

# Medial Meniscal Ramp Lesions: An Arthroscopic Classification



Milind V. Pimprikar, M.S.D. Ortho., and Hitendra G. Patil, M.B.B.S., D.N.B. Ortho.

**Abstract:** Medial meniscus ramp lesions are commonly associated with anterior cruciate ligament injuries. These lesions were defined previously as longitudinal tears around the meniscocapsular junction at the level of the posterior horn of the medial meniscus. However, the recent interpretation of the ramp lesions, their causation, anatomical studies, and histologic studies has uncovered a different dimension to these lesions. With recent knowledge of anatomy and soft-tissue attachments around the posterior horn of the medial meniscus, the attachments of the articular capsule, posteromedial capsule, meniscocapsular ligament, meniscotibial ligament, and semimembranosus, there is a need to understand these injuries differently. Because the anatomical structures injured during the ramp lesion will decide the treatment strategy to repair it anatomically, a review of the classification and repair techniques is necessary. The existing classification is descriptive and does not suggest a repair strategy for each classification. Because the ramp lesion, by definition, does not affect the meniscus tissue, it is a peel-off injury of the posteromedial structures. Hence, injury to the meniscus without injury to the meniscocapsular ligament, or meniscotibial ligament, cannot be classified as a ramp lesion. This article proposes an arthroscopic and functional classification.

The articular capsule attaches the medial meniscus to the posterior tibial plateau, providing restraint for anterior tibial translation alongside the posterior cruciate ligament.<sup>1</sup> The detachment of the articular capsule from the posterior horn of the medial meniscus (PHMM) or a tear of the meniscotibial ligament is defined as a “ramp lesion” of the medial meniscus.<sup>2</sup> Ramp lesions are not considered true meniscus tears in the consensus statement released by European Society for Sports Traumatology, Knee Surgery and Arthroscopy in 2019.<sup>3</sup> The current classification divides ramp lesions into 5 types, which can be grouped together to simplify the classification.<sup>4</sup>

Furthermore, this classification does not address the behavior of the capsuloligamentous structures in knee

flexion and the length of the ramp lesion. The capsuloligamentous structures have a bearing on deciding the repair method. The capsular lesions, which have some attachment to the meniscus and intact meniscotibial ligament (MTL), behave differently and may heal spontaneously. In contrast, lesions that are dehiscent and do not have any attachment to the meniscus do not spontaneously heal, thus requiring a different repair strategy.<sup>5</sup>

## Pathomechanics of the Injury

The medial meniscus is attached to the posterior tibial plateau and articular capsule and is an important structure in knee joint kinematics.<sup>1</sup> It has many functions, including shock absorption, joint lubrication, nutrient supply, and stabilization alongside the anterior cruciate ligament (ACL).<sup>4</sup>

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 (Fig 1). During ACL rupture, excessive anterior translation of the tibia stimulates this semimembranosus to contract, thus placing the posteromedial capsular structures under tension. This causes the meniscus to be trapped between the femur and the tibia, causing injury to the meniscal-capsular junction or the meniscal-tibial ligament.<sup>6</sup>

From Dr Pimprikar's ADTOOS Clinics, Nashik, Maharashtra, India, PDA for M.Sc. SEM University of Bath, Bath, United Kingdom (M.V.P.); and Dr Hitendra Patil's ADTOOS Clinics, Nashik, Maharashtra, India (H.G.P.).

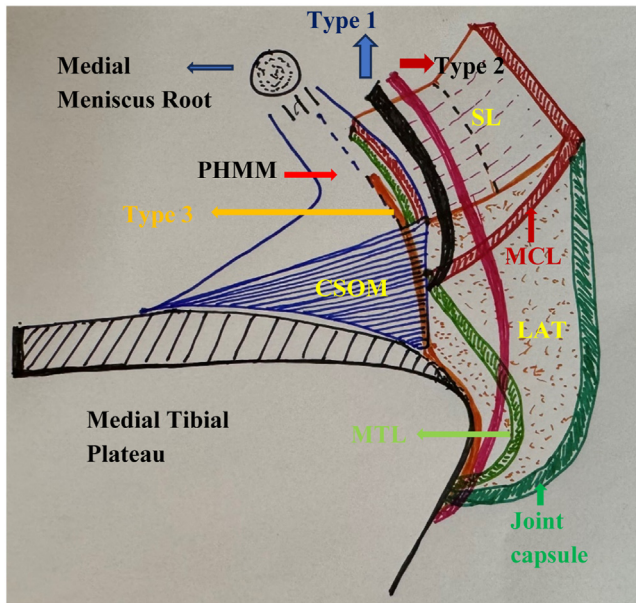
Received May 20, 2024; accepted June 30, 2024.

Address correspondence to Milind V. Pimprikar- M. S. D. Ortho. P. G. Dip. Sports and Exercise Medicine, Dr Pimprikar Hospital, Govind Nagar, Chowk no. 5, Nashik, India. 422009. E-mail: [Milindpimprikar95@gmail.com](mailto:Milindpimprikar95@gmail.com)

© 2024 THE AUTHORS. Published by Elsevier Inc. on behalf of the Arthroscopy Association of North America. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

2212-6287/24817

<https://doi.org/10.1016/j.eats.2024.103203>



**Fig 1.** Schematic figure for the classification of ramp lesions. Blue arrow: type 1; red arrow: type 2; orange arrow: type 3 lesion; black hatched area: articular cartilage; blue hatched area: cut surface of medial meniscus. (CSOM, cut surface of medial meniscus; LAT, loose areolar fat; MCL, meniscocapsular ligament; MTL, meniscotibial ligament; PHMM, posterior horn of medial meniscus; SL, synovial layer.)

### Effects of Ramp Lesion

The incidence of ACL with ramp lesion is 9% to 42%. In the presence of an ACL injury, the medial meniscus and the articular capsule try to stabilize the knee against the anterior translation of the tibia, causing overload and injury. This meniscocapsular disruption causes excessive laxity.<sup>7</sup> The ramp lesion is a cause of explosive pivot shift in the presence of ACL injury. Untreated meniscal ramp lesions lead to decreased quality of life, loss of function, and the inability to perform daily activities or sports.

Because the ramp lesion is not considered a true meniscal tear after the consensus meeting of the European Society for Sports Traumatology, Knee Surgery and Arthroscopy in 2019 and the lesion is essentially in either the articular capsule, MTL, or meniscocapsular ligament (MCL), it should be considered a peel-off injury of the posteromedial capsule. Because the anatomical structures involved are posteromedial, they cannot be addressed by the all-inside method, which relies on the anterior approach. The MTL and the capsular complex are detached from the bone, so they should be reattached to the bone. Suturing the capsule to the meniscus may also add posterior pull on the PHMM.

Smigielski et al.<sup>8</sup> in 2015 showed that zone 4 does not have capsular attachment on the superior surface (Fig 2 A-C). The inferior part of the meniscus is attached to the tibia approximately 7 to 10 mm inferior to the articular cartilage by a loose connective tissue forming an MTL. For the same reason, the prevailing classification system appears complicated. Our proposed classification system, on the basis of the anatomical structure involved in the injury, makes it simple to classify and plan the treatment strategy for each type of injury pattern.

### Proposed Classification

The “ramp” lesions can be classified by considering the anatomical structure involved (Video 1), making them simple to record for research and planning repair methods. We reviewed the existing descriptive classifications, which are not determined on the basis of arthroscopic evaluation. Arthroscopic evaluation is important to diagnose, measure the length, judge the stability, and decide repair strategy for ramp lesions.<sup>4</sup>

In the classification stated by Greif et al., type 2, type 3a, type 4a, and type 5 do not affect the MCL or MTL (Fig 3 A-D). These lesions are limited to the meniscus in the red-red zone of the meniscus. Classifying them as longitudinal meniscus tears of the red-red zone seems reasonable compared with a ramp lesion.

We propose the following classification for the ramp lesions (Table 1): They are classified on the basis of the structure involved in the lesion seen during arthroscopy.

#### Type 1

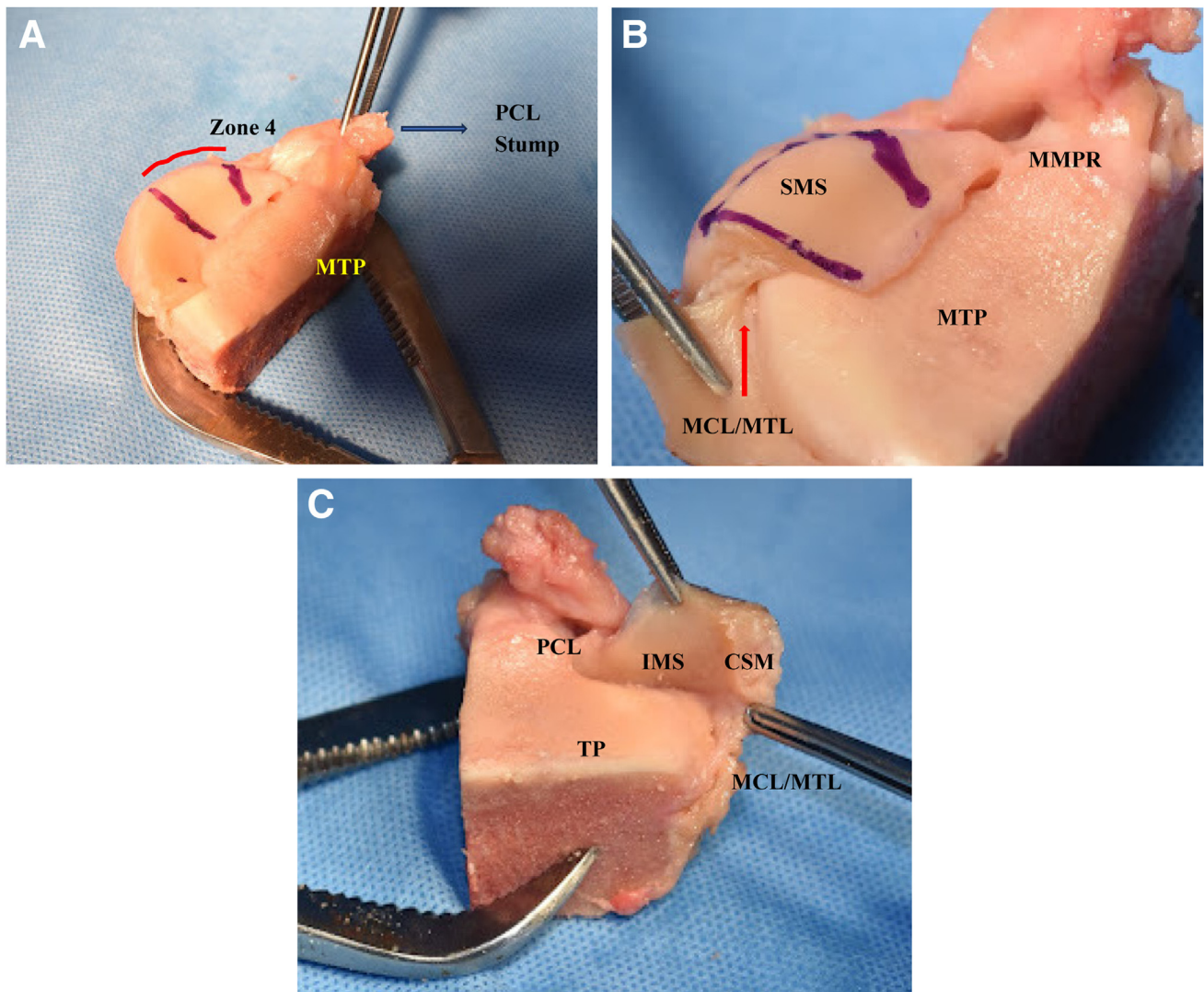
The injury involves only the meniscocapsular junction without disrupting the meniscotibial ligament. It may only affect the synovium (Fig 4). This can sometimes be a stable injury and can be treated conservatively if stable. Unstable lesions that are more than 10 mm long would need repair. However, some authors do not repair lesions larger than 10 mm if they aren't displaced with the probe.<sup>9</sup> These unstable lesions can be repaired using the conventional suture lasso or shoelace repair.<sup>10</sup>

#### Repair Strategy

Attaching the capsule to the inferior aspect of the meniscus using existing methods, such as the lasso technique or a shoelace method, is enough, as the MTL is intact and does not need repair.

#### Type 2

In type 2A, injury to the MCL and MTL causes the posteromedial capsule to peel off from the inferior surface of the meniscus. The tibial attachment of MTL is



**Fig 2.** (A) Cadaveric en bloc–dissected specimen of the tibia with meniscus. Shown is zone 4 of the medial meniscus. (B) Cadaveric en bloc–dissected specimen of the tibia with meniscus. Shown is zone 4 of the medial meniscus. (C) Cadaveric en bloc–dissected specimen of the tibia with meniscus. Shown is zone 4 of the medial meniscus. (CSM, cut surface of meniscus; IMS, inferior meniscal surface; MCL, meniscocapsular ligament; MPR, medial meniscus posterior root; MTL, meniscotibial ligament; MTP, medial tibial plateau; PCL, posterior cruciate ligament; SMS, superior meniscal surface; TP, tibial plateau.)

intact (Fig 5 A and B). In type 2B: The injury may involve both MTL attachments or only the tibial attachment. As the capsule is peeled off from the tibia, it would be insufficiently repaired if not approximated to the bone.

#### Repair Strategy

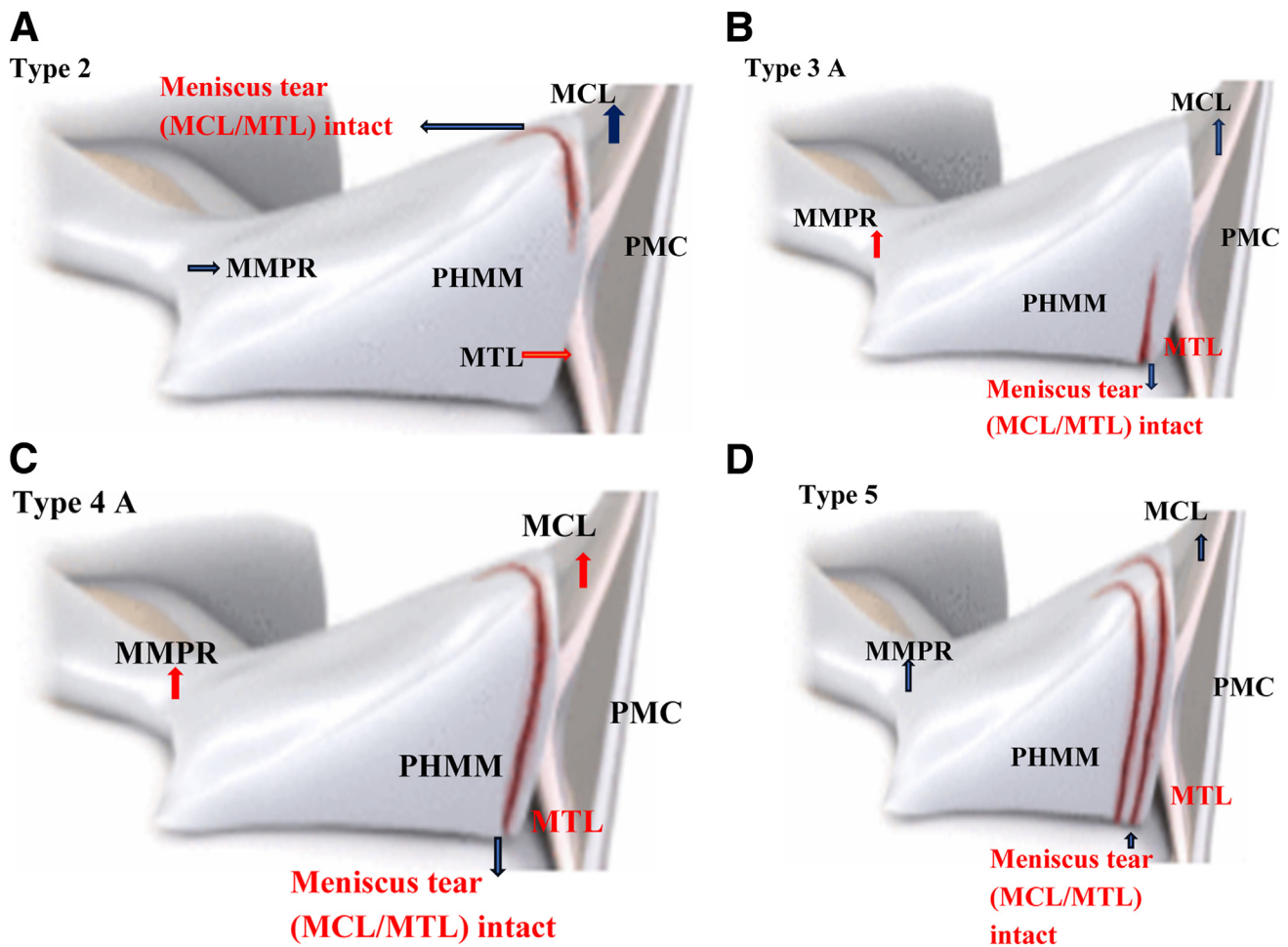
Type 2A injuries are repaired by suturing the MCL and meniscal attachment of MTL to the meniscus using a lasso technique. Type 2B injuries require approximating the capsule to the bone using an all-suture

anchor (1.7-mm SUTUREFIX; Smith & Nephew) from a posteromedial portal would be required. The repair is hypothesized to become synovialized over a period. Type 3 injury is an injury to the meniscus tissue and the MCL and MTL (Fig 6 A and B). The capsule is peeled off with a horizontal meniscus tear in the red-red zone.

#### Repair Strategy

The capsule is reattached to the tibia with a 1.7-mm SUTUREFIX. Once the capsule is approximated to the



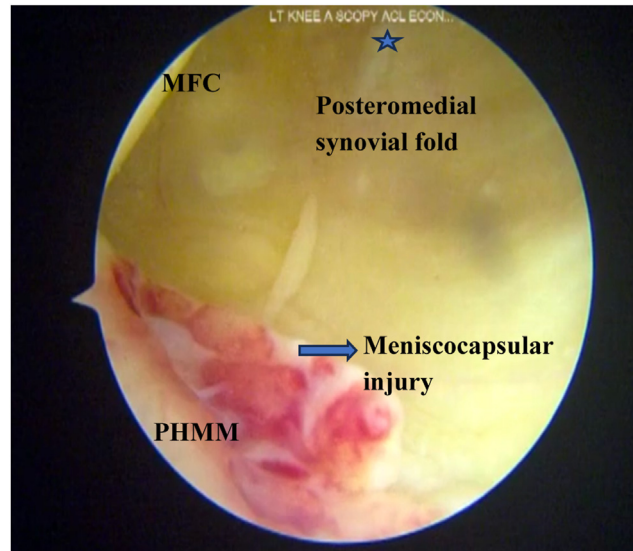


**Fig 3.** (A) Schematic presentation of Thaunat Greif classification (type 2). This is a longitudinal meniscus tear of the superior surface that does not involve the posterior capsular structures. Blue arrow shows meniscus tear. (B) Schematic presentation of Thaunat Greif classification (type 3A). This is a longitudinal meniscus tear of the inferior surface that does not involve the posterior capsular structures. Blue arrow shows meniscus tear. (C) Schematic presentation of Thaunat Greif classification (type 4 A); This is a full-thickness longitudinal meniscus tear not involving the posterior capsular structures. Blue arrow shows meniscus tear. (D) Schematic presentation of Thaunat Greif classification (type 5). This is a full-thickness, double longitudinal meniscus tear not involving the posterior capsular structures. Blue arrow shows meniscus tear. (MCL, meniscocapsular ligament; MPR, medial meniscus posterior root; MTL, meniscotibial ligament; PMC, posteromedial capsule; PHMM, posterior horn of medial meniscus.)

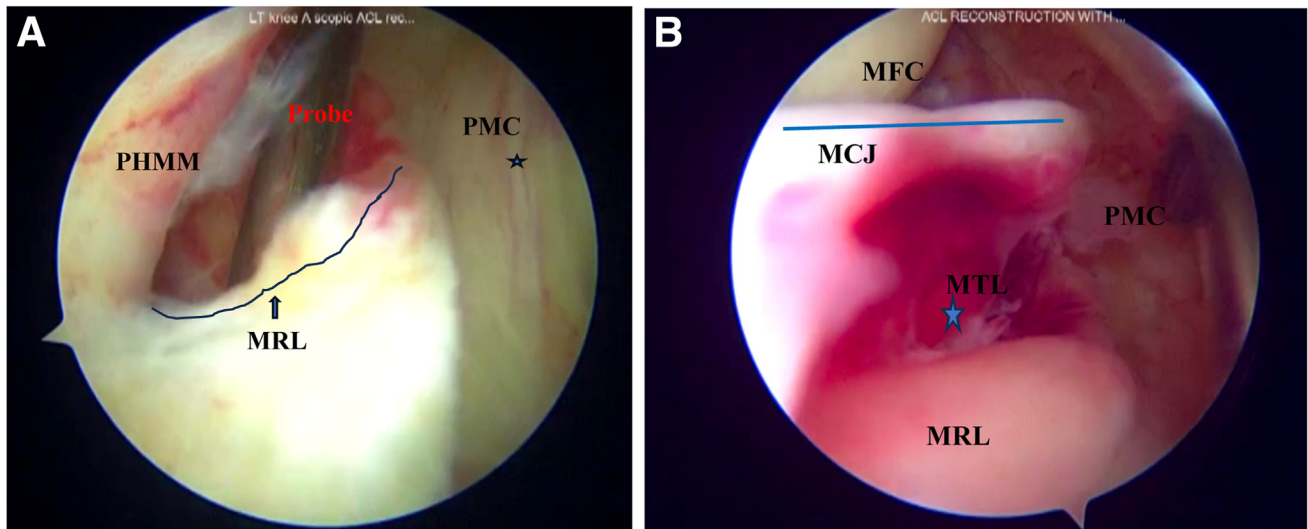
**Table 1.** Arthroscopic Classification and Repair Strategies

Proposed Classification	Grief Classification	Structures Involved	Repair	Stability
Type 1	Type 1+ Type 2	Synovium, and/or MCL (MTL intact, meniscus intact)	Conventional repair with lasso if unstable <sup>6</sup>	Stable/unstable
Type 2A Type 2B	Type 3 A + type 3 B + type 4 B	Synovium, MCL, MTL (meniscal side) synovium, MCL, MTL (tibial side)	Conventional repair with lasso. Fixing MCL and MTL to posteromedial tibia with 1.7-mm. SUTUREFIX (Smith & Nephew).	Unstable
Type 3	Type 4 A + type 5	Synovium, MCL, MTL, meniscus tissue	Same as type 2 +, an all-inside device used to repair the meniscus to the capsule.	Unstable

MCL, meniscocapsular ligament; MTL, meniscotibial ligament.



**Fig 4.** Left knee in supine position at 90° of knee flexion viewing through the notch. Shown is the meniscocapsular separation (type 1 lesion), and the posteromedial synovial fold (blue star) for creating a posteromedial port. (MFC, medial femoral condyle; PHMM, posterior horn of medial meniscus.)

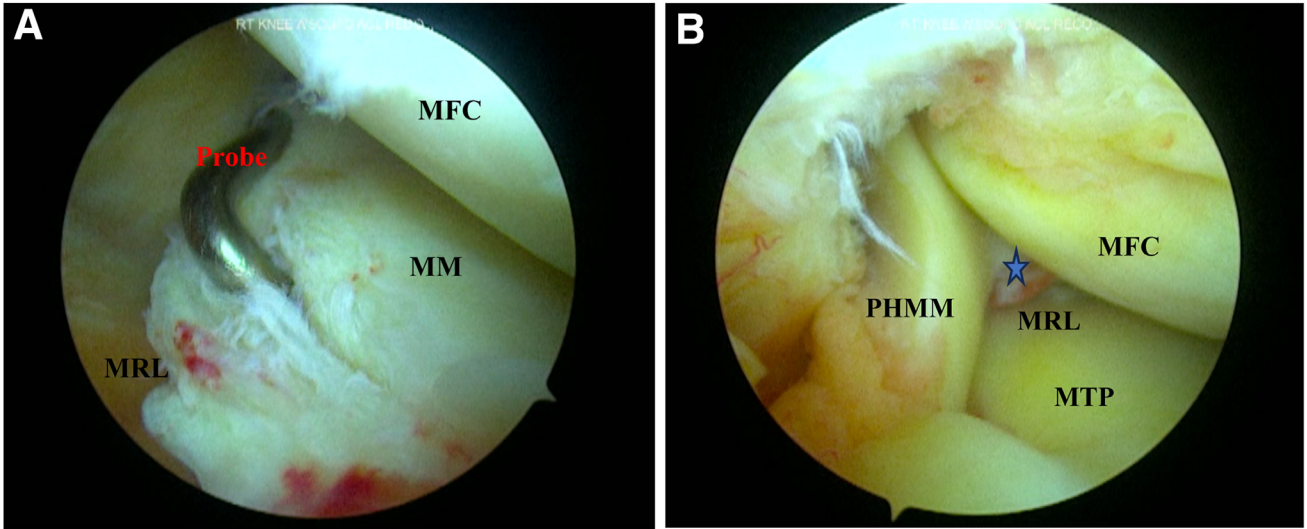


**Fig 5.** (A) Left knee in supine position at 90° of knee flexion viewing through the notch. Shown is meniscocapsular separation with MTL injury (type 2 lesion). The probe is in the lesion. (B) Knee in 90° of flexion viewing through the posteromedial port. Shown is a type 2 ramp lesion. Blue line shows meniscocapsular junction (MCJ); blue star shows meniscotibial ligament (MTL). (MFC, medial femoral condyle; MRL, meniscal ramp lesion; PHMM, posterior horn of medial meniscus; PMC, posteromedial capsule.)

posterior aspect of the tibia, it is technically not difficult to fix the meniscus to the stable capsule using an all-inside device (FAST-FIX 360 reverse curve; Smith & Nephew). The device is deployed on the inferior surface of the meniscus for stability.

## Discussion

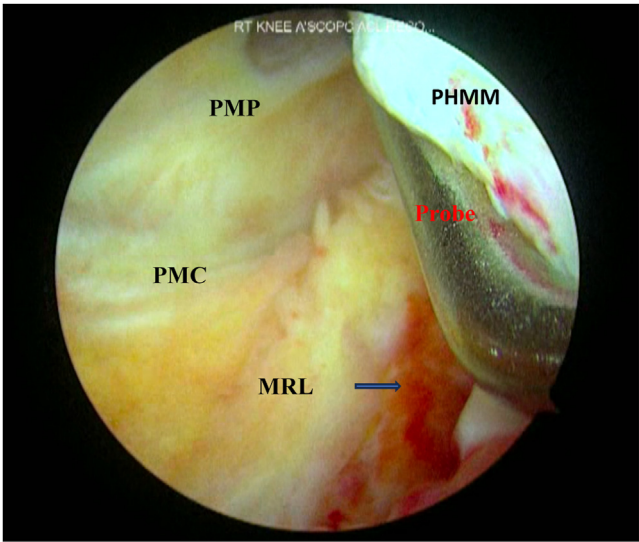
Arthroscopic repair is an established way to treat ramp lesions successfully. Creating a posteromedial portal is the best method to diagnose a ramp lesion, excluding the possibility of a missed lesion.<sup>9</sup> Surgical



**Fig 6.** (A) Right knee in 90° of flexion viewing through the notch. Shown is the probe from posteromedial port in the associated meniscus tear. (B) Right knee in 90° of flexion viewing through the anterolateral port. Shown is the flipped medial meniscus. Blue star indicates the ramp lesion. (MFC, medial femoral condyle; MM, medial meniscus; MRL, meniscal ramp lesion; MTP, medial tibial plateau; PHMM, posterior horn of medial meniscus.)

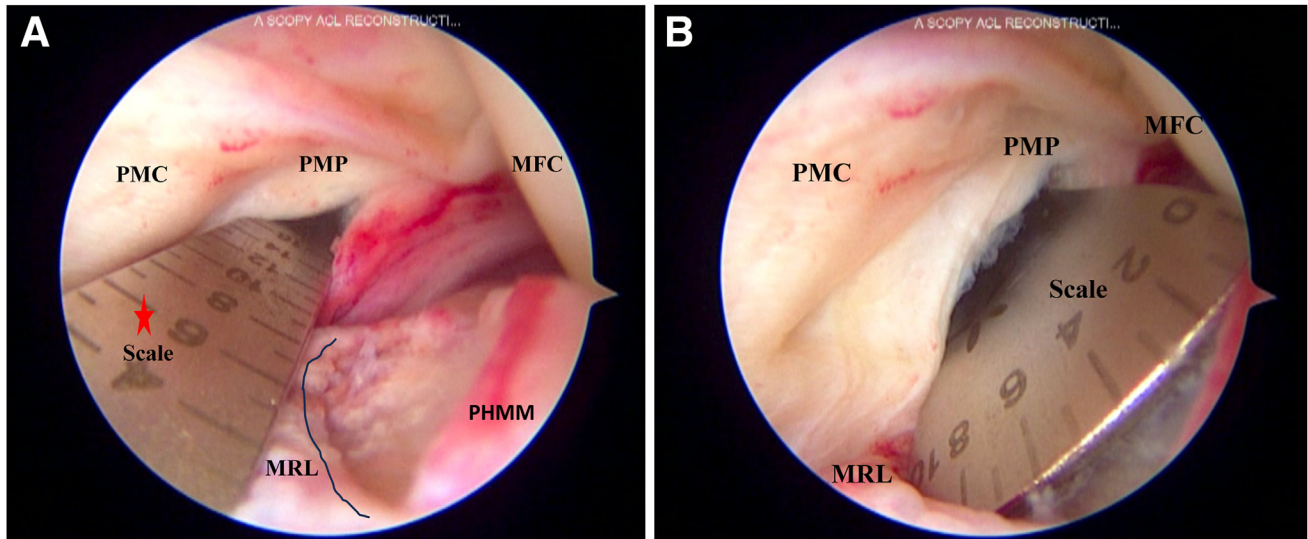
**Table 2.** Advantages and Disadvantages of Repair Technique

Advantages	Disadvantages
<ul style="list-style-type: none"><li>• Using transnotch visualization and a posteromedial portal provides an excellent approach.</li><li>• It is an anatomic repair.</li><li>• Watertight repair of the capsule to the tibia is achieved.</li><li>• No pass made through the meniscus reduces the chances of shearing the meniscal tissue.</li><li>• The use of all-suture anchors does not prevent future interventions.</li><li>• Ease of deployment</li><li>• One posteromedial portal is needed instead of two.</li></ul>	<ul style="list-style-type: none"><li>• There is a need for special instrumentation (SUTUREFIX; Smith &amp; Nephew).</li></ul>

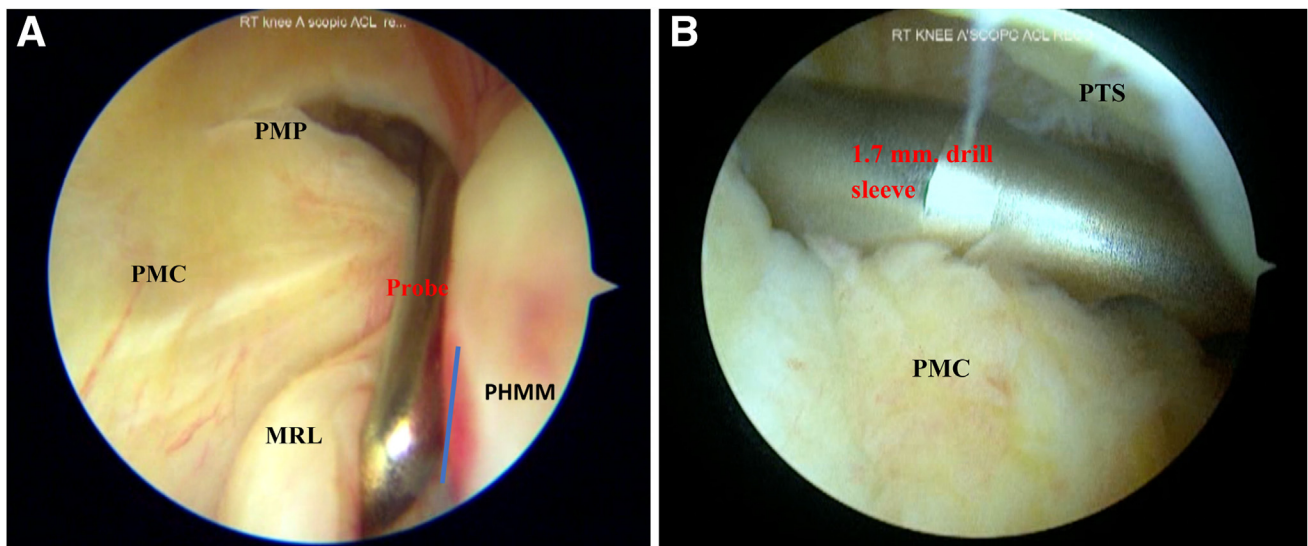


**Fig 7.** Right knee at 90° of flexion viewing through the notch. Shown is the probe exposing the ramp lesion. (MRL, meniscal ramp lesion; PMC, posteromedial capsule; PMP, posteromedial port; PHMM, posterior horn of medial meniscus.)





**Fig 8.** (A) Right knee at 90° of flexion viewing through the notch. Shown is the length of the ramp lesion. Blue line shows extent of ramp lesion; red star indicates arthroscopic measuring scale (Smith & Nephew). (B) Right knee at 90° of flexion viewing through the notch. Shown is the scale measuring distance of MTL attachment from the joint line. (MRL, meniscal ramp lesion; MTL, meniscotibial ligament; PMC, posteromedial capsule; PMP, posteromedial port; PHMM, posterior horn of medial meniscus.)



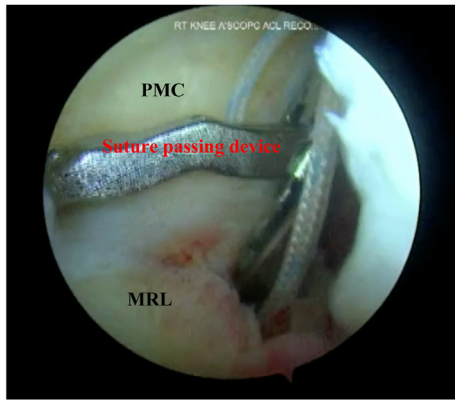
**Fig 9.** (A) Right knee at 90° of flexion viewing through the notch. Shown is the probe exposing the ramp lesion. Blue line indicates the distance of meniscotibial attachment from the meniscus surface. (B) Right knee at 90° of flexion viewing through the notch. Shown is the drill sleeve for deploying all-suture anchor (1.7-mm all-suture anchor; Smith & Nephew) from the posteromedial port. (MFC, medial femoral condyle; MRL, meniscal ramp lesion; PMC, posteromedial capsule; PMP, posteromedial port; PHMM, posterior horn of medial meniscus; PTS, posterior tibial surface.)

repair should be advocated for better clinical outcomes in unstable ramp lesions.

In cases with ACL reconstruction, the failure rate with the inside-out method is significantly lower (2%) than that of all inside techniques (11%).<sup>10,11</sup> Suturing MCL, and MTL to the PHMM may place excessive posterior

pull on the meniscus as the result of pulling of the semimembranosus muscle.

Fixation of MCL and MTL to the tibia has several advantages (Table 2). The ramp lesion is probed and measured with an arthroscopic scale (Smith & Nephew) to determine the stability and extent of the tear (Figs 7 and 8 A and B). A

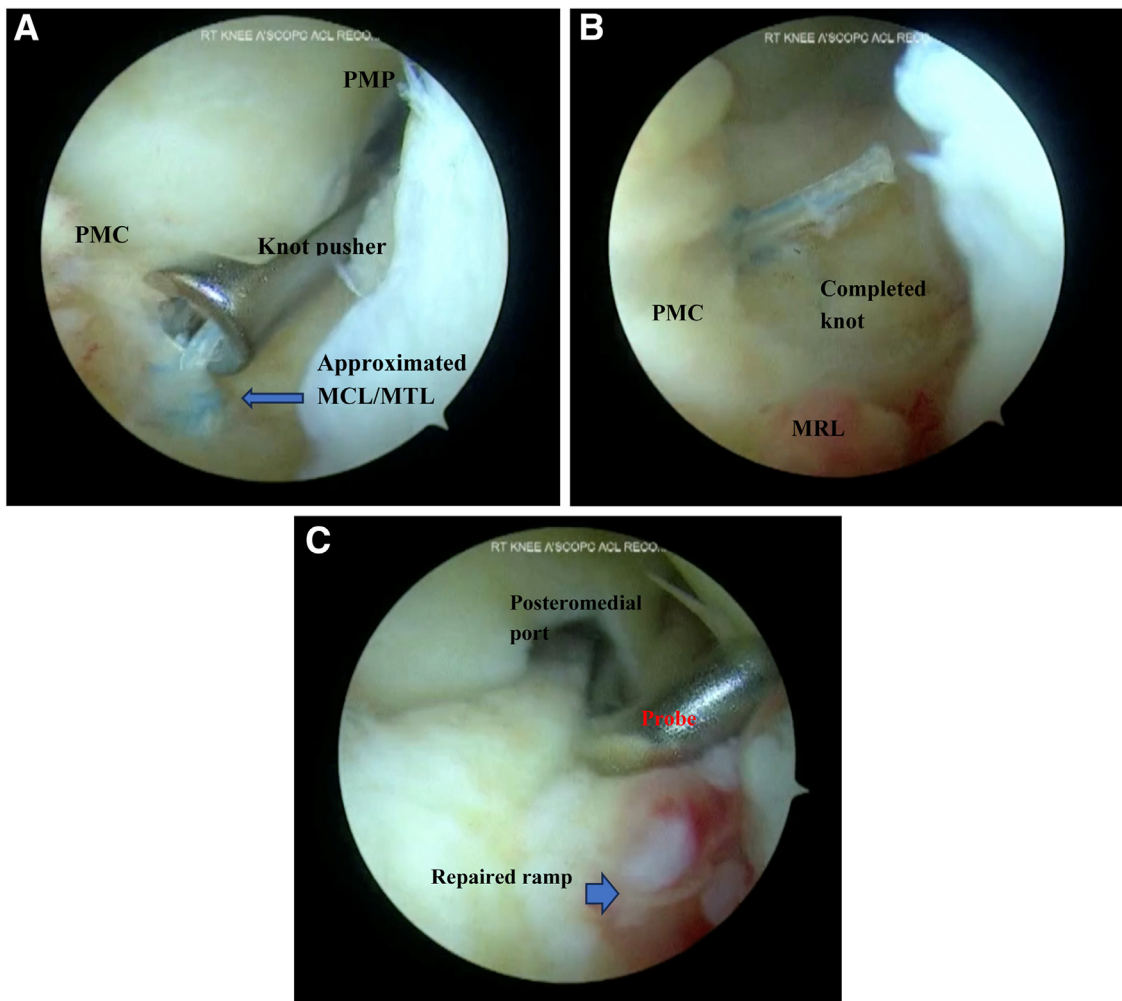


**Fig 10.** Right knee at 90° of flexion viewing through the notch. Shown is an antegrade suture passing device (FIRSTPASS MINI; Smith & Nephew) taking a bite through the posterior meniscocapsular structures. (MRL, meniscal ramp lesion; PMC, posteromedial capsule.)

1.7-mm all-suture anchor (Smith & Nephew) is deployed (7-10 mm) below the articular cartilage (Fig 9 A and B). An antegrade suture shuttle (FIRSTPASS MINI; Smith & Nephew) is used to suture the capsular complex (Fig 10). The capsule is approximated to the posterior aspect of the tibia using a sliding knot (Fig 11 A-C).<sup>12</sup> Any associated meniscal injury is repaired using an all-inside device (FAST-FIX 360; Smith & Nephew) (Fig 12 A and B). A prospective study is required to compare the forces on the meniscus after repairing the meniscocapsular structures to PHMM versus attaching it to the posterior aspect of the tibia.

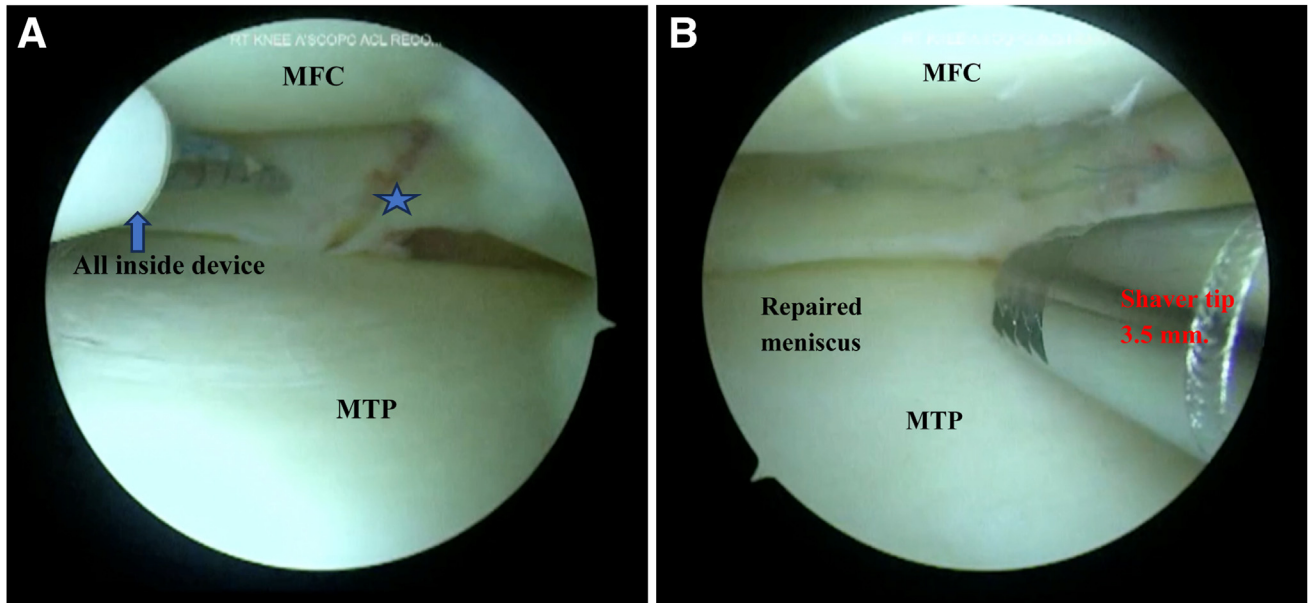
## Disclosures

The authors (M.V.P., 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.



**Fig 11.** (A) Right knee at 90° of flexion viewing through the notch. Shown is a knot pusher from posteromedial port tying the knots. Blue arrow shows approximated meniscocapsular and meniscotibial ligaments. (B) Right knee at 90° of flexion viewing through the notch. Shown is the completed secured knot. (C) Right knee at 90° of flexion viewing through the notch. Shown is a well-approximated and stable ramp repair on probing through the posteromedial port. (MCL, meniscocapsular ligament; MRL, meniscal ramp lesion; MTL, meniscotibial ligament; PMC, posteromedial capsule; PMP, posteromedial port.)





**Fig 12.** (A) Right knee at 90° of flexion viewing through the anteromedial (AM) port. Shown is the reduced meniscus tear for repair. The anterolateral (AL) port introduced an all-inside meniscus repair device (FAST-FIX 360; Smith & Nephew). Blue star stars the meniscus tear. (B) Right knee at 90° of flexion viewing through the AL port. Shown is the completed meniscus repair. The shaver tip is introduced through the AM port to perform a suction test. (MFC, medial femoral condyle; MTP, medial tibial plateau.)

## References

- Johnson DL, Swenson TM, Livesay GA, Aizawa H, Fu FH, Harner CD. Insertion-site anatomy of the human menisci: Gross, arthroscopic, and topographical anatomy as a basis for meniscal transplantation. *Arthroscopy* 1995;11: 386-394.
- Strobel MJ. Knee joint—particular part. In: Strobel MJ, ed. *Manual of arthroscopic surgery*. Berlin, Heidelberg: Springer Berlin Heidelberg, 2002;671.
- Kopf S, Beaufils P, Hirschmann MT, et al. Management of traumatic meniscus tears: The 2019 ESSKA meniscus consensus. *Knee Surg Sports Traumatol Arthrosc* 2020;28: 1177-1194.
- Thaunat M, Jan N, Fayard JM, et al. Repair of meniscal ramp lesions through a posteromedial portal during anterior cruciate ligament reconstruction: Outcome study with a minimum 2-year follow-up. *Arthroscopy* 2016;32: 2269-2277.
- Seil R, Hoffmann A, Scheffler S, Theisen D, Mouton C, Pape D. Ramp lesions: Tips and tricks in diagnostics and therapy. *Der Orthopäde* 2017;46:846-854.
- Cavaignac E, Sylvie R, Teulières M, et al. What is the relationship between the distal semimembranosus tendon and the medial meniscus? A gross and microscopic analysis from the SANTI Study Group. *Am J Sports Med* 2021;49:459-466.
- Mouton C, Magosch A, Pape D, Hoffmann A, Nührenbörger C, Seil R. Ramp lesions of the medial meniscus are associated with a higher grade of dynamic rotatory laxity in ACL-injured patients in comparison to patients with an isolated injury. *Knee Surg Sports Traumatol Arthrosc* 2020;28:1023-1028.
- Smigielski R, Becker R, Zdanowicz U, Cizek B. Medial meniscus anatomy—from basic science to treatment. *Knee Surg Sports Traumatol Arthrosc* 2015;23:8-14.
- Shelbourne KD, Rask BP. The sequelae of salvaged non-degenerative peripheral vertical medial meniscus tears with anterior cruciate ligament reconstruction. *Arthroscopy* 2001;17:270-274.
- Gupta S, Hishikar P, Ray B. Arthroscopic ramp repair: “No-implant, pass, park, and tie technique” using Knee Scorpion. *Arthrosc Tech* 2023;12:e763-e770.
- Ahn JH, Wang JH, Yoo JC. Arthroscopic all-inside suture repair of medial meniscus lesion in anterior cruciate ligament-deficient knees: Results of second-look arthroscopies in 39 cases. *Arthroscopy* 2004;20:936-945.
- Pimprikar MV, Patil HG. Technique for medial meniscus ramp repair: an anatomic approach. *Arthrosc Tech* 2024;13: 103018.