Arthroscopic Meniscus Repair

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Introduction

Sutures, stingers, arrows, darts, and screws. Does all this sound confusing? You bet it is. The hot topic in meniscal repair is the use of bioabsorbable devices to repair the tear. This is a complex topic, and it is difficult to separate fact from hype. Each company has their own device made with various combinations of polymers with appropriate lab pullout strength studies to justify their use. This summary will hopefully unravel some of the truths and myths.

Indications and Contraindications.

First of all, who is a candidate for meniscal repair? The algorithm for meniscal repair should consider the following factors

- Location
  - The ideal type of meniscal tear to consider repairing is the peripheral tear. This is also referred to as the red on red tear, indicating the degree of vascularity. This tear is amenable only to suture repair. Most commonly the tear is in the red on white region, which also has an acceptable successful repair rate when bioabsorbable devices are used.

- Morphology of the tear
  - Size
    - The short tear of 1-2 cm has a better successful repair rate
  - Appearance
    - The vertical longitudinal tear is ideal for repair
Don’t consider repairing degenerative horizontal cleavage tears or flap tears.

- Patient factors
  - Non compliant patient should not be considered for repair
  - The younger patient has a higher success rate. The older patient often has the type of degenerative tear that is non repairable.
  - The rehab must be modified to avoid flexion in the immediate post-op period.
  - 50% of ACL tear’s are associated with meniscal tears.

In summary, the best candidate for meniscal repair is the young compliant patient with a 2 cm long peripheral longitudinal meniscal tear. You should always consider a meniscal repair, rather than a menisectomy in the young athlete to protect his articular cartilage for the future.

**Which tears can you leave alone?**

Shelbourne has shown that the short 1 cm stable tear that is associated with the ACL tear can be left alone. The follow up of the untreated tears shows no increase in late meniscal symptoms or increase in the late menisectomy rate.

This is an incomplete posterior horn lateral tear that is stable. This tear can be left alone.

Some of the incomplete tears can also be treated by trephination.
This stable incomplete tear of the medial meniscus is trephinated in 3 places with a number 18 gauge needle. In a study by Zhongnan, good results were obtained by trephination alone in this type of tear.

This is a repairable longitudinal posterior segment tear of the medial meniscus. This tear should be repaired early to prevent it’s extension into a bucket handle tear.

**The techniques of meniscal repair.**

**Inside out Suture repair.**
The suture repair of the meniscus using non-absorbable vertical loop sutures placed from inside out.

The arthroscopic inside out suture repair originally described by Henning is the gold standard. Rosenberg popularized the double cannula system to place the horizontal sutures. The success rate of this type of repair is about 80%. Johnson described the outside in suture technique. The vertical loop suture was shown by Dervin to be twice as strong as the horizontal loop suture. Multiple vertical loops of non-absorbable material placed 5 mm apart on the superior and inferior surface provides the best repair. Morgan, using the spectrum tissue repair system, described all inside repairs. With the advent of the bioabsorbable devices this technique has largely been abandoned. The advantages of the suture repair technique are that it is proven to be efficacious and cost effective. The disadvantages of the suture technique is that the second incision is required that requires more time and usually a second assistant. There is also a potential for needle sticks and neuro-vascular complications. There is also a significant learning curve in placing and tying the sutures. The medial meniscus is repaired in extension and the lateral meniscus is repaired in the figure four position. In light of the proven success of the suture repair we should think seriously about abandoning this technique in favour of the easier to perform repair with the bioabsorbable devices.

**Inside out suture repair – The technique**

- Examining the meniscus and preparing the edges of the tear
The displaced meniscus tear is reduced and the edges are rasped.

**Making the posterior incision on the medial side**

- The posteromedial incision is made just behind the MCL and anterior to the saphenous nerve. The incision should be centered with 2/3 below the joint line. The superficial fascia is incised, and by blunt dissection the posterior capsule is exposed. A retractor is placed posteriorly to guide the needles anteriorly and to protect the saphenous nerve.
Making the posterior incision on the lateral side

- The posterolateral incision is made just behind the lateral collateral ligament. The LCL can be palpated by placing a varus force on the knee. The incision should be 2/3 below the joint line. The superficial fascia and then the ilio-tibial band is divided. The posterior capsule is exposed by blunt dissection. A retractor is placed posteriorly to protect the peroneal nerve.

Placing the sutures into the meniscus

The sutures are placed with long needles down the zone specific cannula. The sutures may be placed either in a vertical or horizontal fashion. The vertical have a better pullout strength. The sutures may be placed on top or under the meniscus. In this series of pictures the needle is initially placed through the capsule, and then through the meniscal fragment.
Retrieving and tying the sutures
The sutures are retrieved through the posterior incision and tied over the capsule with the knee in extension. To ensure that the sutures are tight the anterior group of sutures can be tied to the posterior sutures.

The technique of meniscal repair using the BioStinger™

The cannulated BioStinger™. The cannulated devices make placement of the device more accurate and the reduction of the tear easier.

Preparing the meniscus
The tear should be initially probed to determine if it is suitable for repair. The edges of the tear should be debrided of fibrous tissue with a rasp or a small shaver. Pavlovich has described the technique of stimulation of the meniscal synovial border with electrocautery. The principle is to lightly 'burn' the synovium to produce a healing response.

The monopolar electrode is used to stimulate the synovium at the tear.
Zhongnan demonstrated that the meniscus and the rim may be trephinated to produce vascular access channels.

The sutures and the bioabsorbable devices must be placed accurately to reduce the tear and hold it until it is healed. A hybrid approach for large bucket handle tears is to use sutures in the middle segment to reduce and hold the bucket tear and then use the bioabsorbable devices in the difficult to repair posterior horn region.

**The technique of the Biostinger™ insertion**

The appropriate length of BioStinger™ is selected, usually 13 mm, and loaded on the cannulated wire of the delivery unit.

The cannula is placed against the meniscus, 2 mm of cannulated wire is delivered into the torn fragment. The fragment is then reduced to the peripheral rim. This step is similar to the inside out suture repair using the zone specific cannulas with the long meniscus repair needles.
When the torn fragment is reduced, the cannulated wire is advanced into the rim using the slider bar on the side of the device.

The BioStinger™ is inserted into the meniscus by depressing the plunger on the end. The meniscus can be felt to ratchet into the meniscus.

Alternately, the insertion of the wire and BioStinger™ can be done with a 3 step trigger on the meniscus gun. This pushes the fixator into the tissue, but does not ‘shoot’ it in. The first pull advances the wire 2 mm to reduce the tissue. The second pull advances the wire 13 mm into the tissue and the 3 pull advances the BioStinger along the wire into the meniscus.

To prevent the cannulated wire from bending, firm pressure must be exerted on the cannula to keep this against the meniscus. The cannula is backed up 5 mm and the head of the BioStinger™ inspected to be sure that it is countersunk under the surface of the meniscus.
This photo demonstrates that the meniscal fixator must be countersunk below the surface of the meniscus.

BioStinger™ Advantages

- Low profile head
- Molder PLLA
- 4 rows of prongs
- cannulated insertion similar to inside out suture repair
- same load to failure as the horizontal suture
- fast and easy to perform

BioStinger™ Disadvantages

- Expensive
- Damage to articular surface due to prominent head
- Damage to neurovascular structures due to over penetration with the BioStinger™
- Learning curve for insertion at the correct angle and position in the meniscus.
- Difficult in tight, small knee
- Prolonged time for resorption of the PLLA material

Relative Contraindications for the use of meniscal fixators

- Peripheral tear at the meniscal synovial junction. The fixator must have 3+ mm of tissue to grasp
- Lateral meniscal tear at the popliteus junction. This is an open space around the tendon that requires sutures to approximate the tissue.
- Chronic displaced bucket handle tear. This may be repaired with a hybrid technique of sutures and fixators.
- Small tight knee in young patient. It is difficult to insert the cannula under the condyle and into the correct position on the meniscus. The long needles of the sutures can be bent and directed into the correct position.
Clinical Results

Peter Kurzweil reported on the results at the AANA 1999 fall course in San Diego.
Albrecht-Olsen 34 patients – 21% failure
Saul Schrieber 37 patients – 5% failure
Peter Kurzweil 40 patients – 12%

Kurzweil discussed and commented on his failures of repairs with the use of the bioabsorbable arrow. The 5 failures in the 40 patients all occurred in the first 10 patients related to the learning curve. He found that 2 failures were due to flexion injuries in the first 3-5 weeks. 3 were due to large peripheral bucket tears that were displaced at the time of diagnosis. Based on his experience he suggested that there should be no accelerated rehab with no flexion or squatting for 4 months. He suggests that you combine the repair techniques of suture and arrows for large displaced bucket tears. He also cycles the knee after the repair to make sure that the bucket tear does not re-dislocate into the notch. He avoids the bioabsorbable devices in the red on red tears, in the popliteal tendon region, in small tight knees, and in large displaced bucket handle tears.

Schepis reported on his results with bioabsorbable arrows in a poster at the Academy in 2001

His suture repair rate was 6.9%. This increased to 19% with the introduction of arrows. He followed 38 patients over 2 years. ACL reconstruction was performed in 22/38 cases. The successful repair rate was 94% as assessed by chart review, phone interview and clinical evaluation. There was a 7% failure rate in stable non ACL reconstruction cases. However, 31% had temporary local irritability to the arrow, but only 1 had persistent symptoms.

We reported on our meniscal repair results in a poster at the AANA spring meeting and a podium presentation at the annual Canadian Orthopedic Meeting. There were 262 meniscal repairs in 2100 ACL reconstructions. In 1990 the suture repair rate was 8.9%, and this increased to 19% with the use of meniscal
fixators. The outcome of suture repair, fixators repair and the hybrid repair was the same as measured by the Tegner, Lysholm, and Cincinnati scale. The failure rate was 4% for fixators, 12% for hybrids and 25% for sutures. The high failure rate for the sutures was probably due to the repair of chronic displaced bucket handle tears.

**Summary**

Meniscus repair in a suitable patient with the appropriate tear is efficacious. The use of the bioabsorbable devices should be used judiciously and in large tears in combination with sutures. At the present time we do not know how much fixation is required to allow a torn meniscus to heal, consequently any of the devices may work. The stimulation of the synovium with the subsequent bleeding and the production of a fibrin clot may be all that is necessary to promote healing of the meniscal tear. The final outcome of the procedure is judged by the clinical result.

My current approach is to use non-absorbable sutures from inside out, with a separate incision to retrieve the sutures and tie them over the capsule. I use the bioabsorbable fixators in the posterior, difficult to access region. If the tear is small, 2 cm, I may use the fixators alone.

Above all, do no harm.

**References**


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