Technical Note

Meniscotibial Ligament Repair of a Ramp Lesion of the Posterior Horn of the Medial Meniscus

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Abstract: The ramp area, which is the junction between the posterior horn of the medial meniscus and the synovium, prevents anterior knee translation, transmits and distributes load, and assumes some rotational stability. Ramp lesions occur in approximately 9% to 15% of patients with anterior cruciate ligament tears. We describe an all-inside repair technique with suture for a meniscotibial ligament tear—type ramp lesion of the posterior horn of the medial meniscus.

Tears of the posterior horn of the medial meniscus (PHMM) are commonly associated with anterior cruciate ligament (ACL) injuries. There are specific medial meniscal lesions that consist of meniscosynovial or meniscocapsular tears, which are difficult to differentiate from the anterior compartment arthroscopically and to recognize on magnetic resonance imaging.[1] Strobel,[2] who first described these lesions in the 1980s, called them "ramp" lesions. Liu et al.[3] proposed defining tears of the peripheral attachment of the PHMM with a length less than 2.5 cm as ramp lesions. Sonnery-Cottet et al.[4] defined ramp lesions as posterior meniscocapsular junction tears. In 2016, Thaunat et al.[5] classified ramp lesions into 5 types. However, we encountered a ramp lesion not considered in the Thaunat classification; thus, we identified it as a meniscotibial ligament tear (MTLT)—type ramp lesion. This article describes an all-inside suture repair technique with a suture hook that has provided satisfactory outcomes in our practice.

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Surgical Technique

Our surgical technique is illustrated in Video 1. Figure 1 depicts the ACL rupture (Fig 1A) and ramp lesion (Fig 1B) as identified on magnetic resonance imaging. Surgery is performed with the patient under general anesthesia, and a pneumatic tourniquet is applied at the thigh base. The patient is in the supine position on the operating table. After skin disinfection, a sterile waterproof sheet is laid. The conventional anterolateral approach in the knee joint is used as the observation portal, and exploration of the knee joint is performed with a 30° arthroscope. An anteromedial portal is created for further exploration of the knee joint with a probe and for ACL reconstruction. Then, the affected knee is naturally flexed to approximately 90° (Fig 2 A and B). An arthroscope is inserted from the anterolateral portal through the intercondylar notch between the medial femoral condyle and the posterior cruciate ligament into the posteromedial compartment. Located by a spinal needle, a posteromedial approach is established behind the medial femoral condyle just above the medial meniscus with an outside-in technique (Fig 2C). The medial meniscal tear is subsequently evaluated by inserting an arthroscopic probe through the posteromedial portal (Fig 3A). The arthroscope is inserted through the posteromedial portal to observe the MTLT-type ramp lesion. The tibial plateau cartilage is exposed because of the MTLT. There is no meniscal tissue behind the tear (Fig 3B). To acquire optimal surgical visualization, the observation portal can be switched to the anterolateral or posteromedial portal as needed.

The posteromedial portal is used for instrument manipulation. We use a meniscal rasp to refresh the rim of the meniscal tear. Then, a 45° suture hook (Linvatec,

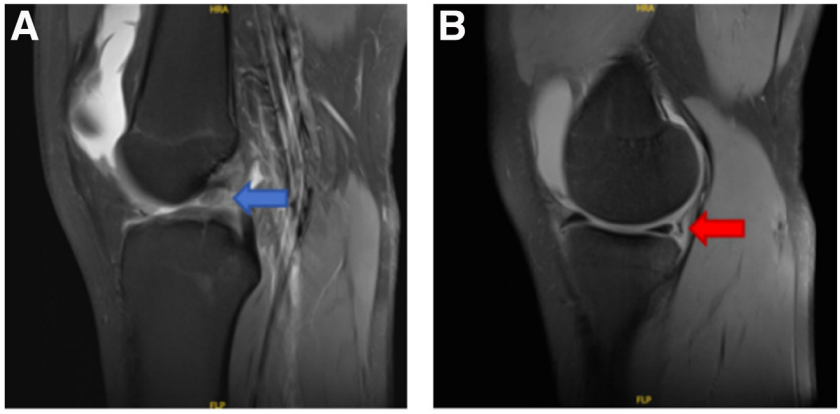

Fig 1. (A, B) Preoperative magnetic resonance imaging scans (sagittal slices) of 24-year-old male patient. The images reveal rupture of the anterior cruciate ligament (blue arrow) and a ramp lesion (red arrow) of the medial meniscus in the affected left knee.

Largo, FL) is passed through the meniscotibial ligament (MTL) and PHMM (Fig 4), and PDS II suture (DePuy Synthes, Raynham, MA) is introduced as a shuttle. Subsequently, a No. 1 Ethibond suture (Ethicon, Somerville, NJ) is introduced via PDS II suture. By use of a 5-mm smooth cannula (Linvatec), side-to-side repair is performed with a knot pusher. Two stitches are performed according to the tear size (Fig 3 C and D). Ramp lesions are associated with ACL tears, and simultaneous ACL reconstruction is performed when indicated.

Rehabilitation

The main goals in the early rehabilitation stage are to control pain and swelling and to protect the healing tissue. Patients must wear an adjustable knee brace for 8 weeks to achieve 90° of knee flexion at 4 weeks and 120° of knee flexion at 6 weeks. Patients are also encouraged to ideally progress to full weight bearing in 6 weeks. Deep squat exercises should be avoided for 3 months.

Discussion

The meniscus consists of fibrocartilage, which is tough and flexible. In contrast, the synovium and MTL are thin and soft connective tissue. The MTL shares a common attachment with the meniscocapsular ligament, which merges into the PHMM. The MTL runs at an oblique angle from the posterior tibia to its insertion proximal to the inferior edge of the PHMM. Furthermore, it attaches inferior to the superior margin of the posterior medial meniscus at a mean depth of 36.4% of the total posterior meniscal height. Its average length is 14.0 ± 5.4 mm.[6] Although no obvious boundary exists between the meniscus and MTL, the differences in stiffness and elasticity can still be assessed via an arthroscopic probe.

In the Thaunat classification, type 1 represents meniscocapsular lesions. These lesions are peripherally located in the synovial sheath, and mobility on probing is low. Type 2 represents partial superior lesions. These lesions are stable and can be diagnosed only with a transnotch approach. Mobility on probing is low. Type 3 represents partially inferior hidden lesions. These lesions are not visible with the transnotch approach but may be suspected when there is significant mobility on probing. Type 4 represents complete tears in the red-red zone. Mobility on probing is high. Type 5 represents double tears.

In MTLT-type ramp lesions, the synovial tissue tends to shift posteriorly and inferiorly when the knee is

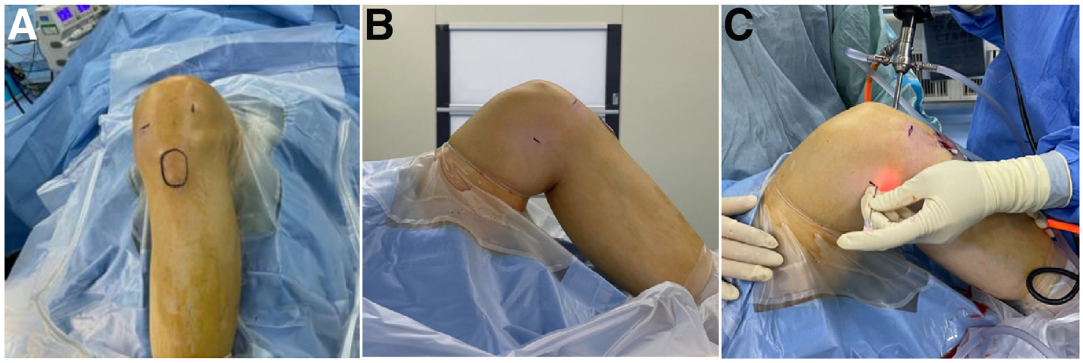

Fig 2. Patient positioning during operation with the left knee naturally flexed 90°. (A) Photograph taken from front of affected knee. The anterolateral approach and the anteromedial portal are marked. (B, C) Photographs taken from medial side of affected knee. The posteromedial approach is marked behind the medial femoral condyle just above the medial meniscus.

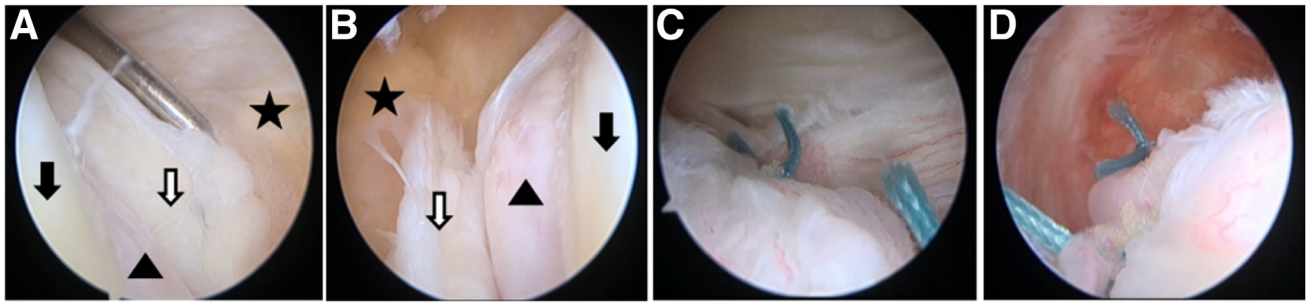

Fig 3. Surgical technique. (A) Intraoperative image taken with 30° arthroscope through anterolateral portal. The medial tibial plateau is visualized with an arthroscopic probe inserted through the posteromedial portal. The black arrow indicates the posterior horn of the medial meniscus; black star, posterior capsule; white arrow, torn meniscotibial ligament; and black triangle, tibial plateau cartilage. (B) Intraoperative image taken with 30° arthroscope through posteromedial portal. The tibial plateau cartilage (black triangle) is exposed because of the meniscotibial ligament tear (white arrow). There is no meniscal tissue behind the tear, which differs from a Thaunat type 4 ramp lesion. The black star indicates the posterior synovial tissue, and the black arrow indicates the posterior horn of the medial meniscus. (C, D) Intraoperative images of repaired meniscus taken with 30° arthroscope through anterolateral and posteromedial portals. The ramp lesion is repaired with No. 1 Ethibond sutures. The anterolateral approach is used as the observation approach in C, and the posteromedial approach is used as the observation approach in D.

flexed because of the MTLT, thereby exposing the tibial plateau cartilage. In addition, the smooth posterior edge of the medial meniscus can be evaluated during surgery, implying the presence of the MTL and synovial tissue but no meniscal tissue behind the tear. This finding differs in type 1 and 4 lesions as described by Thaunat et al.[5] (Fig 5).

In ACL reconstruction cases, the loss of stability of the PHMM often leads to greater stress on the graft,[4,7,8] as well as increased tibial internal rotation of the affected knee.[9] A missed diagnosis of an unstable MTLT-type ramp lesion and repair can lead to instability and pain after ACL reconstruction. The Thaunat classification is

Fig 4. Intraoperative manipulation and patient positioning during operation with affected left knee naturally flexed 90°. In this example, the anterolateral portal is the observation portal and the posteromedial portal is the operation portal for suture hook operations. The 45° right suture hook is passed from posterior to anterior through the capsule tissue and meniscotibial ligament.

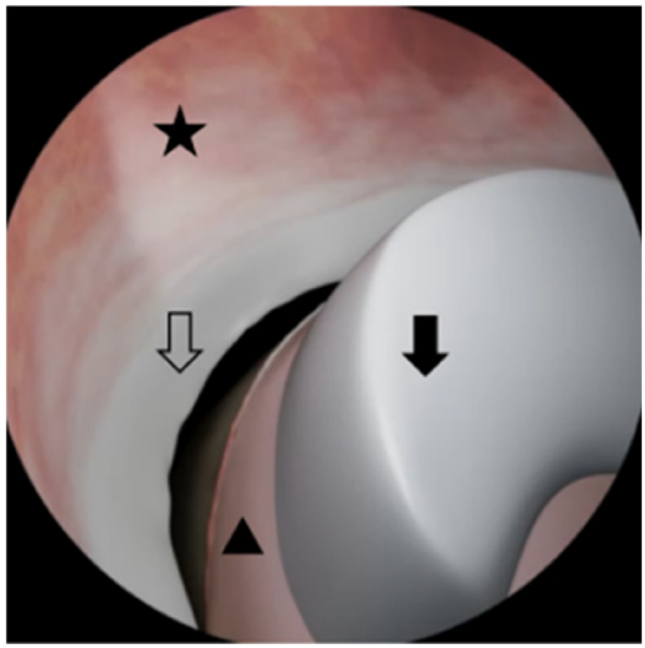

Fig 5. Diagram of meniscotibial ligament tear—type ramp lesion, clearly showing torn meniscotibial ligament (white arrow) and exposed tibial plateau cartilage (black triangle). The black star indicates the posterior synovial tissue, and the black arrow indicates the medial meniscus.

Table 1. Pearls and Pitfalls

Pearls
To obtain optimal visualization, the surgeon should convert the portals appropriately and use a 70° arthroscope if necessary.
The suture hook can be manipulated freely without a sheath, but a smooth thin sheath should be used when performing knot tying to avoid tangles.
The suture hook should be operated under arthroscopic vision to obtain a relatively anatomic meniscal repair.
A spinal needle should be used to help establish a posteromedial approach.
Pitfalls
The surgeon must handle the suture hook carefully to avoid involvement of other capsule tissues during suturing.
The surgeon should carefully establish a posteromedial portal to avoid vision obstruction and damage to nerves or blood vessels. Selection of a posteromedial approach that is too anterior can result in suture hook manipulation limited by the femoral condyle.

Table 2. Advantages and Disadvantages

Advantages
The technique has a lower cost.
Better stability is achieved.
Use of a posteromedial portal allows for easier suture hook manipulation.
The suture hook can anatomically connect the sagging tissues with the PHMM rather than overly tightening the posterior capsule to the PHMM.
Disadvantages
A longer surgery time is required.
There is a longer learning curve.
An additional posteromedial portal is needed.

PHMM, posterior horn of medial meniscus.

based on the stability of ramp lesions. Type 1 tears are usually considered stable, whereas type 4 tears, especially those more than 1.5 mm in size, are extremely unstable and must be repaired.[10]

We find that the MTLT-type ramp lesion is unstable because the posterior part of the tear tends to contract and sag. However, there is still no consensus about the treatment strategies for ramp lesions.[10-12] Ahn et al.[13] reported that unstable ramp lesions may be aggravated by knee flexion. Therefore, surgical repair should be performed even for red-zone meniscal injuries. In contrast, Liu et al.[3] reported that the clinical outcomes of stable ramp lesions treated by abrasion and trephination alone during ACL reconstruction were similar to those of lesions treated surgically. We have found that MTLT-type ramp lesions are unstable and prefer to repair them whenever they are detected.

At present, various meniscal repair techniques, including inside-out, outside-in, and all-inside techniques, are performed.[14] In ramp lesions deemed type 4 by the Thaunat classification, the tears are located on the meniscus and there is enough meniscal tissue behind the tears that can hold the repair implant. These lesions can be repaired with an all-inside repair stapler—a repair technique that requires fewer incisions and creates smaller iatrogenic defects.[15] However, in an MTLT-type ramp lesion, it is difficult to manipulate a stapler through the intercondylar notch. What is more, the posterior synovial tissue and MTL are soft and sagging. Thus, surgical repair with a meniscal stapler often fails.[16] If we penetrate the implant through and hold the posterior capsule, a nonanatomic repair will result. Furthermore, the fragile head of the meniscal stapler might lead to failure.[17] Thus, we prefer to repair this type of ramp lesion with the suture hook repair technique, which is relatively inexpensive and provides better stability. Besides, we recommend using the posteromedial portal for further observation and manipulation, which provides more safety,[18] better visibility, and enough space for meniscal repair. The pearls and pitfalls of our technique are shown in Table 1, and the advantages and disadvantages of our technique compared with previous techniques are shown in Table 2.

Therefore, we propose a complement to the original Thaunat classification of ramp lesions. Furthermore, we insist on performing the all-inside suture repair technique through the posteromedial portal with a suture hook for MTLT-type ramp lesions.

Disclosures

All authors (L.S., S.Y., T.J., H.S.) declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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