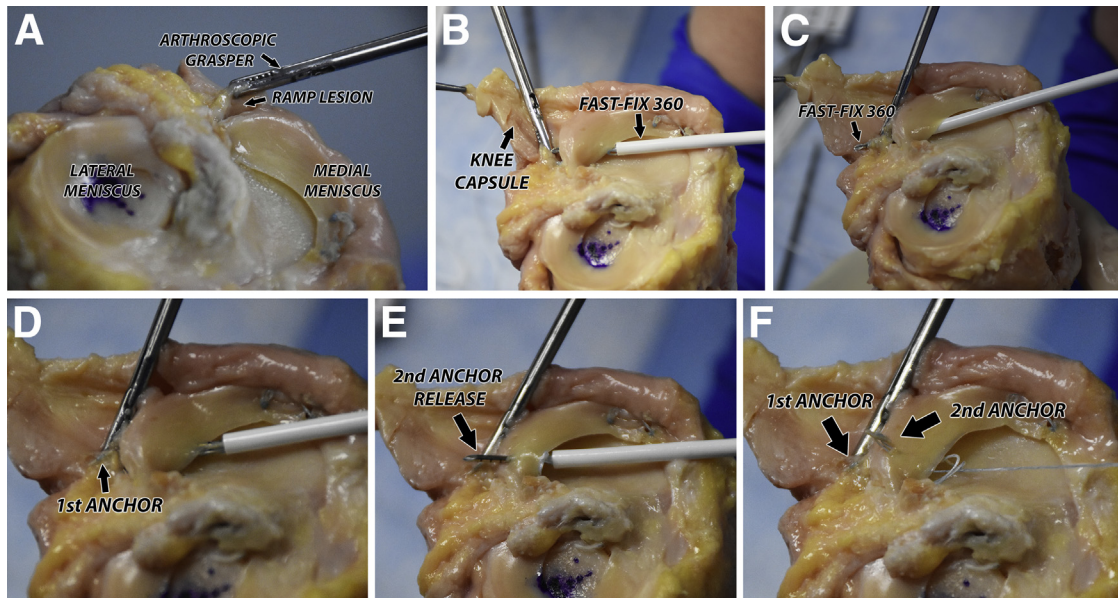


Fig 3. Step-by-step cadaveric example of meniscal ramp lesion repair. Step 1 (A): Hold the meniscotibial ligament with an arthroscopic grasper through the posteromedial compartment. Step 2 (B): Using a Fast-Fix 360 device, point the curve downward through the meniscotibial ligament (C) and release the first anchor (D). Step 3 (E): Then pass the device pointing upward through the meniscus and release the second anchor (F).

medial femoral condyle. On reaching the posteromedial compartment, the 30° optic is positioned facing the plateau to evaluate the ramp segment of the posteromedial meniscotibial ligament (Fig 1A), which in case of injury will be disrupted and the tibial plateau may be visible (Fig 1B).

Maintaining vision through the intercondylar notch, a needle is introduced choosing a more proximal and slightly posterior entry for posteromedial portal placement, to face the PHMM (Fig 1C). A cannula can be used for easy entry and exit with instruments and camera. At this moment, the camera position is changed and is inserted through the posteromedial portal. Turning the optic to the medial femoral condyle, the entire posteromedial meniscotibial segment can be visualized (Fig 1C), and both the size of the ramp lesion and the degree of meniscotibial retraction, if present, can be quantified (Fig 1D).

Ramp Lesion Repair

Step 1. Return to the previous view through the intercondylar notch. In cases of significant meniscotibial retraction, a fixation between the meniscus and the meniscotibial ligament will be very difficult to create. To obtain a secure fixation to both the meniscus and the meniscotibial segment, an arthroscopic grasper (Acuflex; Smith & Nephew) or similar instrument can be passed through the posteromedial portal and used to pick the capsule of the posteromedial recess (which contains the posteromedial meniscotibial ligament), firmly grasp it, and raise it to the height of the meniscus (Figs 2B and 3A).

Step 2. Once the capsular recess is seized, the camera is moved back to the medial compartment. With a slotted cannula (Smith & Nephew), the tip of the curved Fast-Fix 360 implant, calibrated at 1 mm, is presented and carefully passed under the meniscus without taking

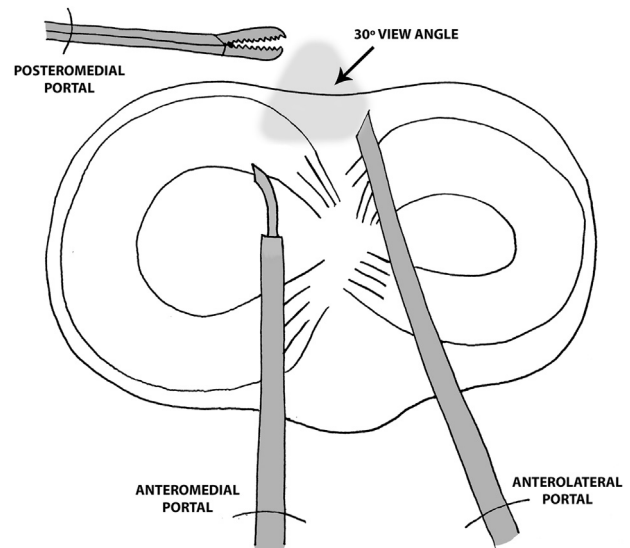


Fig 4. Arthroscopic configuration of all the instruments used for a meniscal ramp lesion repair. The posteromedial portal is used to pass an arthroscopic grasper to hold the meniscotibial ligament. The anteromedial portal is used for the Fast-Fix 360 device. The anterolateral portal is used for the camera, changing between the anteromedial view and the notch view without leaving the anterolateral portal.

Table 2. Advantages and Disadvantages

Advantages	Disadvantages
<ol style="list-style-type: none"> 1. This technique ensures correct meniscotibial ligament and meniscal fixation 2. The posteromedial portal adds a “third hand” and more space to perform the repair 3. No need for an open approach 4. Direct visualization of the meniscus, meniscotibial ligament, Fast-Fix 360 device, and PEEK (polyethylene ether ketone) anchors 5. Biomechanically stronger, as the vertical mattress sutures 	<ol style="list-style-type: none"> 1. Always needs the addition of the posteromedial portal 2. Needs a second surgeon to manipulate the meniscotibial ligament 3. More expensive than the suture hook devices via the posteromedial portal 4. If retraction of the meniscotibial ligament is not present, may not be as useful as with retraction

meniscal tissue, directing the curve downward (Figs 2C and 3B). The camera is changed to notch view to see the tip of the Fast-Fix 360 advance as it crosses the posteromedial meniscotibial ligament while it is held with the grasper, and the first anchor is placed (Fig 3C). Then it is moved back and returned to the starting position.

Step 3. In view of the medial compartment, the Fast-Fix 360 tip is presented under the meniscus pointing the curve upward (Fig 2D). Returning to notch view, the Fast-Fix 360 is moved forward and the second anchor is released. It must be observed that the release is immediately posterior to the PHMM (Figs 2E and 3E) and that the meniscotibial ligament and the meniscus adjoin each other when the suture is pulled, and stay joined, thus closing the ramp lesion (Figs 2F and 3F).

Discussion

Several techniques for the management of ramp-type meniscal lesions have been described. The earlier, all-inside techniques, described by Ahn et al.,¹⁹ use 1 or 2 accessory posteromedial portals, through which a curved suture passer with No. 0 PDS (Ethicon; Somerville, NJ) is introduced, first passing through meniscocapsular tissue and then through the peripheral edge of the meniscus, and using sliding knots for fixation. They obtained good results with magnetic resonance imaging and excellent healing rates in second-look arthroscopic evaluation, achieving 100% when the technique is performed in isolation and lower rates when associated with inside-out techniques. Inside-out techniques are performed in the usual manner, with anterior view, directing the needle with a meniscal repair cannula, and a posteromedial mini-approach for a vertical mattress stitch.²⁰ Other authors recommend the use of all-inside techniques mainly through the posteromedial portal, or FasT-Fix, in association with outside-in techniques only for cases of ramp lesions that extend to the meniscal body.^{15,21}

The different options are not exempt of technical difficulty or visual limitation by the anatomic variability of the posteromedial space. Keyhani et al.²² describe the addition of the transeptal portal for more direct visualization of the ramp lesion, while suturing through

the posteromedial portal with a 90° curved passer. However, in our experience, there are very lax tissues, and curved passers are not the most suitable instruments as they fail to correctly cover the lesion, further injuring the tissue or leaving untreated segments. The addition of the posteromedial portal allows the diagnosis of hidden ramp lesions and is useful for handling, allowing easy manipulation of the capsular recess, which is very helpful in cases of significant retraction of the meniscotibial ligament. The direct visualization allows to see and to verify the passing of the implant and the degree of meniscal contact, thus ensuring the closing of the lesion.

The technique described by Li et al.¹⁸ does not accomplish direct visualization of the defect while suturing, and does not ensure the closure between the ligament and the meniscus, because of the retraction of the meniscotibial ligament in large lesions, when the FasT-Fix curve does not reach the retraction site. We consider that the posteromedial portal is very important in the meniscal ramp lesion diagnosis, and even more important in treatment, allowing a more precise and controlled procedure, when the meniscotibial ligament is elevated with an arthroscopic grasper (Fig 4) (Tables 1 and 2).

The presented technique correctly repairs posteromedial meniscotibial lesions, verifying by direct vision that the suture encompasses the corresponding lesion components with a stable and functional fixation, avoiding lesion progression and further damage in the concomitant reconstruction of the ACL. Direct visualization at the time of meniscal suture ensures contact with the meniscotibial ligament while using all-inside sutures like Fast-Fix 360.

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