



All-Inside Technique for Ramp Lesion Repair: Arthroscopic Suture With Knee Scorpion Suture Passer

Jonatas Brito de Alencar Neto, M.D., M.Sc., Sérgio Marinho de Gusmão Canuto, M.D.,
Marcos Antônio da Silva Girão, M.D., Ricardo Lyra de Oliveira, M.D.,
Maria Luzete Costa Cavalcante, M.D. Ph.D., Camilo Partezani Helito, M.D., Ph.D., and
Diego Ariel de Lima, M.D., Ph.D.

Abstract: Ramp lesions are peripheral tears of the posterior horn of the medial meniscus that involve the meniscocapsular attachments. They are commonly associated with anterior cruciate ligament injury and frequently not diagnosed. There are several suture techniques for ramp lesions. However, most have a long learning curve to be performed adequately and to minimize the risks of neurovascular lesions, cartilage injury, as well as damage to the meniscotibial ligament and meniscus. Thus, as an alternative to minimize costs and provide adequate ramp lesion repair, we present a simple, easy-to-reproduce technique using a Scorpion Suture Passer and all-inside sutures, without the need to leave devices inside the knee, causing no additional lesions and making it less costly than conventional methods. Our technique, which consists of a biomechanically strong suture, with no internal devices, is cheaper, allows several sutures with the same thread and produces satisfactory clinical results.

The dissociation between the capsule and posterior horn of the medial meniscus was first described in 1988 by Strobbel.¹ This injury was later called ramp lesion, and the importance of meniscotibial ligaments in its origin was identified.² The incidence of this lesion is

16% to 24% in patients with anterior cruciate ligament (ACL) injury,³ making its correction and diagnosis important because neglecting it may cause residual rotary instability,^{2,4-6} leading to early failure of ACL reconstruction and/or early degenerative knee disorders.⁷

Ramp injuries are difficult diagnoses and may be suspected by Finochietto sign⁸ on physical examination or by bone edema at the posterior edge of the medial plateau,⁹ which is confirmed intraoperatively.¹⁰ Preferably, a full ACL check should be performed for a ramp lesion, even with alternative examination and microscopes for that injury, using the arthroscopy check sequence described by Sonnery-Cottet.¹¹

Several suture techniques are used for ramp lesions.^{7,12,13} However, most have a long learning curve to be properly executed and to minimize the risks of neurovascular lesion, cartilage injury, as well as damage to the meniscotibial and meniscus.^{1,7,13-15}

Thus, as a lower-cost alternative that provides adequate ramp lesion repair, we present a simple, easy-to-reproduce technique using a Scorpion Suture Passer (Arthrex, Naples, FL) and all-inside sutures, without the need to leave devices inside the knee, causing no additional lesions and making it less costly than conventional techniques.

From the Dr. José Frota Institute, Fortaleza, Ceará (J.B.d.A.N., M.A.d.S.G.); Santa Casa de Misericórdia Hospital de Maceió, Maceio, Alagoas (S.M.d.G.C.); Otávio de Freitas Hospital, Recife, Pernambuco (R.L.d.O.); Department of Orthopedics, Walter Cantídio Hospital University Federal of Ceará, Fortaleza (M.L.C.C.); Grupo de Joelho, Instituto de Ortopedia e Traumatologia, Hospital das Clínicas HCFMUSP, Faculdade de Medicina da Universidade de São Paulo (C.P.H.); and Department of Health Sciences, Universidade Federal Rural do Semi-Árido (UFERSA), Mossoró, RN (D.A.d.L.), Brazil.

The authors report that they have 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 May 18, 2022; accepted August 5, 2022.

Address correspondence to Jonatas Brito de Alencar Neto, M.D., M.Sc., Dr. José Frota Institute, 1816 Barão do Rio Branco Rd., Fortaleza, Ceará, Brazil. E-mail: drjonatasbrito@gmail.com

© 2022 THE AUTHORS. Published by Elsevier Inc. on behalf of the Arthroscopy Association of North America. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

2212-6287/22653

<https://doi.org/10.1016/j.eats.2022.08.008>

Table 1. Pearls and Pitfalls

Pearls	<ol style="list-style-type: none"> 1. Debriding the lesion 2. Posteromedial portal entry according to Sonnery-Cottet¹⁶ 3. Prepositioning 4. Intercondylar notchplasty 5. In larger patients, use a peripheral intravenous catheter, 14 gauge 6. Make the first suture in the capsule and then the meniscus 7. Use 2-0 long high-strength thread (enables 2-3 sutures)
Pitfalls	<ol style="list-style-type: none"> 1. Do not pull the knot to tighten it. Always use the knot pusher 2. Avoid not having good intercondylar access 3. Using a cannula avoids extravasation, but hampers handling 4. Avoid trying to pierce the meniscus and capsule in a single pass of the needle 5. Avoid excess pressure in the pump for liquid extravasation 6. Never activate the Scorpion suture passer without being under direct view

Surgical Technique (With Video Illustration)

The complete technique is demonstrated in [Video 1](#), and the pearls and pitfalls in [Table 1](#).

Patient Position

The patient is placed in the supine position on a surgical table after spinal anesthesia and peripheral nerve block, with the knee to be operated on in 90° flexion with surgical knee positioners ([Fig 1](#)). A pneumatic tourniquet is used on the upper thigh, enabling an excellent attack angle from medial to lateral and posterior to anterior.

Confirmation and Identification of the Tear

Sonnery-Cottet et al.¹⁶ proposed systematic arthroscopic exploration to ensure that ramp lesions are diagnosed and treated. Systematic arthroscopic exploration is performed in 3 stages: standard arthroscopic exploration, posteromedial compartment exploration, and creation of the posteromedial portal.

Although the anteromedial and anterolateral portals are standard, they should ideally be placed a little closer to the patellar tendon and halfway between the inferior border of the patella and the articular interline.¹⁷ This facilitates the handling and passage of the arthroscope in the intercondyle. Since a single ramp or associated lesion is involved, all the compartments as well as the lateral and medial recesses should be examined. Approximately 60% of medial meniscus ramp lesions are diagnosed at this stage.¹⁶

Medial meniscus inspection should start by testing its stability with a probe. To have access to the posteromedial compartment, it must be visualized through the intercondylar space using the modified Gillquist

maneuver.¹⁸ The arthroscope is introduced into the intercondylar region through the anterolateral portal, passing below the posterior cruciate ligament, by applying valgus force, first with the knee extended and then flexed. At this time, the optical lens is turned to allow good visualization of the posteromedial compartment and primarily the meniscocapsular junction, to assess the presence of a ramp lesion. At this stage, approximately 20% of ramp lesions are diagnosed.¹¹ In most cases, visualization is good; however, if necessary, the edge of the femoral condyle or the tibial spine can be shaved to improve visualization. In cases with associated ACL lesion, we recommend ACL debridement, given that it facilitates its visualization.^{11,18}

Creating the Posteromedial Portal and Refreshing the Tear

The posteromedial portal is performed with a needle under arthroscopic control, through the intercondylar notch. Transillumination is used to locate the vascular and neural structures to avoid injuring them. With the knee flexed at 90°, to prevent popliteal and neural vascular lesions, the cutaneous entry point is marked above the hamstring tendons and 1 cm posterior to the medial tibiofemoral articular line. The needle is introduced from outside to inside toward the lesion, and the intra-articular entry point is checked arthroscopically for the needle to be within the quadrilateral formed by the synovial fold of the adductor tendon above, the posterior part of the medial condyle in front and the synovial fold of the medial gastrocnemius behind. The posterior horn of the medial meniscus should be explored with a needle or probe to detect a possible ramp lesion. At this stage, approximately 17% of ramp lesions are diagnosed. As such, to diagnose 100% of ramp lesions, a complete inventory of the posteromedial region of the knee is essential.¹⁶ Anteriorization of the posteromedial portal should be avoided at all costs ([Fig 2A](#)). The ideal posteromedial portal point for this technique is at the height of the meniscus (in the proximal–distal direction) and a little more posterior (where a posterior to anterior and medial to lateral approach is possible) ([Fig 2B](#)).

The lesion is then debrided ([Fig 2C](#)). If the lesion is hidden or partially healed, a needle can be used to debride the region, taking care to use the shaver at low rotation. Next, the extent of the lesion is measured and the degree of meniscotibial ligament retraction determined.

Suture Passage

Step 1

With the arthroscope introduced through the anterolateral portal with an intercondylar view, insert the Scorpion suture passer tweezer into the posteromedial



Fig 1. Ideal patient position for access to the posteromedial portal. (A) Preoperative lateral view. The patient is placed in the supine position on a surgical table after spinal anesthesia and peripheral nerve block, with the knee to be operated on in 90° flexion with surgical knee positioners. A pneumatic tourniquet is used on the upper thigh, enabling an excellent attack angle from medial to lateral and posterior to anterior. (B) Preoperative medial view. (C) Intraoperative medial view demonstrating a free space for access and good attack angle from posterior to anterior and medial to lateral. During the creation of the posteromedial portal, the arthroscope must be in the anterolateral portal with an intercondylar view.

portal. Cannulas can be used in this portal to avoid extravasation but hinder the use of tweezers. If the meniscotibial ligaments are retracted, the tweezer itself can secure the ligament and pull it to the proper position. After the meniscal ligament is secured, the high-strength 2.0 thread (FiberWire; Arthrex) is passed through the meniscotibial ligament from the posterior to anterior, exiting with the aid of the tweezer through the posteromedial portal (Fig 3A). The Scorpion suture passer tweezer must be used on the same thread, but with the end of the thread facing the meniscus (Fig 3B).

Step 2

Reintroduce the Scorpion tweezer through the posteromedial portal and pass the thread on the posterior

border of the meniscus from the posterior to anterior (Fig 3C). Remove the tweezer with the thread and tie a sliding fishing knot.

Step 3

A knot pusher is always used to push the knot to prevent it from fraying (Fig 3D). Next, it should be checked entering the posteromedial portal with the arthroscope and by the intercondylar view itself (Fig 3E). If necessary, the same thread can be used for 1 or more sutures (Video 1).

Postoperative Rehabilitation

Our protocol does not vary whether there is a concomitant ACL lesion or not. The arc of movement is

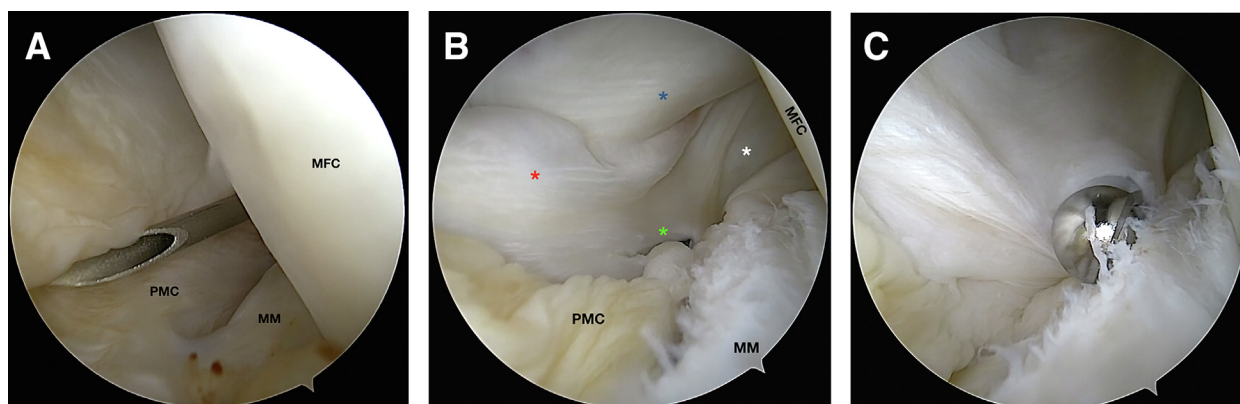


Fig 2. Creating the posteromedial portal and refreshing the tear. Arthroscopic view of the intercondylar notch entering the anterolateral portal. (A) Demonstrates a 40 × 12 needle to initially calculate the ideal height of the posteromedial portal. With the knee flexed at 90°, to prevent popliteal and neural vascular lesions, the cutaneous entry point is marked above the hamstring tendons and 1 cm posterior to the medial tibiofemoral articular line. The needle is introduced from outside to inside towards the lesion, and the intraarticular entry point is checked arthroscopically for the needle to be within the quadrilateral formed by the synovial fold of the adductor tendon above, the posterior part of the medial condyle in front and the synovial fold of the medial gastrocnemius behind. Note the meniscocapsular dissociation (ramp lesion). (B) Ideal entry point for the posteromedial portal for this technique. (C) Lesion debridement. Green asterisks indicate ideal entry point, white asterisks indicate very anterior entry point, blue asterisks indicate very proximal/high entry point, and red asterisks indicate very posterior/central entry point. (MFC, medial femoral condyle, MM, medial meniscus, PMC, posterior medial capsule/meniscotibial ligament.)

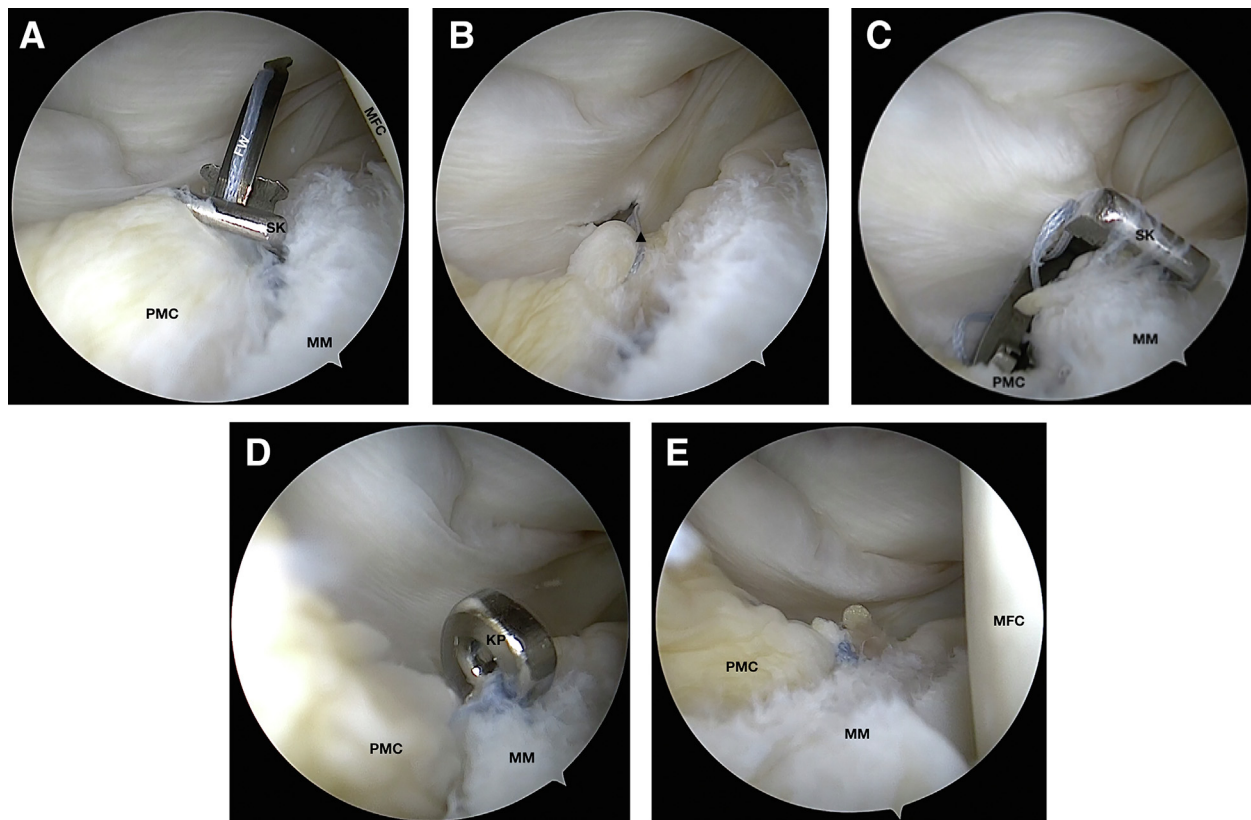


Fig 3. Step-by-step suture. Arthroscopic view of the intercondylar notch with the arthroscope entering the anterolateral portal. (A) Step 1. With the arthroscope introduced through the anterolateral portal with an intercondylar view, insert the Scorpion suture passer tweezer into the posteromedial portal. If the meniscotibial ligaments are retracted, the tweezer itself can secure the ligament and pull it to the proper position. After the meniscal ligament is secured, the high-strength 2.0 thread (FiberWire; Arthrex) is passed through the meniscotibial ligament from the posterior to anterior, exiting with the aid of the tweezer through the posteromedial portal. (B) The Scorpion suture passer tweezer must be used on the same thread, but with the end of the thread facing the meniscus. (C) Step 2. Reintroduce the Scorpion tweezer through the posteromedial portal and pass the thread on the posterior border of the meniscus from the posterior to anterior. (D) Step 3. Remove the tweezer with the thread and tie a sliding fishing knot. A knot pusher is always used to push the knot to prevent it from fraying. (E) Final suture aspect with complete closing of the ramp lesion. If necessary, the same thread can be used for 1 or more sutures. Black triangle indicates part of the high-strength thread facing the meniscus. (FW, FiberWire; KP, Knot Pusher; MFC, medial femoral condyle, MM, medial meniscus, PMC, posterior medial capsule/meniscotibial ligament; SK, Scorpion Knee.)

allowed immediately, with 0 to 90° of flexion until the fourth week, after which it progresses until total arc movement. Partial weight-bearing with crutches is allowed (15% load), thereby avoiding quadriceps atrophy. Weight-bearing is gradually increased according to the patient's pain. Since the ramp is a longitudinal lesion, the load will exert compression, thereby promoting healing. We do not use an immobilizer during the procedure. Isometric exercises are prescribed gradually. Patients can run after 3 months and engage in sports after 5 months.

Discussion

Ramp lesions are neglected in 20% to 40% of the cases and are one of the causes of residual rotary instability post-ACL reconstruction, leading to early failure or arthrosis.^{2,4,12} It can be identified in a

physical examination by the Finochietto sign¹² (consisting of a sudden jerk that appears when the free edge of the posterior horn of the medial meniscus is dislocated anteriorly to the medial condyle interposition when an anterior drawer test is performed on a knee with ramp lesion), on preoperative magnetic resonance imaging (bone contusion swelling at the posterior border of the medial plateau),³ and intraoperatively. Kim et al.¹¹ proposed a ramp lesion verification system that consists of visualizing through the anterolateral portal with an intercondylar view,⁸ subsequently checking through the posteromedial portal with a 30° arthroscope and then through the same portal with a 70° arthroscope. In our routine, we used the same sequence, but with the same conventional 30° arthroscope, and active inspection with a probe and grasper.

Table 2. Advantage and Disadvantages

Advantages	<ol style="list-style-type: none"> 1. Low cost 2. Capsule–meniscus suture 3. Absence of devices inside the knee 4. Technically rapid and practical 5. Uses only 2 portals simultaneously 6. Does not require open access 7. Direct visualization of the lesion, checking all the angles after suturing 8. Enables more sutures (up to 4) 9. Useful when there is and is not meniscotibial ligament retraction
Disadvantages	<ol style="list-style-type: none"> 1. Posterior compartment infiltration with excess pressure in the pump 2. Always requires the posteromedial portal 3. Needs Scorpion tweezers

Ramp lesion repair is technically demanding. The first techniques used a hook through the posteromedial portal.^{7,13} This involves a long learning curve and may damage the cartilage, meniscus, and meniscotibial ligament, in addition to the risk of vascular lesion.¹⁵ The most recent techniques describe all-inside methods with or without using the posteromedial portal.^{7,13-15} These techniques are costly, leave devices inside the knee, and run the risk of causing vascular lesion due to the anterior to posterior approach. Choi et al.¹ created an all-inside suturing technique without the addition of the posteromedial portal by pie-crusting the medial collateral ligament. Despite avoiding the posteromedial portal, this technique causes a hitherto nonexistent lesion, correct debridement cannot be performed, nor can the meniscotibial ligament be shortened if it is retracted.

In our technique using the Scorpion suture passer, we achieve optimal visualization and correct inspection of lesion extension and degree of meniscotibial retraction. Moreover, we can reduce retraction with Scorpion, using them to make 3 sutures with a same high-strength thread. Another advantage is being able to use the same tweezer to repair other meniscal lesions (lateral, radial, longitudinal) (Video 1). Some pearls and pitfalls should be observed during this technique (Table 1). The main disadvantage is always needing the posteromedial portal, which, in our opinion, should be performed for correct debridement and lateral meniscus tear inspection (Table 2).

The main risk of this technique is the activation of the Scorpion passer on the posterior part of the knee behind the capsule, putting the vascular structures at risk. To avoid this, the needle should only be activated under direct visualization into the knee. As limitations, our technique presents the need for a specific tool (Scorpion suture passer).

Our all-inside repair technique for ramp lesions of the medial meniscus under direct visualization using the Scorpion passer provides biomechanically strong

sutures, with no internal devices, is cheaper, and enables several sutures with the same thread, producing satisfactory clinical results.

References

1. Choi KY, Koh IJ, Kim MS, In Y. Medial meniscal ramp lesion repair through anterior portals using a medial collateral ligament pie-crusting technique. *Arthrosc Tech* 2021;10:e1073-e1077.
2. DePhillipo NN, Moatshe G, Brady A, et al. Effect of meniscocapsular and meniscotibial lesions in ACL-deficient and ACL-reconstructed knees: A biomechanical study. *Am J Sports Med* 2018;46:2422-2431.
3. Koo B, Lee SH, Yun SJ, Song JG. Diagnostic performance of magnetic resonance imaging for detecting meniscal ramp lesions in patients with anterior cruciate ligament tears: A systematic review and meta-analysis. *Am J Sports Med* 2020;48:2051-2059.
4. Mouton C, Magosch A, Pape D, Hoffmann A, Nührenböcker C, Seil R. Ramp lesions of the medial meniscus are associated with a higher grade of dynamic rotatory laxity in ACL-injured patients in comparison to patients with an isolated injury. *Knee Surg Sport Traumatol Arthrosc* 2020;28:1023-1028.
5. Naendrup JH, Pfeiffer TR, Chan C, et al. Effect of meniscal ramp lesion repair on knee kinematics, bony contact forces, and in situ forces in the anterior cruciate ligament. *Am J Sports Med* 2019;47:3195-3202.
6. Bumberger A, Koller U, Hofbauer M, et al. Ramp lesions are frequently missed in ACL-deficient knees and should be repaired in case of instability. *Knee Surg Sport Traumatol Arthrosc* 2020;28:840-854.
7. Alessio-Mazzola M, Lovisolo S, Capello AG, et al. Management of ramp lesions of the knee: A systematic review of the literature. *Musculoskelet Surg* 2020;104:125-133.
8. Espejo-Baena A, Espejo-Reina A, Espejo-Reina MJ, Ruiz-Del Pino J. The Finochietto sign as a pathognomonic finding of ramp lesion of the medial meniscus. *Arthrosc Tech* 2020;9:e549-e552.
9. Kumar NS, Spencer T, Cote MP, Arciero RA, Edgar C. Is edema at the posterior medial tibial plateau indicative of a ramp lesion? An examination of 307 patients with anterior cruciate ligament reconstruction and medial meniscal tears. *Orthop J Sport Med* 2018;6:1-6.
10. Hatayama K, Terauchi M, Saito K, Aoki J, Nonaka S, Higuchi H. Magnetic resonance imaging diagnosis of medial meniscal ramp lesions in patients with anterior cruciate ligament injuries. *Arthroscopy* 2018;34:1631-1637.
11. Kim SH, Lee SH, Kim K II, Yang JW. Diagnostic accuracy of sequential arthroscopic approach for ramp lesions of the posterior horn of the medial meniscus in anterior cruciate ligament-deficient knee. *Arthroscopy* 2018;34:1582-1589.
12. Thaanat M, Jan N, Fayard JM, et al. Repair of meniscal ramp lesions through a posteromedial portal during anterior cruciate ligament reconstruction: Outcome study with a minimum 2-year follow-up. *Arthroscopy* 2016;32:2269-2277.

13. Gülenç B, Kemah B, Yalçın S, Sayar Ş, Korkmaz O, Erdil M. Surgical treatment of meniscal RAMP lesion. *J Knee Surg* 2020;33:255-259.
14. Chen Z, Li WP, Yang R, et al. Meniscal ramp lesion repair using the FasT-Fix technique: Evaluating healing and patient outcomes with second-look arthroscopy. *J Knee Surg* 2018;31:710-715.
15. Negrín R, Reyes NO, Iñiguez M, Pellegrini JJ, Wainer M, Duboy J. Meniscal ramp lesion repair using an all-inside technique. *Arthrosc Tech* 2018;7:e265-e270.
16. Sonnery-Cottet B, Conteduca J, Thaunat M, Gunepin FX, Seil R. Hidden lesions of the posterior horn of the medial meniscus: A systematic arthroscopic exploration of the concealed portion of the knee. *Am J Sports Med* 2014;42:921-926.
17. Acosta J, Ravaei S, Brown SM, Mulcahey MK. Examining techniques for treatment of medial meniscal ramp lesions during anterior cruciate ligament reconstruction: A systematic review. *Arthroscopy* 2020;36:2921-2933.
18. Lee JY, Chia ZY, Jiang L, Ang B, Chang P. A Review of the Gillquist maneuver: Modifications for a safer and easily reproducible approach for knee transintercondylar notch posterior compartment arthroscopy. *Arthrosc Tech* 2020;9:e435-e438.