Technical Note

Modified Outside-in Repair Technique for Chronic Retracted, Unstable Bucket-Handle Anterior Horn Lateral Meniscal Tear

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Abstract: The meniscus plays a very important role in normal functioning of the knee joint. It acts as a shock absorber, gives stability to the knee joint, delays the onset of osteoarthritis, provides load sharing, and so on. It is a well-known fact that after meniscectomy, there is a significant increase in joint reaction forces leading to early osteoarthritis. Hence, in the past decade, meniscal repair has gain enormous importance and various techniques have been developed to repair the meniscus. Conventionally, posterior-third meniscal tears are repaired with all-inside and outside-in techniques whereas middle-third meniscal tears are repaired with all 3 methods: inside out, outside in, and all inside. For tears of the anterior horn of the meniscus, only the outside-in method is used. We have developed a method for repair of chronic unreduced, retracted bucket-handle anterior horn lateral meniscal tears, in which we combined the use of both the outside-in and all-inside methods of repair. Hence, this method is called modified outside-in meniscal repair for chronic retracted bucket-handle anterior horn lateral meniscal tears.

Once thought to be a vestigial organ, the meniscus is now very well proven to have various functions such as acting as a shock absorber, providing stability to the knee joint, helping to prevent osteoarthritis, and providing load transmission.[1,2] Recently, meniscal repair has gained enormous importance because of the aforementioned functions. Meniscal repair has shown success rates between 85% and 90%.[3] Various techniques of meniscal repair have been described in the literature, such as all inside, inside out, and outside in.[4] Posterior horn meniscal tears can be repaired very well with all-inside and inside-out repair techniques, whereas middle-third meniscal tears can be repaired by all 3 methods.[5] It is only anterior horn tears of both menisci that require repair by only an outside-in technique.[6,7]

The outside-in meniscal repair technique for anterior horn meniscal tears is routinely performed by using two 18-gauge spinal needles and No. 2-0 FiberWire (Arthrex, Naples, FL). This conventional outside-in repair technique is useful in treating longitudinal, stable, and reducible anterior horn tears.[8] The technique described in this article differs from the routine conventional outside-in technique because it is used to treat chronic retracted, unstable bucket-handle anterior horn lateral meniscal tears. In addition, with a routine 18-gauge

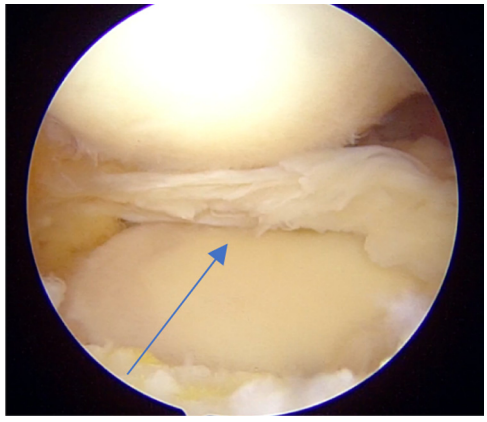

Fig 1. With the patient in the supine position with the knee dangling in 90° of flexion, a view from the high anterolateral portal shows a chronic retracted bucket-handle anterior horn lateral meniscal tear (arrow) exposing the anterolateral tibia.

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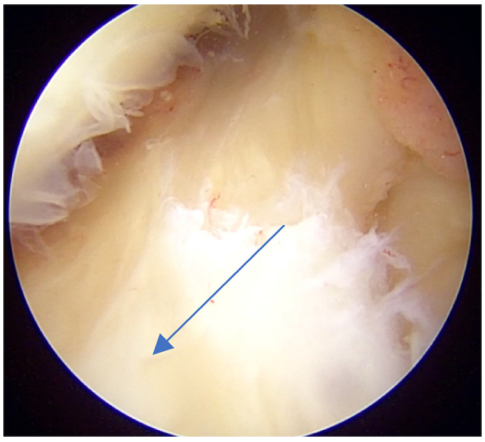

Fig 2. View from anteromedial portal showing reducible anterior horn bucket-handle lateral meniscal tear (arrow).

spinal needle and No. 2-0 FiberWire, we use a Knee Scorpion device (Arthrex) to take a bite of the retracted meniscal tissue and then shuttle relay it through the anterior capsule. Hence, this technique is a modified outside-in repair technique because it is uses both outside-in and all-inside meniscal repair methods (Video 1).

Surgical Technique

Position

The patient is positioned with the supine leg dangling after receiving spinal anesthesia. The operative knee is prepared and draped. A tourniquet is applied at the proximal aspect of the thigh and elevated up to 300 mm.

Surgical Steps

In total, 3 portals are used: high anterolateral (AL), low AL, and mid anteromedial (AM). Viewing from the high AL portal allows confirmation of a chronic retracted, unstable bucket-handle tear of the anterior horn of the lateral meniscus with synovitis (Fig 1). Viewing from the high AL portal, the surgeon creates the mid AM portal, and through this portal, torn meniscal tissue is probed to assess its reducibility and tissue quality (Fig 2). A shaver blade is used from the mid AM portal for synovial debridement; in addition, the torn end of the meniscus is debrided with low suction force to avoid iatrogenic injury to the meniscus (Fig 3). A meniscal rasp is used to abrade the capsule and torn end of the meniscus to enhance the healing potential. Another low AL portal is created, and a PassPort cannula (Arthrex) is inserted through this portal for hassle-free suture management.

The arthroscope is shifted to the mid AM portal for viewing, and an 18-gauge spinal needle preloaded with No. 2-0 FiberWire is percutaneously inserted anterolaterally in the mid-third area, piercing the capsule and entering the joint (Fig 4). The FiberWire is then

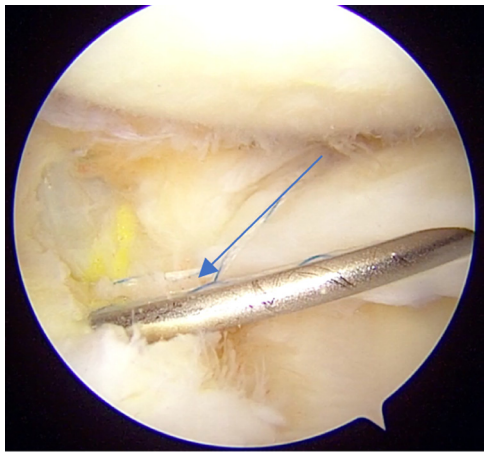

Fig 4. Eighteen-gauge spinal needle looped with No. 2-0 FiberWire (arrow) coming from anterolateral capsule at lateral joint line level as viewed from anteromedial portal.

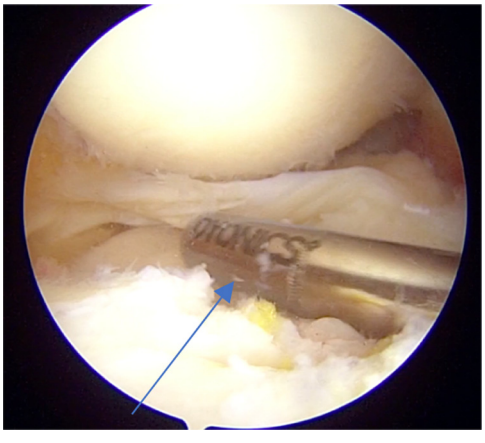

Fig 3. Viewing from the high anterolateral portal, the surgeon introduces the shaver blade (arrow) from the anteromedial portal to freshen the torn edges of the meniscus and capsule to enhance the healing potential.

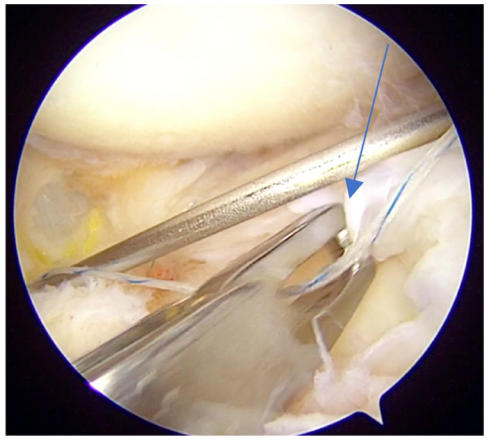

Fig 5. The looped No. 2-0 FiberWire is retrieved with the help of a retriever (arrow) coming from the low anterolateral portal and the arthroscope in the anteromedial portal.

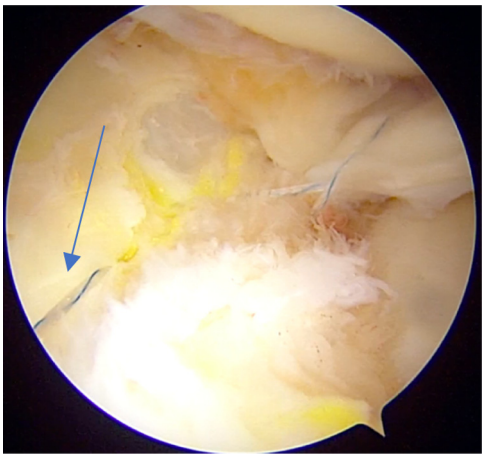

Fig 6. The No. 2-0 FiberWire (arrow) is now passing from the anterolateral capsule through the posterior aspect of the anterior capsule and coming out from the low anterolateral portal with the arthroscope in the anteromedial portal.

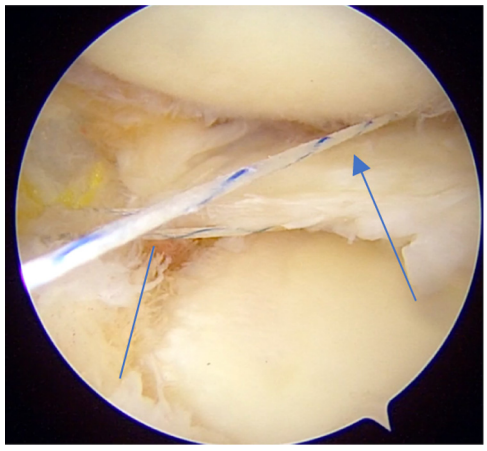

Fig 8. View from anteromedial portal showing No. 2-0 FiberWire coming from anterolateral capsule passing through healthy meniscal tissue (line) and coming out of low anterolateral portal (arrow).

retrieved out of the joint from the low AL portal (Fig 5). This No. 2-0 FiberWire forms a loop on the posterior aspect of the AL capsule (Fig 6). The No. 2-0 FiberWire, which has been retrieved from the low AL portal, is loaded on the Knee Scorpion device outside the joint. This Knee Scorpion device with No. 2-0 FiberWire is now inserted in the joint through the low AL portal and takes a bite of the healthy portion of the meniscus as in an all-inside method (Fig 7). After bite is taken in the healthy torn anterior horn of the meniscus, the No. 2-0 FiberWire is pulled out of the joint through the low AL portal. The No. 2-0 FiberWire is now coming from the AL capsule through the anterior horn of the lateral meniscus and outside the low AL portal (Fig 8).

Next, we need to transfer the No. 2-0 FiberWire from the low AL portal to the AL capsule in a vertically fashioned suture configuration. For this, we use the same 18-gauge spinal needle, which is now preloaded with a No. 1 Ethilon loop (Ethicon, Somerville, NJ) and is introduced in the joint percutaneously just below the previous bite (Fig 9). The No. 2-0 FiberWire from the low AL portal is now retrieved back through the Ethilon loop (Fig 10). The Ethilon loop, along with the FiberWire and 18-gauge spinal needle, is pulled out through the AL capsule, which forms a strong vertical stitch in the mid-third AL portion of the tear (Fig 11). In a similar way, we take reaming 4 bites from the posterior to anterior aspect of the tear. In all, 5 vertically fashioned stitch configurations are taken percutaneously from the posterior to anterior aspect on the torn anterior horn of the lateral meniscus (Fig 12).

The skin between the FiberWires, on the AL aspect of the knee joint, is incised up to the subcutaneous tissue to pull all the FiberWires out of the skin. Then, blunt

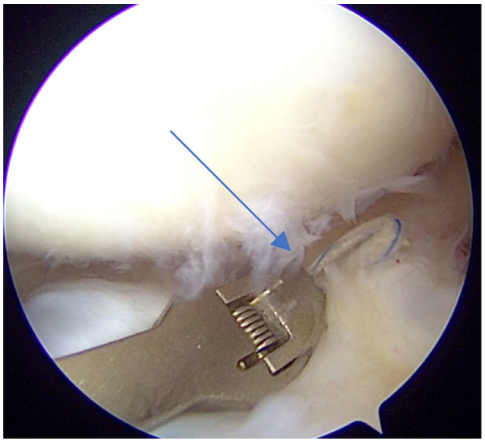

Fig 7. View from anteromedial portal showing Knee Scorpion (arrow) taking bite in healthy anterior horn of lateral meniscus with No. 2-0 FiberWire, which is introduced from low anterolateral portal.

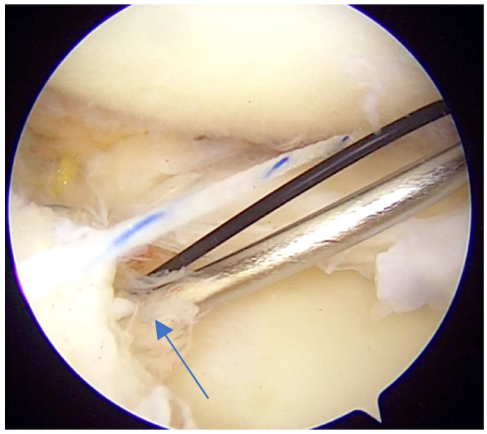

Fig 9. Another 18-gauge spinal needle looped with No. 1 Ethilon (arrow) percutaneously piercing from anterior capsule vertically below first bite as viewed from anteromedial portal.

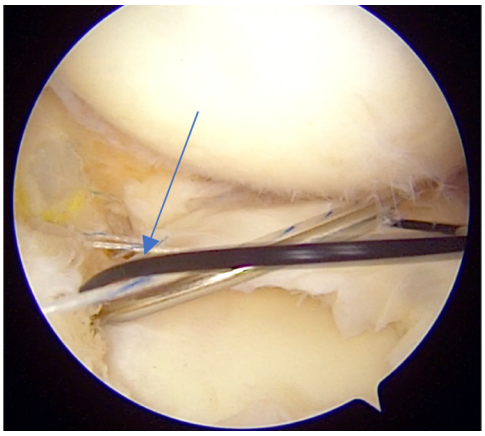

Fig 10. View from anteromedial portal showing free end of No. 2-0 FiberWire from low anterolateral portal is retrieved through Ethilon loop (arrow).

dissection is performed with an artery forceps to clear the fat tissue and iliotibial band to allow clear visualization of the AL capsule. All the FiberWires are retrieved posterior to the iliotibial band and anterior to the capsule. One by one, all the sutures are tied on the AL capsule, from the posterior to anterior aspect, helping the meniscus to reduce to its anatomic location (Fig 13). This knot tying is performed with the knee in 90° of flexion. After tying of all the knots, the meniscal repair is again viewed from the AM portal and a probe is used from the AL portal to check the stability of the repair (Fig 14). All 3 portals, along with the horizontal wound on the AL aspect of the knee, are closed subcutaneously (Fig 15).

Discussion

The meniscus, acting as a shock absorber, is a very important structure for normal functioning of the knee joint. It not only gives stability but also transmits load,

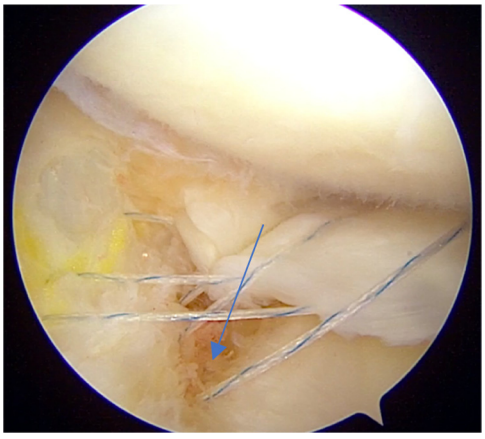

Fig 11. With the arthroscope in the anteromedial portal, the FiberWire is retrieved from the Ethilon loop and is shuttle relayed from the anterolateral capsule just below the previous FiberWire, providing a vertical stitch configuration (arrow).

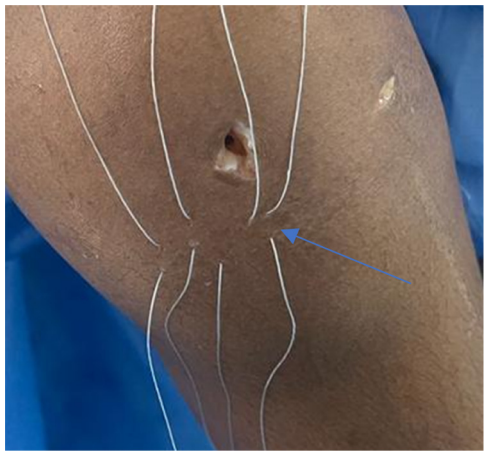

Fig 12. External aspect of knee showing percutaneously passed FiberWires (arrow) along with high anterolateral and anteromedial portals.

and more important, it prevents the early onset of osteoarthritis.[1,2] Meniscal repair has shown a good success rate if associated with an anterior cruciate ligament tear or if performed in isolation.[3] All-inside, inside-out, and outside-in techniques are most commonly used for meniscal repair.[4]

Routinely, an all-inside repair technique is used for posterior-third meniscal tears, but this technique can be extended to mid-third tears as well.[5] Outside-in and inside-out meniscal repairs are ideally performed for mid-third tears but can be extended to posterior-third tears with safety incision.[6,7] It is only anterior-third tears of both menisci that can be repaired by an outside-in technique only.[8] To increase the healing potential of the meniscus, various meniscus healing techniques have been introduced, including trephination, rasping, fibrin clot infiltration, and subchondral microfracture.[9,10]

It is very well proven in the literature that after total meniscectomy, there is alteration in load transmission

Fig 13. All tied knots (arrow) on anterolateral capsule. The knots are tied sequentially from the posterior to anterior aspect to properly reduce the meniscus onto the capsule.

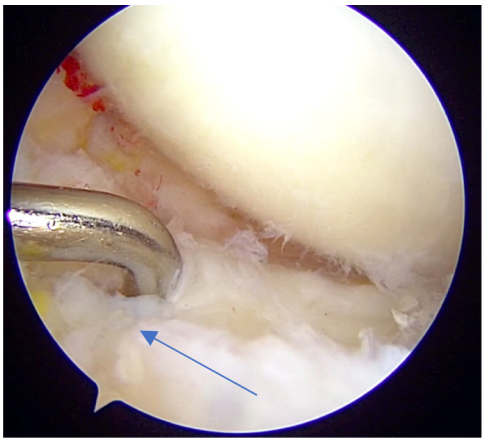

Fig 14. Intra-articular picture after complete repair of torn meniscus. With the arthroscope in the anteromedial portal, a probe (arrow) is used to check the stability of the repair.

of the knee joint that increases peak stresses, decreases the shock-absorber function of the meniscus, and reduces the contact area, thereby resulting in early osteoarthritis.[11] Hence, the use of meniscectomy has decreased in the past decade and meniscal repair has gained enormous importance.[12]

When a conventional outside-in meniscal repair technique is used for anterior horn meniscal tears, it is performed either using two 18-gauge spinal needles or with the help of a meniscal mender set and No. 2-0 FiberWire. In this conventional technique, one 18-gauge spinal needle is passed percutaneously from the skin through the capsule and in the joint; another 18-gauge spinal needle is then passed percutaneously from the skin through the capsule through the meniscal substance, and the FiberWire is shuttle relayed through the loop outside the capsule to form a vertical stitch, which reduces the meniscus onto the capsule.[13] Recently, another outside-in repair technique, known as the "suture shuttle technique," was developed by Joshi et al.[14] for longitudinal meniscal tears. However, in the case of chronic retracted anterior horn meniscal tears, it is sometimes not possible to hold the reduction of the meniscus and pass the spinal needle through it, so this conventional method of outside-in meniscal repair is not possible when treating such chronic retracted, unstable bucket-handle anterior horn meniscal tears.

Fig 15. Final subcutaneous closure of external wound (arrow).

Table 1. Advantages and Disadvantages of Modified Outside-in Repair Technique

Advantages
Simple and reproducible
Inexpensive
Anatomic reduction possible
Multiple stitches can be placed
Disadvantages
Special instruments (e.g., Knee Scorpion) needed
Accessory low AL portal

AL, anterolateral.

Our technique, which is a modified outside-in repair method, is indicated for chronic retracted, unstable bucket-handle anterior horn lateral meniscal tears. In this technique, we use the same 18-gauge spinal needle to take the first bite percutaneously in the capsule and we then retrieve the FiberWire from the low AL portal. This FiberWire from the low AL portal is now loaded on an all-inside meniscal repair device such as the Knee Scorpion to take a bite of the retracted meniscal tissue. This meniscal bite is not possible with the conventional outside-in method because the tissue is retracted and unstable. Thereafter, we use the same 18-gauge spinal needle with an Ethilon loop to retrieve the FiberWire from the meniscus through the capsule to form a vertical stitch configuration. Because an additional step has been added to the existing conventional outside-in repair by using an all-inside meniscal repair device, we call this a modified outside-in repair technique. The advantages of the technique are that it is simple and inexpensive, multiple stitches can be placed, and sequential reduction of the meniscus from posterior to anterior is possible. So, there is less chance of retear and complete meniscocapsular repair is possible. A disadvantage is that we need to use a specialized all-inside meniscal repair instrument, such as the Knee Scorpion device, to create the accessory portals (Table 1).

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