All-Inside Arthroscopic Meniscal Repair with the Arthrex Meniscal Cinch™ II

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ABSTRACT
Meniscal tears are the most common indication for knee surgery. An appreciation of the limitations associated with the gold-standard inside-out meniscal repair technique has resulted in the development of newer all-inside techniques that overcome many of these issues. This paper describes, with a video illustration available online, a one-handed all-inside meniscal repair technique using the Meniscal Cinch™ II (Arthrex, Inc., Naples, FL).

INTRODUCTION
Meniscal tears are the most common indication for knee surgery. Historically, meniscectomy was the procedure of choice for patients requiring surgery, but meniscal-preserving techniques are increasingly being used to preserve the biomechanical function of the meniscus and prevent early degenerative change in the affected compartment. Recent studies have shown that even small reductions in meniscal volume can significantly alter knee biomechanics, resulting in increased peak contact pressures and increased mean pressures.

The gold-standard technique for meniscal repair has been the inside-out technique, in which posteromedial or posterolateral incisions allow access to the posterior capsule so that sutures can be passed through the meniscus in a vertical or horizontal mattress configuration under arthroscopic visualisation. However, this technique can incur complications associated with the accessory incision, as well as potential damage to the saphenous vein medially and peroneal nerve and popliteal neurovascular bundle laterally. It is technically challenging, requires extra assistance with consequently extended theatre times and has limited scope for repairing posterior horn tears.

More recently, all-inside meniscal repair devices have eliminated the need for accessory incisions and their associated complications. The all-inside technique also allows better access for posterior horn repairs and can be carried out by a single surgeon, thus reducing theatre times. Studies have shown that it is equivalent to traditional inside-out techniques in terms of functional outcomes and clinical failure rates. This paper describes a one-handed all-inside meniscal repair technique using the Meniscal Cinch™ II (Arthrex, Inc., Naples, FL) device (Video 1).
All-Inside Arthroscopic Meniscal Repair with the Arthrex Meniscal Cinch™ II
JENKINS/HOPPER/MACKAY

SURGICAL TECHNIQUE

The patient is placed in the supine position, a tourniquet is placed on the upper thigh and a lateral side support is positioned. The injured leg is prepared and draped in the surgeon’s preferred method. Standard anteromedial and anterolateral portals are used. A general inspection of the joint is performed and the meniscal tear requiring repair with the Meniscal Cinch™ II (Arthrex) is identified (Fig. 1).

Under direct visualisation, the meniscus is measured using the laser lines at the tip of the Meniscal Cinch™ II (Arthrex) needle to minimise soft tissue damage by the needle (Fig. 2A). The depth stop is set according to this measurement by rotating the dial with the desired number facing upwards. The depth stop can be set to 2mm longer than the meniscus to ensure the implant is deployed fully, behind the meniscus. For instance, if the meniscus measures 14mm, the depth stop is set to 16mm. The needle is then inserted, ensuring anatomical reduction of the tear and advanced to a safe depth through the meniscal capsular junction (Fig. 2B). The first implant is pre-loaded and deployed by advancing the first trigger fully and then retracting fully until it is locked in place. The needle is then withdrawn from the meniscus, leaving the first implant in place. To load the second suture into the needle tip, the second trigger is partially advanced until it docks in the trigger bump. Suture slack is available to allow accurate positioning of the second suture (Fig. 2C). The needle is then advanced upwards. The depth stop is then removed from the joint and the 2-0 FiberWire® (Arthrex) suture tail is loaded into the threader of the knot pusher/suture-cutter. When the black tab of the threader is pulled, the suture mass enters the threader. It is then advanced down to the meniscus whilst gentle tension is applied to the suture to remove any suture slack. The self-tying slidding knot is then tightened down fully (Fig. 2E). After the desired tension is achieved and the tear is reduced, the black trigger is advanced forward to cut the suture tail, leaving a small buried knot with minimal suture mass within the joint (Fig. 2F).

DISCUSSION

Appreciation of the long-term morbidity associated with meniscectomy has led to an increased interest in meniscal-sparing techniques. There is growing evidence to support the role of the meniscus in cartilage longevity as well as stabilisation of the knee, particularly in the anterior cruciate ligament (ACL)-deficient joint. Radiological studies comparing partial meniscectomy to meniscal repair have consistently shown increased osteoarthritic change in the meniscectomy group compared to those who undergo meniscal repair. Biomechanical changes following partial meniscectomy decrease the tibio-femoral contact area and increase peak loading pressure, creating a loading profile similar to that of a knee that has undergone total meniscectomy and hastening the progression of osteoarthritis. These radiological findings correlate with patient-reported outcomes at long-term follow-up, with meniscal repair demonstrating superior short- and long-term clinical outcomes in terms of symptomatic relief and activity level when compared to meniscectomy with preservation of joint architecture and biomechanics.

For meniscal tears that can be repaired, the inside-out method has been the gold standard technique for restoring biomechanical function to the meniscus for several years. However, limitations of this technique, i.e., risks to neuromuscular structures associated with accessory incisions, technical difficulty and limited access to posterior horn injuries, have resulted in a move towards all-inside techniques, which overcome many of these issues. Interestingly, recent studies have shown that failure rates for both all-inside and inside-out techniques have reduced in recent years. This can be explained by progressive improvements in implant design and the sharing of knowledge.

The Meniscal Cinch™ II (Arthrex, Inc.) device provides an effective method for meniscal repair, restoring integrity and function of the meniscus with minimal intra-articular suture material. It allows for a one-handed technique, thus minimising the need for surgical assistance and consequently reducing theatre time. Whilst mechanical studies have shown that vertical mattress sutures provide stronger fixation than horizontal mattress sutures, more recent studies have shown that, with high-strength suture material, the load to failure rate is the same regardless of suture orientation. The technique we have outlined allows for both horizontal and vertical mattress sutures with high-strength 2-0 FiberWire® (Arthrex) to allow for tear anatomy and surgeon preference. The 2-0 FiberWire® (Arthrex) allows for a smaller needle, which makes access to the posterior capsule easier as well as reducing the amount of material present on the meniscal surface. Advantages and
disadvantages of this technique as well as some pearls and pitfalls are outlined in Tables I and II.

Post-operative rehabilitation with this technique is similar to that with other meniscal repair techniques. To prevent undue strain on the meniscal repair, the patient should avoid weight-bearing with the knee in flexion for the first 4-6 weeks, as well as activities involving deep flexion and tibial rotation. Knee flexion beyond 90 degrees is associated with significant posterior translation of the femoral condyle on the tibia, risking increased stresses within the meniscus as well as causing increased compressive and shear forces in the posterior horn of the meniscus. However, the exact duration and structure of the physiotherapy program post-operatively will depend on the type and location of the meniscal injury repaired and the surgeon’s preference. In particular, rapid rehabilitation programs have been described which allow early full weight-bearing, unrestricted movement and no restriction on returning to pivoting sports after postoperative effusions have

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<tr>
<th>Table I</th>
<th>Advantages and disadvantages of this technique</th>
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<td><strong>Advantages</strong></td>
<td><strong>Disadvantages</strong></td>
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<td>Restores the integrity and function of the meniscus with minimal intra-articular suture material.</td>
<td>Increased cost compared to some outside-in techniques.</td>
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<td>Single hand technique with minimal deployment steps - reduces surgical time and need for a surgical assistant.</td>
<td>Theoretical risk to popliteal neuromuscular bundle in posterior horn repairs.</td>
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<td>Allows access to posterior horn tears.</td>
<td>Reduced complications compared with outside-in techniques.</td>
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<td>Allows vertical or horizontal suture repairs.</td>
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<th>Table II</th>
<th>Pearls and pitfalls of this technique</th>
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<td><strong>Pearls</strong></td>
<td><strong>Pitfalls</strong></td>
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<td>Utilise the adjustable depth stop, which facilitates safe insertion by concealing the needle in a retractable sheath.</td>
<td>Articular surface can be damaged during insertion and care should be taken to avoid this.</td>
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<td>Apply only gentle tension to the suture to prevent strangulation of the knot.</td>
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resolved. Clinical judgement of the repair strength, tear anatomy and blood supply should be considered.

**CONCLUSION**

This paper describes an all-inside meniscal repair technique using the Meniscal Cinch™ II (Arthrex, Inc., Naples, FL) device. This is a meniscal-preserving technique that restores integrity and biomechanical function to the meniscus, protecting the compartment from osteoarthritic change. This simple single-handed technique offers reduced operating time, access to posterior horn repairs and reduced complications compared to outside-in repairs.

**AUTHORS’ DISCLOSURES**

Professor Mackay is a consultant for, and receives royalties, from Arthrex Inc. All other authors have no conflicts of interest to disclose.

**SUPPLEMENTARY DATA**

Video 1 Demonstration of all-inside meniscal repair using the Meniscal Cinch™ II (Arthrex, Inc., Naples, FL) device.

**REFERENCES**