

Autologous Platelet-Rich Fibrin Matrix—Augmented Repair for Parameniscal Cysts: Surgical Technique



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Abstract: Parameniscal cysts are defined as an internal disorder of the knee joint. It is known that parameniscal cysts are associated with horizontal meniscal tears that could lead to the collection of synovial fluid within the cyst. Despite the treatment of meniscal tears, cyst recurrence is still an issue that needs to be addressed. In this regard, there has been an increasing interest in the use of biologic agents to enhance the vascularity and healing of the meniscus. Preliminary results for biologic therapeutic agents, such as growth factors, bone marrow, and aspirate concentrate, have been encouraging. However, these options are more demanding in regards to time, financial burden, resources, and so on. Autologous platelet-rich plasma is readily available, easy to use, affordable, and minimally invasive. This Technical Note will describe a step-by-step and reproducible technique for the harvesting, preparation, and use of an autologous platelet-rich fibrin matrix used to augment the healing of meniscal repairs.

Parameniscal cysts are defined as an internal disorder of the knee joint and are located on the medial or on the lateral side. The patient may be asymptomatic or symptomatic, with issues such as knee pain, joint swelling, and soft-tissue masses.^{1,2} It is known that parameniscal cysts are associated with horizontal meniscal tears that can lead to the collection of synovial fluid within the cyst.³ In symptomatic patients, surgical treatment is mandatory.⁴ Due to the deep extension of the cyst into the red—red zone of the meniscus, biological factors may be taken into consideration to promote biological repair. Common methods to enhance the vascularity and healing of the meniscus include trephination, synovial abrasion, fibrin clot application, and platelet-rich plasma (PRP). PRP is characterized by

a concentration of platelets above the baseline values.⁵ It is theorized that greater levels of platelets allow the release of growth factors, which may promote angiogenesis and soft-tissue healing.^{6,7} It has been widely used in various orthopaedic procedures; recent papers report promising and satisfying results following a meniscal tissue repair with PRP augmentation.⁸ The purpose of the present Technical Note is to describe a simple and reproducible technique used to carry out a biological treatment of the parameniscal cyst with the harvesting and deployment of an autologous platelet-rich fibrin matrix (APRFM).

Surgical Technique (With Video Illustration)

Indication

The technique is indicated for every symptomatic parameniscal cyst. It was ideated as a biological form of augmentation of the red—red zone of the meniscus involved in the formation of the cyst. Due to the association of parameniscal cysts with meniscal tears,³ it is fundamental that the APRFM is applied after a knee arthroscopy to detect and treat any meniscal tears. The technique can be applied in the case of meniscal sutures or in meniscectomies despite any other variable, such as size or position of the cyst, age at surgery, or revision surgeries.

Patient Evaluation and Imaging

The knee should be systematically examined. The examination of the knee should start by scrutinizing the

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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 April 24, 2021; accepted July 1, 2021.

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2212-6287/21616

<https://doi.org/10.1016/j.eats.2021.07.005>

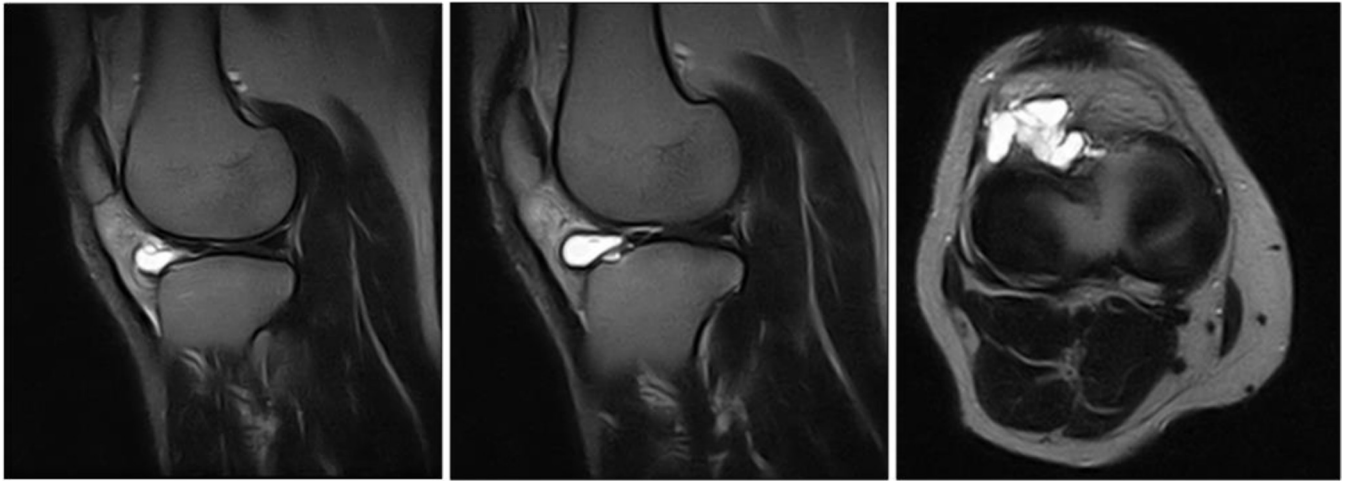


Fig 1. Right knee of 34-year-old man affected by lateral parameniscal cyst diagnosed after knee trauma. T2-weighted magnetic resonance imaging in the sagittal and axial plane showing an anterolateral parameniscal cyst. A horizontal lesion on the lateral meniscus showing the pathway that communicated the cyst with the interior of the joint.

patient while they are standing. The symptomatic knee should be inspected from the front, from both lateral and medial sides, then posteriorly. The meniscal rim should be carefully palpated to detect any mass or swelling. Meniscal and ligament tears should always be sought. Preoperative knee examination should be repeated under anesthesia. Preoperative magnetic resonance imaging and radiographs of the knee are mandatory to assess the presence, location, and size of the parameniscal cyst (Fig 1).

Autologous Platelet-Rich Fibrin Membrane Preparation

The APRFM (RegenKit Extracell Membrane, Regen Lab SA, Le Mont-sur-Lausanne, Switzerland) is a thin layer of autologous fibrin that is very rich in platelets. It is obtained by the high-speed centrifugation of a small quantity of PRP. The kit consists in a system that takes the blood sample from the peripheral site of the patient, then separates the PRP, and finally transfers the PRP into the recipient to then prepare the membrane. All the steps operations are sterile, without any contact with air, and last about 25 minutes following the manufacturer's instructions (Fig 2). The final product is an autologous fibrin membrane, enriched in PRP with a diameter of 35 mm. The overall thickness can vary. The mechanical strength for traction is remarkable, allowing good handling, cutting, suturing, punching, and stitching without additional problems (Fig 3).

Patient Positioning and Preparation

Once anaesthetized, the patient is placed in the supine position on the operating table. A well-padded high-thigh tourniquet is subsequently placed on the operative leg that is positioned into a leg holder. In case of a lateral parameniscal cyst, it is preferable to administer

general anesthesia because of the relative proximity of the procedure to the peroneal nerve and the need for a postoperative physical examination to document intact neurologic function. If parameniscal cysts are palpable on physical examination, we recommend marking it with sterile skin-marker before tourniquet inflation (Fig 4). The operative leg is prepped and draped in the usual sterile fashion. The leg is exsanguinated, and the tourniquet inflated.

Surgical Approach

A general knee arthroscopic examination is routinely carried out via anterolateral and anteromedial portals. A diagnostic arthroscopy is conducted to ensure that there is no additional intra-articular pathology. The



Fig 2. Autologous platelet-rich fibrin membrane preparation kit preparation.



Fig 3. Autologous fibrine enriched in platelet-rich plasma.

meniscal tear should be identified and characterized based on its location, size, stability, and overall quality. The tear should be anatomically reduced, and the sutures should be placed perpendicularly to the lesion to

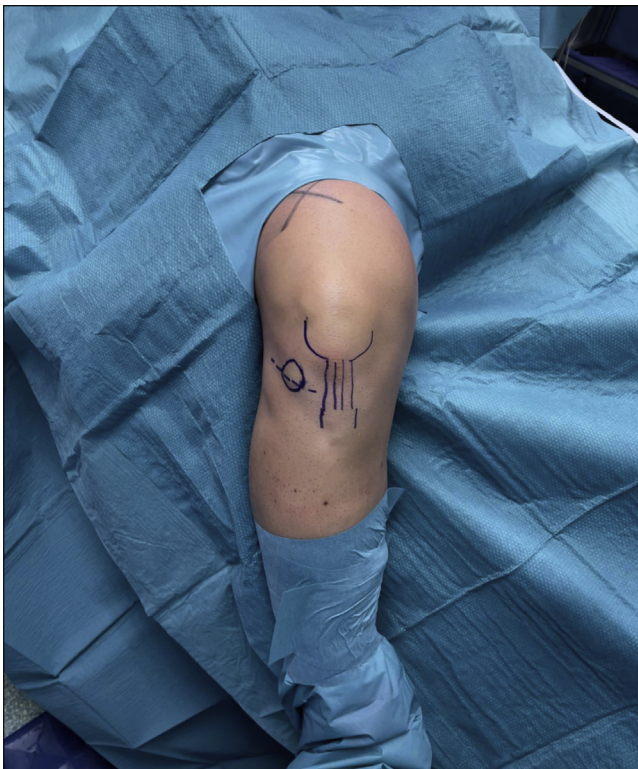


Fig 4. Patient positioning. The operative (right) leg is sterilized in the standard fashion. Parameniscal cyst, joint line, patella, and patellar tendon are marked with a sterile skin-marker.

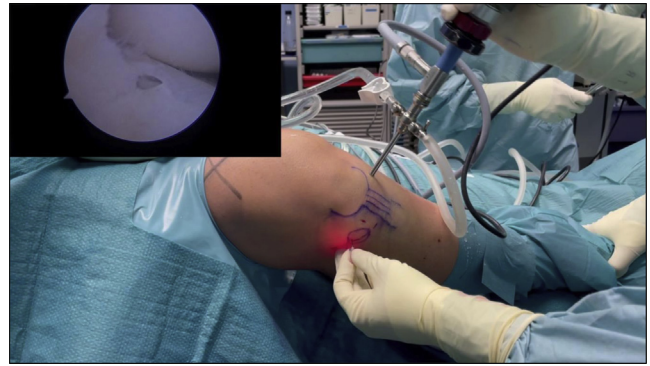


Fig 5. Right knee. Left panel, arthroscopic view (anterolateral portal) of the lateral meniscus. The tip of the needle is located in correspondence of the tear. The surgeon is able to center and minimize the incision of the skin on the parameniscal cyst.

restore its anatomic position. Subsequently, a needle could be located on the meniscal tear under arthroscopic view to center the skin incision of the cyst (Fig 5). Meniscal repair is always encouraged over a meniscectomy. The authors prefer inside-out or all-inside repair techniques because of their ability to confer greater stability to the lesion via increased number of sutures.

Application of APRFM

In the case of a parameniscal cyst located on the posterior horn medial meniscus, an oblique vertical incision is performed posterior to the medial collateral ligament. After a sharp and blunt dissection of the sartorius fascia, an anatomic triangle composed of the posteromedial joint capsule anteriorly, the medial gastrocnemius posteriorly, and the semimembranosus inferiorly is identified. Similarly, in case of a parameniscal cyst located on the posterior horn on the lateral meniscus, a vertical incision is performed posterior to the fibular collateral ligament. A Z-shaped incision is performed on the iliotibial band. Next, a blunt dissection is performed toward the fibular head, and an interval is created with the lateral head of the gastrocnemius superiorly and posterolateral joint capsule anteriorly. Whereas, if the cyst is located on the anterior horn or on the mid-portion of the lateral meniscus, the skin incision needs to be centered on the cyst.

It is important to note that symptomatic parameniscal cyst most commonly develops on the anterior horn of the lateral meniscus.⁹

Table 1. How to Minimize and Center the Skin Incision on Parameniscal Cyst

Mark the cyst with sterile skin-marker if it is palpable on physical examination
Use inside-out suture to treat the associate meniscal tear. The tip of the needle visualizes the exact point of skin incision
Transillumination of the lateral compartment during arthroscopy



Fig 6. Transillumination of the lateral compartment could help the surgeon minimize the skin incision in correspondence to the cyst.

Several recommendations are listed in [Table 1](#) to center and minimize skin incisions on the parameniscal cyst ([Figs 6](#) and [7](#)). A Z-shaped incision is performed on the iliotibial band ([Fig 8](#)). A small horizontal incision of the capsule is performed over the joint line in correspondence of the cyst. The cyst is evacuated ([Fig 9](#)). A meniscal rasp and a curette are used to debride the cyst wall through the open incision. The APRFM is located in the cyst and then sutured side-to-side to the adjacent capsule with an absorbable suture ([Fig 10](#) and [Video 1](#)).

Postoperative Protocol

Postoperatively, all patients start a range of motion exercises 7 days after the surgery. Physical therapy emphasizes early quadriceps muscle activation and knee flexion from 0° to 90° restricted for the first 4 weeks and progresses thereafter. Patients treated with a meniscal suture remain non-weight-bearing for 4 weeks. Patients are recommended to avoid deep squatting, sitting cross-legged, or performing any heavy lifting activities for a minimum of 4 months post-surgery.

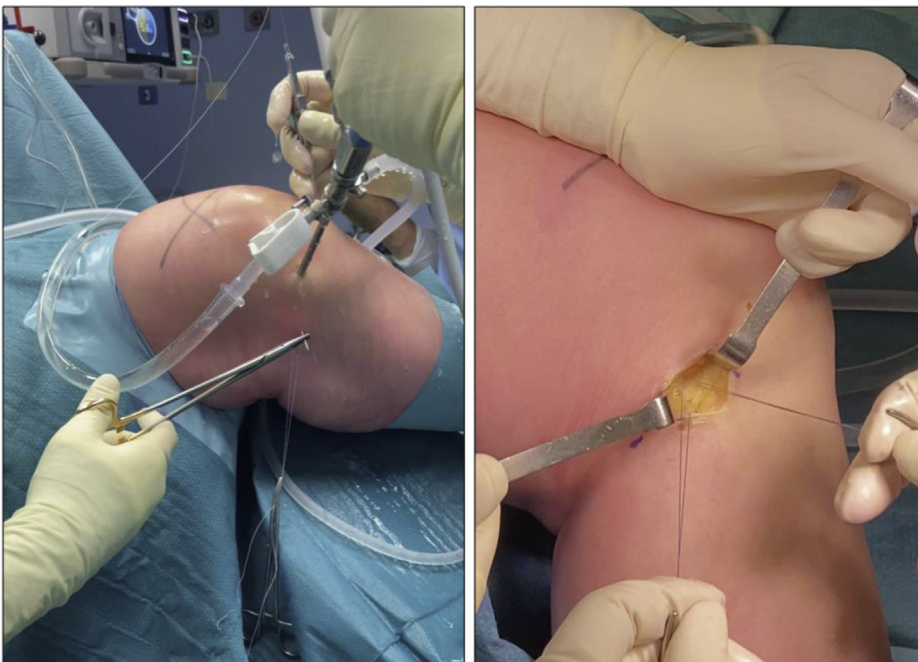


Fig 7. By in-out suture, the surgeon places the suture cannula in the desired location at the tear site and passes the tip of the needle just over the skin to visualize the exact entry point into the skin and capsule.



Fig 8. A Z-shaped incision is performed on the iliotibial band (*).

Discussion

The extent of the parameniscal cyst in the red–red zone might suppose the use of biological factors to promote meniscal repair. Growth factor injection, bone marrow stimulation, fibrin clot application, stem cell therapy, and PRP are seemingly viable options for improving healing. However, most of them are too expensive, with scant clinical data that can be used in clinical practice.¹⁰

PRP has been used since the 1970s due to its increased concentrations of autologous growth factors, such as the platelet-derived growth factor (PDGF), thought to promote tissue growth and differentiation. In an *in vitro* study, Ionescu et al.¹¹ reported an increased cell proliferation and extracellular collagen matrix formation following the use of PDGF in torn meniscus zones compared with control. Similarly, Tumia and Johnstone¹² observed that meniscal cells from the avascular and vascular zone are able to proliferate and generate new extracellular matrices following the addition of PDGF. The APRFM contains a high concentration of platelets that release growth factors with healing properties. The membrane is easily suturable and has been successfully used for the therapy of vascular ulcers, and promising results have been reported in the treatment of rotator cuff tears.^{13,14} In our technique, the autologous membrane represents a “patch” that reinforces the meniscocapsular junction in correspondence to the parameniscal cyst by a side-to-side suture in the inner layer of the capsule to avoid recurrence. We recommend using our described technique for the harvest and placement of the APRFM in the treatment of parameniscal cyst. We believe that our technique is not only highly reproducible but also less technically challenging and financially costly than some of the other alternatives (Table 2). Properly conducted outcome studies are needed, however, to properly assess its beneficial effects.

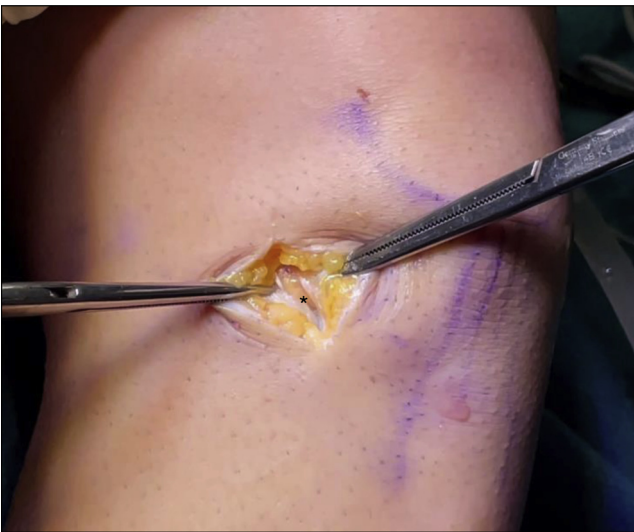


Fig 9. A horizontal-oblique incision of the capsule is performed over the joint line in correspondence of the cyst. The cyst is evacuated (*).



Fig 10. The autologous platelet-rich fibrin matrix is sutured side-to-side to the adjacent capsule with an absorbable suture.

Table 2. Technical and Biological Advantages of the Technique

Technical
Applicable to any type of parameniscal cysts
Easy and reproducible
No particular planning required
Minimal costs
No expertise required
Easily suturable
Biological
Autologous: no host to graft reactions
No donor-site morbidity
Release growth factors from platelets
Minimal invasiveness

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