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Video Article

# Arthroscopic all-inside repair of challenging meniscus tears

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ABSTRACT

Meniscus tears are prevalent in isolation and in combination with anterior cruciate ligament (ACL) injury. Meniscus lesions can be difficult to access and often display complex tear patterns, which result in technical challenges for the operating surgeon during surgical treatment. The aim of this video article is to demonstrate technical tips and tricks for performing all-inside repair of challenging meniscus tears. The presented techniques are indicated in young, physically active patients with symptomatic tears of the lateral and medial menisci, with or without concomitant ACL injury. The procedure is performed using standard anterolateral and anteromedial arthroscopic portals for direct visualization of complex meniscus tear patterns and all-inside instrument access. A suture passing device is used for the placement of suture loops for meniscus root repair. All-inside repair devices are used to repair the radial meniscal tears along the native circumferential fibers using a horizontal mattress suture configuration, with curved devices to achieve optimal access to challenging tears affecting the anterior and posterior aspects at the mid-body of the meniscus. Repair of radial tears at the avascular zone of the meniscus may be augmented with an autologous fibrin clot delivered using an arthroscopic cannula.

**All-inside repair of challenging meniscus tears:**

- Thorough review of tear pattern and location with magnetic resonance imaging (MRI).
- The patient is positioned supine with a lateral post or thigh holder as necessary. Concomitant ACL surgery may require 90° of knee flexion.
- Standard anterolateral and anteromedial portals are used for arthroscopic access. A figure of four positions may facilitate access to the lateral meniscus. Accessory portals can be used to achieve appropriate trajectory for all-inside meniscus repair.
- Case 1: Meniscus root tear & radial split tear
  - o An arthroscopic suture passer is used to pass two loops of #2 braided sutures through the intact medial meniscus.
  - o A tip aimer guide is used to drill the tibial tunnel to match the tension pattern of the medial meniscus. Anatomic repair is desired, but non-anatomic tunnel placement may be acceptable with up to 5 mm from the native meniscus root attachment site [1].
  - o Tension is applied to reduce the medial meniscus, and fixation is performed with a suspensory device at 60° of knee flexion.
  - o Horizontal mattress sutures are passed using an all-inside technique for fixation of the radial split tear along the circumferential fibers of the lateral meniscus.
- Case 2: Complex meniscus tear pattern
  - o Adjustable-angle all-inside devices can be used to facilitate access to the anterior aspect of the complex tear site at the mid-body of the lateral meniscus.
  - o All-inside repair of a complex meniscus tear pattern with horizontal, radial, and vertical components can be augmented with the addition of an autogenous fibrin clot delivered using a 7 mm cannula.
  - o All-inside devices are used to place an additional horizontal mattress suture posteriorly and repair the horizontal cleavage tear component of the complex meniscus tear.

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## Technique structure

### *Outline of the problem*

Challenging meniscus tears are characterized by multiplanar disruption in the structural integrity of meniscal tissue relative to the circumferential collagen fibers involved in load transmission. Inferior patient-reported and radiologic outcomes observed following partial meniscectomy compared to meniscus preservation and repair have shifted the consensus in favor of meniscus repair whenever possible [2]. However, challenging meniscus lesions are heterogeneous in terms of location and tear pattern, which may present challenges to the operating surgeon.

### *Surgical indications and contraindications*

While no clearly defined patient criteria for meniscus preservation currently exist, recent technical advances have expanded indications for the all-inside repair of challenging meniscus tears [2]. In general, surgeons should strive to repair challenging meniscus lesions in young, physically active patients with symptomatic tears. The feasibility of meniscus repair also depends on the specific combination of tear patterns (vertical longitudinal, horizontal, horizontal, radial, and posterior root), their location, and healing potential, which should always be considered. Repair of the posterior root is recommended in patients with concomitant anterior cruciate ligament (ACL) injury [2]. Grade III and IV osteoarthritis, body mass index greater than 35 kg/m$^2$, untreated ligamentous knee instability, and tibiofemoral malalignment are strict contraindications of meniscus repair [2].

### *Treatment options*

Meniscus tears localized to the peripheral third of meniscal tissue (red-red zone) demonstrate favorable healing potential. However, challenging meniscus tears often involve several segments of the meniscal tissue, where surgical treatment with inside-out or all-inside techniques may be required to achieve adequate patient outcomes [2]. All-inside meniscus repair can be performed with or without the use of a transcapsular anchor [3] and multiple possible repair configurations [4]. Moreover, the delivery of autogenous fibrin clot can be used to augment meniscal healing in the avascular zone [5].

### *Outcomes of the technique*

It is well-documented that meniscus repair results in better long-term outcomes than partial meniscectomy, including higher International Knee Documentation Committee (IKDC) and Lysholm scores and lower pain scores, as well as lower rates of post-traumatic osteoarthritis and surgical failure [6]. However, there is a paucity of literature demonstrating the clear superiority of one meniscal repair technique over others. The all-inside technique has risen in popularity recently over inside-out or outside-in repair due to its reduced operation time, repair of meniscal tears without fixation to surrounding tissue, reduced risk of neurovascular and soft tissue damage, and native restoration of contact area through a wider range of knee motion [2]. Several studies document similar failure rates, functional outcome scores, and complication rates following all-inside and inside-out meniscus repair [2]. A 20% failure rate was reported for both all-inside and inside-out techniques in a cohort of 42 patients, with no significant differences in post-operative Tegner or IKDC scores [7]. Further, similar failure rates for all-inside and inside-out repair (15.8% vs 14.2%, respectively) were reported at minimum five years of follow up [8]. However, a significantly greater failure rate was observed with medial repairs compared to lateral repairs (23.9% vs 12.6%, respectively). While patients with meniscus repair (>90%) return to sport (RTS) at consistently high rates [9], no studies have demonstrated the superiority of all-inside meniscus repair in terms of RTS compared with other meniscus repair techniques. Failure to adequately repair meniscal injuries has been shown to increase rotatory knee instability, even in ACL-intact knees [10].

### *Complications*

Complications of the all-inside meniscus repair technique include chondral damage, device-induced irritation, device breakage, foreign body, reaction, and synovitis. Furthermore, patients may experience neurovascular and arterial injury along with the failure of meniscal repair or recurrence of symptoms [2].

### *Conclusion and future perspectives*

This technical video describes techniques for the arthroscopic all-inside repair of challenging meniscus tears using standard anterolateral and anteromedial portals. The advantages of all-inside meniscus repair include a lower risk of neurovascular injury, elimination of the need for additional skin incisions, and direct visualization of complex tear patterns. Moreover, all-inside repair techniques can be combined efficiently with the transosseous repair of the meniscal root. Consequently, all-inside meniscus repair should be a technique available in the toolkit of all knee surgeons treating patients with challenging meniscus tears. Future studies are required to evaluate the long-term impact of all-inside meniscal repair techniques on patient outcomes, treatment failure rate, and RTS.

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jisako.2023.02.007.

## Conflict of interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests:

Volker Musahl reports a relationship with Smith and Nephew Inc that includes speaking and lecture fees. Volker Musahl reports a relationship with Arthrex Inc that includes speaking and lecture fees. Volker Musahl reports a relationship with DePuy Synthes that includes speaking and lecture fees. Volker Musahl reports a relationship with CONMED Corp that includes speaking and lecture fees. Volker Musahl reports a relationship with Springer Publishing Company LLC that includes consulting or advisory. Volker Musahl reports a relationship with Knee Surgery Sports Traumatology and Arthroscopy that includes employment. Volker Musahl has patent #61/566,761 licensed to US Patent. NIH Grant Support: U01AR076144, W81XWH-16-PRORP-ICTA.

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