Arthroscopic Medial Meniscus Root Repair With Soft Suture Anchor Without Posterior Portal Technique

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Abstract: Medial meniscal root injury is known to cause an increase in tibiofemoral contact pressure and results in early osteoarthritis. There have been many reports on meniscal root repairing techniques, which can be categorized into 2 groups. One is transosseous suture, and the other is anchor suture repair. Both techniques show improvement in not only clinical performance, but also radiographic finding. However, the meniscal root repair procedure must be performed by experienced physicians. Most techniques require a posteromedial portal, which takes time and may even complicate the procedure. The technique proposed in this study provides a simple procedure in which no posteromedial portal is required and a soft anchor suture, a commonly used suture in glenolabral repair, is used. The use of this suture, instead of the conventional anchor suture, is believed to lessen possible injury to the cartilage and results in easier revision surgery.

It has been increasingly recognized that menisci, crescent-shaped fibrocartilaginous structures, provide tibiofemoral joint congruity, stabilization, shock absorption, and possibly proprioception, which are essential for joint preservation. The root of the menisci are the key to stabilizing and maintaining meniscal hoop tension. Biomechanical studies have shown better femorotibial contact force following meniscal root repair compared with that after meniscectomy. Recently, there have been many published meniscus root repair techniques, which can be categorized into 2 groups: transosseous suture and suture anchor repair. The latter is advantageous for its ability to lessen the chance of or avoid causing tibial bone tunnels, which interfere with the concomitant ligament reconstruction and distal fixation, which in turn leads to abrasion and places sutures at risk of failure. However, there are many techniques requiring a posteromedial portal in an attempt to assist meniscal root repair and resulting in a more complex procedure. The anchor suture, a small and low-profile suture, is believed to lessen the risk of cartilage injury. The JuggerKnot 1.4-mm anchor (Biomet Sports Medicine, Warsaw, IN) is a low-profile soft anchor, but it has a high pullout strength in biomechanical testing. There has been a previous report of lateral meniscal root repair with this soft anchor suture. We herein propose a technique with this soft anchor, without a posteromedial portal, in order to facilitate the medial meniscus root repair procedure.
Surgical Technique

Once anaesthetized, the patient is placed in the supine position with the surgeon sitting ipsilaterally. The patient’s affected leg is held away from the operating table and positioned on the surgeon’s thighs. The affected knee is then positioned into 90° angulation, which will facilitate the manipulation by the surgeon and his/her assistant. Unless clinically contraindicated, a tourniquet is applied proximal to the knee. General arthroscopic examination is routinely carried out via anterolateral and anteromedial portals.

To assess the medial meniscus root tear (Fig 1), we place the patient’s knee into the semiextended valgus position by placing the patient’s foot on the surgeon’s contralateral hip and with a valgus force applied by a second surgeon (Fig 2) in order to open the knee joint medial compartment. From the anteromedial portal, we use passing suture material, carried by a FIRSTPASS suture passer (Smith & Nephew), to suture the torn meniscus. When the suture passer reaches the meniscal root, it is rotated obliquely to avoid cartilage injury and the meniscal root is sutured. After suturing the meniscal root, the mobility and tension of the torn meniscal root are checked by pulling the suture and checking the location of the anatomical footprint of the torn meniscal root to locate the anchor placement location (Fig 3). The far anteromedial portal, which is located 2 to 3 cm medial to anteromedial portal, is opened for insertion of the guide sleeve (Fig 4). There are 2 purposes for opening this portal. First, through the temporary guided-needle arthroscopic view, we are able to create the best position for the drill sleeve to be placed on the anatomic footprint of the meniscal root (Fig 5). Second, this portal allows the surgeon to release some parts of deep medial collateral ligament with the needle pie-crusting technique by applying gentle valgus force and using an 18-gauge needle to puncture through it in order to open the medial joint compartment, in case it was too tight. After creating the far anteromedial portal, a 1.4 mm diameter flexible drill bit (Biomet Sports Medicine, Warsaw, IN) is used to create a pilot hole, following the curved guide sleeve (Fig 6) through this portal. A JuggerKnot 1.4 anchor is inserted into the hole through this guide sleeve. We connected each strand of the previous passing suture and the anchor suture together and then shuttled them through the torn meniscus from the inferior to superior aspect with the shuttle relay technique through the anteromedial portal. A knot is pushed down under adequate tension (Fig 7, Video 1).

Postoperative Protocol

The patient was put on a motion control knee brace with 0° to 30° flexion to prevent excessive femoral rollback. After 6 weeks, incremental 15° flexion was applied weekly until full range of motion was achieved. Close-chain quadriceps exercise was initiated on the first postoperative day. An ambulatory program was
introduced, starting from toe-touch non-weight bearing to full weight bearing after 6 to 8 weeks. Low-impact activities were allowed at 4 months, and full sport activities resumed at 6 months postoperatively.

Advantages/disadvantages and pearls/pitfalls of the procedure are further described in Tables 1 and 2.

Discussion

The meniscus provides tibiofemoral joint congruity, stabilization, and shock absorption. Injury to the meniscal root usually increases the tibiofemoral contact pressure and leads to early osteoarthritic change. The biomechanical study by Allaire et al. revealed that the outcome from the medial meniscal root tear is similar to that of total meniscectomy. A cadaveric study by Marzo and Gurske-DePerio also reported similar findings. The comparison study between partial meniscectomy and fixation of meniscal root by Chung et al. showed that the latter group significantly lowered the rate of conversion to total knee arthroplasty. Therefore, in the circumstance that no significant arthritis change is detected, meniscal root repair is recommended.

Meniscal root repair can be divided into transosseous suture and suture anchor repair. The latter technique has many advantages over the former one. Suture anchor repair lessens the chances of tibial bone tunnels formation, which subsequently interferes with concomitant ligament reconstruction. It also minimize the need for distal fixation, which often places sutures at risk of failure due to abrasion. Comparing the 2 techniques, according to the biomechanical study by Feucht et al., a lower displacement after 100, 500, and 1,000 cycles (P < .001) and a higher stiffness (P = .016) was noted in the suture anchor group. The maximum load did not differ significantly between these 2 techniques. In terms of clinical comparison, the study by Kim et al. compared arthroscopic suture anchor repair of the posterior root of medial meniscus tears with pullout suture repair. The results revealed a significant functional improvement in both groups after 2 years; however, no statistically significant difference was detected between them.

The biomechanical study by Starke et al. reported that the highest mean tension (60.1 ± 20.2 N) in the
repaired medial meniscal root was generated by applying 500-N load on internal rotation and 90° of knee flexion. Regarding the study by Barber et al.,13 the mean pullout force of the JuggerKnot anchor in rotator cuff and glenoid anchor was 239.1 ± 30.2 N. The JuggerKnot anchor can create a pullout strength higher than the mean highest tension achieved from the repaired medial meniscal root. We consider JuggerKnot a suitable implant for repairing the meniscal root. Moreover, there was also a previous report by Prasathaporn et al.12 that demonstrated a favorable result upon the use of soft anchor suture only in patients with lateral meniscal root tear and concomitant anterior cruciate injury. However, the technique proposed here is suitable for all medial meniscal root injuries. Medial meniscal root tear increases the femorotibial contact pressure similar to complete meniscectomy, which leads to early osteoarthritis change. Medial meniscal root repair provides a better hoop tension and hence better results compared with meniscectomy. This technique simplifies the procedure and shortens the operative time. The use of this small and low-profile soft anchor suture also may enable easier revision surgery. Therefore, we recommend this technique using the soft suture anchor without posterior portal for arthroscopic repair of medial meniscal root injury.

### Table 2. Pearls and Pitfalls

| Pearls |
|--------|
| Semixtended knee positioning with assistant controlling the valgus force in order to open the medial joint compartment. |
| Rotating the suture passer obliquely before suturing the torn meniscus. |
| Creating a far anteromedial portal with needle guided under arthroscopic view to create the best position for placing the drill sleeve. |
| Using a needle pie-crusting technique to release some part of the medial collateral ligament in the tight medial compartment knee. Curved guide drill sleeve should be used to place more vertical soft anchor suture. |

| Pitfalls |
|---------|
| Not enough medial joint compartment working space. |
| Not rotating the suture passer when reaching the meniscal root, which limits passing the suture material. |
| Placing the drill sleeve too horizontally. |

### Table 1. Advantages and Disadvantage

| Advantages |
|------------|
| No need to create posteromedial portal, which reduces operative time. |
| Familiar approach through anteromedial and anterolateral portal. |
| Less risk of chondral injury due to low-profile anchor suture. |

| Disadvantage |
|--------------|
| May need to release part of medial collateral ligament in the tight medial joint compartment. |

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