Technical Note

Arthroscopic Repair of Radial Tears in the Junction of the Anterior Horn and Body of the Lateral Meniscus Using an All-Inside Device

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Abstract: Surgical treatment of radial tears in the junction of the anterior horn and body of the lateral meniscus is indicated in the acute setting and with failure of nonoperative therapy. There are several options for arthroscopic repair; however, these are more technically difficult to perform because of the current surgical instruments available to address these tears. An outside-in technique is the current standard of care for this tear location and pattern. We present a technique for an all-inside side-to-side repair of the lateral meniscus for radial tears in the junction of the anterior horn and body.

Radial tears in the junction of the anterior horn and body of the lateral meniscus can alter the contact pressure of the knee and risk progression to degenerative arthritis because of the loss of hoop stress protection. Radial tears are often debrided, resulting in a partial or subtotal meniscectomy because of their poor healing potential.[1] Such debridement can be detrimental to articular cartilage in younger patients, resulting in increased stress and wear, especially in athletes. Lohmander et al.[2] found that 50% of patients with a meniscus or ACL tears were found to have osteoarthritis 10 to 20 years after their diagnosis. Radial tears of the anterior horn and body junction are particularly difficult to repair; this location of tear on the lateral meniscus is technically difficult to treat arthroscopically despite the previously described all inside, inside-out, and outside-in techniques.[3] We present a technique for all-inside side-to-side repair using the NOVOSTITCH Pro Meniscal Repair (Smith & Nephew, Fremont, CA) with 2-0 suture cartridges and 45° IDEAL Suture Grasper (Mitek Products Inc., Westwood, MA) for such tears (Fig 1).

Surgical Technique

Patient positioning and Preparation

Lateral meniscus repair (Video 1) is performed with the patient under general anesthesia. The patient is placed in the supine position on the operating table. The leg is then prepped and draped in the usual sterile fashion.

Diagnostic Arthroscopy

The anatomic landmarks of the anteromedial and anterolateral portals are marked and injected each with 1 mL of 1% lidocaine with epinephrine. Twenty-five milliliters of 1% lidocaine with epinephrine is injected into the knee through a superolateral puncture. The anterolateral portal is established with a scalpel, and the arthroscope is introduced through this portal. Under direct visualization, the anteromedial portal is established with a localizing needle followed by a scalpel. A probe is then introduced into the anteromedial portal. A systematic diagnostic arthroscopy is conducted to rule out additional pathology that would need to be addressed.

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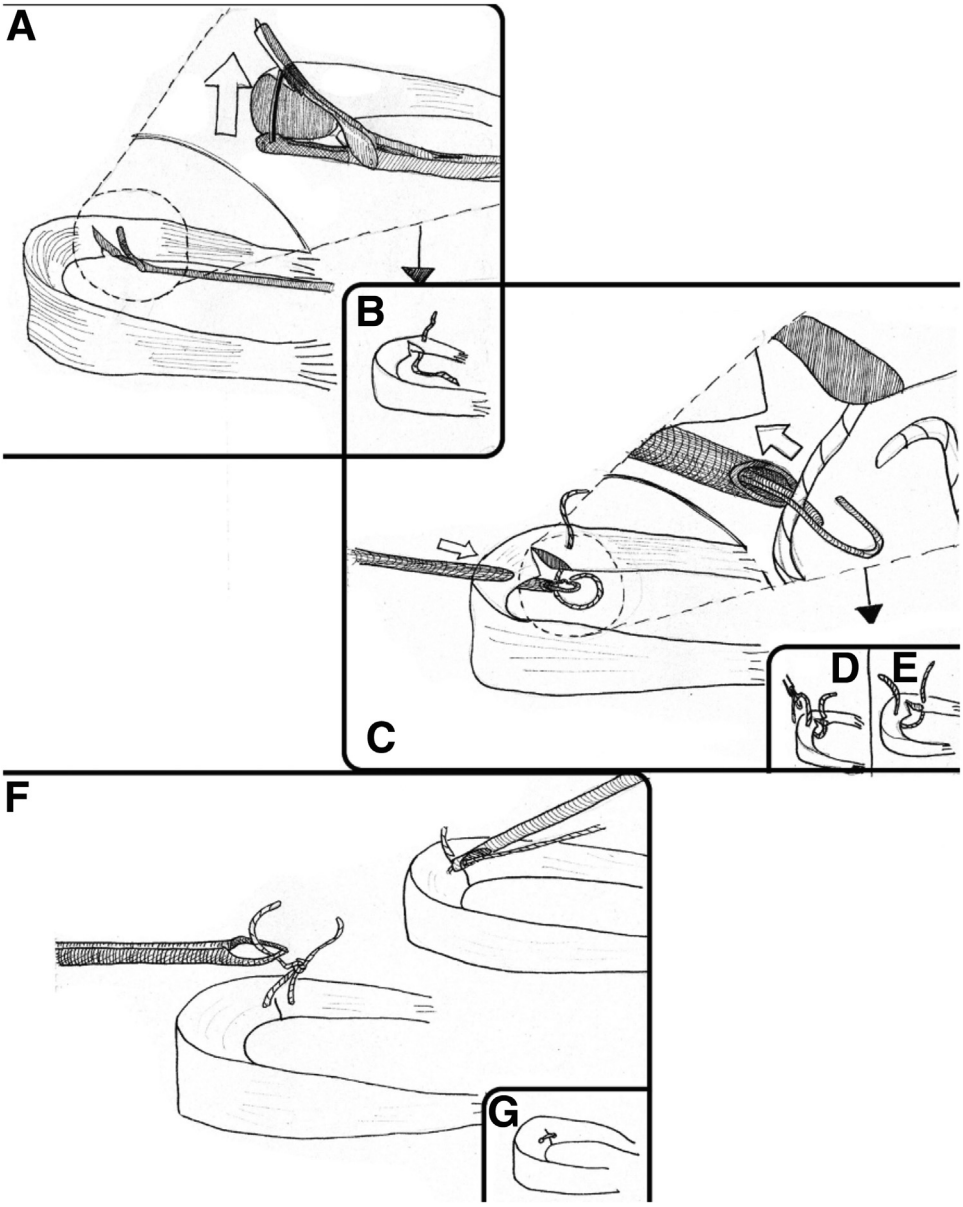

Fig 1. Repairing a radial tear at the junction of the anterior horn and body of the lateral meniscus using an all-inside device. (A, B) The tear is approximated by using the NOVOSTITCH Pro Meniscal Repair (Smith & Nephew, Fremont, CA) in the anterolateral portal to pass a 2-0 stitch through the posterior limb of the tear. (C-E) A 45° IDEAL Suture Grasper (Mitek Products Inc., Westwood, MA) is used to pierce the anterior limb from the top aspect of the meniscus down thru the tissue exiting below. The suture tail is then grabbed and shuttled back through the tissue with both ends of the suture ending up on top of the meniscus. (F, G) The suture tails are tied using an arthroscopic knot pusher to complete the side-to-side repair compressing the radial meniscus edges together.

All-Inside Meniscal Repair

The leg is placed in a figure-of-4 position to better visualize the lateral meniscus. The lateral meniscus is then evaluated with a probe and the tear is identified (Fig 2). The tear edges are prepped using a shaver, a biter, or both (Fig 3). Using the anteromedial portal for the camera, the anterolateral portal is used for instrument and suture passing. The tear is approximated by using the NOVOSTITCH Pro Meniscal Repair (Smith & Nephew, Fremont, CA) in the anterolateral portal to pass a 2-0 stitch through the posterior limb of the tear (Fig 4). A suture retriever is used to grab the suture tail passed through the meniscus and move for easier access (Fig 5). A 45° IDEAL Suture Grasper (Mitek Products Inc., Westwood, MA) is used to pierce the anterior limb from the top aspect of the meniscus down through the tissue exiting below. The suture tail is then grabbed and shuttled back through the tissue, with both ends of the suture ending up on top of the meniscus (Fig 6). Both tails are then grabbed with a suture retriever out of the anterolateral portal to remove any chance of a soft tissue bridge formation. The suture tails are tied using an arthroscopic knot pusher to complete the side-to-side repair compressing the radial meniscus edges together. A probe is then used to check stability after the repair (Fig 7). Technical pearls and pitfalls for all inside meniscal repair are outlined in Table 1, and technique advantages and disadvantages are outlined in Table 2.

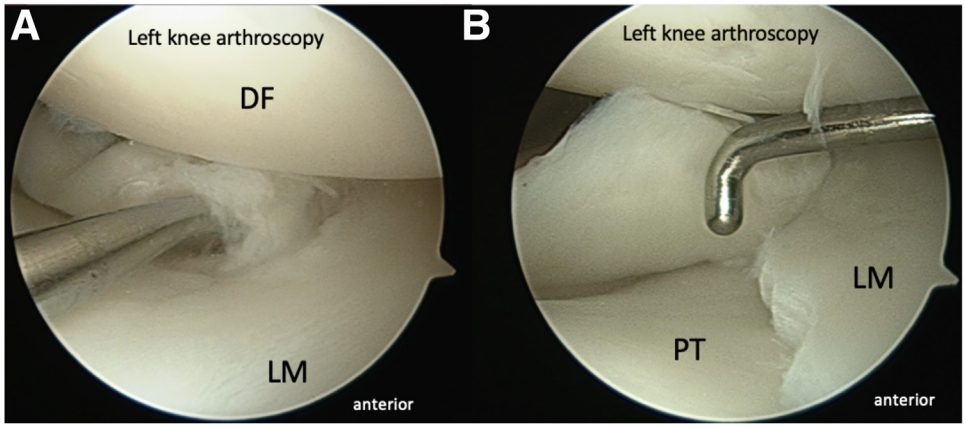

Fig 2. (A, B) A probe is entered though the anterolateral portal, is used to find the radial tear edges at the anterior horn/body junction of the lateral meniscus. Left knee arthroscopy using a 30° scope in the anteromedial portal. DF, distal femur; PT, proximal tibia; LM, lateral meniscus.

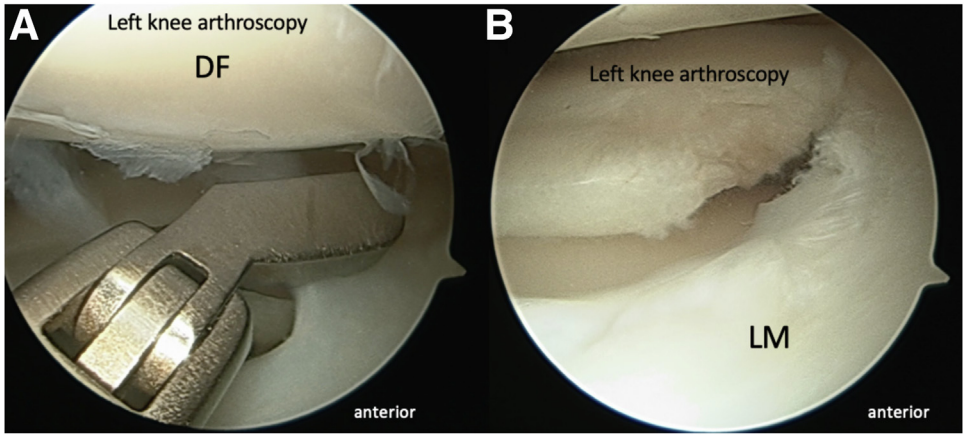

Fig 3. (A, B) A 45° to the right biter entered through the anterolateral portal is used to clean up the tear edges. Left knee arthroscopy using a 30° scope in the anteromedial portal. DF, distal femur; PT, proximal tibia; LM, lateral meniscus.

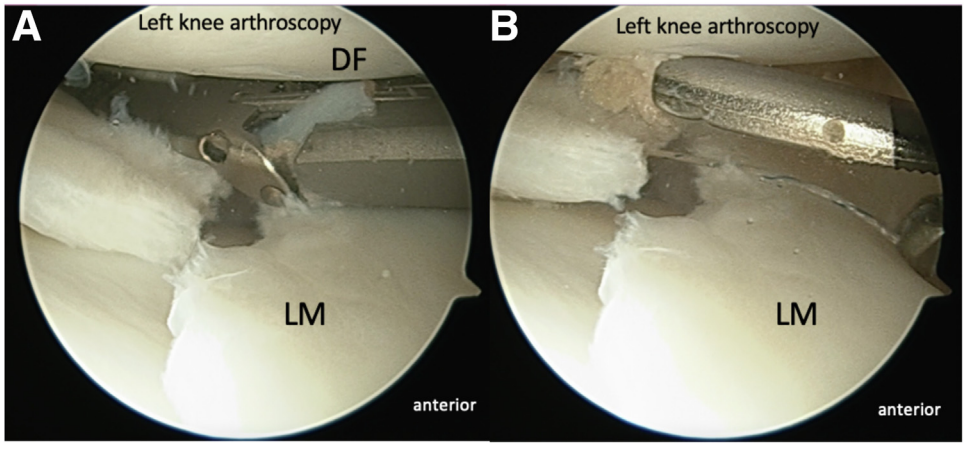

Fig 4. (A, B) The 2.0 NOVOSTITCH is entered through the anterolateral portal and is used to grasp the posterior limb of the tear passing the suture from inferior to superior through the meniscal tissue. Left knee arthroscopy using a 30° scope in the anteromedial portal. DF, distal femur; PT, proximal tibia; LM, lateral meniscus.

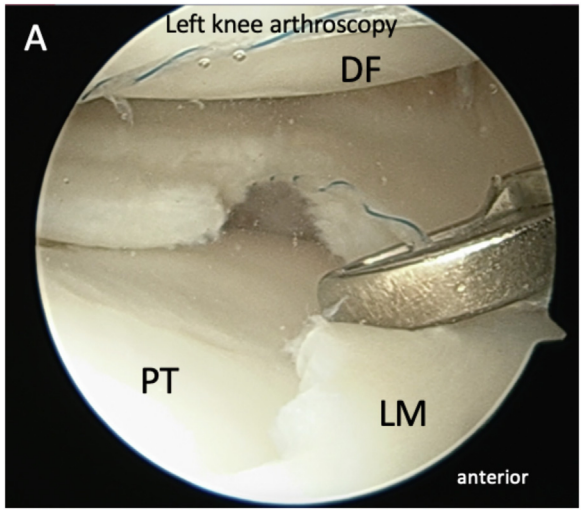

Fig 5. A looped suture retriever is passed through the anterolateral portal and is used to move the inferior suture for easier access. Left knee arthroscopy using a 30° scope in the anteromedial portal. DF, distal femur; PT, proximal tibia; LM, lateral meniscus.

Wound Closure

Once the repair is complete, all particulate debris is removed. The knee is copiously rinsed and then drained. The portals are closed with interrupted 4-0 monocryl sutures. Steri-Strips are applied, followed by a sterile soft dressing secured with a Webril dressing and a thigh-high thrombo-embolus deterrent stocking.

Postoperative Recovery and Rehabilitation

After surgery the patient remains non-weightbearing for 5 weeks but has no limitations on range of motion of their knee, and physical therapy is started within the first week.

Discussion

Radial tears of the meniscus in the junction of the anterior horn and body are concerning due to difficulty of repair and low healing potential. Haklar et al.[4] published a prospective case study on five patients with tears at the junction of the anterior horn and body of the meniscus in which they chose an inside-out technique for repair requiring zone specific cannulas, long needles, and a 5 cm incision at the lateral aspect of the knee, which could pose a threat to the peroneal nerve. Their repair had good clinical and radiologic outcomes, with evidence of healed meniscus tears in all patient on MRI.[4] In a case series by Choi et al.,[5] 14 patients with radial tears of the midbody of the lateral meniscus underwent repair with an all-inside technique using a suture hook and PDS suture. Although their technique is technically demanding, they found partial and complete healing of the meniscus and favorable patient-reported outcomes.[5] Steiner et al.[6] proposed an outside-in repair and purport its usefulness in radial tears of the body and anterior horn, finding that this technique allows for improved

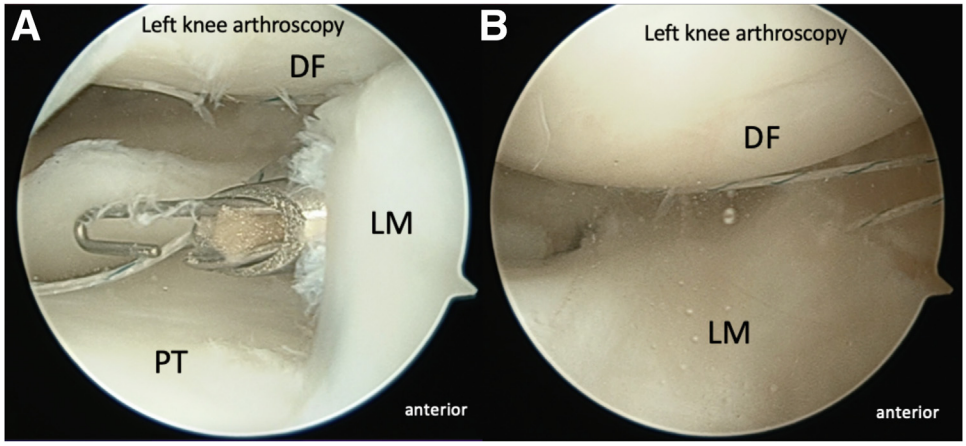

Fig 6. (A, B) IDEAL Suture Grasper entered through the anterolateral portal is used to penetrate through the anterior meniscal limb at the edge of the tear, grasp the inferior suture, and shuttle it back through the anterior limb coming out superior to the meniscal tissue. Left knee arthroscopy using a 30° scope in the anteromedial portal. DF, distal femur; PT, proximal tibia; LM, lateral meniscus.

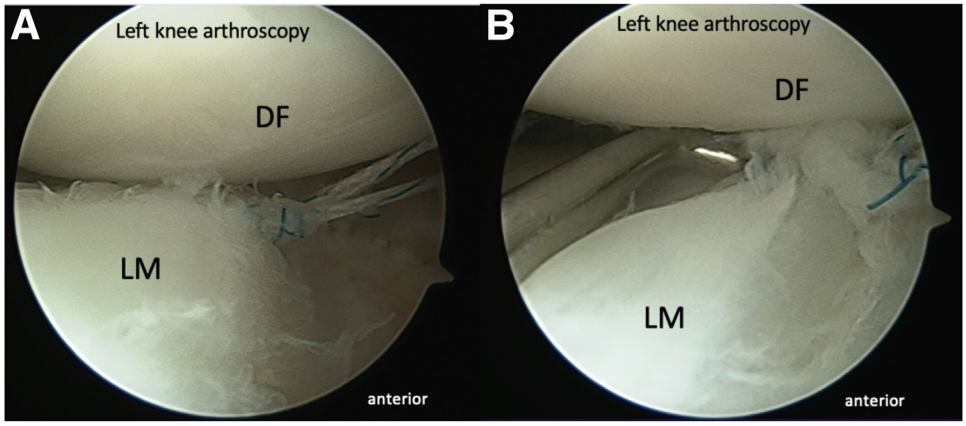

Fig 7. (A, B) Through the anterior lateral portal, the suture is tied using a locking sliding knot and the knot pusher to bring the edges of the radial tear together. A probe is then used to check the stability of the repair. Left knee arthroscopy using a 30° scope in the anteromedial portal. DF, distal femur; PT, proximal tibia; LM, lateral meniscus.

reduction vectors of the meniscus using crossing horizontal mattress sutures, however, with increased technical difficulty and the need for an additional incision. Yeh et al.[7] proposes a cross-suture double-vertical all-inside technique for radial tears of the lateral meniscus. Although this technique has favorable healing rates at 2 years and comparable functional outcome scores, this technique requires an accessory portal, and the suture pattern is complicated, which requires skills in suture passing and suture management.[7] Lin et al.[3] repairs radial tears of the anterior horn body junction using a mini open outside-in technique that ties the meniscus to the capsule with a double horizontal mattress repair. Their review article mentions several suture pattern repair techniques; however, they conclude the evidence is still limited for the ideal suture pattern. Another proposed method by Tao et al.[8] is to use a Caspari suture punch to repair the inner leaflet of the radial tear to restore normal meniscal excursion; however, this group augmented their repair with horizontal mattress sutures to the capsule using an inside-out fixation. Uchida et al.[9] described a technique in which a quick-pass suture lasso is used for an all-inside repair for midbody lateral meniscal tears. This also restores meniscal function without anchoring the repair to the capsule; however, it requires several passes in and out of the joint with instruments and suture.[9] Our technique allows side-to-side repair using all-inside devices for radial tears of the meniscus at the junction of the anterior horn and body. Because of the tibial spine and angle of the tear in the lateral meniscus, it is very technically challenging to use a single traditional all-inside device. NOVOSTITCH was designed for a 2-suture deployment technique, but because of the angle of this tear and the relationship of the portals, the device cannot be used as implemented. Therefore our technique overcomes this issue by using a separate device to shuttle the suture across the tear into each meniscal limb. This could also be used with another suture retriever device that passes a suture from inferior to superior on 1 limb of the meniscus and then using a suture retriever to grab the other suture tail to pass through the other limb of the meniscus, ending with both free suture tails on top. This 2-device all-inside technique to repair the radial tear compresses the 2 meniscal limbs, which improves healing and restores the mechanical advantage of the meniscus. By avoiding repair to the capsule with an inside-out or outside-in technique, a more physiological meniscal movement can be achieved. If the tear is large, more than one compression stitch can be applied. Although nonabsorbable suture is used for the repair, it has been seen to epithelialize over the suture, preventing cartilage damage. Stability and accuracy of meniscal repair is crucial for meniscal healing and restoration of the normal shock-absorbing function of the lateral meniscus. We believe our technique provides a safe and useful way to repair tears in the junction of the anterior horn and body of the lateral meniscus.

Table 1. Pearls and Pitfalls

Pearls
Use the probe to release the meniscus edges if they are tucked under; need to identify all free edges of meniscus
Pass the first suture limb, remove the device and leave the first limb retained within the joint, use a crab claw to move the first limb to facilitate easier grasping with the retriever
Use a crab claw to reduce the incidence of a soft tissue bridge by ensuring the suture limb is free
Can use plastic or passport cannulas to avoid tangling of sutures during knot tying; we have found this makes it difficult to best visualize the repark
Pitfalls
All-inside device damaging cartilage during device insertion and meniscal stump penetration
Unsuccessful healing of the meniscal tissue after repair
Recurrent tearing of meniscus after repair

Table 2. Advantages and Disadvantages

Advantages
Restoration of normal meniscal biomechanics with reduction of tear edges
Uses standard anterior knee arthroscopy portals
Avoiding nerve or vascular injury
Avoiding suture entrapment or capsule entrapment
Avoid needle stick injury to surgeon or first assistant
No additional portals or incisions required
No zone specific cannulas required
Disadvantages
Cost of device/suture
Device issues
Non-absorbable suture
Laceration of meniscal stump with penetration of retriever
Cutting of stump during knot tying

Acknowledgments

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