Technical Note

An Approach to Chronic and Displaced Bucket Handle Meniscal Tear—Assessment, Repair (Push-and-Pull Technique), or Salvage

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Abstract: Meniscal repairs are preferred to meniscectomies to preserve meniscal function and mitigate the risk of degeneration. However, repair of a chronic and displaced bucket handle tear of the meniscus can be technically challenging. We introduce a systematic method for assessment, reduction, repair, or salvage in this situation with an aim of reducing operating time and improving the chance of a favorable outcome. This technique describes repair of a bucket handle tear on the medial meniscus with displacement into the intercondylar notch. An arthroscopic probe is used for reduction and suture tension (push-and-pull technique) when using an all-inside suture device (FAST-FIX 360 repair system; Smith & Nephew) on the middle and posterior part of the tear. The anterior part of the tear is repaired with an outside-in method. If reduction is not possible, then a salvage reduction and hybrid repair is carried out instead. Postoperatively, patients will be nonweight-bearing on the operated limb, and range of motion restricted from 0 to 90° for 6 weeks, with the aim of resuming running by 6 months.

A meniscal repair is preferred to a partial or total meniscectomy to preserve meniscal function and mitigate the risk of degeneration.[1-9] Different repair techniques have been described, and there are comparable outcomes reported[10-14] between the all-inside and inside-out repair techniques. The repair of bucket handle tears[15-18] has shown promising results. Nevertheless, the repair of a chronic and displaced bucket handle tear poses a challenge for the less-experienced surgeon. A systematic approach in assessment, reduction, and repair or salvage facilitates the operative process and conserves tourniquet time. The authors propose this approach and the respective techniques for repair and salvage of a chronic and displaced bucket handle meniscal tear.

Surgical Technique (With Video Illustration)

The technique is described on a medial meniscus with a bucket handle tear displaced into the intercondylar notch. The patient is supine under general anesthesia. A tourniquet of appropriate size is applied onto the proximal thigh and the patient is cleaned and draped. The standard anteromedial and anterolateral portals are made. The arthroscope is inserted routinely into the anterolateral portal and the arthroscopic probe is inserted via anteromedial portal. A diagnostic arthroscopic examination is performed before proceeding to address the pathology. A 30° lens is used throughout the surgery.

Assessment and Reduction

The knee is in 30° flexion and under valgus stress. The mobility of the torn segment is assessed and an arthroscopic probe is used to reduce it. It is helpful to passively range the knee with the arthroscopic probe exerting a constant pressure on the torn segment to move it out of the intercondylar notch (Fig 1). The arthroscope is now changed to the anteromedial portal to assess the reduction. The tactile feedback from the arthroscopic probe enables assessment of adequacy of the reduction. A proper reduction is one with no gap

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The authors report the following potential conflicts of interest or sources of funding: S.-Y.J.L. reports other from Smith & Nephew, outside the submitted work. Full ICMJE author disclosure forms are available for this article online, as supplementary material.

Received February 11, 2021; accepted April 2, 2021.

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2212-6287/21224
https://doi.org/10.1016/j.eats.2021.04.005

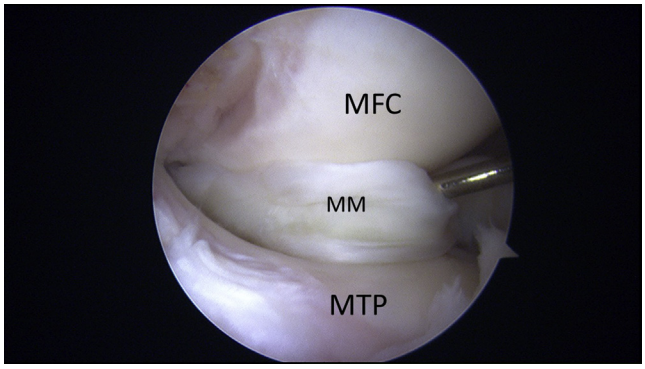

Fig 1. Right knee in 90° of flexion. Anteromedial portal view. Bucket handle torn segment is displaced into the intercondylar notch and results in impingement on knee extension. (MFC, medial femoral condyle; MM, medial meniscus; MTP, medial tibial plateau.)

between the torn edges and no instrument is required to maintain reduction. The tear margins are debrided and trephined. The adhesions at the corners of the tear (Fig 2) at anterior and posterior horns are debrided to enable reduction. We need to be careful not to detach or break up the torn segment during debridement. A meniscal rasp is preferred for release at the posterior horn if there is limited visibility or accessibility for the arthroscopic shaver. Assessment of the posterior horn by notch view is helpful. When the torn segment is long and twisted, a grasper is preferred for reduction.

Reduction Suture and Repair (Push-and-Pull Technique)

An all-inside suture device (FAST-FIX 360 repair system; Smith & Nephew, Andover, MA) is introduced via the anterolateral portal using a metal slotted

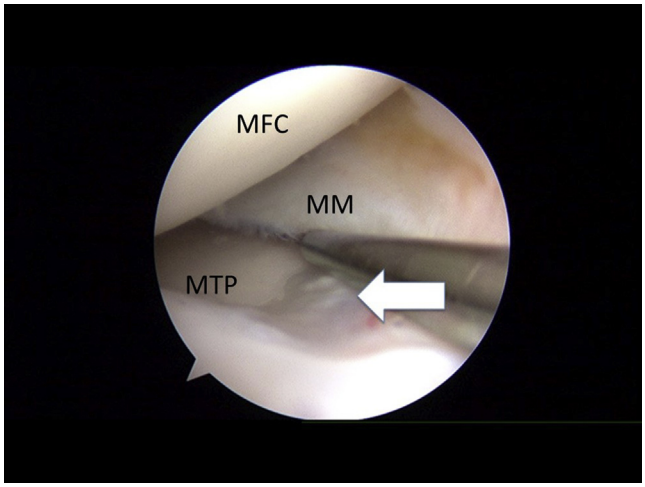

Fig 2. Right knee in 90°of flexion. Anteromedial portal view. Scarring at anterior horn corner. This hinders reduction. (MFC, medial femoral condyle; MM, medial meniscus; MTP, medial tibial plateau.)

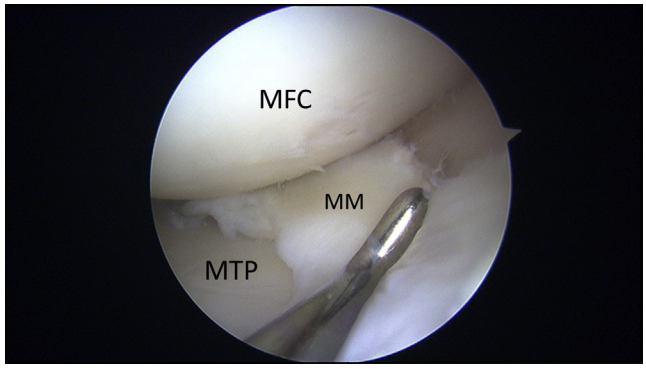

Fig 3. Right knee in 90° of flexion. Anteromedial portal view. Arthroscopic probe reducing the torn segment at its midpoint. The reduction is adequate when the torn segment remains in reduction and no gap is seen between the torn margins when the probe is taken off. (MFC, medial femoral condyle; MM, medial meniscus; MTP, medial tibial plateau.)

cannula. It is positioned at the mid-point of the length of the torn segment. The first anchor is passed above the torn segment and deployed (Fig 2). The second anchor is passed under the torn segment when it is small or friable and deployed (Fig 3). This reduction suture is tightened progressively with the arthroscopic probe under it (Video 1). The arthroscopic probe counters the pull of the suture on the torn segment, positions the torn segment and prevents the free edge lifting up (Figs 4 and 5). A subsequent all-inside repair for the posterior part of the tear is performed. An outside-in repair (Meniscus Mender II; Smith & Nephew) is performed for the anterior part of the tear. A 20-G needle is used to determine the site of the tear. A vertical incision followed by blunt dissection of the soft tissue using an artery forceps down to the capsule is performed. The first suture (ULTRABRAID; Smith & Nephew) is passed over the torn segment. The second suture is passed through the torn segment or under it if it is small or friable. An arthroscopic probe is used for reduction and suture tensioning. Additional outside-in repairs are performed as indicated.

Salvage

If reduction is not possible, the torn segment is detached from the anterior horn via an arthroscopic scissor. The free end of the torn segment is reduced with the arthroscopic grasper (Fig 6) via the anteromedial portal and the arthroscope in the anterolateral portal. A 20-G needle is used to confirm the anterior extent of the torn fragment. A vertical skin incision followed by blunt dissection down to the capsule is performed. After anchoring the anterior end of the torn segment with an outside-in repair, an all-inside repair is deployed for the remaining torn segment. This is considered when the anterior end of the remnant segment after reduction is anterior to the medial

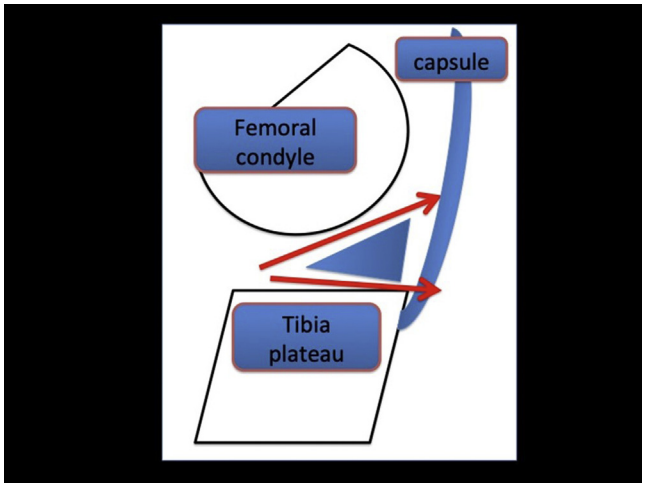

Fig 4. Repair schematic. One suture passed above the torn segment. The other suture is passed under it.

collateral ligament. When the torn remnant is limited to the posterior half, an all-inside repair is possible.

Postoperative Rehabilitation

The surgery requires less than a 24-hour inpatient stay. The patient does not bear weight for 6 weeks after surgery, and the allowed range of motion is from 0 to 90°. After this period, weight-bearing and active range of motion is as tolerated. The focus during this period is good pain control to enable recovery of active range of motion and strength. Running starts by 6 months after surgery.

Discussion

It is general consensus and shown in studies that meniscus repair results in a better outcome than partial or total meniscectomy.[1-9] There is a significant lower chance of meniscal repair as time from injury progresses. Amidst the controversies, the outcome[12,15-18] of repair of the bucket handle tear is promising. For the less-experienced surgeon, a systematic approach to assess and to determine the treatment options saves operative time and potentially improves outcome for the patient.

When the bucket handle tear is chronic and the torn segment displaced into the intercondylar notch, it undergoes neovascularization and becomes scarred down. This is evidence of the chronicity of the injury and is a telling tale sign of the possible technical challenge. A concurrent anterior cruciate ligament tear poses another technical challenge due to knee subluxation. It is important the knee is congruent to facilitate repair.

The reduction of the torn segment has 2 purposes. The first reduction is tentatively with the arthroscopic probe. By placing the arthroscopic probe at the midpoint of the torn segment, the segment is tensed up evenly. A gap will be present when the torn segment is tight and not reducible. For a reduced torn segment, the reduction is maintained with an all-inside suture repair. Optimal tensioning of the suture is key to reduction and repair. This allows limited to-and-fro sliding movement of the torn segment to equalize its length on each side of the reduction suture. The optimal tension is enough for meniscal reduction and for the probe tip to pass snugly under it. This is achieved by tightening the reduction suture with an arthroscopic probe under it. By placing the reduction suture, a clear view of the posterior meniscus is obtained to facilitate repair. Other techniques[13,14,19,20] had been described to reduce the tear. The current technique reduces the torn segment with an all-inside repair.

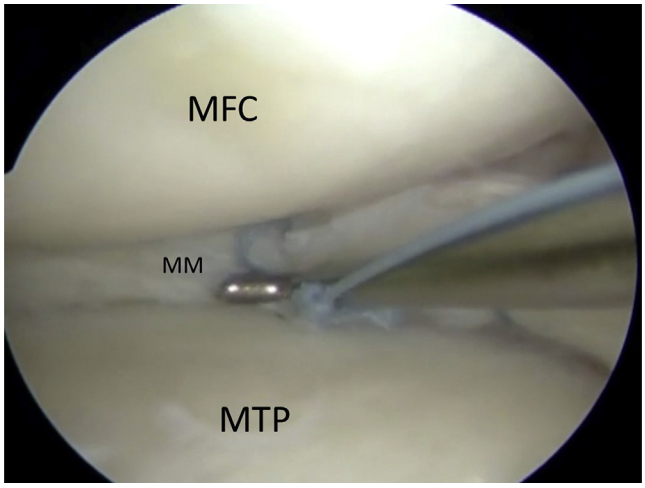

Fig 5. Right knee in 90° of flexion. Anteromedial portal view. Reduction suture. An arthroscopic probe controls suture tensioning. The probe alternately pushes (push) on the suture and the meniscus as the suture loop is tightened (pull). (MFC, medial femoral condyle; MM, medial meniscus; MTP, medial tibial plateau.)

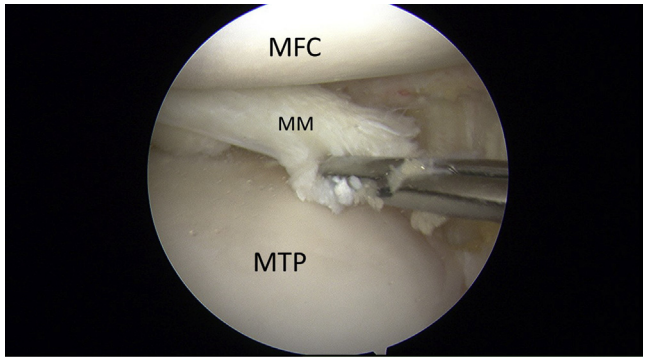

Fig 6. Right knee in 90° of flexion. Anteromedial portal view. Irreducible tear. The torn segment is cut at its attachment at the anterior horn. An arthroscopic grasper is used to position the cut anterior end and to facilitate outside-in repair. Subsequent repair on the remaining segment is with all-inside sutures. (MFC, medial femoral condyle; MM, medial meniscus; MTP, medial tibial plateau.)

Table 1. Pearls and Pitfalls

	Pearls	Pitfalls
Assessment	An arthroscopic probe is useful for reduction, as it enables tactile feedback on the tension of the meniscus reduction and repair suture. A gap between the torn margins signifies excess tension and inadequate reduction.	Not recognizing the tension at the tear margins can result in suture cut out.
Reduction	An all-inside repair for reduction minimizes the need for a skin incision. This reduces the risk of wound infection and nerve injury as well as reduces operative time. Optimal tensioning of reduction suture is important to enable anatomical reduction, and this is by placing an arthroscopic probe under the suture during tensioning. By reducing the torn segment in the mid-body, the posterior half comes into view and facilitates repair. When there is a concurrent anterior cruciate ligament tear, it is important to prevent subluxation, as this hinders reduction of the meniscus tear.	Overtightening of the reduction suture hinders sliding movement and equilibrating the length of the torn segment. This affects proper reduction of the tear. Passing the suture anchor through a thin or friable torn segment can result in tearing the segment or suture cut-out.
Salvage	The irreducible torn segment undergoes controlled release at the anterior horn. It remains attached at the posterior horn. The anterior end is repaired with the outside-in technique and subsequent all-inside technique for the remaining segment. This preserves meniscus bulk and function.	Debriding the irreducible torn segment results in loss of meniscus tissue and function.

The authors prefer blunt dissection of the soft tissue down to the capsule prior to deploying the outside-in technique for anterior meniscus repair. This prevents accidental cutting of repair suture, ensures the suture knot is on the capsule and reduces the risk of nerve injury. When repair is not feasible, the authors prefer a salvage option to a meniscectomy. The torn segment is reduced onto the meniscus and takes its alignment from its native attachment at the posterior horn. It is used as a graft to preserve bulk of the meniscus and function (Table 1). This is a preliminary report, and outcome studies are needed to determine its clinical benefit (Table 2). This is an easily reproducible approach to assess and to determine the treatment options for a chronic and displaced bucket handle tear.

Conclusions

It is a technical challenge for the less-experienced surgeon to address a chronic and displaced bucket handle tear of the meniscus. A systematic approach in assessment, reduction, repair or salvage reduces the operative time and improves the chances of a favorable outcome.

Table 2. Limitation(s)

1. The posterior attachment may be accidentally cut during release or debridement.
2. The free-floating salvage remnant fragment may not be properly reduced.
3. There is a time limitation in attempting to release, reduce, and repair the tear. Addressing the tear may be a stand-alone surgery, or part of a bigger surgery, and time allocation is critical.
4. Failure of the repair may necessitate a second surgery.
5. This is a preliminary study, and clinical study is required to determine the clinical outcome of the salvage technique.

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