



# Arthroscopic Meniscus Ramp Repair: The Shoelace Technique

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**Background:** A “ramp lesion” is described as an injury involving the peripheral attachment of the posterior horn of the medial meniscus. Ramp lesions are associated with increased loads on anterior cruciate ligament and leads to rotatory instability of knee. During anterior cruciate ligament reconstruction, failure to identify and treat ramp lesion leads to increased forces on the reconstructed graft and residual instability which ultimately increases chances for graft failure. It is important to identify the ramp lesions by looking at the posterior compartment and repair ramp lesion. Ramp lesions are still a challenge to treat due to misdiagnosis and long learning curve of current techniques. In this technique, we are presenting margin convergence shoelace technique to repair a large ramp lesion.

**Indications:** Isolated ramp lesions or ramp lesions associated with other ligamentous injuries.

**Technique Description:** Through standard anteromedial and anterolateral portals, diagnostic arthroscopy is done. Using Gillquist maneuver, posteromedial compartment is visualized to look for ramp lesion. Probing is done with 18-gauge spinal needle from posteromedial aspect of knee to look for hidden lesions and extent of tear. We use 2 additional portals, low and high posteromedial portals for ramp repair. Visualizing from anterolateral portal entry is made in the posteromedial compartment; low posteromedial portal is created at the level of meniscus; 8-mm passport cannula is inserted and used as working portal; and then, high posteromedial portal is created and used as viewing portal. Visualizing through high posteromedial portal rasping of ramp lesion is done. Now with knee scorpion loaded with 2-0 fiber wire, bites are taken along posterior margin of meniscus and capsular portion of tear edges alternatively in shoelace manner from lateral to medial. Finally, compression and knot tying are done and secured with multiple half hitches.

**Results:** Surgical repair of ramp lesions is associated with good healing, and it restores stability of knee. Follow-up of more than 2 years shows better functional outcome and reduced retear rates.

**Discussion/Conclusion:** Currently, there are a lot of techniques described for ramp repair. We present arthroscopic ramp repair with dual posteromedial portals by shoelace technique, which is a safe, easy, and cost-effective method and gives excellent results and good healing especially in larger tears.

**Patient Consent Disclosure Statement:** The author(s) attests that consent has been obtained from any patient(s) appearing in this publication. If the individual may be identifiable, the author(s) has included a statement of release or other written form of approval from the patient(s) with this submission for publication.

**Keywords:** Ramp; shoelace technique; meniscus repair; dual posteromedial portal; ACL reconstruction

## VIDEO TRANSCRIPT

We present surgical technique for arthroscopic ramp repair using shoelace technique.

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Ramp lesion is defined as tear of the peripheral capsular attachment of the posterior horn medial meniscus at the meniscocapsular junction. Term coined by Strobel and classification was given by Thaunat et al.<sup>9</sup> It may be missed on magnetic resonance imaging (MRI) and arthroscopy, so often called as hidden lesion.

Incidence of ramp lesion varies between 15% and 30%.<sup>3</sup> It is more commonly seen in males, aged <30 years. Risk factors for ramp lesion were enumerated by Kim et al,<sup>5</sup> which includes bone contusion at posteromedial tibia, chronic anterior cruciate ligament (ACL) injury, varus >3°, steep tibial, and meniscal slope.

Valgus, rotation, and axial force injury are transmitted to posteromedial capsule, leading to ramp lesion. Ramp lesion leads to increased rotational instability and excessive anterior translation unidentified and untreated



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ramp, and leads to increased ACL graft failure rate.<sup>4</sup> Untreated ramp causes accelerated degeneration of cartilage in medial compartment.

Ramp lesion is evaluated clinically by signs of ACL, Lachman test, Drawer test, and pivot shift. Radiologically by MRI and by Arthroscopic Posteromedial exploration.

As ramp lesion is located at the meniscocapsular junction, it is difficult to diagnose it on routine arthroscopy with anterior portals, and to diagnose it is essential to do exploration by entering into the posteromedial compartment.

The posteromedial compartment is entered by using Gillquist maneuver. First enter into the triangle between posterior cruciate ligament (PCL), medial femoral condyle (MFC), and tibial spine Valgus force, first in flexion than in extension. Slight internal rotation on tibia gives better picture of ramp.

Once you are in posteromedial compartment, using transillumination circle, put spinal needle and use it as probe to check for ramp. In this video, needle test demonstrates normal meniscocapsular junction. Make it habit to enter posteromedially and do needle test. Careful probing using spinal needle shows significant ramp lesion in this video, which otherwise can be missed easily. Once into posteromedial compartment classify type of ramp lesion for ease of treatment planning.

One technique is using single posteromedial portal and repair using suture lasso device or ramp lasso. Another technique in which if it is not feasible to pass suture lasso through both meniscus and capsule together a scorpion device can be used to pass through capsule.

Drawback of single portal technique particularly in large lesion is that complete visualization is not feasible from anterolateral portal and incomplete repair may happen. In this case while visualizing from high posteromedial portal, it is clear that far medial portion is still not addressed. These 2 ports give advantage to pass instruments through lower posteromedial portal while looking from high posteromedial portal for undervision secure repair.

Indications for ramp repair are unstable ramp lesion diagnosed on probing posteromedial compartment and ACL with positive pivot and ramp lesion. There are various surgical options for ramp repair, all inside repair using implant devices, all inside using lasso loop/scorpion relay, single posteromedial portal repair,<sup>8</sup> and dual portal posteromedial repair.<sup>7</sup>

We named our technique as shoelace technique. It is 2 portal technique high and low posteromedial portals. High posteromedial is used for visualization and low for instrumentation. It is no-implant technique and easy to reproduce, and provides secure fixation and cost-effective.

Summary of patient is as follows: Patient is 30-year-old man with weight of 80 kg and body mass index (BMI) of 30; he is a policeman by profession and had fall during long jump 3 months back on left knee. He complains of instability and inability to jog and run. On examination, he has full range of movements, with good quadriceps control. His Lachman test and Drawer

test are positive. He also has grade 2 pivot. Magnetic resonance imaging findings of this case demonstrate complete ACL tear.

Patient is taken under spinal anesthesia. Supine position is given with leg hanging down in 90° of flexion. Standard anterolateral and anteromedial portals are made. Also, 2 posteromedial portals, high and low, are also made for this technique. Diagnostic arthroscopy of left knee demonstrates complete tear of ACL. Probing of lateral meniscus is done both on superior and on inferior surface; medial meniscus is also probed carefully to look for any tear on inferior and superior surface. By doing Gillquist maneuver entry into posteromedial compartment is made.

Significantly large ramp lesion is seen which is further confirmed by probing with spinal needle. Spinal needle is placed just at the level of medial meniscus and parallel to floor. Keeping spinal needle at place, 11 number knife is used to make lower posteromedial portal. Port is dilated with mosquito forceps, and 8-mm passport cannula is placed. Another portal is made above it, using spinal needle, and switching stick is placed.

Now, scope is shifted from anterolateral portal to high posteromedial portal. This gives better visualization and extent of ramp lesion. Rasp is used now to promote better healing. Now, a single fiber wire is taken, 1 end of this 2-0 fiber wire we will call it as end "A" it is loaded on to knee scorpion is passed from low posteromedial port in such a way to take bite from meniscus and retrieved back. Another end of fiber wire, we will call it as end "B," suture is now mounted on knee scorpion and bite taken from capsular side and retrieve back.

Again, end "A" is mounted on scorpion, and bite is taken from capsular side and retrieved. Now, end "B" is mounted, and bite is taken from meniscus side. Again, "A" end is mounted on scorpion, and bite is taken from capsular side and retrieved. Now, end "B" is mounted, and bite is taken from meniscus side. These steps are sequentially repeated, which give appearance of shoelace.

Finally, tension is given at both ends which leads to side-to-side closure of ramp lesion. Knot tying is done using alternate half hitches, sutures are cut, and probing is done which confirms stable and secure fixation.

This shoelace technique is simple, effective, secure, and no-implant technique by just using single 2-0 fiber wire and knee scorpion. Stable repair is again checked by looking from anterolateral portal, and probing from posteromedial portal finally graft is passed and fixed completing the ACL reconstruction.

Patient is kept in knee immobilizer and nonweight bearing for 4 weeks. Active and passive range is allowed till 90° only for first 6 weeks. Strengthening is started at 10 weeks and jogging at 12 weeks. Full return to sport activity is at 9 months.

These are the pitfalls and tips illustrated for our shoelace technique. This table summarizes advantages of shoelace technique and also enumerated disadvantage and complication of shoelace technique.

To avoid tangling, we have modified the suture passage technique; probe is coming from low posteromedial portal

indicative of ramp. Scorpion is passed from the meniscus and then from the capsular side; now, one-by-one sutures are passed which can be parked from anterolateral portal as seen in this video; now, this parked suture is taken back into the low posteromedial portal and then passed into the capsular side; these steps can be repeated to form a shoelace configuration.


There are certain controversies in surgical repair of ramp lesion. Xin Liu et al<sup>6</sup> in *American Journal of Sports Medicine* (AJSM) 2017 in prospective randomized controlled trial (RCT) concluded that stable ramp repair without surgery gives similar outcomes in terms of healing and clinical outcomes. In systematic review, Riccardo D'Ambrosi et al<sup>2</sup> concluded that unstable meniscus ramp need surgery and in stable ramp lesion surgeon may decide on repair based on patient profile.

The outcomes/results of ramp repair are encouraging improved Lysholm scores and International Knee Documentation Committee (IKDC) scores after ramp repair is seen by Chen et al.<sup>1</sup> Improved Western Ontario and McMaster Universities Arthritis Index (WOMAC) score reported by DePhillippo et al.<sup>3</sup> In systematic review by D'Ambrosi,<sup>2</sup> 8 studies showed improved IKDC score and 6 showed improved Lysholm score.

To summarize posteromedial portal and needle test should be done routinely during ACL reconstruction. Failure to diagnose ramp or inadequate repair may lead to failure of concomitant ACL reconstruction. Two posteromedial portals give an added advantage not only for visualization of full extent of ramp but also ease of repair from low posteromedial portal. This shoelace technique is inexpensive implant-less quick and gives better stability.

These are our references for this technique.

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