Meniscus Repair With Anterior Cord Release for Peripheral Tear Type of Discoid Lateral Meniscus

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Abstract: With improvement in arthroscopic techniques, partial meniscectomy with repair for symptomatic discoid lateral meniscus (DLM) has been the preferred treatment to restore meniscal function. It was reported that DLM exhibited deformation and extrusion shortly after saucerization with repair. Therefore it is desirable to minimize removal of the DLM. The anterior zone of the DLM is often tighter than that of the normal meniscus and anatomic variant. It is considered that the anterior and anterocentral dislocation types in the majority of symptomatic DLM can be related to both peripheral instability and anterior tightness. We present a technique that, first, the inside-out repair technique is applied from the posterior to middle segment of the DLM; next, the tension of the anterior zone during knee flexion–extension is confirmed to determine the released amount of that part; and, finally, all sutures are tied to reproduce the normal meniscus movement. Meniscus repair with anterior cord release without any meniscectomy could resolve peripheral instability of DLM and prevent degeneration of the articular cartilage.

The prevalence rate of discoid lateral meniscus (DLM) ranges from 0.4% to 17%. It is particularly common in the Asian population.1–4 The DLM is larger and thicker than the normal lateral meniscus and susceptible to damage and presents symptoms, such as pain, click, snapping, and locking. Recently, it has been reported that 38% to 88% of symptomatic DLMs exhibit peripheral instability. Especially, the anterior dislocation type is common and has poor prognosis; thus repair at the posterior meniscocapsular junction with saucerization has been recommended over meniscectomy.5,6 However, Matsuo et al.7 revealed that the DLM exhibited deformation and extrusion from 2 weeks to 6 months after a saucerization with repair and that the function of load transmission was not maintained appropriately. Another study reported that the thickness and width of the residual DLM decrease over time after partial meniscectomy and arthritic change in the knee progresses.8 Therefore it is desirable to minimize removal of the DLM. Peripheral instability extends from the popliteal hiatus, which is exposed to the greatest mechanical and shear stress in most cases because of the thickness of the DLM. Additionally, the anterior zone of the DLM is often tighter than that of the normal meniscus, and anatomic variants, such as cord-like anterior intermeniscus ligament, have been reported.9 Therefore this surgical technique aimed to reproduce the normal tension balance of DLM by initially resolving peripheral instability and then releasing anterior tightness without meniscectomy (Video 1).

Surgical Technique

Indications

The indication of this procedure is a diagnosis of DLM and the chief complaint of locking, including a block to extension. Patients indicated for surgery often have a history of locking and clear physical findings, such as McMurray and Thessaly tests. In some cases, the patient can reproduce the locking and snapping, and apprehension is positive in the McMurray test (Table 1). On sagittal magnetic resonance imaging, the signal change
in the meniscocapsular portion, effusion, and accompanying anterior movement in the posterior segment of DLM are identified (Fig 1).

**Surgical Approach**

The procedure was performed with the patient under general anesthesia in the supine position with a leg holder allowing full range of motion. Standard anteromedial and anterolateral portals were established, and diagnostic arthroscopy was performed. We identified the tear site and instability by careful probing and then observed the movement of the lateral meniscus during knee flexion–extension.

When the indication for this procedure was decided, a 3-cm skin incision was made just behind the fibular collateral ligament, and the popliteal retractor was inserted between the lateral gastrocnemius and posterior capsule (Fig 2). First, vertical divergent suturing was performed on the superior and inferior surfaces of the DLM from the posterior segment using suture with a Henning needle (Stryker Japan KK, Tokyo, Japan) (Fig 3). At this time, the suture was not tied but left so that the tension of suture could be subsequently adjusted. In case of instability in the midbody of the meniscus (anterior popliteal tendon), a far anteromedial portal was created and sutured in the same way without knot tying. Then, the iliotibial band around the exit of the needle was split in a line of fibers, exposing the joint capsule.

Once tension was applied to the suture at the posterolateral tear site of the meniscus, the posterior portion at the anterior horn of meniscus increased the tension. In the posterior part around the anterior horn of the DLM, an abnormally enlarged fibrous continuity was observed to be continuous with the anterior cruciate ligament, apart from the fiber with straight arrangement to the attachment on the tibia. From the anterolateral portal, the free end of the meniscus was gradually released by inserting a scalpel slowly, and tension was applied to the suture. When the

**Table 1. Indications and surgical steps of arthroscopic repair with anterior cord release of the discoid lateral meniscus**

| Indications                        | Surgical steps                                                                                                                                                                                                 |
|-----------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Locking knee with the DLM         | Routine arthroscopy is performed using the standard anterolateral and anteromedial portals, additional far anteromedial portal when suturing the middle segment of DLM. Locking, popping, and abnormal movement of DLM during knee flexion–extension are examined. Moreover, meniscus tear or peripheral instability are analyzed according to their location, type, and size. |
|                                   | The meniscus tear site and synovial junction are rasped. A 3-cm lateral skin incision is made just behind the fibular collateral ligament, and the popliteal retractor is inserted between the lateral gastrocnemius and posterior capsule. Inside-out suture is used for the posterior segment, and meniscus movement is observed with the sutures left untied. For the anterocentral dislocation type, the iliotibial band is split in a line of fibers and retracted for the exit of the needle. Inside-out suture is used for middle segment, and meniscus movement is observed with the sutures left untied. Finally, posterior thick and tight portion of the anterior horn of the DLM is released with use step by step. The degree of release is determined by observing meniscus movement while applying tension to the untied suture. Tension in each suture and meniscus movement is confirmed arthroscopically; then, the sutures are tied. |

**DLM. discoid lateral meniscus.**

Fig 1. (A) Coronal magnetic resonance imaging of left knee in a 9-year-old girl shows an incomplete-type discoid meniscus. (B) Sagittal magnetic resonance imaging shows an anterocentral shift-type discoid meniscus.
DLM was reduced posteriorly and laterally, the released part was opened, and a smooth line was drawn (Fig 4). It is confirmed that normal movement of the lateral meniscus during knee flexion–extension (posterior movement in flexion and anterior movement in extension) can be reproduced and that dislocation does not occur; then, a meniscus suture was tied (Fig 5).

Fig 2. (A) Left knee, lateral side. A 3-cm skin incision is made just behind the fibular collateral ligament (triangle). (B) The interval between the biceps femoris tendon and iliotibial band is incised (black arrow), and the retractor is inserted between the posterior capsule and lateral gastrocnemius (white arrow). The retractor should be positioned anterior to the gastrocnemius.

Fig 3. Left knee view from the anterolateral portal in a 14-year-old boy. (A) At first glance, it looks like a complete discoid lateral meniscus (DLM), but it is a peripheral tear of incomplete DLM. (B) Anterocentral dislocation at deep knee flexion. (C) A probe is inserted from the anteromedial portal to push the meniscus body posterolaterally. Then, we recognize that the anterior part of the meniscus is thicker and tighter than the normal meniscus (arrow, asterisk). (D) Initially, peripheral tears in the posterior segments are repaired with an inside-out technique using a Henning’s instrument (Stryker, Kalamazoo, MI) through the anteromedial portal. (E) A scalpel is inserted from the anterolateral portal to gradually release the anterior medial cord-like fiber. (F) The middle segment was sutured from the far anteromedial portal, and tension is applied to the suture to determine the degree of release and at tying the suture. The released stump opens (asterisk).
Postoperative Rehabilitation

After surgery, the knee was immobilized using a brace in full extension for 4 weeks. Partial weightbearing was allowed after 1 week, progressing to full weightbearing as tolerated for 2 weeks. Range of motion should focus on achieving 0° to 90° for the first 4 weeks and progressing to normal range of motion thereafter. Squatting was restricted for at least 3 months. Return to sports was allowed at 4 months, provided patients had achieved full range of motion, strength, and neuromuscular control.

Discussion

With improvement in arthroscopic techniques, partial meniscectomy with repair for symptomatic DLM has been the preferred treatment to restore meniscal function. The described technique was developed through the authors’ experiences in the treatment of...
symptomatic DLM with the anterior and anterocentral dislocation type. (1) In the second-look arthroscopic evaluation after saucerization with repair, articular cartilage damage progressed even after 1 year. (2) We tried to resolve peripheral instability by itself, but there was recurrence of locking after surgery. In the arthroscopic findings, we observed rupture of the suture site and greater tightness in the anterior zone of the DLM. Therefore it is considered that the anterior and anterocentral dislocation types of DLM can be related to both peripheral instability and anterior tightness of DLM.

A previous histologic study on collagen fibril texture of DLM showed that the femoral surface of the DLM is covered by dense and well-arranged thick fibrils. In the central layer, its medial zone shows thin, loosely, and irregularly arranged fibrils without bundle formation. Therefore, in the treatment of DLM, if meniscectomy is performed before repair, there is a problem that the stout femoral surface of the free edge could be disrupted and this vulnerable inner zone of DLM could be exposed. The surgeon will often encounter horizontal tears in the medial middle zone because of meniscectomy and thus may have removed more than the intended amount for resection. The collagen fibrils with straight arrangement in the radial direction in the anterior and posterior zones allow the meniscus to strongly attach to the tibia. However, it is occasionally observed that all these fibrils are not attached to the tibia, and the free edge behind the anterior horn of DLM is relatively thick, which is considered to be the anatomic variant of anterior tightness of DLM with anterior and anterocentral dislocation.

The described technique has several advantages (Table 2). The limitations are related to the Henning suture procedure. It is recommended to insert a popliteal retractor to protect the peroneal nerve and to suture anterior to the fibular collateral ligament through the far anteromedial portal. Additionally, this method is limited to DLM Ahn classification of anteroinferior dislocation and antero-central dislocation type. Careful anterior release is required for the amount of release because of individual differences. If the release is excessive, lateral meniscus extrusion or DLM tibial attachment damage may be a concern. Meniscus repair with anterior cord release without any meniscectomy could resolve peripheral instability of DLM and prevent the degeneration of the articular cartilage.

Table 2. Advantages, Limitations, Pearls, and Pitfalls

| Advantages | Pearls | Pitfalls |
|------------|--------|----------|
| This technique is able to preserve the meniscus as much as possible. | When suturing the middle segment, the sutures are inserted through the far anteromedial portal and tied anterior to the popliteus tendon. An assistant confirms that the suture needles do not penetrate the fibular collateral ligament. Iliotibial band should be split in a line of fibers. | Many sutures may become entangled because the anterior cord release is added at the end without the sutures tied. |
| This technique can reproduce proper meniscus movement and restore its normal hoop stresses. | Requires posterolateral incision. |

References
1. Kim JG, Han SW, Lee DH. Diagnosis and treatment of discoid meniscus. Knee Surg Relat Res 2016;28:255-262.
2. Jeon SW, Choi CH, Jung M, et al. The fate of the contralateral knee in patients with a lateral discoid meniscus. Arthroscopy 2019;35:500-506.
3. Ahn JH, Choi SH, Lee YS, et al. Symptomatic torn discoid lateral meniscus in adults. Knee Surg Traumatol Arthrosc 2011;19:158-164.
4. Ahn JH, Lee SH, Yoo JC, Lee HJ, Lee JS. Bilateral discoid lateral meniscus in knees: evaluation of the contralateral knee in patients with symptomatic discoid lateral meniscus. Arthroscopy 2010;26:1348-1356.
5. Ahn JH, Kim IK, Wang JH, Jeon JW, Cho YC, Lee SH. Long-term results of arthroscopic reshaping for symptomatic discoid lateral meniscus in children. Arthroscopy 2015;31:867-873.
6. Ahn JH, Lee YS, Ha HC, Shim JS, Lim KS. A novel magnetic resonance imaging classification of discoid lateral meniscus based on peripheral attachment. Am J Sports Med 2009;37:1564-1569.
7. Matsuo T, Kinugasa K, Sakata K, Ohori T, Mae T, Hamada M. Post-operative deformation and extrusion of the discoid lateral meniscus following a partial meniscectomy with repair. Knee Surg Traumatol Arthrosc 2017;25:390-396.
8. Lee CR, Bin SI, Kim JM, Kim NK. Magnetic resonance imaging findings in symptomatic patients after arthroscopic partial meniscectomy for torn discoid lateral meniscus. Arthroscopy 2016;32:2366-2372.
9. Ozcanli H, Keles N, Gocmen-Mas N, Ozenci AM, Aydin AT. Relation of discoid lateral meniscus and cord-like anterior intermeniscal ligament: morphological and clinical study. Surg Radiol Anat 2011;33:673-678.
10. Cui JH, Min BH. Collagenous fibril texture of the discoid lateral meniscus. Arthroscopy 2007;23:635-641.
11. Suzuki T. Arthroscopic meniscal sparing technique with release the cord-like anterior horn of discoid lateral meniscus. Bessatsu Seikeigeka 2020;77:200-205.