

The Inside-Out Technique of Deep Medial Collateral Ligament Release Could Provide Good Visualization during Knee Arthroscopy

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ABSTRACT

Introduction: During knee arthroscopy, clear vision of the intra-articular structures is essential. Two techniques have been described to improve visualization by releasing the medial collateral ligament (MCL). The outside-in technique continues to be the most popular, but saphenous nerve injury is one of the risk associated with this procedure. The inside-out techniques for releasing the deep MCL (dMCL) tend to be safer since the procedure is done under direct visualization through an anteromedial portal.

Methods: This study was a retrospective study of two years duration and included 22 patients who underwent the dMCL release using an inside-out technique during knee arthroscopy. The outcome variables are the opening of the medial joint space and the occurrence of complications such as neurovascular injury, residual pain, and valgus knee instability after the procedure.

Result: The result of the intra-operative measurement of the medial joint space opening after the procedure varies from 3mm to 7 mm (mean 4.04 ± 1.21). After the procedure, no patients in this study developed any complications.

Conclusion: The inside-out technique of dMCL release could provide good visualization and sufficient space for the medial compartment of the knee with minimal complications.

Keywords: Deep Medial Collateral Ligament; Release; Knee Arthroscopy

Introduction

The accurate visualization of the intra-articular structures during knee arthroscopy is of paramount importance. Insufficient visibility in tight knees increases the risk of complications, such as the ignored or inadequate treatment of meniscal or chondral pathologies, as well as iatrogenic injuries. Several studies have reported that the posteromedial compartment is one of the primary contributors to diagnostic mistakes in knee arthroscopy¹⁻³, and accessing it can be challenging, particularly in patients with tight medial joint space.⁴

Two techniques have been described to improve visualization by increasing the intra-articular space of the medial knee compartment through the release of the medial collateral ligament (MCL) during knee

arthroscopy, such as outside-in and inside-out techniques. The outside-in approach continues to be commonly used by releasing the posterior third of the superficial MCL (sMCL), posterior oblique ligament, or both using a 16 or 18-G needle.⁵ Transillumination from the arthroscopy is used to identify the neurovascular structure of the saphenous, reducing the risk of injury during a skin puncture. However, this technique increases the risk of saphenous nerve injury due to the needle's proximity.

In contrast, the inside-out technique increases medial compartment space by releasing the deep MCL (dMCL). Various instruments, such as a needle, banana blade, and electrocautery hook device have been used for this purpose.⁶⁻⁸ A study by Atoen et al.⁶ described how to release the dMCL using an 18-G needle through the anteromedial portal. Since 2021, we have used this method for surgery on the medial horn and root meniscus. The purpose of this case series is to demonstrate the outcome of MCL release using an inside-out technique during knee arthroscopy.

Material and methods

Patient selection

This retrospective study of two years duration involved 22 adult patients who underwent MCL release using the inside-out technique during knee arthroscopy due to a meniscal tear at Siloam Hospital in Lippo Village from 2021 to 2023. The inclusion criteria included patients with no cartilage damage (Outerbridge grade 1 and 2), patients who underwent knee arthroscopy for meniscus surgery, and patients who underwent MCL release using the inside-out technique. The exclusion criteria included patients with MCL injuries and significant cartilage lesions (Outerbridge grade 3 and 4). The reported outcomes are opening of the medial joint space and other problems like pain, valgus knee instability, and damage to the saphenous nerve and blood vessels after the procedure.

Inside-out Technique of MCL release

The inside-out technique for dMCL release is performed by one orthopedic surgeon when tight medial joint space prevents the clear view of the medial horn meniscus and obstructs the surgical instrument during knee arthroscopy. An arthroscopic probe hook with a 5 mm tip is used to measure the medial joint space (Fig.1). An 18-G needle is inserted through the anteromedial portal, followed by the application of a gentle valgus force. Under direct visualization, multiple needle punctures are performed in the transition region between the body and the posterior horn of the medial meniscus, beginning at the posterior portion and extending anteriorly to release the dMCL fibers while the surgeon assistant continues to apply a gentle valgus strain to the knee (Fig.2). A puncture at the site will result in a crunching sensation and an opening in the medial joint space can be observed. After the procedure, the surgeons remeasure the joint space to evaluate the opening of the medial joint space's opening. (Fig.3).

Post-operatively, the patients were treated with the specific procedure for immobilization and physical therapy, with weight bearing as appropriate. In addition to the MCL release procedure, the patient required additional knee bracing to prevent further injury to the MCL.

Result

A total of 22 patients met the inclusion criteria, in which there were 15 females and 7 males with ages ranging from 21 to 69 years old (Mean : 48.18 ± 14.73) (Median: 48.5). Among all patients, 12 patients

underwent meniscus medial repair in which 5 of them were accompanied with anterior cruciate ligament reconstruction, 9 patients underwent meniscus medial root repair, and 1 patient underwent partial meniscectomy. The result of intra-operative measurement in medial joint space opening after the procedure varies from 3mm to 7 mm, with a mean of 4.04 ± 1.21 and median of 4. None of the patients in the present series developed complications such as neurovascular saphenous injury, residual pain and joint instability after the procedure during two years follow-up. However, there were 2 cases of mild needle scratches on the medial border of the femoral condyle during the procedure with no significant consequences. The patient data, results, and demographic details have been summarized in Table I and Table II.

Discussion

The opening of the medial joint space in patients who undergo dMCL release using an inside-out technique showed promising results in our study, with a mean of 4.04 ± 1.21 mm and a median of 4 mm. Two cadaveric studies have documented the amount of medial compartment opening after sMCL release using an outside-in (pie-crust) technique. Roussignol *et al.*⁹ have reported an increase in the medial compartment after the sequential release of the sMCL. The compartment is opened by 1mm, 2.3mm, and 3.9 mm sequentially by opening the anterior third, the anterior two-thirds, and then the subtotal release of the dMCL respectively. Claret-Garcia *et al.*¹⁰ reported a 2.9 mm increase in the medial compartment after pie-crusting release of dMCL using ultrasound assessment. Our study showed a substantial increase in the medial joint space using the inside-out technique. Furthermore, there is no incidence of complications have been found such as neurovascular saphenous injury and residual pain and joint instability in patients after the procedure during two years follow-up.

The ability to see and access intra-articular structures is of utmost importance in the diagnosis and treatment of meniscal pathologies. Efforts to address these pathological conditions in the absence of MCL release may result in iatrogenic chondral injury or unregulated harm to the MCL, when excessive valgus force is applied to the knee during the operation.

The outside-in arthroscopic pie-crusting release technique allows the surgeon to effectively reach these pathologies. However, it is important to note that this approach carries a higher potential for saphenous nerve injury when the needle traverses to the sMCL. Additionally, we have observed that this technique can cause discomfort for the patient due to the need for multiple skin punctures. Multiple clinical studies have also documented the presence of residual pain following the sMCL release procedure using the outside-in approach. However, this pain is just temporary and entirely vanishes during long-term follow-up.¹¹⁻¹³

The inside-out approach ensures that saphenous injury is quite unlikely, as it is carried out with direct visualization through the anteromedial portal. Moreover, this technique is less agonizing as the dMCL is liberated without piercing the dermis, as the needle is inserted via the arthroscopy portal. This procedure involves the controlled release of the posterior part of the deep medial collateral ligament (MCL) while the surgeon applies a valgus force to the knee. The goal is to visualize the entire posterior horn of the medial meniscus and introduce arthroscopic tools without causing injury to the cartilage. We started to adopt the inside-out technique for releasing dMCL since 2021 in our center after we found several patients

complaining of transient itchy skin in the first weeks and one patient suffered a saphenous neuroma on the anteromedial knee after the outside-in (pie-crust) procedure was done.

Our study had some limitations. The number of samples in this study is relatively small, namely only 22 patients. Also, we don't employ a radiological knee stress view when evaluating the post-procedure residual knee instability and joint laxity; instead, we rely only on the physical examination. Hence, further studies are needed to fully assess the benefits of the inside-out technique to release dMCL during knee arthroscopy.

Conclusion

The inside-out technique of dMCL release could provide good visualization and sufficient space for posterior medial compartment of the knee with minimal complications.

Conflict of Interest

The authors declare no potential conflict of interest.

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Table 1. Patient Profile, Outcome, and Complications

Abbreviations – M: Male, F: Female, ACLT: ACL tear, MMCPT: Meniscus medial cornu posterior tear, MMPRT: Meniscus medial posterior root tear, MMBHT: Meniscus medial bucket handle tear, MMRL :

No.	Age (Years)	Sex	Medial Joint space (mm)			Diagnosis	Other Procedure	Complications
			Before	After	Opening			
1	39	M	2	8	6	ACLT & MMCPT Genu L	ACLR & MMR	None
2	66	F	3	6	3	MMPRT Genu L	MMRR	None
3	49	F	2	5	3	MMCPT Genu L	MMRR	None
4	43	M	2	9	7	MMBHT Genu L	MMBHR	None
5	55	F	3	6	3	MMPRT Genu L	MMRR	None
6	43	M	3	6	3	MMBHT Genu R	MMBHR	None
7	65	F	2	5	3	MMPRT Genu R	MMRR	None
8	43	F	2	6	4	MMPRT Genu R	MMRR	None
9	47	F	3	6	3	MMCPT Genu R	PM	None
10	61	F	2	7	5	MMPRT Genu R	MMRR	None
11	23	F	2	8	6	ACLT & MMCPT Genu R	ACLR & MMR	None
12	52	F	2	6	4	MMPRT Genu L	MMRR	None
13	69	F	5	8	3	MMCPT Genu L	MMR	None
14	62	F	2	7	5	MMPRT Genu R	MMRR	None
15	58	F	2	6	4	MMPRT Genu R	MMRR	None
16	21	M	2	5	3	MMCPT Genu L	MMR	None
17	38	F	2	7	5	ACLT & MMBHT Genu L	ACLR & MMBHR	None
18	30	M	2	5	3	ACLT & MMRL Genu R	ACLR & MMR	None
19	56	M	3	6	3	MMCPT Genu L	MMR	None
20	68	F	3	8	5	MMPRT Genu L	MMRR	None
21	24	M	2	6	4	ACLT & MLCPT & MMCPT Genu L	ACLR & MMR & MLR	None
22	48	F	2	6	4	MMPRT Genu L	MMRR	None

Meniscus medial ramp lesion, MLCPT: Meniscus lateral cornu posterior tear, ACLR : ACL

reconstruction, MMR: Meniscus medial repair, MMRR : Meniscus medial root repair, MMBHR: Meniscus medial bucket handle repair, PM: Partial Meniscectomy, MLR: Meniscus lateral repair

Table 2. Demographic details of the study participants (n=22)

Variable	Observation
1. Age of patients (Mean ± SD)	(48.18±14.73) years [Range : 21-69 years]
2. Gender	
Male	7 patients (32%)
Female	15 patients (68%)
Male : Female	1 : 2.1
3. Medial joint space opening (Mean ± SD)	(4.04 ± 1.21) [Range 3mm-7mm] [median 4]
4. Laterality Genu	
Right	9 patients (41%)
Left	13 patients (59%)

Abbreviations – SD: standar deviation



Figure 1. Measurement of medial compartment opening with the hook before the release



Figure 2. Arthroscopic puncturing of posterior portion of deep MCL using 18-G needle.



Figure 3. Medial joint space opening after MCL release.