A modified pull-out suture technique for root tear of the medial meniscus posterior horn using a posteromedial portal that provides a safe and easy handling of the suture hook. It may reduce the possibility of additional a chondral or meniscal injury. In addition, it can produce the accurate repair of root tear of the medial meniscus posterior horn easily and reduce operation time.

**Key words:** Root tear of posterior horn, Medial meniscus, Modified pull-out suture.
anteromedial cortex of the proximal tibia after a 2-cm vertical incision was made.

The entry point of tibial anteromedial cortex aimed midportion of tibial shaft near 2 to 3 cm anterior portion from medial collateral ligament insertion. A guide pin was drilled from the anteromedial cortex of proximal tibia to the insertion site of the posterior root tear site of the medial meniscus through the sleeve (Fig. 2). A tibial tunnel was made from the anteromedial cortex of the proximal tibia to the footprint of the posterior root of the medial meniscus by use of a guide pin with a 6 mm reamer (Linvatec). While visualizing from anterolateral portal, a crescent-shaped suture hook (Linvatec) loaded with a No. 0

Fig. 1. Arthroscopic photograph shows the complete root tear of the posterior horn of the MM through anterolateral portal of the right knee, which was displaced completely by a probe inserted through the anteromedial portal. MM: medial meniscus, MFC: medial femoral condyle.

Fig. 2. Under visualization through the anterolateral portal, the anterior cruciate ligament tibial drilling guide was introduced through the posteromedial portal. The sleeve of the guide was fixed on the anteromedial cortex of the proximal tibia after a 2-cm vertical incision was made. A guide pin was drilled from the anteromedial cortex of the proximal tibia to the insertion site of the posterior root tear site of the medial meniscus through the sleeve.

Fig. 3. This arthroscopic photograph shows the sharp tip of the crescent-shaped suture hook penetrating the detached root portion of the MM posterior horn from the femoral surface to the tibial surface in a vertical direction. After one end of the strands of the PDS was advanced through the suture hook, it was retrieved out through transtibial tunnel with already inserted grasper at the same time. MM: medial meniscus, MFC: medial femoral condyle, MTC: medial tibial condyle, G: grasper.

Fig. 4. Arthroscopic photograph from the anterolateral portal shows reattachment of the posterior root of the medial meniscus to the tibial tunnel site in adequate tension. MM: medial meniscus.
PDS (Ethicon, Somerville, NJ, USA) suture material was inserted through the posteromedial portal. The detached root portion of the medial meniscus posterior horn was penetrated by the sharp tip of the crescent-shaped suture hook from the femoral surface to the tibial surface of the meniscus in a vertical direction. Then No 0 PDS suture was advanced through the suture hook. After passing some of the total length of the PDS, already inserted grasper, it was advanced into the intra-articular space through the tibial tunnel, retrieved out one end of the strands of the PDS through tibial tunnel at the same time (Fig. 3). Such simultaneous procedure can save operation time. Then the suture hook was upward withdrawn. Then, the other ends of the PDS strands were retrieved through a tibial tunnel with a grasper again. In this manner, additional 1 PDS suture material was sutured through the posterior horn of the medial meniscus out into the tibial tunnel with grasper. By pulling the ends of the suture materials under adequate tension, the posterior root of the medial meniscus could be reduced and stabilized with adequate tension (Fig. 4). Under adequate reduction and tension, the PDS suture materials were post-tied to and fixed with a 6.5 mm cancellous bone screw and smooth washer on the anterior cortex of the tibia.

1. Postoperative Management

After surgery, a cylinder leg splint was applied for 2 weeks with the leg in a fully extended position and a limited-motion brace was subsequently applied to control motion. Postoperatively, patients were non-weight bearing on crutches for 6 weeks. Patients were introduced to perform quadriceps muscle exercise, as well as straight-leg raise exercises several times daily. Patients were allowed active motion of up to 90° after the first 4 weeks. Then, patients were allowed to gradually increased flexion degrees up to 135°. Full flexion and squatting were allowed 3 months after the surgery. Patients returned to exercise after 6 months postoperative. We performed 13 cases (65% in total 20 cases) of second look arthroscopy and screw removal. We checked well healed repaired site and improved patient’s symptoms.

Discussion

Bin et al.9 examined 345 consecutive knee arthroscopies performed to treat a medial meniscus tear and found that 28% of all medial meniscal tears involved the posterior attachment site. Of those for which magnetic resonance imaging (MRI) scans were available, meniscal extrusion was present in 79% of patients with complete medial meniscal root tears, in 64% with partial medial meniscal root tears, and in 50% with a degenerative medial meniscal root.

The patient may feel a click or have a sensation of giving way, associated with medial joint pain. Physical examination findings usually consist of tenderness at the medial joint line, a minor effusion, and slightly diminished knee flexion3. The McMurray test is positive for pain with varus stress, but this does not create mechanical click. Meniscal extrusion on MRI scan, defined as >3 mm measured from the outer margin of the meniscus to the outer articular margin of the medial tibial plateau on mid coronal MRI scans4 is an important secondary sign that there may be pathology at the meniscal root origin.

In the past, some authors treated posterior horn meniscus root tear using a partial meniscectomy. However, it has been recognized that while some of these patients do well, many patients continue to have knee pain with weight-bearing activities and are dissatisfied with the outcome of this procedure. Partial meniscectomy does not restore the normal biomechanical function of the meniscus. It is believed that a medial meniscus root tear should be repaired to recover hoop tension, even though the posterior horn attachment of the meniscus is covered with vascular synovial tissue and appears to have a good blood supply3.

Surgical options include partial meniscectomy, meniscal repair, and meniscal transplantation. Repair is a reasonable option in acute and subacute cases or in chronic cases in which there is little or no articular cartilage disease and good preservation of healthy meniscal tissue. Several techniques have been reported in the literature, Raustol et al.5 used a long pin and sutures passed through a posteromedial accessory arthroscopy portal in a transosseous fashion. Recently, Griffith et al.7 described a technique that combines an arthroscopic approach to repair the medial meniscal root to a decorticated footprint via suture tunnels over a bone bridge. Ahn et al.6 reported pull out suture using a posterior trans-septal portal.

We used all-arthroscopic modified pull-out suture technique in an attempt to restore the attachment. Benefits of this technique are simple, less invasive, and reduced operation time by simultaneous suture with a hook via posteromedial portal and pulling of the string with a grasper. Our indications of this technique were patients with Outerbridge 1-2 arthritic change and minimal varus axis change.

We think that this procedure is very simple and less invasive. This technique minimizes iatrogenic injury to the cartilage and saves operation time.
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