Technical Note

Simplified Technique for Arthroscopic Repair of the Meniscus Root Tear of the Knee

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Abstract: This report describes the arthroscopic transtibial pullout repair technique using multiple simple stitch (MSS), which was used to treat a medial meniscus posterior root tear (MMPRT) of the knee. The most commonly used technique to address this type of MMPRT is currently arthroscopic transtibial pullout repair. MSS pullout repair technique can provide excellent pullout strength and large tissue-bone contact area, which facilitates successful healing potential. This MSS pullout repair technique may be suggested as another useful option that can be used in the treatment of MMPRT.

The medial meniscus posterior root (MMPR) is important for absorption of hoop stress by the meniscus and prevention of meniscus extrusion.[1,2] After MMPRT, tibiofemoral contact pressure is significantly increased due to altered knee joint kinematics. MMPRT typically results in loss of hoop tension and exposure of cartilage, which results in meniscus extrusion, narrowing of the knee joint space, and rapidly progressed knee arthritis.[1,3-5] The standard treatment for MMPRT was meniscectomy in the past, but various repair methods have continued to be developed, and treatment strategies have continued to evolve accordingly.

Arthroscopic transtibial pullout repair is currently the most commonly used method used to treat MMPRT. Among the sutures needed to complete this approach, simple sutures, horizontal mattress sutures, or modified Mason-Allen sutures can be used. Of these, the modified Mason-Allen suture has displayed the best pullout strength in open rotator cuff repairs.[6-9] However, the use of appropriate suture configurations in arthroscopic MMPR repair surgery is challenging and requires management of instruments such as suture hooks within the small space provided by the knee with intact ligaments. Therefore, successful repairs require not only that the sutures have a high degree of pullout strength but that the procedures themselves are relatively simple and provide large tissue-bone contact areas. Through consideration of recent trends in MMPR repair, we describe an arthroscopic pullout repair technique that uses multiple simple stitch (MSS) to repair MMPRT.

Surgical Technique

Standard anterolateral and anteromedial (AM) portals are created and routine arthroscopy is performed. The MMPR can be difficult to thoroughly inspect arthroscopically; hence, whether the root can be repaired must be confirmed by direct visualization and tactile probing. This ensures that the tissue remaining is of adequate quality with minimal retraction of the meniscus. Next, the synovial and fibrous tissues surrounding the posterior cruciate ligament and the tibial insertion site are arranged using a motorized shaver and a radiofrequency device because adequate space must be made for the use of a curved suture hook (Linvatec). For this procedure, it is critical to prepare a broad tibial insertion site within the bleeding bone bed. In order for the MMPR to be placed in an anatomic position, bone bed preparation must be performed around the area of the MMPRT insertion and in the area of the shiny white fiber distal to the posterior root attachment fibers of the medial meniscus posterior horn.

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A curved curette is inserted through the AM portal, and the insertion area of the MMPRT is thoroughly prepared. The suture hook is loaded with a nonabsorbable polyamide monofilament surgical suture, No. 0 Dafilon (B. Braun Surgical, S.A.). The sharp tip of the suture hook penetrates medial meniscus from the femoral to the tibial surface in the vertical direction. A distance of at least 3 mm from the meniscal tear site is used to avoid the need to cut sutures through the meniscal tissue (Fig 1A). Once the leading limb of the No. 0 Dafilon is sufficiently placed into the joint, the suture hook is withdrawn from the meniscus. A suture retriever is inserted through the AM portal to retrieve the leading limb of the suture. Finally, both ends of the sutures are removed using the AM portal. Next, an extra portal is made on the medial side of the AM portal, and sutures from the AM portal are redirected through the extra portal using a suture retriever. This procedure is repeated in an identical manner for 4 to 7 simple loop stitches (Fig 1B). All sutures are placed as widely as possible through the meniscus, the red-red zone, and the meniscocapsular junction of the medial meniscus posterior horn.

A 3-cm vertical incision is made in the anteromedial aspect of the proximal tibia, the commercial tibial tunnel anterior cruciate ligament guide is set to 45°, and the intra-articular exit point of the guide pin is directed to the lateral corner of the shiny white fibers of the medial meniscus (Figs 1C). The exit point is over-reamed with a cannulated reamer (2.9 mm) to facilitate the passage of multiple sutures, the cannulated reamer is temporarily fixed, and finally, the reamer is used to maneuver the looped wire into the intra-articular space through the tibial tunnel (Fig 1D). After the looped wire is inserted through the 2.9-mm cannulated reamer, it is retrieved through the AM portal. The looped wire is

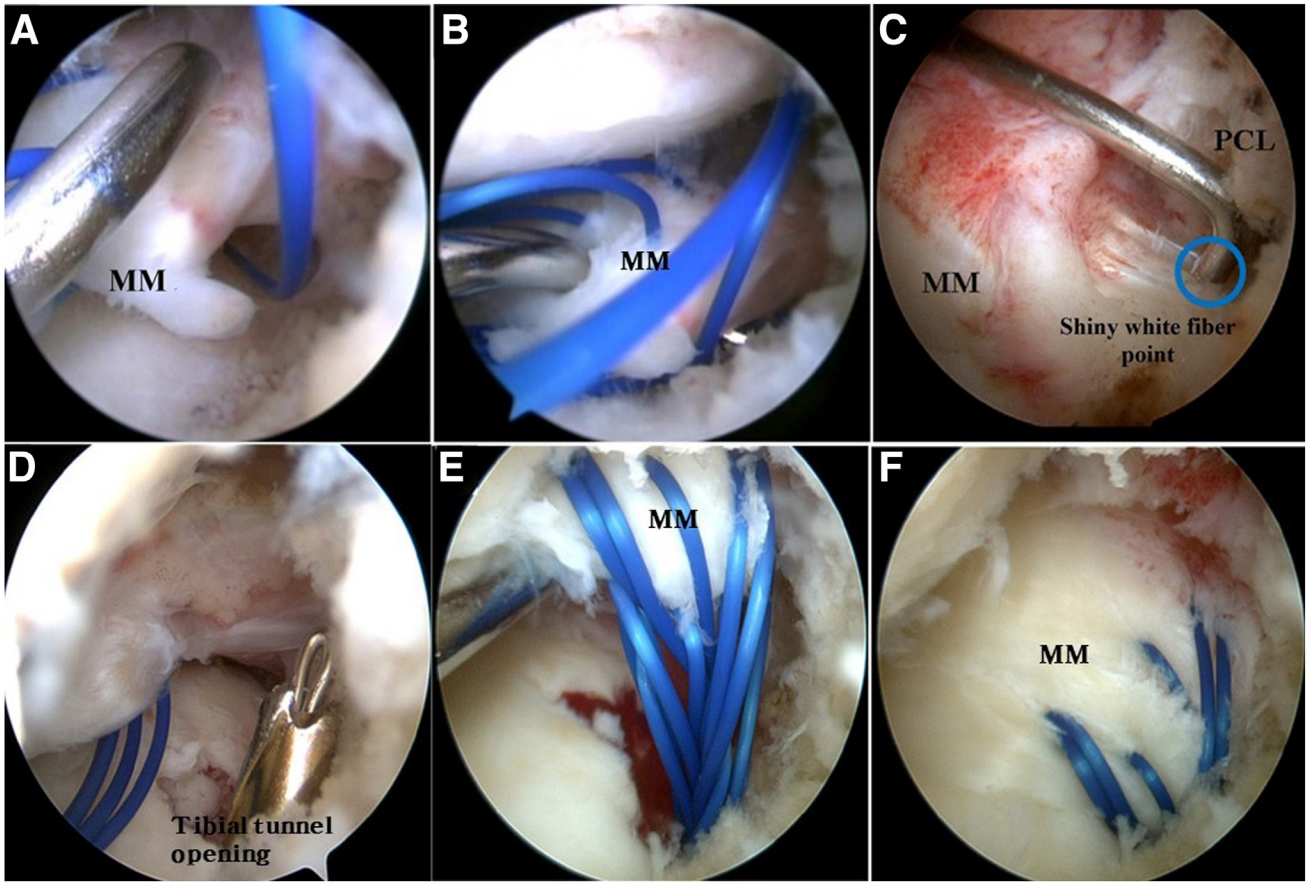

Fig 1. A multiple simple suture procedure is shown. A distance of at least 3 mm from the meniscal tear site is used to avoid the need to cut sutures through the meniscal tissue (A). This procedure is repeated in an identical manner for 4 to 7 simple loop stitches (B). The intra-articular exit point of the guide pin is directed to the lateral corner of the shiny white fibers of the medial meniscus (C). The reamer is used to maneuver the looped wire into the intra-articular space through the tibial tunnel (D). The looped wire is used to pull the multiple sutures from the extra portal of the tibial tunnel (E). Using adequate tension to pull the ends of the sutures through the tibial tunnel in this manner facilitated the reduction and stabilization of the meniscus (F). The patient is positioned supine, and the operative proximal thigh is fixed in a leg holder. With 90° of knee flexion and by use of leg-drop position. Viewing from the anterolateral portal of the left knee.

used to pull the multiple sutures from the extra portal of the tibial tunnel (Fig 1E). Using adequate tension to pull the ends of the sutures through the tibial tunnel in this manner facilitates the reduction and stabilization of the meniscus (Fig 1F). Extracortical fixation is performed by tying the sutures over a 15-mm suture washer (Smith & Nephew). Finally, careful examination of the meniscus confirms that the torn posterior root is firmly reattached at the end of surgery (Video 1).

Postoperative Protocol

For the first 2 weeks following surgery, the knee is immobilized using a full-extension brace. Isometric exercises are initiated 1 day after surgery. For the first 6 weeks after surgery, partial weightbearing with the aid of a crutch is allowed. For the 8 weeks following surgery, the patient progressively works toward the goal of bearing full weight. Neither squatting nor deep flexion is allowed for a minimum of 3 months after surgery. Return to normal activities, including sports, is allowed after 6 months.

Discussion

Various treatment options are available for managing MMPRT, but because root repair restores the functioning of joint biomechanics, every effort should be made to repair root tears. A number of technical matters need to be considered. In our technique, multiple

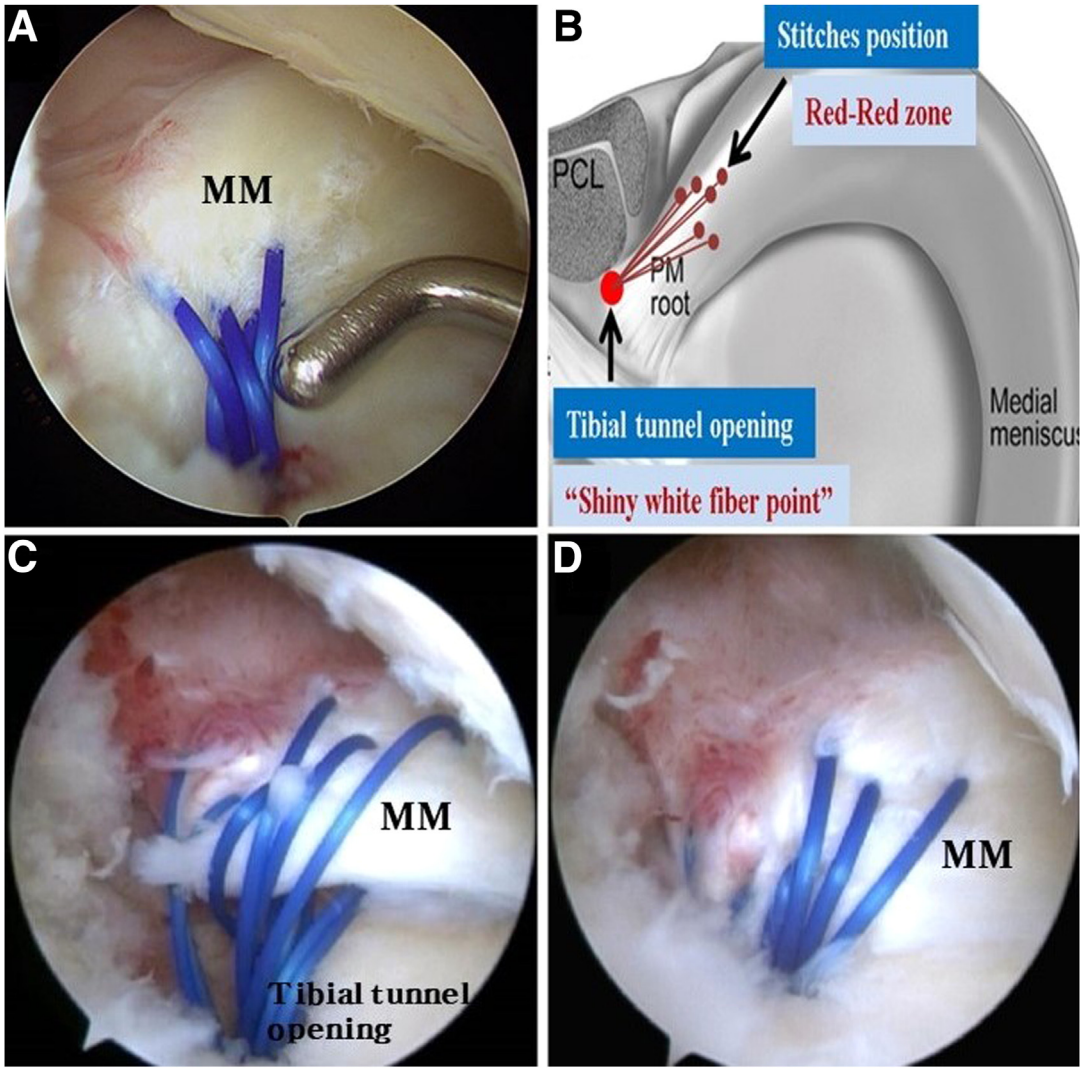

Fig 2. Technical considerations when determining the intra-articular exit point of the guide pin. (A) The tibia tunnel position shown is more anteromedial than the normal footprint, and the meniscus is reduced and stabilized in an awkward position. (B) We recommend that as many multiple sutures as possible be placed through the red-red zone and that the intra-articular exit point of the guide pin be directed to the distolateral corner of the shiny white fiber to the greatest degree possible. (C, D) The meniscus is reduced and stabilized. The patient is positioned supine, and the operative proximal thigh is fixed in a leg holder. With 90° of knee flexion and by use of leg-drop position. Viewing from the anterolateral portal of the left knee.

Table 1. Advantages and Disadvantages of the Novel Medial Meniscus Posterior Root Tear Repair Technique

Advantages
Standard arthroscopic setup and portals and relative simplicity of technique
Pullout strength greater than that of the modified Mason-Allen stitch
Firm and wide contact surface reattachment of the meniscus after multiple pullout suture repair
Disadvantages
May need to release part of medial collateral ligament in the tight medial joint compartment

sutures are made through the red-red zone and the meniscocapsular junction of the medial meniscus posterior horn. We recommend using a flexible material for sutures. Nonabsorbable monofilament threads (Dafilon No. 1) are ideal for this technique because the threads have a smooth surface that allows for easy passage through tissue. Further, these threads provide good flexibility to maneuver around obstructions after leaving the suture hook.

We have, albeit rarely, observed incorrect tibial insertions. Typically, in these cases, the anterior and medial sides of the meniscus have been reduced, which has led to awkwardly positioned stabilization (Fig 2A). Placing the horn attachment 3 mm medially decreased the tension at the horn attachment by 49% to 73%. Generally, we recommend that the intra-articular exit point of the guide pin should be directed to the disto-lateral corner of the shiny white fiber area (Fig 2B) to the greatest extent possible and that it be overreamed with a cannulated reamer (2.9 mm) to allow for the placement of multiple sutures.[10] Use of the procedure has increased the likelihood of achieving increased tension (Fig 2 C and D).

Our technique provides several potential advantages over techniques currently used. First, we believe that this multiple pullout suture technique (4-7 stitches) can create a stronger hold than the modified Mason-Allen stitch, which uses just 3 simple stitches (2 strands of suture). Gerber et al.[11] showed that the modified Mason-Allen stitch had almost double the ultimate strength of simple sutures. Due to the use of multiple, widely placed stitches, we have been able to achieve firm, wide contact surface reattachment using our new method. Second, our technique is not as constrained by its requirement of a fixed number of stitches or the position of stitches and has a higher degree of tolerance for error than does the modified Mason-Allen suture. In fact, if 1 or 2 stiches fail, it is not a serious problem. Third, our technique minimizes further damage because it avoids passing a suture shuttle device multiple times through already damaged tissue of the meniscal root. This minimizes damage at the meniscus-suture interface, which is an important advantage (Tables 1 and 2). Researchers who used a porcine model to assess transtibial pullout repair reported that suture cutout from the meniscus contributes significantly to displacement.[3]

Table 2. Pearls and Pitfalls

Pearls
The insertion area of the MMPRT is thoroughly prepared until bleeding healthy bone is observed.
The intra-articular guide pin is directed to the shiny white fiber point.
Pitfalls
Failure to repair the meniscal root in an anatomic position can lead to unfavorable results.
There is not enough medial joint compartment working space.

MMPRT, meniscus posterior root tear.

In a recent current concepts review,[12] root repairs have been reported to improve clinical outcomes, decrease meniscal extrusion, and slow the onset of degenerative changes. An all-inside meniscal suture method and the transtibial pullout repair method were most commonly used, and it was found that there was no significant difference in the results of the 2 methods.[13,14]

Last, some limitations should be mentioned for our technique. For making the tibial tunnel, the intra-articular exit point of the guide pin was directed to the lateral corner of the shiny white fibers of the medial meniscus. However, we do not know the exact point proven by biomechanical studies. Furthermore, there are technical difficulties associated with guiding an aiming device.

In summary, our results suggest that this multiple simple suture repair technique is a reliable and useful treatment for medial meniscus posterior root tears.

Disclosures

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