

Meniscal Repair—Outside-In Repair

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KEYWORDS

- Meniscus • Outside-in • Repair • Arthroscopy
- Knee injury

HISTORICAL PERSPECTIVE

In 1948, Fairbank¹ described the radiographic changes that develop after meniscectomy, suggesting the protective effect of the meniscus. Early biomechanical studies have further defined the importance of the meniscus in normal knee joint function. These studies found a 50% to 70% reduction in femoral condyle contact, a 100% increase in contact stress with removal of the medial meniscus, a 40% to 50% decrease in contact area, and increase in contact stress to 200% to 300% with removal of the lateral meniscus.^{2,3} Since then, it has become a well-accepted notion that the menisci play a critical role in load transmission, shock absorption, and secondary stabilization of the knee. Acceptance of the crucial role of the meniscus in knee kinematics coupled with improved understanding of meniscal healing, anatomy, microstructure, and biochemistry has led to the concept that, whenever feasible, the meniscus should be preserved rather than resected.

As the preferred method of treatment of meniscal injuries has swung from resection to preservation over the last several decades, the techniques used to repair meniscal tears has also evolved. Current techniques typically use an arthroscope and favor smaller incisions to decrease the amount of surgical trauma. Techniques are commonly described as outside-in, inside-out, and all-inside, with each technique having its own advantages and disadvantages.

The outside-in technique is named for the direction that the suture is first passed into the knee joint. As described in further detail in the technique section of this report, several subtle technique variations exist when performing an outside-in meniscal repair, but all techniques use a spinal needle to enter the joint under direct visualization, minimizing the risk of injury to both articular cartilage and extracapsular

The authors disclose no conflicts.

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Clin Sports Med 31 (2012) 33–48

doi:10.1016/j.csm.2011.08.011

0278-5919/12/\$ – see front matter Published by Elsevier Inc.

sportsmed.theclinics.com

neurovascular structures. Unlike the inside-out technique, the outside-in technique does not require the use of a rigid cannula and, therefore, the risk of articular cartilage damage is further reduced. Additionally, the outside-in technique can be accomplished with only a small incision to tie sutures over the capsule, minimizing surgical trauma. In this technique, sutures can be placed in a vertical mattress fashion, which has been shown to have an increased ultimate strength compared with horizontal sutures, arrows, suture anchor devices, and staples.⁴⁻⁷ This review describes the outside-in technique for meniscal repair in detail, including indications and contraindications, preoperative planning, various techniques, postoperative rehabilitation, complications, and results.

INDICATIONS AND CONTRAINDICATIONS

Before deciding whether to use an outside-in meniscal repair technique, one must first decide whether any meniscal repair is indicated. Several factors must be considered, including location of the tear, the type or pattern of the tear, the quality of the meniscal tissue, chronicity of the tear, patient physiologic age, patient expectations and goals, and stability of the knee when contemplating meniscal repair. Although the decision regarding meniscal repair should be individualized for each patient, one commonly accepted criteria for meniscal repairs includes a complete vertical longitudinal repair greater than 10 mm long, a tear within the peripheral one-third of the meniscus or within 3 to 4 mm of the meniscocapsular junction, an unstable tear that can be displaced by probing, a tear without secondary degeneration or deformity, a tear in an active patient, and a tear associated with concurrent ligamentous instability.⁸ Perhaps the most important factor to consider is the location of the tear, because tears closer to the periphery of the meniscus have an increased potential to provide a healing response. Meniscal repair is most likely to be successful for an acute, vertical, longitudinal tear in the vascular periphery of the meniscus in a relatively young patient with a stable knee.

Although both acute and chronic tears may be repaired successfully, it is generally accepted that a higher healing rate exists when meniscal tears are repaired acutely. Henning and colleagues⁹ reported higher healing rates in meniscal tears repaired within 8 weeks of injury in knees with concomitant anterior cruciate ligament (ACL) tears.⁹ Tenuta and Arciero¹⁰ reported better healing rates of meniscal repairs when they were performed within 19 weeks of injury and also reported improved healing rates when a combined ACL reconstruction was performed.¹⁰

Several additional studies have also found a higher failure rate of meniscal repairs in ACL-deficient knees and, therefore, concomitant ACL reconstruction is recommended.^{11,12} However, Fetzer and colleagues¹³ recently reported on the MOON cohort of 1014 ACL reconstructions and found that although 36% of knees had medial meniscal tears and 44% of knees had lateral meniscal tears, only 31% of those medial meniscal tears and 12% of the lateral meniscal tears were deemed repairable at the time of surgery. They did recommend consideration of more aggressive attempts at meniscal preservation, such as implants, advanced repairs to avascular zones, and the use of meniscal scaffold replacements.

Warren¹⁴ first described the arthroscopic outside-in technique primarily as a method to decrease the risk of peroneal nerve injury during lateral meniscal repair as well as other problems encountered at that time with inside-out and open meniscal repair techniques. The outside-in meniscal repair technique has since become an accepted technique for repairing meniscal tears in both the medial and lateral menisci. A key advantage of the outside-in technique is the ability for the surgeon to place needles in an accurate fashion, avoiding injury to surrounding neurovascular

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