

# Arthroscopic Procedure for Chronic Isolated Bucket-Handle Meniscal Tears



Ibrahim Abolaji Alabi, M.B.B.S., F.W.A.C.S., F.M.C.Ortho., Bancha Chernchujit, M.D.,  
Chanont Kanokvaleewong, M.D., Arrisna Artha, M.D., and Reneil Jay Pena, M.D.

**Abstract:** Arthroscopic treatment is the treatment of choice in bucket-handle meniscal tears (BHMTs). Following BHMT, however, surgery failure rates are approximately 20% in the literature. Achieving the healing of BHMT is difficult. This is worse in chronic situations because the torn meniscus is deformed, leading to nonanatomical reduction. Some authors have reported greater failure rates, especially in the early postoperative period. In isolated BHMTs, the failure rate is greater because of inadequate and incomplete repairs due to the tight medial compartment. Multiple techniques for possible reduction of failure rate have been described. We describe an arthroscopic technique for treating chronic isolated BHMT using the technique of subcutaneously releasing the posterior fibers of the medial collateral ligament to provide adequate space for arthroscopy, meniscal reduction, and repair. A combined inside-out and all-inside repair technique was used to enhance anatomic reduction, stable fixation, surface fixation (rather than the usual suture-points fixation), and biologic healing in repairable chronic BHMTs.

**B**ucket-handle tears of the meniscus comprise nearly 10% of all meniscal tears.<sup>1</sup> Meniscal repair is desirable over resection to prevent postmeniscectomy arthritis.<sup>2,3</sup> From the biomechanical and biological points of view, an arthroscopic meniscal repair always should be considered as an option.<sup>2,4</sup> Compared with meniscectomy, arthroscopic meniscal repair outcomes are better.<sup>4</sup> Although the repair of chronic bucket-handle meniscal tears can lead to good clinical outcomes with a relatively low (17%) failure rate, repairs of isolated meniscal tears have a significantly greater risk of failure than repairs performed in conjunction with anterior cruciate ligament reconstruction.

At early follow-up, the overall failure rate is 14 of 33 (42%); complex tears (80%) and bucket-handle tears (47%) have greater overall failure rates compared with

simple tears (18.2%).<sup>3</sup> Attempts have been made at the biological enhancement of healing. These include mechanical stimulation, supplemental bone marrow stimulation, platelet-rich plasma, stem cell therapy, and scaffolds and membranes.<sup>4</sup> In chronic settings, the torn menisci are deformed, bulbous, with various degrees of degenerations. This technique is aimed at preventing early failure, which commonly characterizes chronic isolated bucket-handle meniscal tear (CIBHMT) repairs, by ensuring adequate and complete repair, with a cost-effective biologic augmentation.

## Clinical and Radiologic Diagnosis

Patients with CIBHMT are often male, young, athletic individuals without previous meniscal surgery. They may have mild-to-moderate osteoarthritis clinically and radiologically. Medial bucket-handle meniscal tear is more common than lateral.<sup>3</sup> One in 5 patients suffer a re-tear of the affected meniscus at a mean of 20.94 months postoperatively, and at a mean of 6.25 months of follow-up, and no preoperative or intraoperative differences exist between those with and without meniscal re-tear.<sup>5</sup> Displacement of the free segment can lead to significant pain and disability, necessitating reduction and surgical treatment.<sup>1</sup> Other symptoms that patients may experience with a bucket handle tear include stiffness, tightness, swelling, and locking. One can elicit joint line tenderness in the affected compartment when chondral damage is

*From the Department of Orthopaedics, Faculty of Medicine, Thammasat University Hospital, Pathumthani, Thailand.*

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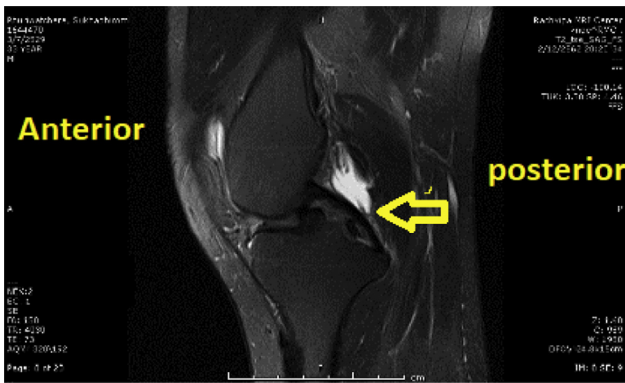
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*Address correspondence to Ibrahim Abolaji Alabi, M.B.B.S., F.W.A.C.S., F.M.C.Ortho., Department of Orthopaedics, Faculty of Medicine, Thammasat University, Pathumthani 12120, Thailand. E-mail: [ibrahimic75@yahoo.com](mailto:ibrahimic75@yahoo.com)*

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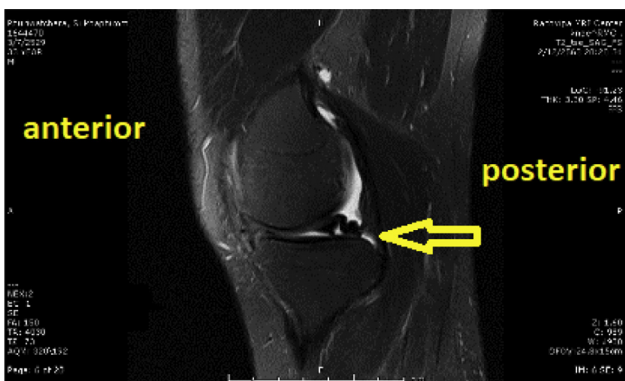


**Fig 1.** Double posterior cruciate ligament in a sagittal view; the likely findings in a right knee, sagittal view, with bucket handle meniscal tear.

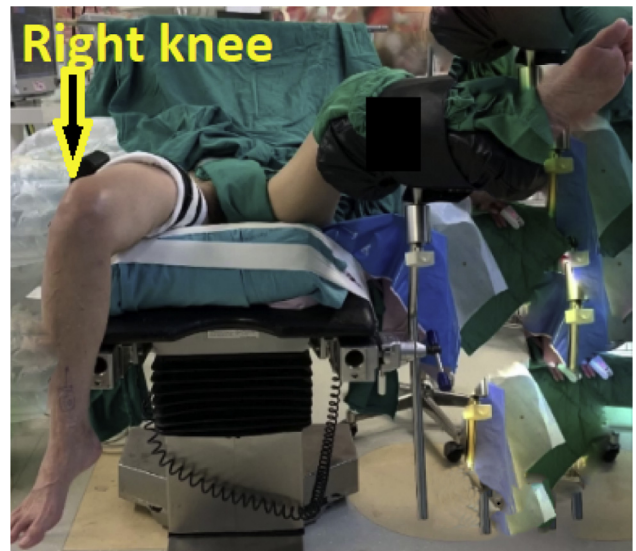
involved.<sup>6</sup> Preoperatively, plain radiograph (anteroposterior, lateral, and skyline views) are done to rule out the intra-articular bony anomaly and assess the grade of osteoarthritis if present (Fig 1 A-C). Magnetic resonance imaging of the affected knee is requested to evaluate the status of the menisci (double posterior cruciate ligament sign could be seen especially when there is a flip into the intercondylar notch [Fig 2, A-C]), rule out other ligamentous injuries, as well as osteochondral lesions.

**Patient Position (With Video Illustration)**

Following a spinal or general anesthesia (according to the patient’s preference), after a femoral nerve block, the patient is positioned supine with the affected leg hanging over the edge of the operating table the contralateral leg is placed in an abduction stirrup (Fig 3; Video 1). This position allows a figure of 4 position and full flexion of the knee with a wide range of motion during fixation. A well-padded high thigh pneumatic tourniquet is applied. The



**Fig 2.** Lamination and tears in a sagittal view; the likely findings in a right knee, sagittal view, with bucket handle meniscal tear.

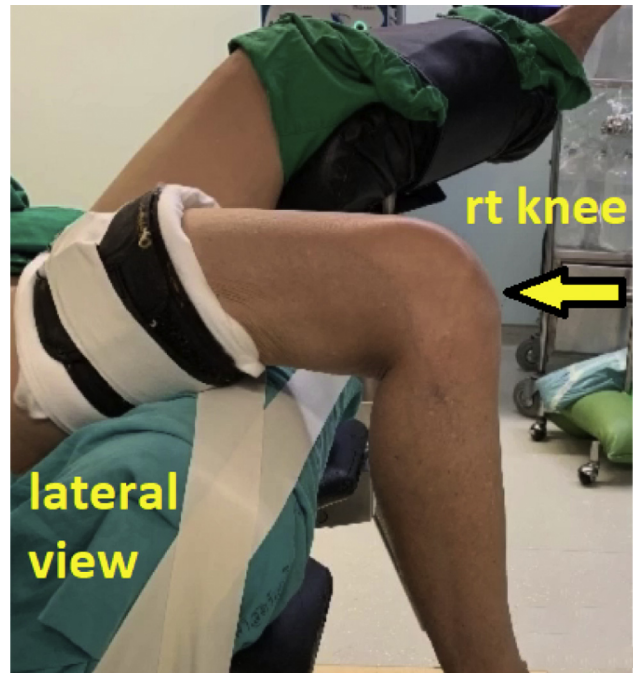


**Fig 3.** Patient is in the supine position with index leg (right leg) hanging and the contralateral leg in abduction. The arrows point to the affected knee.

tourniquet is inflated after surgical-site preparation and exsanguination.

**Arthroscopic Examination**

Following examination under anesthesia, a routine arthroscopic examination is performed through the standard anterolateral and anteromedial portals to confirm the diagnosis and confirm the integrity of other



**Fig 4.** Lateral view. Patient is in the supine position with index leg (right leg) hanging and the contralateral leg in abduction. The arrows point to the affected knee.

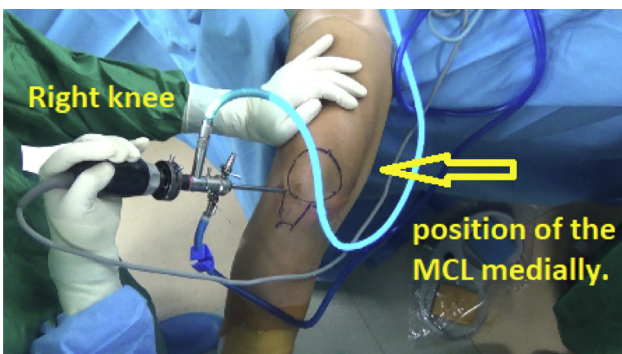


**Fig 5.** Posteromedial (transseptal) portal in use in the right knee of a patient in the supine position.

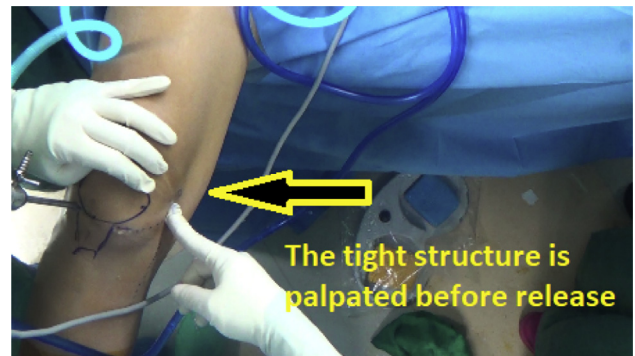
intra-articular structures, especially anterior cruciate ligament and posterior cruciate ligament injuries that are commonly associated with meniscal injuries. Prepatellar pad of fat is cleared to improve arthroscopic vision. Accessory posteromedial and posterolateral portals are made in cases of posterior laminations (Figs 4 A-E and 5).

### Releasing the Medial Collateral Ligament (MCL)

Medial bucket-handle meniscal tear is more common than lateral.<sup>3</sup> In cases of medial CIBHMT, there is a need to properly open up the medial compartment in which just valgus position of the knee may not give sufficient exposure if other ligaments within and around the knee are intact. This is not unconnected with the deformation that follows chronic tears. The anterior portion usually becomes bulbous, making reduction into the tight medial compartment and anatomic repair difficult. Visualization and arthroscopic repair of tears in the posteromedial corner of the torn menisci are also difficult in tight knees. Iatrogenic chondral lesions (which may result from working in such a tight space) and residual unrepaired tears (from inadequate view in a tight knee) might cause serious



**Fig 6.** Maximal valgus position; patient is in a supine position.



**Fig 7.** Palpation of tensed fibers; patient is in a supine position.

morbidity and inadequate relief of symptoms. Arthroscopic treatment of tears in the middle and posterior parts of the medial meniscus can be difficult when the medial tibiofemoral compartment is tight.<sup>7</sup>

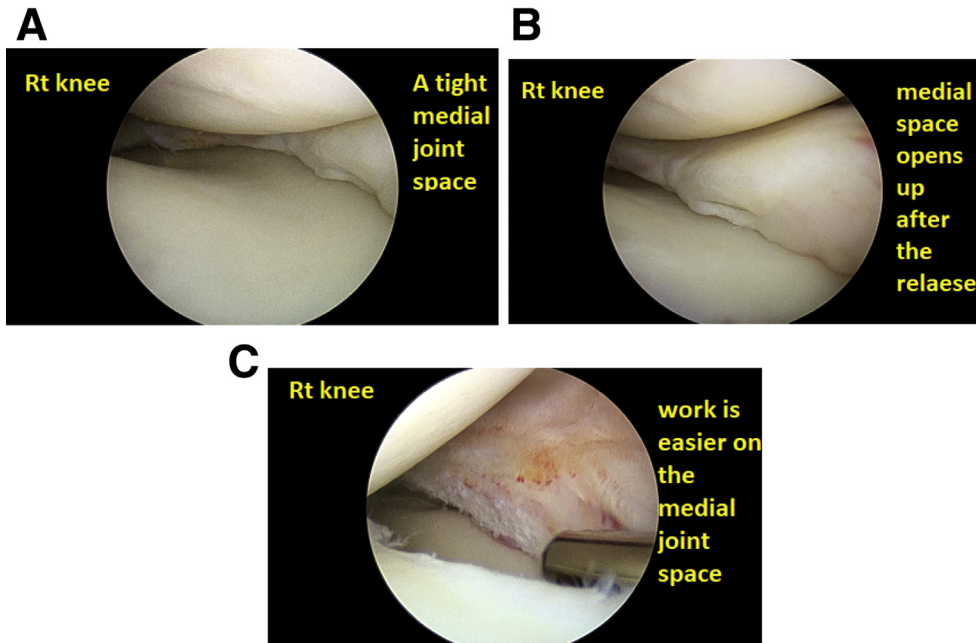
The outside-in, percutaneous release of the MCL is a technique used to increase the medial tibiofemoral joint space during arthroscopy to facilitate the use of instrumentation and improve visualization without causing iatrogenic cartilage damage<sup>8</sup> (Video 1). Thus, we routinely release the posteromedial fibers of the MCL using the subcutaneous pie-crusting technique at our previously described magic point (Figs 6-9). The knee is flexed to 20° while applying valgus deformation on the knee and external rotation of the foot. The improvement in the visualization of the medial compartment is instantly obvious (Fig 9 A and B).

### Preparation of the Soft-Tissue Bed

The surface of the meniscus attached to the capsule or the capsule (in cases of lamination) is debrided and freshened using arthroscopic 4.5-mm shaver blades. Trephinations are made into the bed using 1.8-mm Kirschner wire to a depth of about 2 to 4 mm and 2-mm apart to stimulate fresh bleeding, fibrin clot formation and release of progenitors that will enhance biologic healing (Figs 10 and 11; Video 1).



**Fig 8.** Release of tensed fibers; patient is in a supine position.



**Fig 9.** The patient is in a supine position. (A) Before MCL release. (B) Post-MCL release. (C) Good access to the bed. (MCL, medial collateral ligament.)

### Reduction and Repair of the Torn Meniscus

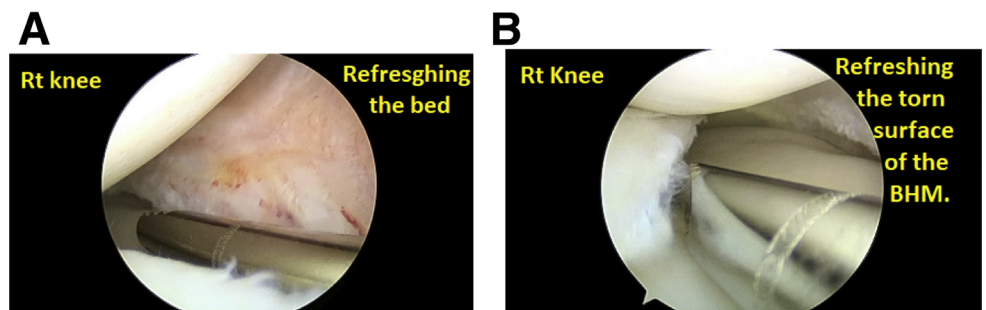
The torn and usually flipped meniscal segment was then reduced into its anatomic position gently using a probe (Fig 12; Video 1). The bulbous anterior portion may need some strength on the probe and steadiness to get it reduced. Through an anterolateral portal, a zone-specific single lumen cannula is placed above the upper surface of the meniscus, and a number 2 ETHIBOND carrying needle is loaded into the cannula to repair the meniscus back to its point of detachment from the upper surface, with care taken not to damage the saphenous nerve branches as the threads are brought out on the medial side (Fig 13). The cannula is redirected to deliver a second suture in a vertical pattern passing through the meniscus, the tear, and the capsule to the exterior. Other vertical sutures are placed in similar patterns from above the surface of the meniscus into its substance (Fig 14). A horizontal array of sutures is placed on the upper surface of the

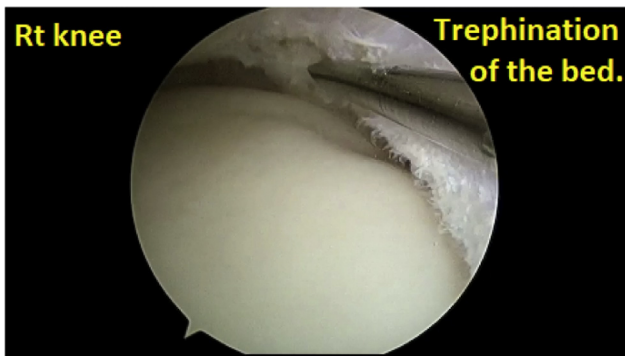
meniscus to give a Mason–Allen suturing effect leading to surface contact rather than suture points contact (Fig 15; Video 1).

In the posterior part of the meniscus, all inside technique repair was used using a Fast-Fix all-inside meniscal suture device (Smith & Nephew, Andover, MA; Video 1). The eventual arthroscopic views are as shown in Figure 16. These combined techniques reduce the risk of failure, restore surface contact (rather than suture-points contacts), and enhance biologic healing.

On the skin medially, a small incision is made between sutures from the upper and the lower surfaces of the meniscus. The saphenous nerve is safeguarded through blunt dissection down to the capsule and retrieval of sutures is done through the small wound (Fig 17). Fat tissue is removed and the knots are tied over the capsule (Fig 18). The wound is apposed and dressed. A brace is applied in extension before the patient left the suit.

**Fig 10.** (A) Debriding the bed. (B) Debriding base of torn medial meniscus.





**Fig 11.** Trephination being done. The anteromedial portal is the working portal while the anterolateral portal is the viewing portal here. The patient is in a supine position.

### Postoperative Rehabilitation

Postoperatively, isometric exercises commence immediately and the patient is ambulated on protected weight-bearing with the knee immobilized in full extension with a brace for the first 2 weeks (Fig 19A). A range of motion exercise is commenced at 2 weeks of the postoperative period while the patient carries on with the isometric exercises (Fig 19B). Often, the patient can straight-leg-raise at 2 weeks of the postoperative period (Fig 19C). The patient is followed up at 2 weeks, 6 weeks, 3 months, 6 months, 1 year, and 2 years. Postoperative MRI is done at 12 and 24 weeks. Active rehabilitation exercise is commenced at 6 months of the postoperative period.

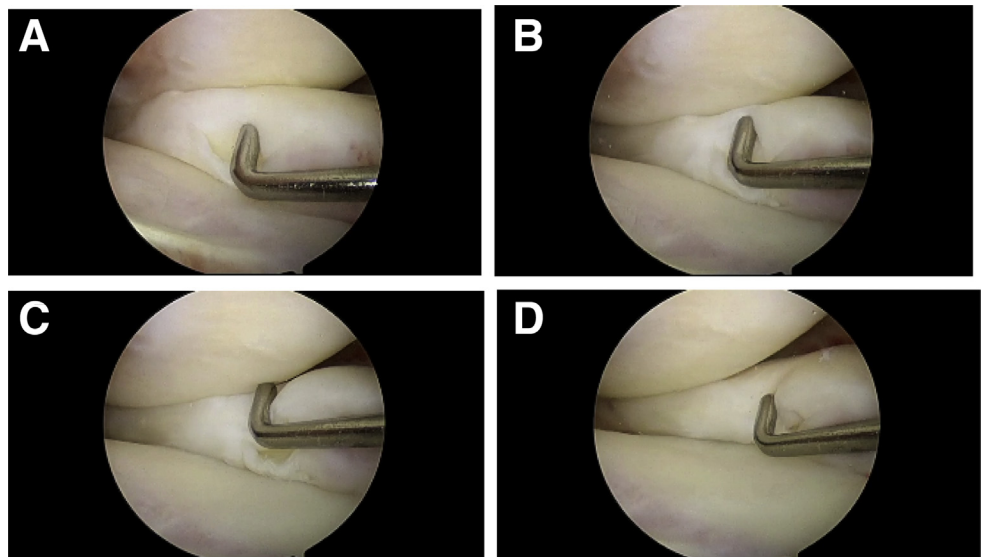
### Discussion

Isolated meniscal tears have a significantly greater risk of failure than repairs performed in conjunction with anterior cruciate ligament reconstruction.<sup>5</sup> This is not

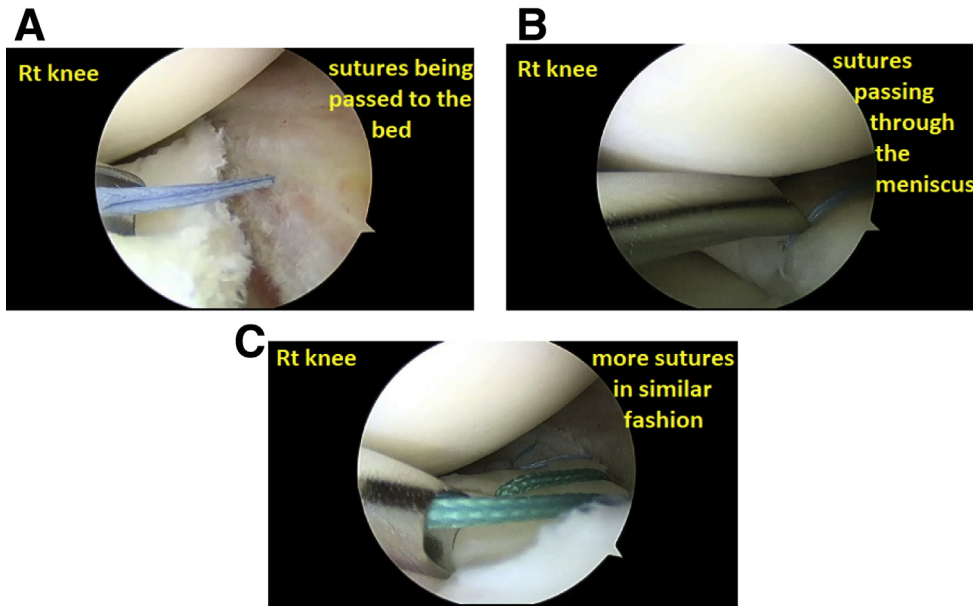
unconnected with the limited exposure of the medial compartment, leading to incomplete and inadequate repair that subsequently results in high failure rates in the early stages and osteochondral damage.<sup>8</sup> We do a subcutaneous release of the posterior fibers of the MCL to improve the exposure of the medial compartment for better visualization, anatomic reduction of the torn meniscus, and its surface attachment to the wall. This maneuver ensures a complete stable repair with good surface contact instead of the suture points contacts in poorly visualized joints. This is similar to the findings of Moran et al., Javidan et al., and Hinton.<sup>8-10</sup>

We found out that releasing the medial meniscus does not lead to valgus instability following arthroscopic treatment for CIBHMT. This finding was similar to those of Moran et al., who found out that controlled release of the MCL in tight knees allowed easier handling in posterior medial meniscus tears and a better understanding of tear configurations, avoiding iatrogenic chondral damage and the MCL injury healed uneventfully.<sup>8</sup> Although, Lons et al.<sup>11</sup> found out that that valgus laxity is still present at 6 weeks post-piecrusting of the MCL, more papers cited no medial-lateral instability at the short- and long-term follow-up. It suffices to also mention that majority of the procedure carried out by Lons et al. were meniscectomies (33 of 40 meniscal surgeries).

We used a combined inside-out and all-inside modality with multiple suturing techniques to ensure stable and adequate fixation. This approach was approved as being appropriate by many researchers<sup>1,2,12-15</sup>; however, some authors have recorded better outcomes with all-inside repairs when compared with inside-out repairs.<sup>12</sup> Our assertion was similar to those of Yilmaz et al.,<sup>13</sup> who found out that combined

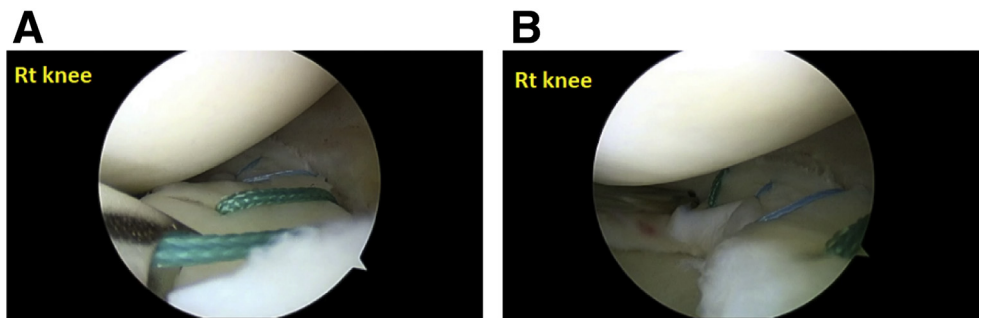


**Fig 12.** (A-D) Gentle gradual reduction using the probe. The anteromedial portal is the working portal whereas the anterolateral portal is the viewing portal. The patient is in the supine position.



**Fig 13.** (A-C) Inside-out suturing technique from the upper surface. The anteromedial portal is the viewing portal whereas the anterolateral portal is the working portal at this point. The patient is in the supine position.

**Fig 14.** (A-B) After an adequate number of vertical sutures are placed. The anteromedial portal is the viewing portal whereas the anterolateral portal is the working portal. The patient is in the supine position.



**Fig 15.** (A-C) Vertical sutures with horizontal suturing to create the Mason–Allen suturing technique effect. The patient is in the supine position. The anterolateral portal is the working portal whereas the anteromedial portal is the viewing portal.

inside-out and all-inside meniscal repair technique is a successful and cost-effective treatment method in bucket-handle meniscus tears.

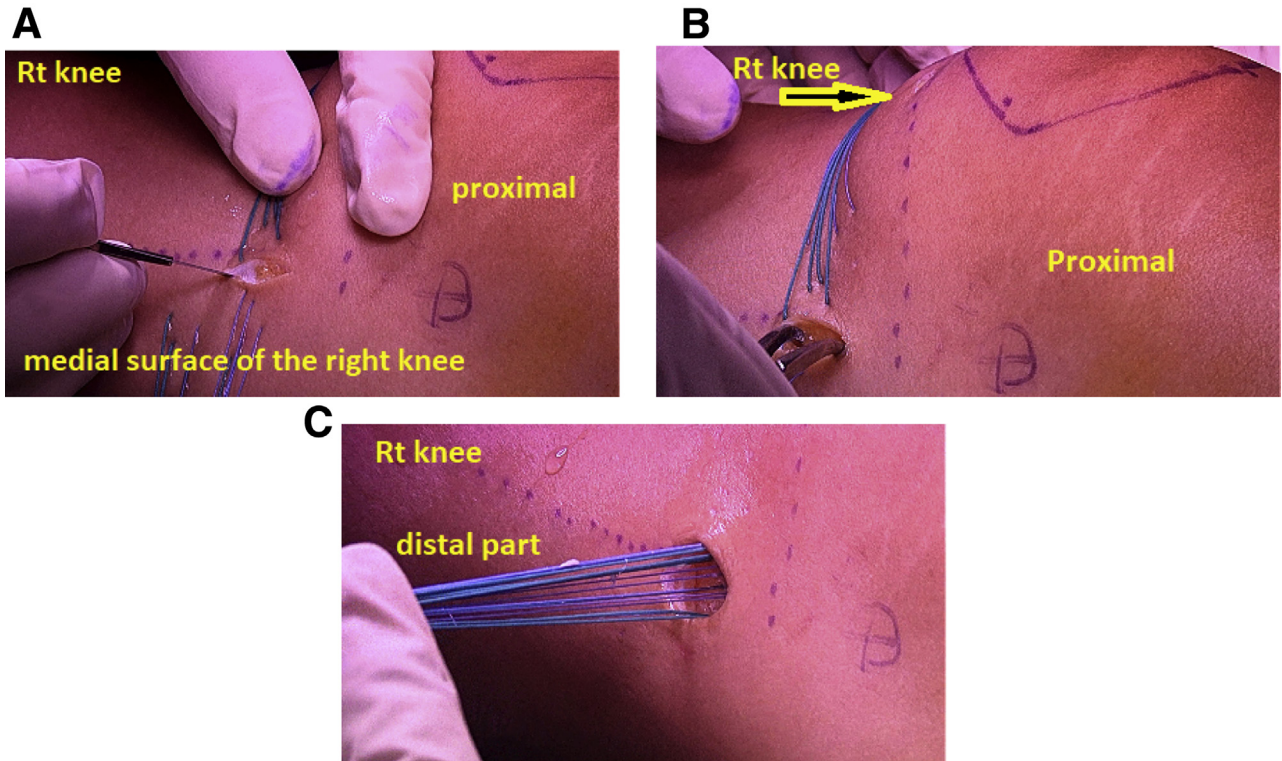
Various authors have used various modalities to enhance biologic healing. Some biological therapies tried to enhance meniscal repair success (but their efficacy needs further research) include mechanical stimulation, supplemental bone marrow stimulation, platelet-rich plasma, stem cell therapy, and scaffolds

and membranes.<sup>4</sup> Our trephination of the bed before a repair will give similar results at no extra cost to the patient. It promotes bleeding, which will lead to clot formation. It also leads to the release of progenitor cells that will further enhance biologic healing. These advantages of this procedure and its limitations or disadvantages are summarized in [Table 1](#).

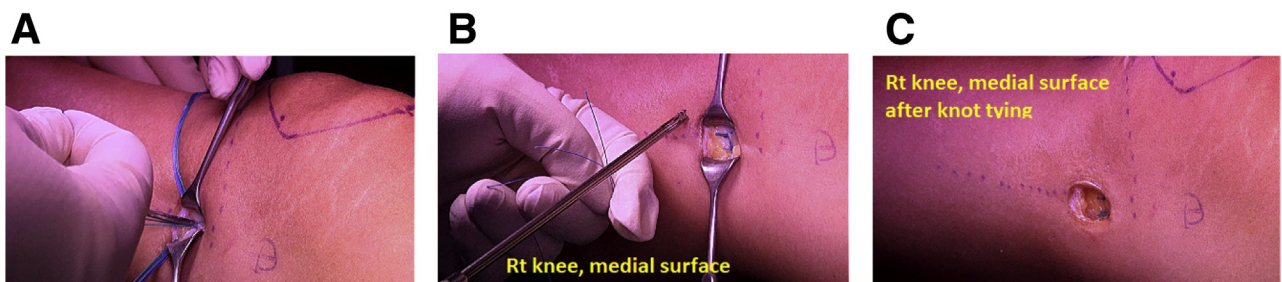
Different modalities of weight-bearing postmeniscal repairs have been done. Muckenhirn et al.<sup>1</sup> also allows



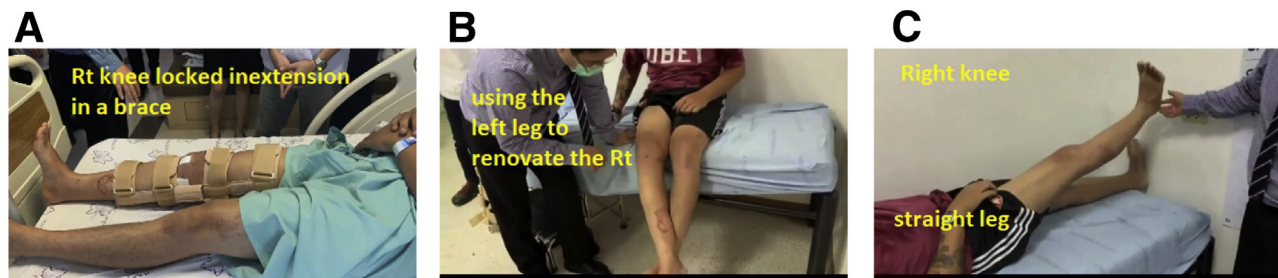
**Fig 16.** (A-C) Combined inside-out and all-inside repairs after debris is removed using the anteromedial portal as the viewing portal whereas the anterolateral portal is the working portal. The patient is in the supine position.



**Fig 17.** (A-C) A 1- to 1.5-cm incision, blunt dissection, is performed, and the retrieval of sutures through the wound is made. The patient is still in the supine position, but with the knee fully extended and supported with a Mayo instrument trolley at the heel.



**Fig 18.** Sutures are tied on the capsule to protect the saphenous nerve and ensure a firm repair on the medial surface of the right knee. The patient is still in the supine position, but with the knee fully extended and supported with a Mayo instrument trolley at the heel.



**Fig 19.** (A) The knee is kept in extension with a brace locked in extension after surgery in a supine position. (B) The patient commences range of motion exercises at 2 weeks using the normal left knee to support and exercise the operated knee in a sitting position. (C) The patient performing straight leg raise; he was able to achieve full extension in supine position.

immobilization, physical therapy, and weight-bearing as appropriate. Lons et al.<sup>11</sup> will allow immediate postoperative full weight-bearing. We allowed early protected weight-bearing, with the knee kept in extension through the use of a brace, as shown in [Video 1](#). The meniscus is stable and locked in extension and the repair is protected. Allowing protected weight-bearing promotes condylar remodeling of the newly repaired meniscus. Our maintaining the knee in extension will prevent motion and twisting that could disrupt the healing process of the meniscus in the early postoperative period. We commence full weight bearing by 2 weeks of the postoperative period. The details of this procedure and our rehabilitation protocols are demonstrated in [Video 1](#).

### Conclusions

Good patient positioning, subcutaneous MCL release, combined inside-out and all-inside repairs, Mason–Allen suturing techniques, trephination of the bed, surface fixation (rather than suture point fixations), and early protected weight-bearing are effective in arthroscopic chronic bucket-handle meniscal tears repairs.

**Table 1.** Advantages and Disadvantages of Our Arthroscopic Repair of Chronic Isolated Bucket-Handle Meniscal Tear

Advantages	Disadvantages
<ul style="list-style-type: none"> <li>• Provides adequate exposure during repair</li> <li>• Does not require hardware removal</li> <li>• Ensures complete repair of meniscal tears</li> <li>• It gives surface contact rather than suture-points contact</li> <li>• Enhance biologic healing</li> <li>• No risk of cartilage damage</li> <li>• It is cost-effective</li> <li>• Does not involve the use of exogenous substances</li> <li>• It is surgeon friendly</li> </ul>	<ul style="list-style-type: none"> <li>• A slightly more than arthroscopic portal scar medially</li> <li>• Risk of damaging the saphenous nerve in inexperienced hands</li> <li>• Not all chronic bucket handle meniscal tears are salvageable.</li> </ul>

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