Technical Note

Adjuvant Medial Collateral Ligament Release at the Time of Knee Arthroscopy: A Controlled Percutaneous Technique

Tyler M. Hauer, M.D., Lawrence J. Wengle, M.B.B.S., and Daniel B. Whelan, M.D., M.Sc., F.R.C.S

Abstract: The posterior horn of the medial meniscus can be challenging to view during arthroscopy because the medial femoral condyle obstructs vision, especially in tight medial compartments. Previous studies have described techniques for improving access, one being a percutaneous medial collateral ligament (MCL) release. This technique allows for increased medial compartment space, which offloads a tight medial compartment, minimizes iatrogenic chondral injury, incomplete meniscal resection, uncontrolled MCL rupture, and allows for accurate diagnosis and management. Studies have proven the safety of the controlled percutaneous MCL release, with no significant postoperative MCL laxity on stress views, no subjective patient instability, fewer iatrogenic cartilage lesions, and no saphenous neurovascular injury. Furthermore, retrospective studies have shown improved postoperative patient-reported outcomes with a controlled percutaneous MCL release in comparison to standard of care without a release. We hypothesize that a controlled percutaneous release of the MCL effectively alleviates some of the pressure within the medial compartment, which could potentially explain the improved postoperative clinical outcomes. This technique also facilitates improved visualization, a decreased risk of iatrogenic chondral injury, and a more complete meniscal resection. The purpose of this Technical Note is to describe our surgical technique and provide surgical pearls for a controlled percutaneous MCL release during knee arthroscopy.

Injuries to the meniscus are a common problem seen by orthopaedic surgeons. Arthroscopic surgery to address symptomatic meniscal tears is one of the most prevalent operations performed.[1,2] In general, these operations have enjoyed reasonable success with a relatively low rate of complications.[3] Despite this, there are often technical limitations that even skilled arthroscopists find challenging to overcome. One of these challenges is achieving complete visualization of the entire meniscus for accurate diagnosis and management.

The posterior horn of the medial meniscus can be particularly challenging to view because the medial femoral condyle obstructs direct vision, especially in varus knees. This portion of the meniscus is also a common site of injury. Inadequate visualization can lead to diagnostic and treatment errors during knee arthroscopy,[4-6] increasing the risk of persistent symptoms and reoperation.[7] Aggressive introduction of instrumentation has been recognized to cause iatrogenic cartilage damage, predisposing the patient to degenerative changes in the knee.[8] Additionally, increasing valgus force on the knee to open the medial compartment can lead to complications including uncontrolled rupture of the medial collateral ligament (MCL) and femoral fracture.[9,10]

Previous studies have described techniques for improving access to the posterior medial meniscus. One such technique is an outside-in percutaneous controlled MCL release, first described in 2004.[11] This technique allows for increased medial-compartment space, which minimizes iatrogenic chondral injury,

From the Division of Orthopaedic Surgery, St. Michael's Hospital, Toronto, Canada, and University of Toronto Orthopaedic Sports Medicine (UTOSM), Division of Orthopaedic Surgery, Department of Surgery, University of Toronto, Toronto, Canada.

T.M.H. and L.J.W. contributed equally to this work.

The authors report no conflicts of interest in the authorship and publication of this article. Full ICMJE author disclosure forms are available for this article online, as supplementary material.

Received February 17, 2022; accepted April 25, 2022.

Address correspondence to Tyler M. Hauer, M.D., University of Toronto Orthopaedic Sports Medicine (UTOSM), Division of Orthopaedic Surgery, Department of Surgery, University of Toronto, 149 College St, Toronto, Ontario, Canada M5T 1P5. E-mail: tyler.hauer@mail.utoronto.ca

2212-6287/22238

https://doi.org/10.1016/j.eats.2022.04.004

incomplete resection, uncontrolled MCL rupture and allows for accurate diagnosis and management.[8,12-14]

Our technique for controlled percutaneous MCL release as an adjuvant in knee arthroscopy is described in this article and Video 1. Our aim is to describe this technique and provide technical pearls that allow for adequate release while minimizing complications. On the basis of previous retrospective and prospective studies, as well as surgeon experience, we believe that our technique provides (1) mechanical offloading of the medial compartment, (2) a decreased risk of iatrogenic chondral damage, (3) improved visualization of the entire meniscus, and (4) a more complete meniscal resection (fewer residual tears left untreated).

Surgical Technique

Step 1: Patient Positioning and Setup

Once the patient has been safely intubated with a general anesthetic, the patient is positioned supine with a thigh tourniquet. A thigh bolster (Arthroscopic Stress Post; Meditek, Winnipeg, Canada) is placed over the lateral aspect of the thigh, and a foot bolster (Knee Stabilizer; Steris, Mentor, OH) is placed in a position to keep the knee in 90° of flexion and the foot in a comfortable resting position (Fig 1). The thigh bolster should be placed in a position that will allow for appropriate valgus stress during the procedure. The surface anatomy of the knee is then identified, and the surgical portals are marked out accordingly (Fig 2). Anteromedial and anterolateral portals are marked out in a horizontal fashion.

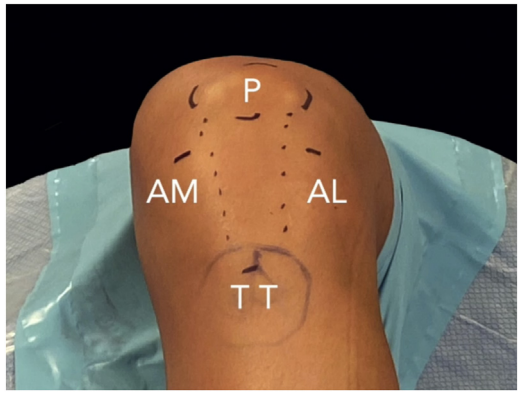

Fig 2. Surface anatomy of the knee at 90° with portal placement. The surface anatomy and portal placement are marked out for the left knee. We use horizontal incisions for portal establishment. (AL, anterolateral portal; AM, anteromedial portal; P, patella; TT, tibial tuberosity.)

Step 2: Diagnostic Arthroscopy

A diagnostic arthroscopy is performed to confirm meniscal and other intra-articular pathology. Chondral changes are graded. Valgus stress and slight flexion are then applied to complete an assessment of the medial compartment of the knee.

Step 3: Controlled Percutaneous Release of Deep Fibers of Superficial MCL Under Direct Visualization

The medial compartment is visualized arthroscopically from the lateral portal with a 30° arthroscope. The starting point of the release is approximated by the surface anatomy landmarks and confirmed arthroscopically. With respect to the surface anatomy, the starting point is roughly 2 to 3 cm distal to the palpable posteromedial corner of the tibial plateau and 1 cm

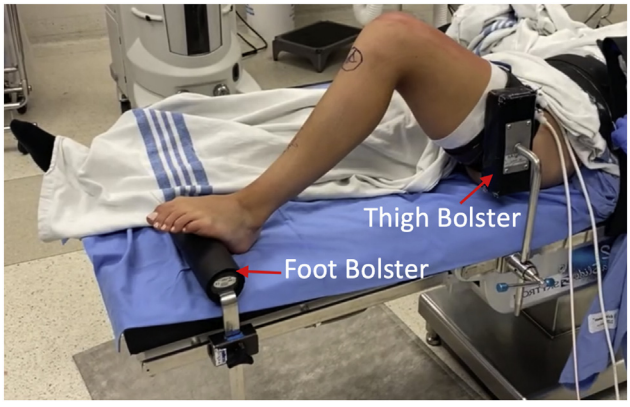

Fig 1. Patient positioning and setup. The patient is positioned supine with a thigh tourniquet. A thigh bolster is placed over the lateral aspect of the thigh, and a foot bolster is placed in a position to keep the knee in 90° of flexion with the foot in a comfortable resting position. The thigh bolster should be placed in a position that will allow for appropriate valgus stress of the knee during the procedure.

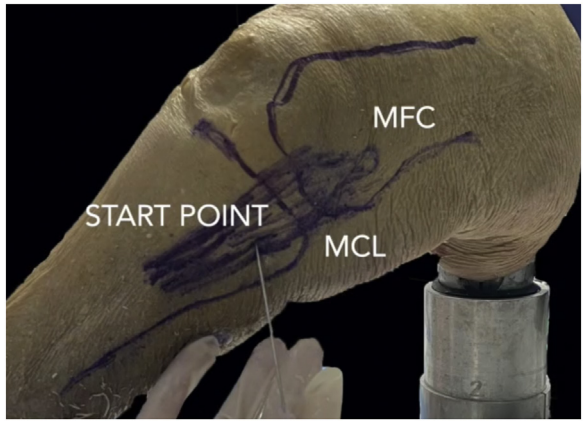

Fig 3. Cadaveric surface anatomy showing the starting point of the adjuvant percutaneous medial collateral ligament (MCL) release. In our technique, the starting point is 2 to 3 cm distal to the palpable posteromedial corner of the tibial plateau and 1 cm anterior to this mark. (MFC, medial femoral condyle.)

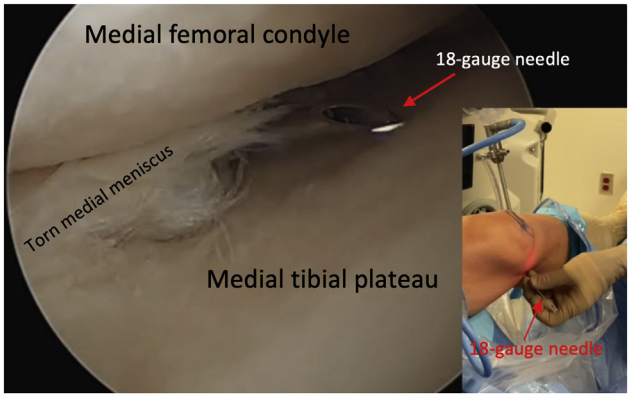

Fig 4. Arthroscopic view of the medial compartment from the anterolateral portal in a left knee, showing confirmation of the starting-point location in the anterior-to-posterior plane. The starting point of the release is confirmed as the surgeon identifies the junction between the body and posterior horn of the medial meniscus; this should coincide with the posteromedial corner of the tibial plateau. An 18-gauge spinal needle is placed in a submeniscal manner at this location, under arthroscopic visualization, and can be seen in the arthroscopic image. This spinal needle is then advanced 2 to 3 cm distal and 1 cm anterior to this mark, identifying the location of release.

anterior to this mark (Fig 3). Arthroscopically, this is confirmed as the surgeon identifies the junction between the body and posterior horn of the medial meniscus. An 18-gauge spinal needle (BD Spinal Needle, 18 gauge × 3.50 in; Becton, Dickinson and Company, Franklin Lakes, NJ) is placed in a submeniscal manner at this location, under arthroscopic visualization (Fig 4). Once this point is identified, the needle is moved 2 to 3 cm distal on the proximal tibia (proximal to distal location) and 1 cm anterior. Percutaneous pie crusting is then performed through the same stab incision using the 18-gauge spinal needle, moving posteriorly to anteriorly over the deep fibers of the superficial MCL. This is performed with the knee in slight flexion and in valgus stress. A puncture at the site will produce a crunching sensation with a concomitant opening in the medial joint space seen on the arthroscopy monitor (Fig 5). The release is titrated until the desired opening is achieved.

Step 4: Surgical Treatment of Meniscal Pathology

Meniscal pathology can now be addressed surgically with superior visualization, resulting in a more accurate diagnosis and more complete resection of pathology. No postoperative bracing is used. The patient is allowed to bear weight as tolerated. Table 1 presents advantages and disadvantages of the described surgical technique, and Table 2 lists pearls and pitfalls.

Discussion

Multiple studies, as well as a recent systematic review, have proven the safety of the controlled percutaneous MCL release, with no significant postoperative MCL laxity on stress views, no subjective patient instability, fewer iatrogenic cartilage lesions, and no saphenous neurovascular injury.[8,12-21] A cadaveric study has also proven safety of this procedure, measuring the distance of the controlled percutaneous MCL release to the saphenous nerve and vein on the medial side (Fig 6).[22] Furthermore, retrospective studies have shown improved postoperative patient-reported outcomes with a controlled percutaneous MCL release in comparison to standard of care without a release.[8] Studies have differed in their postoperative protocols, with some studies enforcing postoperative MCL bracing[17,19] and others allowing for free range of motion without bracing.[14,16,20] These studies have shown no residual postoperative MCL laxity regardless of bracing. Moreover, a recent study has shown that iatrogenic injuries to the MCL during knee arthroscopy can be treated successfully without bracing, with complete MCL recovery observed at 6 weeks.[23] Given these findings, as well as our own clinical experience, we do

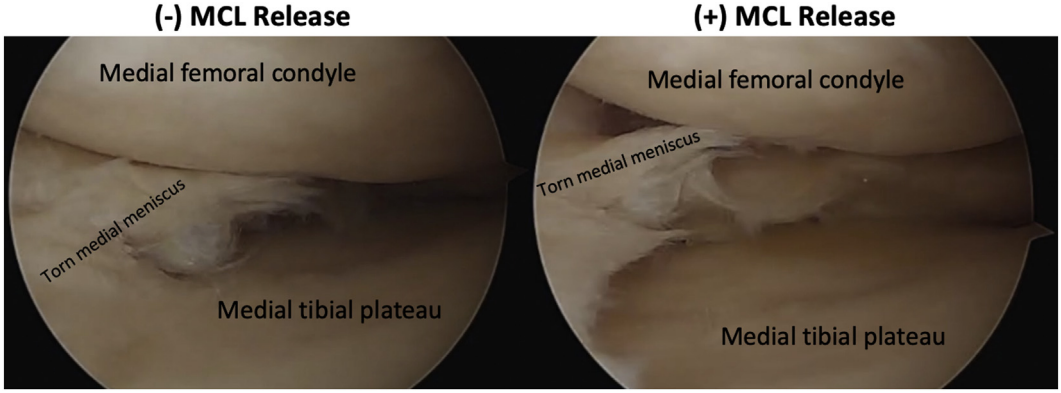

Fig 5. Two separate arthroscopic views of the medial compartment from the anterolateral portal in a left knee: before medial collateral ligament (MCL) release (left) and after MCL release (right). One should note the improved visualization of the torn medial meniscus and increased space in the medial compartment.

Table 1. Advantages and Disadvantages of Surgical Technique

Advantages
The technique offloads a tight medial compartment.
Iatrogenic chondral injury is minimized.
The technique allows for improved medial-compartment visualization, which provides improved visualization of the entire meniscus. This minimizes incomplete resection of meniscal pathology (fewer residual tears left untreated).
The technique minimizes uncontrolled MCL rupture.
There is potential for an improved healing capacity due to hyperemia (trephination). The ability to perform meniscal repair techniques in the setting of ramp and/or root lesions is improved.
Disadvantages
There is a risk of saphenous vein and nerve injury.
There is a risk of postoperative symptomatic MCL laxity.
There is a risk of increased postoperative pain at the site of MCL release.

MCL, medial collateral ligament.

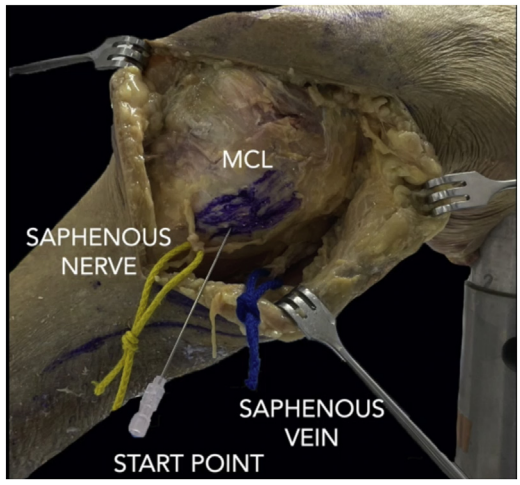

Fig 6. Cadaveric surface anatomy showing the starting point for the adjuvant percutaneous medial collateral ligament (MCL) release and its distance from the medial-sided knee structures (saphenous nerve [yellow] and saphenous vein [blue]), which must be avoided during the procedure.

not routinely put our patients in knee immobilizers postoperatively.

Studies related to MCL release have also differed in the location of release, varying from the femoral side of the MCL to the tibial side of the MCL or a location at the joint line.[9,14,15,19] In a recent Technical Note with video, the authors described their preferred release 1.5 cm posterior and slightly distal to the medial epicondyle, just proximal to the joint line.[24] This method differs from our release as described in this Technical Note because our starting point is 2 to 3 cm distal to the palpable posteromedial corner of the tibial plateau and 1 cm anterior to this mark. In the literature, all described techniques have been performed safely without risk of short- or long-term morbidity.[21,24]

At this time, most of the evidence regarding the safety and efficacy of controlled MCL release is retrospective in nature. There have been 2 prospective studies, both of which were relatively small and lacked a valid control group.[14,20] No complications of the procedure were reported—neither persistent valgus instability nor saphenous nerve or vein injury—and improved patient-reported outcomes were observed.

In multiple recent randomized controlled trials, there have been equivocal results with arthroscopic partial

Table 2. Pearls and Pitfalls of Surgical Technique

Pearls	Pitfalls
The lateral thigh bolster must be in the appropriate location to allow for optimal valgus stress. One should test this position prior to draping.	Improper positioning of the lateral thigh bolster can lead to inadequate valgus stress and compromise the adequacy of release (use of an arthroscopic leg holder can be considered).
The starting point for release is 2-3 cm distal and 1 cm anterior to the posteromedial corner of the tibial plateau.	Saphenous nerve and vein injury is possible if outside of the preferred release location (too posterior and too distal would put these structures at risk).
To confirm the posteromedial corner of the tibial plateau, an 18-gauge needle can be placed in a submeniscal manner at this location. This should be the junction between the body and posterior horn of the medial meniscus.	
Percutaneous pie crusting should be performed by moving posteriorly to anteriorly over the deep fibers of the superficial MCL (the tactile sensation of fiber release "popping" or "crunching" will be acquired with time and experience, allowing for titration of the release).	
The MCL release should be performed with the knee in slight flexion (no more than 15°-20°) and valgus stress to keep the MCL under tension. The increase in the medial joint space is visualized on the arthroscopy monitor, and the release is titrated until the desired opening is achieved.	

MCL, medial collateral ligament.

meniscectomy in the setting of degenerative meniscal tears, showing this procedure to be equal to physical therapy or sham surgery.[25-29] This could be because either (1) the procedure is ineffective or (2) the procedure we are performing is not achieving its intended purpose. With the adjuvant MCL release, we are aiming to maximize the potential benefit by way of a simple and effective procedure, performed concomitantly at the time of arthroscopy.

In our experience, we have observed that patients with degenerative medial meniscal tears routinely present with tight medial compartments. Meniscal pathology—often intrasubstance change—is the first stage of the disease. Once the degenerative process is initiated, the medial compartment loses some height and the MCL correspondingly shortens. Over time, chondral changes of the medial-compartment cartilage and an acquired varus alignment can develop in these patients. Clinically, these patients experience pain when in positions of strain. We hypothesize that a controlled percutaneous release of the MCL at the time of arthroscopy effectively alleviates some of the pressure within the medial compartment, which could potentially explain the improved postoperative clinical outcomes. With this procedure, there are also the more obvious benefits of improved visualization, a decreased risk of iatrogenic chondral damage, and a more complete meniscal resection, which have been described in the literature. In conclusion, we feel that this technique provides (1) mechanical offloading of the medial compartment, (2) a decreased risk of iatrogenic chondral damage, (3) improved visualization of the entire meniscus, and (4) a more complete meniscal resection (fewer residual tears left untreated).

References

1. Thorlund JB, Hare KB, Lohmander LS. Large increase in arthroscopic meniscus surgery in the middle-aged and older population in Denmark from 2000 to 2011. *Acta Orthop* 2014;85:287-292.
2. Garrett WEJ, Swiontkowski MF, Weinstein JN, et al. American Board of Orthopaedic Surgery practice of the orthopaedic surgeon: Part-II, certification examination case mix. *J Bone Joint Surg Am* 2006;88:660-667.
3. Fabricant PD, Jokl P. Surgical outcomes after arthroscopic partial meniscectomy. *J Am Acad Orthop Surg* 2007;15:647-653.
4. Tolin BS, Sapega AA. Arthroscopic visual field mapping at the periphery of the medical meniscus: A comparison of different portal approaches. *Arthroscopy* 1993;9:265-271.
5. Ahn JH, Oh I. Arthroscopic partial meniscectomy of a medial meniscus bucket-handle tear using the posteromedial portal. *Arthroscopy* 2004;20:e75-e77.
6. Ozkoc G, Circi E, Gonc U, Irgit K, Pourbagher A, Tandogan RN. Radial tears in the root of the posterior horn of the medial meniscus. *Knee Surg Sports Traumatol Arthrosc* 2008;16:849-854.
7. Nielsen DM, Twyman R. Arthroscopic visualization of the posterior horn of the medial meniscus. *Arthroscopy* 2005;21:1272.
8. Claret G, Montañana J, Rios J, et al. The effect of percutaneous release of the medial collateral ligament in arthroscopic medial meniscectomy on functional outcome. *Knee* 2016;23:251-255.
9. Roussignol X, Gauthe R, Rahali S, Mandereau C, Courage O, Duparc F. Opening the medial tibiofemoral compartment by pie-crusting the superficial medial collateral ligament at its tibial insertion: A cadaver study. *Orthop Traumatol Surg Res* 2015;101:529-533.
10. Reigstad O, Grimsgaard C. Complications in knee arthroscopy. *Knee Surg Sports Traumatol Arthrosc* 2006;14:473-477.
11. Agneskirchner JD, Lobenhoffer P. Arthroskopische Meniskuschirurgie: Technisch-operative Verfahren [Arthroscopic meniscus surgery: Technical-operative methods]. *Unfallchirurg* 2004;107:795-801 [in German].
12. Todor A, Caterev S, Nistor DV. Outside-in deep medial collateral ligament release during arthroscopic medial meniscus surgery. *Arthrosc Tech* 2016;5:e781-e785.
13. Polat B, Aydın D, Polat AE, et al. Objective measurement of medial joint space widening with percutaneous "pie crust" release of medial collateral ligament during knee arthroscopy. *J Knee Surg* 2020;33:94-98.
14. Lons A, Boureau F, Drumez E, Pasquier G, Putman S. Does medial collateral ligament pie-crusting induce residual laxity in arthroscopic management of medial meniscus tears? A prospective study of 40 cases. *Orthop Traumatol Surg Res* 2018;104:707-711.
15. Fakioglu O, Ozsoy MH, Ozdemir HM, Yigit H, Cavusoglu AT, Lobenhoffer P. Percutaneous medial collateral ligament release in arthroscopic medial meniscectomy in tight knees. *Knee Surg Sports Traumatol Arthrosc* 2013;21:1540-1545.
16. Javidan P, Ahmed M, Kaar SG. Arthroscopic release of the deep medial collateral ligament to assist in exposure of the medial tibiofemoral compartment. *Arthrosc Tech* 2014;3:e699-e701.
17. Gurpinar T, Polat B. Is percutaneous release of medial collateral ligament in medial compartment arthroscopy effective and reliable? *Ann Med Res* 2019;26:2114-2118.
18. Hinton MA. Percutaneous partial medial collateral ligament release (PPMCLR) does not result in residual medial collateral laxity (MCL). *Orthop J Sports Med* 2015;3:2325967115S00117 (suppl 2).
19. Jeon SW, Jung M, Chun YM, et al. The percutaneous pie-crusting medial release during arthroscopic procedures of the medial meniscus does neither affect valgus laxity nor clinical outcome. *Knee Surg Sports Traumatol Arthrosc* 2018;26:2912-2919.
20. Hammouda IA, Elnahas MA, Khodair MSM. Percutaneous medial collateral ligament release in arthroscopic medial menisectomy in knees with tight medialcompartment. *Egypt J Hosp Med* 2019;76:3626-3632.
21. Moran TE, Awowale JT, Werner BC, Fox MA, Miller MD. Associated morbidity after the percutaneous release of the medial collateral ligament for knee arthroscopy. *Arthroscopy* 2020;36:891-900.

22. Claret-Garcia G, Montañana-Burillo J, Tornero-Dacasa E, et al. Pie crust technique of the deep medial collateral ligament in knee arthroscopy: Ultrasound and anatomic study. *J Knee Surg* 2019;32:764-769.
23. Jung KH, Youm YS, Do Cho S, Jin WY, Kwon SH. Iatrogenic medial collateral ligament injury by valgus stress during arthroscopic surgery of the knee. *Arthroscopy* 2019;35:1520-1524.
24. Moran TE, Demers A, Awowale JT, Werner BC, Miller MD. The outside-in, percutaneous release of the medial collateral ligament for knee arthroscopy. *Arthrosc Tech* 2020;9:e393-e397.
25. Herrlin S, Hållander M, Wange P, Weidenhielm L, Werner S. Arthroscopic or conservative treatment of degenerative medial meniscal tears: A prospective randomised trial. *Knee Surg Sports Traumatol Arthrosc* 2007;15:393-401.
26. Katz JN, Brophy RH, Chaisson CE, et al. Surgery versus physical therapy for a meniscal tear and osteoarthritis. *N Engl J Med* 2013;368:1675-1684.
27. Kise NJ, Risberg MA, Stensrud S, Ranstam J, Engebretsen L, Roos EM. Exercise therapy versus arthroscopic partial meniscectomy for degenerative meniscal tear in middle aged patients: Randomised controlled trial with two year follow-up. *BMJ* 2016;354:i3740.
28. Sihvonen R, Paavola M, Malmivaara A, et al. Arthroscopic partial meniscectomy versus sham surgery for a degenerative meniscal tear. *N Engl J Med* 2013;369:2515-2524.
29. Van De Graaf VA, Noorduyn JC, Willigenburg NW, et al. Effect of early surgery vs physical therapy on knee function among patients with nonobstructive meniscal tears: The ESCAPE randomized clinical trial. *JAMA* 2018;320:1328-1337.