



Arthroscopic All-Inside Repair of Medial Meniscus Grade 2 Horizontal Cleavage Tear Using Additional Posteromedial Portal

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Abstract: Management of intrasubstance horizontal cleavage meniscal lesions of microtraumatic origin remains poorly defined in young patients. For grade 2 lesions resistant to conservative measures, the standard technique is debridement of the intrasubstance tear and open suture repair via a posteromedial approach. The objective of this Technical Note is to propose an arthroscopic alternative to this open technique, using an arthroscopic additional posteromedial portal. This technique facilitates an approach to the lesion via its peripheral portion without creating an iatrogenic lesion of the free edge of the meniscus, which is located in the white zone and thus exhibits limited vascularity.

Horizontal meniscal cleavage lesions may be degenerative or microtraumatic (in the context of overuse). For symptomatic degenerative lesions, conservative treatment is recommended. However, when such lesions are of microtraumatic origin, treatment protocols are poorly defined.

Conservative management for such lesions typically involves a combination of activity modification, analgesia, physiotherapy, and intra-articular infiltration of a corticosteroid. If and when conservative management fails, surgical options include an upper and/or lower portion meniscectomy, arthroscopic repair with all-inside suture hybrid implants, or open vertical suture repair.¹

In young athletes, horizontal lesions can account for up to 22.5% of meniscal lesions in a stable knee.² A recent study by Beamer et al.³ revealed that horizontal cleavage tears in the medial meniscus cause a significant (approximately 70%) increase in contact pressures owing to a significant reduction in contact area. The authors went on to show that partial meniscectomy and subtotal meniscectomy significantly increase average peak contact pressure and reduce average contact area, at all degrees of flexion, compared with that in the intact state. However, repair of these horizontal cleavage tears return the contact area and contact pressure to nearly normal (within 15% of baseline and statistically similar to the intact state at varying degrees of flexion).

Grade 3 horizontal lesions are usually treated arthroscopically with an all-inside technique with meniscal implants.⁴ A vertical repair technique using vertical sutures performed through a standard posteromedial approach has been proposed for grade 2 lesions, with good results at long-term follow-up.⁴⁻⁶

The current authors propose a surgical technique that is an arthroscopic variant of the open technique. The goal is to avoid a large posteromedial incision by performing a suture repair via a posteromedial arthroscopic approach (Fig 1).

Technique

Indications

The indication for this procedure is a grade 2 horizontal cleavage tear of the medial meniscus (Fig 2) in

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The authors report the following potential conflicts of interest or sources of funding: M.T., J.M.F., and B.S.-C. are consultants for Arthrex. B.S.-C. receives royalties from Arthrex. G.V., J.N., and G.C. have received a grant from Arthrex. Full ICMJE author disclosure forms are available for this article online, as [supplementary material](#).

Received March 15, 2018; accepted May 6, 2018.

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2212-6287/18346

<https://doi.org/10.1016/j.eats.2018.05.002>

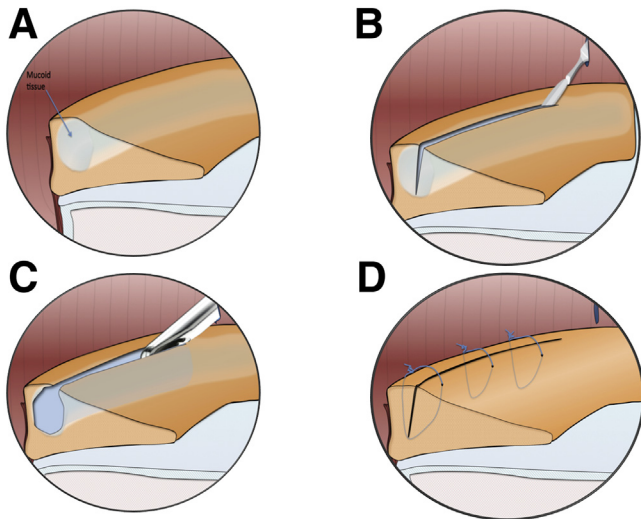


Fig 1. Principle of arthroscopic repair of grade 2 lesions. Right knee. (A) Intrasubstance grade 2 lesion in the peripheral zone of the posterior horn of the medial meniscus. (B) The lesion is approached via the posteromedial arthroscopic portal; a longitudinal incision of the meniscus is made with a Beaver blade (No.11) from the upper surface of the meniscus to the lesion. (C) The lesion is debrided with a motorized shaver. (D) Following debridement of the mucoid tissue, the lesion is closed with vertical suturing with a resorbable single-stranded suture.

patients who have failed conservative treatment modalities.

Procedure

The procedure is performed under general anesthesia after antibiotic prophylaxis (Table 1; Video 1). The patient is supine, with a tourniquet positioned high on the thigh. Lateral support is at the level of the tourniquet, and a foot support is used to stabilize the knee at 90°. This setup prevents external rotation of the leg.

The first stage involves fashioning standard high anterolateral and anteromedial arthroscopic portals.

Table 1. Technical Steps for Arthroscopic All-Inside Medial Meniscus Grade 2 Repair

Procedure Stage	Details
Patient setup	<ul style="list-style-type: none"> • Patient supine • Tourniquet placed on thigh • Lateral post positioned proximal to knee joint, at level of padded tourniquet
Stage I	<ul style="list-style-type: none"> • Foot support is used to keep knee flexion at 90° • Arthroscopic high anterolateral and anteromedial portals
Stage II	<ul style="list-style-type: none"> • Anterior assessment of the meniscus • Posteromedial portal established under arthroscopic control
Stage III	<ul style="list-style-type: none"> • Exploration of posteromedial compartment • Release of mucoid structures with a Beaver blade via posteromedial portal
Stage IV	<ul style="list-style-type: none"> • Debridement with motorized shaver via posteromedial portal • Incision of middle segment through anteromedial portal • Debridement with motorized shaver through anteromedial portal • Confirm integrity of inferior aspect of meniscus with probe
Stage V	<ul style="list-style-type: none"> • Posterior segment vertical sutures applied with 25° left suture hook device • Middle segment vertical sutures applied with aid of lumbar puncture trocar using outside-in technique • Suture stability testing with arthroscopic hook

After cartilage, meniscus, and ligament assessment, an arthroscopic hook probe is passed above, below, and on the free edge of the meniscus to confirm communication with the meniscal lesion (Fig 3). In the current case, absence of such communication confirmed a grade 2 lesion.

The second stage consists of exploration of the posteromedial compartment and the creation of a posteromedial portal. First, the arthroscope is placed in the anterolateral portal and pushed through the notch beneath the femoral insertion of the posterior cruciate

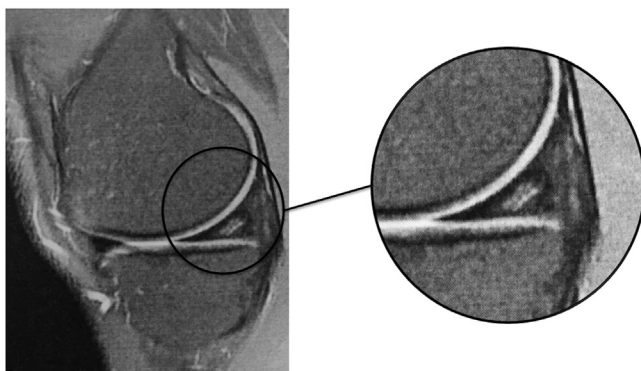


Fig 2. Right knee. Magnetic resonance T1 preoperative sagittal slice. Grade 2 intrasubstance lesion of the posterior horn of the medial meniscus.

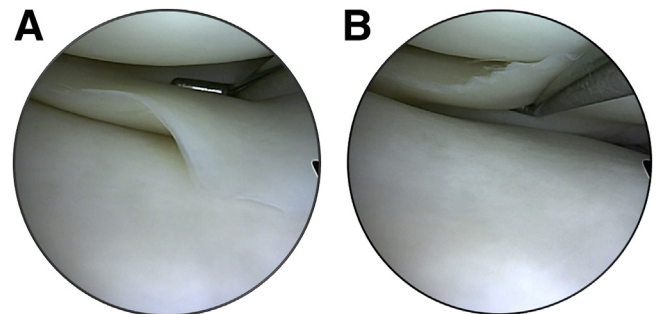


Fig 3. Anterior arthroscopic assessment of the medial meniscus. Right knee. The superior (A) and inferior (B) aspects are assessed. By passing a hook probe under the free meniscal edge, communication with the intrasubstance lesion is assessed.

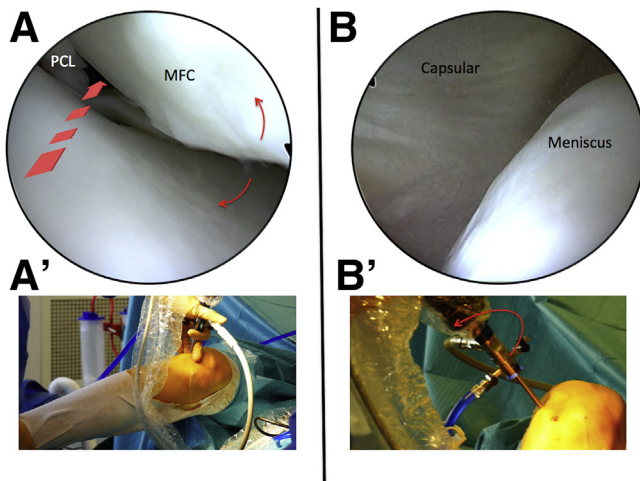


Fig 4. Exploration of the posteromedial compartment. Right knee. The scope is passed through the notch (red dashed arrow), beneath the femoral insertion of the posterior cruciate ligament (PCL), flush with the lateral surface of the medial femoral condyle (MFC) (A). A valgus constraint facilitates passage of the scope through the notch (A'). The camera is then oriented (B') so as to look medially to observe the posterior aspect of the meniscus and the capsulomeniscal junction (B).

ligament ("transnotch" approach) to access the posteromedial compartment. Passage of the arthroscope is facilitated by applying a valgus stress to the knee at 20°

of flexion. The camera is then oriented to look medially to visualize the posterior aspect of the medial meniscus (Fig 4).

After confirming posterior extension of the grade 2 lesion, a posteromedial approach is performed with a needle (21G) used to confirm the correct trajectory (with the aid of transillumination of the skin from within the joint) and a size 11 scalpel following this trajectory to fashion a 5- to 10-mm portal, under arthroscopic guidance, with the knee at 90° of flexion. Exploration of the posteromedial compartment can be completed by placing the arthroscope in the posteromedial portal, to confirm the absence of a transfixing lesion and to assess the posterior junction of the middle segment.

The third stage involves meniscal opening or superior partial longitudinal meniscotomy. It is carried out in red-red zone, capsulomeniscal junction, to facilitate healing. The arthroscope is placed in a transnotch area through the anterolateral portal to visualize the posteromedial compartment. The lesion is then approached from the upper edge of the meniscus through the posteromedial approach. The meniscotomy is performed along the entire length of the lesion using a Beaver blade. In this case, the blade was first introduced posteromedially to approach the lesion at its posterior segment, then anteromedially to approach the middle

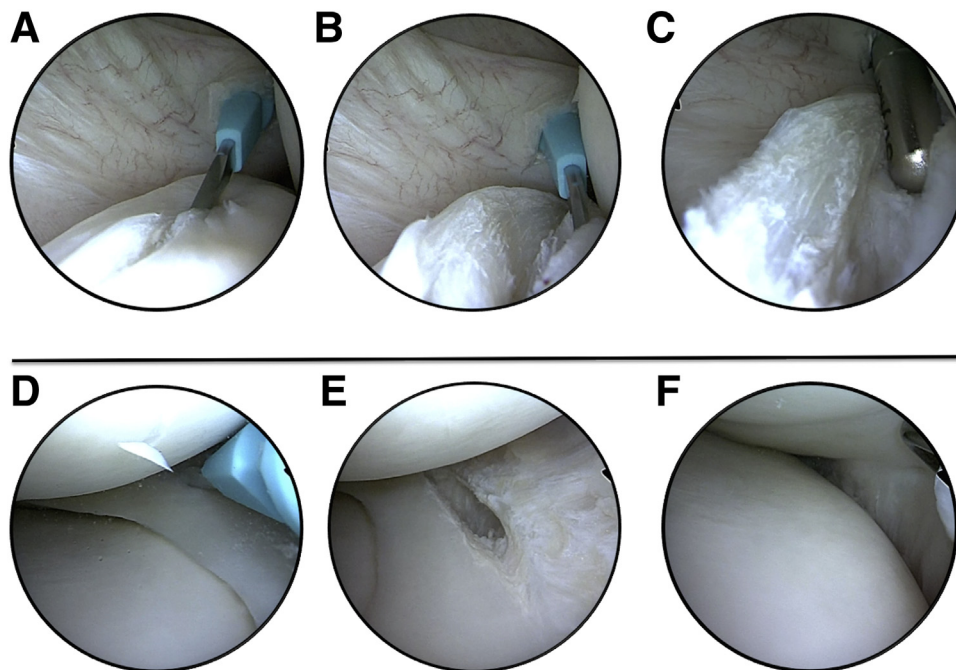


Fig 5. (A, B, C) Posterior horn of the medial meniscus. Right knee. (A) The lesion is incised with the Beaver blade at the posteromedial portal. The superior aspect is incised in the red-red zone. (B) The incision is extended medially while at a consistent depth to preserve the inferior aspect of the meniscus. (C) Debridement of the lesion with the motorized shaver. (D, E, F) Middle segment of the medial meniscus. (D) At the level of the middle segment, the lesion is incised with the Beaver blade through the anteromedial approach. (E) Visualization of the lesion after shaver debridement. (F) Confirmation of the integrity of the inferior aspect of the meniscus by passing the probe under the free edge of the meniscus.

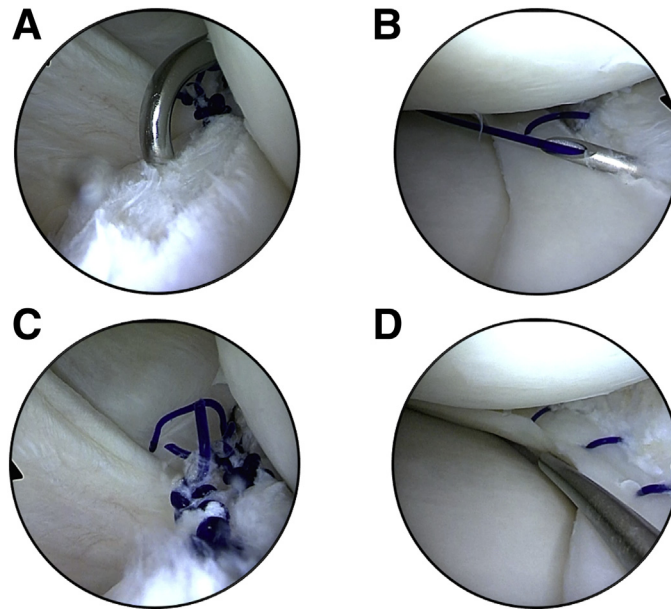


Fig 6. Right knee. (A) Posteriomedial hook suture of the posterior horn lesion. (B) Outside-in suture of the middle segment. Visualization (transnotch camera position) of 3 vertical sutures in the posterior horn (C) and in the middle segment (anterolateral camera position) (D).

segment. The blade is applied to the lesion, but not beyond it, to release the mucoïd elements while preserving the lower meniscal portion (Fig 5).

The fourth stage involves debridement with a motorized shaver. This is performed via the posteromedial portal for the posterior segment and via the anteromedial portal for the middle segment. At the same time, meniscal wall abrasion is performed to stimulate the healing process (Fig 5).

The fifth stage involves meniscal suturing or closure of the partial longitudinal meniscotomy and lesion. Suturing of the posterior segment is performed with a hook SutureLasso (Arthrex, Naples, FL) through the posteromedial portal.^{7,8} Thus, 3 vertical resorbable sutures (PDS No. 1; Ethicon, Somerville, NJ) are applied to the posterior segment using the 25° suture hook device. Suturing of the middle segment is performed with PDS No. 1 (Ethicon) using an outside-in technique with the aid of a lumbar puncture trocar. Finally, the stability of the suture repair is tested with the arthroscopic hook probe. The skin is closed with nonabsorbable sutures (Fig 6).

Postoperative Management

The procedure is performed on an outpatient basis. For 6 weeks, full weight bearing is allowed while wearing a knee extension brace. Figure 7 presents magnetic resonance imaging of a right knee at 1 month postsurgery.

Active and passive flexion is encouraged but limited to 90°. Cycling is permitted at 3 months, running at 4.5 months, and resumption of all sports activities at 6 months postoperatively.

Discussion

Arthroscopic repair of grade 2 horizontal meniscal lesions is readily achievable. The technique that the current authors describe facilitates an approach to the lesion via its peripheral portion without creating an iatrogenic lesion of the free edge of the meniscus, which is located in the white zone and thus exhibits limited vascularity. The benefits of arthroscopic surgery compared with those of open surgery are cosmesis and a reduction in postoperative pain and stiffness. This can be augmented by an appropriate postoperative analgesic protocol and early rehabilitation. It is postulated that owing to small skin incisions and thorough arthroscopic lavage, there is also a reduction in the rate of joint infection.^{7,8} Finally, another potential advantage of an arthroscopic technique lies in less trauma to the

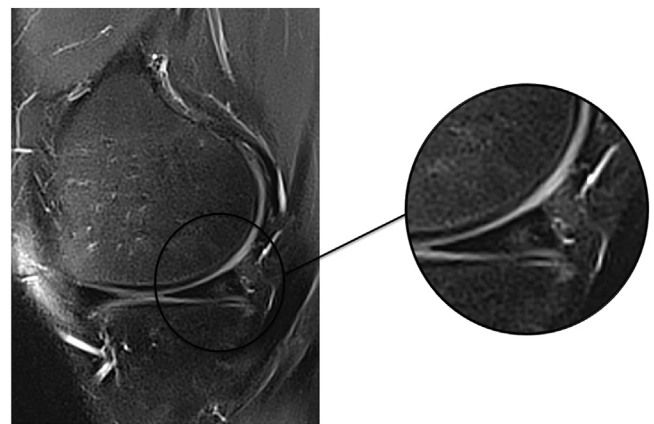


Fig 7. Right knee. Magnetic resonance T2 sagittal section at 1 month postsurgery.

Table 2. Advantages and Disadvantages of an Arthroscopic All-Inside Medial Meniscus Grade 2 Repair Technique

Advantages	Disadvantages
<ul style="list-style-type: none"> • Transillumination to avoid vessels and neurovascular injury • Detailed intra-articular examination for concomitant pathology lesions • Easy access to medial meniscal lesion • Lesser trauma to the capsulomeniscal junction • Preservation of the inferior aspect of the meniscus • Rapid postoperative recovery • Reduction of postoperative pain • Lower rate of complications than with open surgery 	<ul style="list-style-type: none"> • Steeper learning curve for suture placement • Third portal incision • Increased duration of surgery • Risk of stiffness • Risk of septic arthritis • Sinovial fistula formation • Risk of neurovascular injury • Potential risk of suture loosening due to improper knot tying

capsulomeniscal junction. Indeed, complete capsulomeniscal disinsertion of the entire thickness of the meniscus is required when a vertical suture is performed using an open technique. In the arthroscopic technique, capsulomeniscal disinsertion is limited to half of the superior thickness or superficial leaflet.

Some studies propose an arthroscopic suture technique using all-inside hybrid meniscal suture implants applied via anterior portals for grade 3 lesions.^{9,10} For grade 2 lesions, this technique requires completion of a meniscotomy on the free edge of meniscus to allow access and debridement of the horizontal lesion in the white zone. The use of an all-inside meniscal suture anchor to treat this type of lesion via anterior portals does not facilitate complete visualization of the lesion or the meniscotomy and thus increases the risk of iatrogenic injury and secondary migration of implants. Moreover, it is difficult, using an anterior approach, to achieve biomechanically optimal vertical sutures, for instance, perpendicular to the horizontal cleavage plane of the lesion. Finally, transfixing the meniscus in the white zone with an implant involves the risk of a new lesion secondary to the path of the implant as described by Tachibana et al.¹⁰ The posteromedial suture technique allows access to the lesion with a well-visualized debridement of the upper edge. The inferior meniscal body is preserved when accessing the lesion and is closed under visual control with a resorbable wire.

The arthroscopic repair technique for the grade 2 meniscal lesion described is relatively experimental, and long-term data are needed to definitively establish the efficacy of this technique in treating grade 2 meniscal lesions.

It should be noted that the technique in this article is not entirely new given that open repair for grade 2 lesions such as these has been described. One study reported clinical results for 11 patients at a minimum of 2 years of follow-up.⁵

The risks of this technique include a longer duration of surgery, neurovascular injury, postoperative

stiffness, septic arthritis, sinovial fistula formation, and suture loosening due to improper knot tying (Table 2).

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