

Technique for Medial Meniscus Ramp Repair: An Anatomic Approach



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Abstract: Medial meniscus ramp lesions are commonly associated with anterior cruciate ligament injury. They are one of the causes of positive pivot shift and can lead to failure to obtain rotary stability if missed during the surgical procedure. Several repair methods use a suture lasso from 2 posteromedial portals to attach the posteromedial capsule to the meniscus. Because it was concluded at the consensus meeting of the European Society for Sports Traumatology, Knee Surgery and Arthroscopy in 2019 that ramp lesions are not considered a meniscal tear and the lesion is essentially in either the articular capsule, meniscal capsular ligament, or meniscotibial ligament (MTL), it should be considered as a peel-off injury of the posteromedial capsule. This lesion is a meniscocapsular separation with or without MTL injury. Thus, reattaching the capsule and MTL to the bone on the posteromedial aspect would provide adequate anatomical repair. The prevailing repair methods suture the capsule to the meniscus, ignoring the MTL attachment. This technique addresses the refixation of the meniscal capsular ligament and MTL to the bone where it is attached instead of suturing it to the meniscus, thus providing sounder anatomical repair.

The medial meniscus is attached to the posterior tibial plateau by the articular capsule and provides restraint for anterior tibial translation alongside the posterior cruciate ligament.¹ The articular capsule's detachment from the medial meniscus's posterior horn or a tear of the meniscotibial ligament (MTL) is defined as a "ramp lesion."² These ramp tears often do not affect the meniscus tissue and thus are not considered valid in the consensus statement released by European Society for Sports Traumatology, Knee Surgery and Arthroscopy in 2019.³

The medial meniscus is attached to the posterior tibial plateau and articular capsule.¹ It has a multitude of functions, such as shock absorption, joint lubrication,

nutrient supply, and stabilization alongside the anterior cruciate ligament.⁴

Loose adipose tissue lies between the posterior horn of the medial meniscus and the articular capsule, where the capsular arm of the semimembranosus is attached. During the anterior cruciate ligament rupture, excessive anterior translation of the tibia stimulates semimembranosus to contract, thus putting the posteromedial (PM) capsular structures under tension (Fig 1). This causes the meniscus to be trapped between the femur and the tibia, leading to injury to the meniscocapsular junction or the MTL.⁵ This technique describes an anatomical approach towards repairing the MTL by attaching the meniscal capsular ligament (MCL) and MTL to the bone.

Surgical Technique

The patient is positioned in a supine position under spinal anesthesia and is painted and draped in a standard fashion with side support to the table at the level of the thigh (Video 1). The knee is placed at 90° of flexion, and a diagnostic arthroscopy is performed using the anterolateral port as a viewing portal. An anteromedial portal is created as a working portal. The standard 30° scope is passed in the PM compartment between the posterior cruciate ligament and the medial femoral condyle (Gillquist maneuver). One can visualize the ramp lesion at this point (Fig 2A). The knee is then placed on the table at 90° of flexion with the scope

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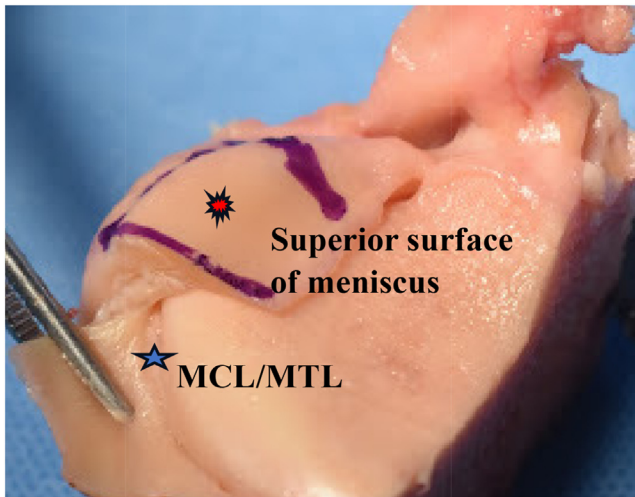


Fig 1. Cadaver study showing capsular attachment of the meniscus. Red asterisk: Shows no capsular attachment to superior surface of the meniscus. Blue star: Shows inferior capsular attachment of the meniscus to the posteromedial capsular complex.

in the PM compartment. A high PM portal is created with an outside-in technique with an 18-gauge spinal needle followed by a No. 11 surgical blade with a planned repair trajectory (Fig 2B). The probe is then passed, and the ramp lesion is probed to evaluate the extent of the tear (Fig 2C). The PM surface of the tibia 7 to 10 mm below the articular cartilage is prepared with the diamond rasp. The capsule is also rasped to enhance chances of healing.

Depending on the size of the tear, a 1.7-mm single-loaded anchor (SUTUREFIX; Smith & Nephew, Andover, MA) is inserted on the posterior tibia in the subchondral region (7-10 mm) below the articular cartilage. This is inserted with a trajectory perpendicular to the bony surface of the tibia (Fig 3). At times, there is

a risk of missing the proper trajectory (Table 1). A 6.5-mm transparent cannula is inserted in the PM portal with the suture ends brought into the cannula (Fig 4A). A self-retrieving suture shuttle (FIRSTPASS MINI; Smith & Nephew) is inserted through the cannula. The free end of the suture is loaded on the passing device and is passed through the posterior capsular structures (MCL and MTL) near the midline (Fig 4B). Using the knot pusher, a sliding locking knot with 3 half hitches is tied to approximate the capsule to the posterior aspect of the tibia. A second suture is passed in the similar fashion repeating the steps for the first anchor (Fig 5A), thus achieving stable watertight fixation without violating the meniscal tissue (Fig 5B). It has the advantage of using a single PM portal (Table 2). If there is an associated meniscal injury, it is tackled through the anterior ports using an all-inside meniscus repair device (FAST-FIX 360; Smith & Nephew).

Postoperative Rehabilitation

The knee is protected in an extension knee brace. Isometric quadriceps exercises, ankle pumps, hip rotations, hip abduction, and extension exercises are started from day 1. Toe-touch mobilization is performed for 2 weeks in addition to passive range of motion exercises up to 60° of knee flexion, gradually increasing to 90° (in the next 15 days). Full weight-bearing and range of motion are started after 4 weeks. Associated injuries and progression-based rehabilitation criteria dictate further rehabilitation.

Discussion

The incidence of ACL with ramp lesion ranges from 9% to 42%. In the presence of ACL injury, the medial meniscus and the articular capsule attempt to stabilize the knee against the anterior translation of the tibia,



Fig 2. (A) Left knee at 90° of flexion; Viewing through the notch: Arthroscopic picture of deploying a blunt trocar and the sleeve for a 1.7-mm all-suture anchor (SUTUREFIX; Smith & Nephew), which is then drilled and the anchor is placed. (B) Right knee at 90° of flexion; Supine position with stopper at 90° and side support at the level of the tourniquet visualization through the notch, trajectory to deploy all-suture anchor is decided to make deployment as perpendicular to the bone as possible for secure fixation. The anchor is placed 7-10 mm below the articular cartilage. (HPMP, high posteromedial portal; MM, medial meniscus; PMC, posteromedial capsule.)

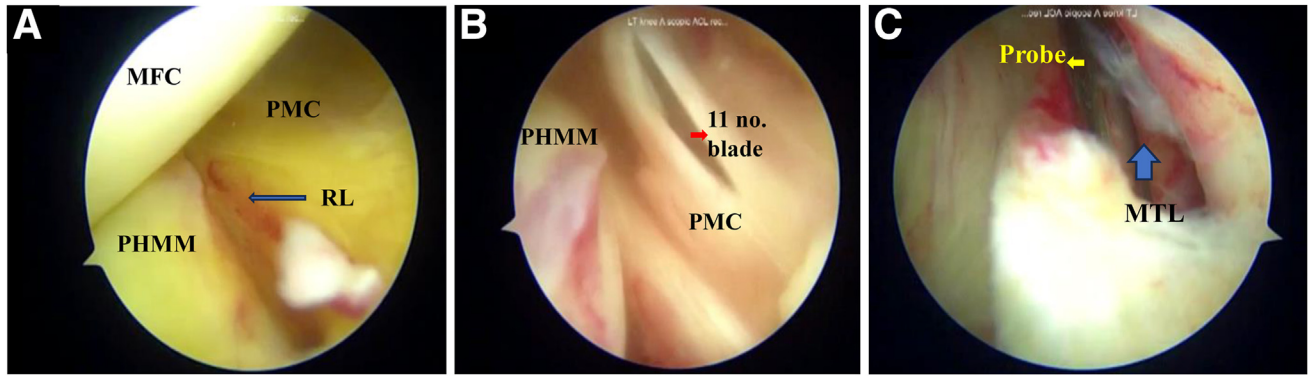


Fig 3. (A) Left knee at 90° of flexion: Visualization and confirmation of the ramp lesion through the notch. (B) Left knee at 90° of flexion: Viewing through the notch: high PM portal is created with a No. 11 surgical blade, after confirming the portal position with an 18-gauge spinal needle. (C) Left knee at 90° of flexion: Viewing through the notch: the probe is inserted through the PM portal to probe and evaluate the extent of the lesion and confirm the avulsion of the MTL. (MFC, medial femoral condyle; MTL, meniscotibial ligament; PHMM, posterior horn medial meniscus; PM, posteromedial; PMC, posteromedial capsule; RL, ramp lesion.)

causing overload and injury. This meniscocapsular disruption causes excessive laxity.⁵ The ramp lesion is described as the cause of explosive pivot shift in the presence of ACL injury. Untreated meniscal ramp lesions have poor outcomes. Hence, prompt identification and treatment are essential.

Ramp lesions are successfully treated arthroscopically.⁶ There are various methods to repair the ramp lesion arthroscopically. They are best seen and diagnosed by creating a PM portal at 90° of knee flexion. This excludes the possibility of a missed lesion.^{7,8}

Methods of Repair

There are several repair methods, discussed to follow, reported in the literature. (1) All-inside method: the all-inside method using a hook is the most commonly used method. However, this method may not capture the MTL and can increase the chances of failed repair.⁵ (2) Hybrid method: If the tear extends into the meniscus body, a combination of outside-in and inside-out sutures and all inside is used.⁸ (3) PM portal: This method uses the additional PM portal and a suture lasso to suture the capsule to the meniscus using a high-strength suture material.⁹

The failure rate with the inside-out method was significantly lower (2%) than that of all inside

techniques (11%) in cases of ACL reconstruction.¹⁰ Surgical repair should be advocated in all unstable ramp lesions for better clinical outcomes.¹¹ The overall success rates in ramp lesion repair are 87% with complete healing and 13% with partial healing.¹²

Since it was decided at the consensus meeting of European Society for Sports Traumatology, Knee Surgery and Arthroscopy³ that the ramp lesion is not considered a meniscal tear and the lesion is essentially in either the articular capsule, MTL, or MCL, it should be considered a peel-off injury of the PM capsule. Because the anatomical structures involved are PM, they cannot be addressed by the all-inside method, which relies on the anterior approach. Ramp lesion affects zone 4 of the Smigielski classification.¹³ In this zone, the superior surface of the meniscus does not have any capsular attachment. Hence, suturing the meniscus to the capsule alone without addressing MTL may not be a perfect strategy for repair. This, at times, also increases the chances of meniscus lacerations or cutting the suture through the meniscal tissue. The inferior part of the meniscus is attached to the tibia about 7 to 10 mm below the articular cartilage by a loose connective tissue forming a MTL. MCL and MTL are inseparable in this area and cannot be identified as separate structures. The meniscosynovial junction

Table 1. Pearls and Pitfalls

Pearls	Pitfalls
<ul style="list-style-type: none"> • Ensure the presence of MTL injury. • Always scope through the PM port. • Plan the trajectory of drill sleeve for all-suture anchor. • Confirm the deployment of all-suture anchor by giving a gentle tug over the sutures. 	<ul style="list-style-type: none"> • Failure to deploy all-suture anchor because of wrong trajectory of insertion.

MTL, meniscotibial ligament; PM, posteromedial.

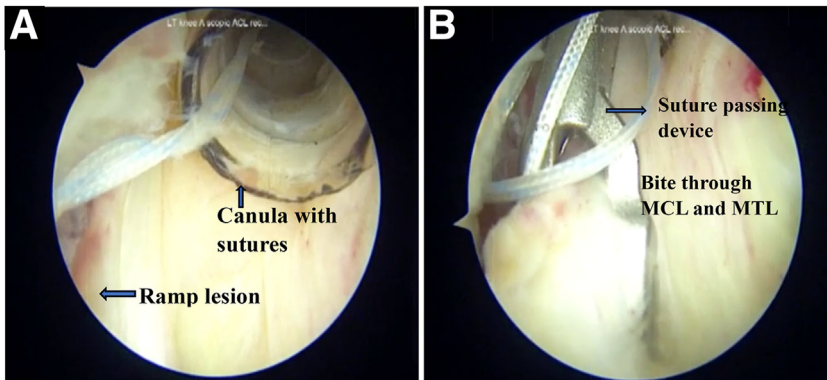


Fig 4. (A) Left knee at 90° of flexion: Visualization through the anterolateral portal and the notch. A 6.5-mm transparent canula is inserted with the sutures parked inside the canula. (B) Left knee at 90° of flexion: Visualizing from the anterolateral portal through the notch, a bite is taken with a self-retrieving suture passing device (FIRSTPASS MINI; Smith & Nephew) with one of the free ends of the suture in the all-suture anchor through the posterior meniscocapsular ligament (MCL) and meniscotibial ligament (MTL).

Fig 5. (A) Left knee at 90° of flexion: Visualization through the notch. A second 1.7-mm all-suture anchor (SUTUREFIX; Smith & Nephew) is deployed in the similar fashion as the first one and sutures are parked in the canula. (B) Left knee at 90° of flexion: Visualization through the notch shows the final repair with well-approximated meniscocapsular complex.

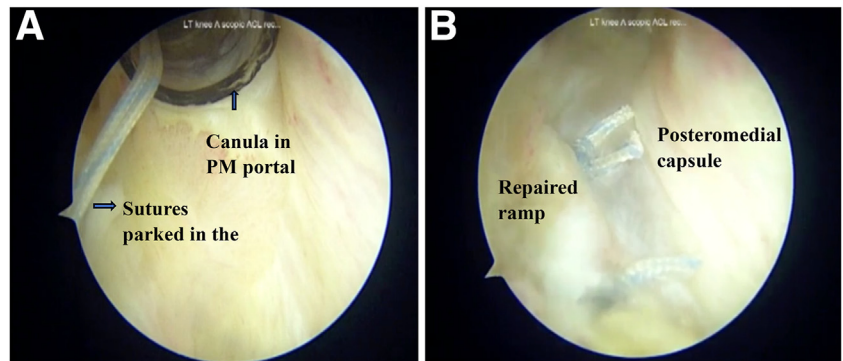


Table 2. Advantages and Disadvantages of the Technique

Advantages	Disadvantages
<ul style="list-style-type: none"> Using transnotch visualization and the PM portal provide an excellent approach Watertight repair of the capsule to the tibia No pass made through the meniscus reduces chances of shearing the meniscal tissue Use of all-suture anchor does not prevent future interventions Ease of deployment One PM portal needed instead of two 	<ul style="list-style-type: none"> There is a need for special instrumentation (SUTUREFIX; Smith & Nephew/Q-FIX with flexible drill)

PM, posteromedial.

consisted of collagen of medium density and was partially oriented. This tissue was well vascularized with numerous capillaries and has a good chance of healing.¹⁴ The joint attachments of the meniscosynovial and meniscotibial junctions constitute a simple, single anatomic unit.³

This indicates that the ramp lesion is an avulsion of the meniscocapsular attachment on the inferior side of the meniscus. The repair methods presently take a bite through the entire thickness of the meniscus, starting from the superior surface, which is unnecessary. The repair can be achieved by reattaching the meniscocapsular sleeve as one unit in the subchondral region (7-10 mm) below the articular cartilage and attaching

the inferior surface of the meniscus to the repaired capsular complex using all-inside reverse curved device would result in better outcomes as the tissue is fixed to the anatomical footprint.

This technique can be used in lesions involving the MTL.

A classification system that is more functional and based on anatomy of the lesion needs to be evaluated.

Disclosures

All authors (M.V.P. and H.G.P.) declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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