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SIMULTANEOUS SURGICAL RECONSTRUCTION OF THE MENISCUS WITH ANTERIOR CRUCIATE LIGAMENT RECONSTRUCTION

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ABSTRACT

Among the wide variety of intra-articular knee pathologies, anterior cruciate ligament (ACL) injuries are frequently accompanied by meniscal damage. These lesions are detrimental to the articular cartilage and ultimately lead to the early development of osteoarthritis. Simultaneous reconstruction of the ACL and meniscus helps preserve the biomechanics of the knee joint, prevent early onset of osteoarthritis, and improve functional outcomes. According to many authors, concurrent repair of the meniscus and ACL improves clinical outcomes and slows the progression of degenerative changes. However, the effectiveness of an integrated approach to meniscal reconstruction during ACL reconstruction remains insufficiently studied. This article is intended to expand the general knowledge base on this issue for specialists who may encounter this clinical challenge.

KEYWORD:- Anterior cruciate ligament, Meniscus, Reconstruction, Arthroscopy, Knee joint, Functional outcomes.

INTRODUCTION

Although the first reports of meniscal suturing were published by Thomas Annandale (Annandale T. An operation for displaced semilunar cartilage. Br Med J. 1885) more than a century ago, widespread adoption of this procedure in clinical practice began only in the past 15–20 years. The increase in injuries among the working-age population, the active development of minimally invasive techniques, and favorable long-term outcomes of meniscus-preserving surgeries have all contributed to the growing popularity of such interventions.

Currently, there are three main techniques for meniscal repair: the “outside-in,” the “inside-out,” and the “all-inside” method. The latter has taken a leading position due to its technical simplicity and minimal risk of neurovascular complications. Biodegradable fixators used in the all-inside technique became widely adopted in the late 1990s and early 2000s. However, studies have shown that the insufficient biomechanical properties of these devices and a high complication rate led to a decline in their widespread use.

Modern second-generation fixators are low-profile, flexible constructs with self-tightening knots (e.g., FiberWire by Arthrex), providing reliable compression and tissue fixation during meniscal suturing. According to various sources, the incidence of meniscal injuries combined with anterior cruciate ligament (ACL) tears reaches 55–65%. Both isolated ACL injuries and their combination with meniscal damage significantly increase the long-term risk of developing osteoarthritis.

According to a systematic review by F.R. Noyes and colleagues (Noyes F.R. et al., 2020), during ACL reconstruction, meniscectomy is performed 2–3 times more often than meniscal repair. This is confirmed by the study of V. Musahl, which found that in 70% of ACL reconstruction cases, meniscectomy is performed, and only in 30% of cases is meniscal suturing carried out. This can be attributed to the anatomical and functional characteristics of meniscal blood supply, the shape and location of the tear, and the presence of degenerative changes.

Several studies have demonstrated that simultaneous meniscal suturing during ACL reconstruction yields

better long-term outcomes compared to isolated meniscal repair. According to L. Girolamo and colleagues, this may be related to the high intra-articular concentration of growth factors observed after drilling bone tunnels and resecting the ACL stump (Girolamo L. et al., 2015).

MATERIAL AND METHODS

Between 2020 and 2024, a total of 52 meniscal repair surgeries using the all-inside suture technique with a hook, in combination with anterior cruciate ligament (ACL) reconstruction, were performed. In 10 patients, a second-look diagnostic arthroscopy was conducted at an average of 20 months after the initial procedure (ranging from 6 to 40 months).

All meniscal sutures were performed using the all-inside technique through two standard arthroscopic portals. During the second-look arthroscopy, healing was assessed and categorized into three groups: complete healing, partial healing, and no healing. Additionally, characteristics of the meniscal injury were analyzed, including the type, size, and location of the tear. Indications and contraindications for arthroscopic intervention are presented in Table 1.

Table 1.

Indications	Contraindications
Acute (within 6 weeks) traumatic meniscal tears in the vascular zone (red-red or red-white zones);	Degenerative meniscal tears;
Stable fixation of the ACL graft;	Chronic knee instability lasting more than 16 months;
Patient age under 38 years;	Severe degenerative changes (Outerbridge grade III–IV);
High level of physical activity and strong motivation for rehabilitation.	Severe degenerative changes (Outerbridge grade III–IV) (listed twice in original);
	Patient non-compliance with the rehabilitation protocol.

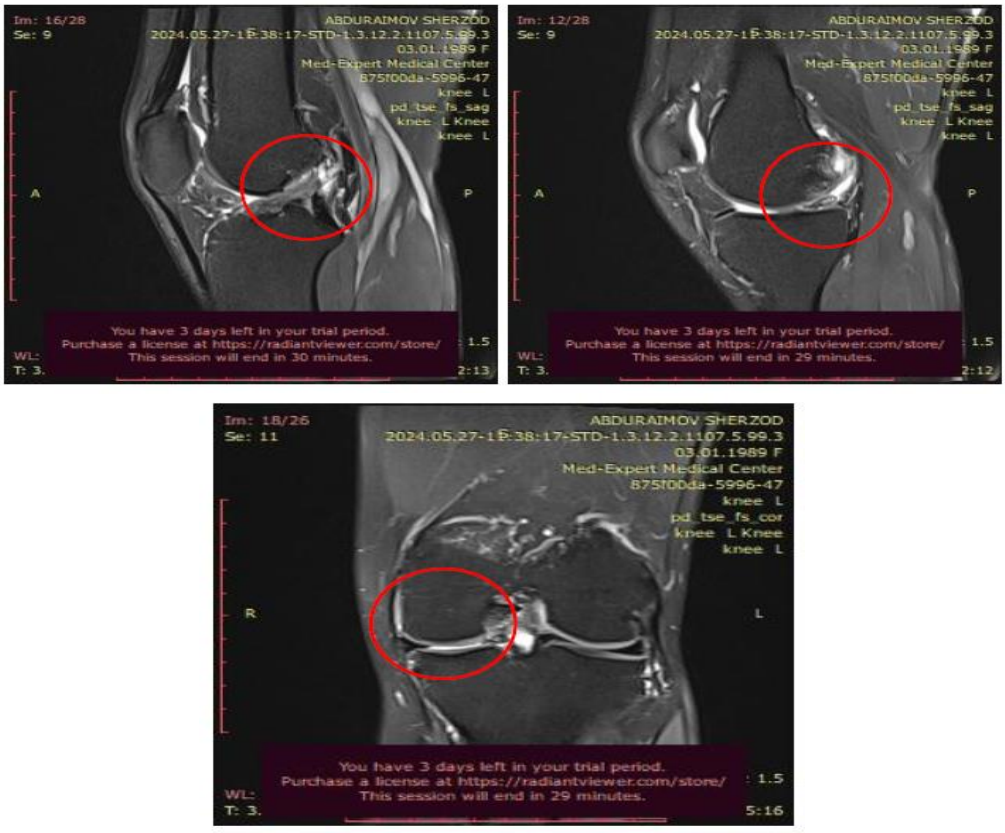


Fig. 1: MRI of the knee joint, T1.5, in sagittal and coronal planes.

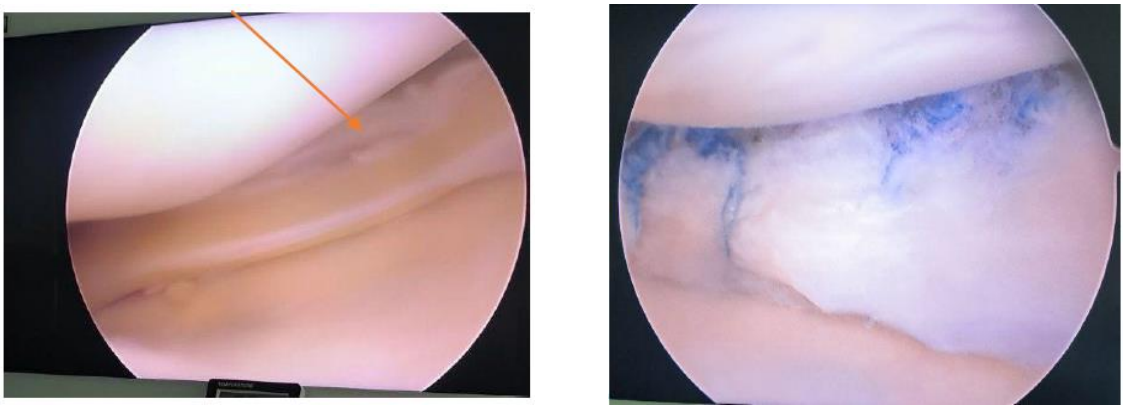
Surgical technique

With the patient in the supine position, using lower limb holders and a pneumatic tourniquet, triple antiseptic preparation of the surgical field was performed under spinal anesthesia. Standard arthroscopic portals were created, followed by a comprehensive inspection (diagnostic arthroscopy) of the knee joint.

Visual and palpatory assessment of the menisci, intra-articular ligaments, articular surfaces, and recesses was carried out using a probe.

If meniscal integrity could not be restored through suturing, a partial meniscectomy was performed. In cases of significant intercondylar notch narrowing, a notchplasty was carried out. When meniscus preservation was indicated, the tear edges were debrided using a rasp, followed by arthroscopic suturing with horizontal stitches according to the standard technique.

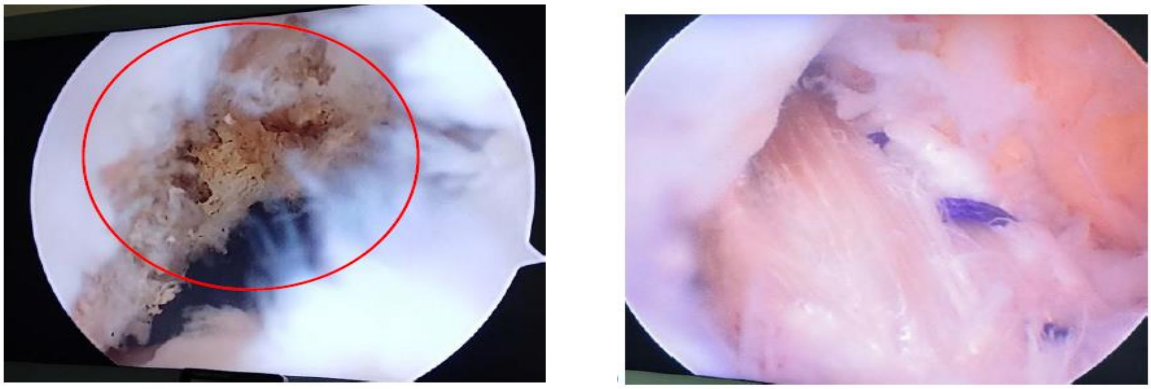
The number of implanted FiberWire (Arthrex) fixators ranged from one to four, depending on the length and morphology of the tear, with suture stability checked using a probe (Fig. 2).



A) **B)**

Fig. 2: A) Arthroscopic knee surgery: intraoperative image. Vertical tear of the medial meniscus. B) Suturing of the posterior horn of the medial meniscus using a FiberWire (Arthrex) fixator.

Anterior cruciate ligament (ACL) reconstruction was performed using an autograft formed from the semitendinosus and gracilis tendons. The graft fixation in the femur was carried out with a suspensory cortical fixation device, such as a screw-type TightRope (Arthrex), and in the tibia with the biodegradable screw with a guide pin (Arthrex) (Fig. 3).



A) **B)**

Fig. 3: A) Arthroscopic image of the anterior cruciate ligament (ACL) tear site. B) Image after reconstruction with autograft using the semitendinosus and gracilis muscles.

At the end of the procedure, an arthroscopic check was performed, during which the graft tension, the accuracy of anatomical placement, isometry of the positioning, and the absence of impingement signs at different knee flexion angles were evaluated. The joint cavity was irrigated with a large volume of saline solution. Postoperative wounds were sutured in layers. The limb was then wrapped with an elastic bandage and immobilized using a straight brace.

Postoperative management

In the postoperative period, the operated lower limb was immobilized using a straight orthosis for four weeks. The rehabilitation program included a phased recovery of the range of motion in the knee joint: from the second week, flexion up to 45° was allowed, from the fourth to the eighth week – up to 90°-110°, and from the ninth to the twelfth week – up to 135°.

From a functional perspective, during the first two weeks, the patient was allowed to move with additional support (crutches) while completely excluding axial load on the operated limb. Starting from the fourth week, partial weight-bearing up to 20 kg was permitted, and from the fifth week, up to 50 kg. From the sixth week, full weight-bearing on the operated limb was allowed.

To prevent thromboembolic complications, all patients

were provided with appropriate prophylactic therapy throughout the period of immobilization and limited load on the operated leg.

RESULTS

The average interval from the surgical procedure to the subsequent clinical examination using orthopedic scales was 55.2 ± 3 months (ranging from 18 to 105 months). Assessment of long-term functional outcomes using the Cincinnati scale showed a median of 97 points (interquartile range: 90–100), with excellent results recorded in 42 patients (93%) and good results in 3 patients (7%). When analyzed using the IKDC scale, the median value was 90.8 points (IQR: 86.2–95.4); excellent functional outcomes were observed in 23 (51%) patients, good in 15 (33%), and satisfactory in 7 (16%). No unsatisfactory outcomes were reported. A similar assessment using the Lysholm scale revealed a median of 95 points (IQR: 90–100); excellent results were achieved in 34 (76%) patients and good in 11 (24%).

In total, complications were registered in 5 out of 45 patients. Two of them underwent knee joint aspiration in the early postoperative period due to significant hemarthrosis. One patient was diagnosed with a massive subcutaneous hematoma in the anteromedial area of the shin on the fifth day after surgery, which required conservative therapy and adjustment of the rehabilitation regimen. One patient underwent a repeat arthroscopy 2 years after the primary reconstruction due to a new injury. On the second day after the re-injury, a resection of the previously intact medial meniscus was performed, while the previously sutured medial meniscus showed complete healing.

Two patients required repeat arthroscopic procedures due to the development of arthrofibrosis and ineffectiveness of conservative treatment. In one case, arthrolysis and reduction were performed within the first year after surgery; in the second case, a similar procedure was performed at a different medical facility. In both cases, the sutured menisci remained intact with signs of full healing.

All documented complications were related to the anterior cruciate ligament reconstruction component rather than meniscal suturing. No additional surgical interventions outside of those mentioned were required. Patients who underwent repeat arthroscopic procedures were included in the overall analysis since the previously sutured menisci did not experience re-injury. Statistical analysis did not reveal significant differences in treatment outcomes based on patient sex and age ($p > 0.05$). No significant correlation was found between the time from injury to surgery and functional outcomes ($p > 0.05$).

To assess the effectiveness of the treatment, the Visual Analog Scale for Pain (VAS) was used to determine the intensity of the pain syndrome (Gélinas C, Puntillo KA, Levin P, et al. Pain 2017). The VAS categorizes pain into five levels: 0 points – no pain; 1–3 points – mild pain (minimal functional impairment); 4–6 points – moderate pain (moderate impairment); 7–8 points – severe pain (significant impairment); 9–10 points – extremely intense, unbearable pain (maximum functional impairment). The comparison of results between the main and control groups is presented in (Fig. 4). The assessment was conducted through patient surveys in the preoperative period as well as between 12 and 24 months after surgery.

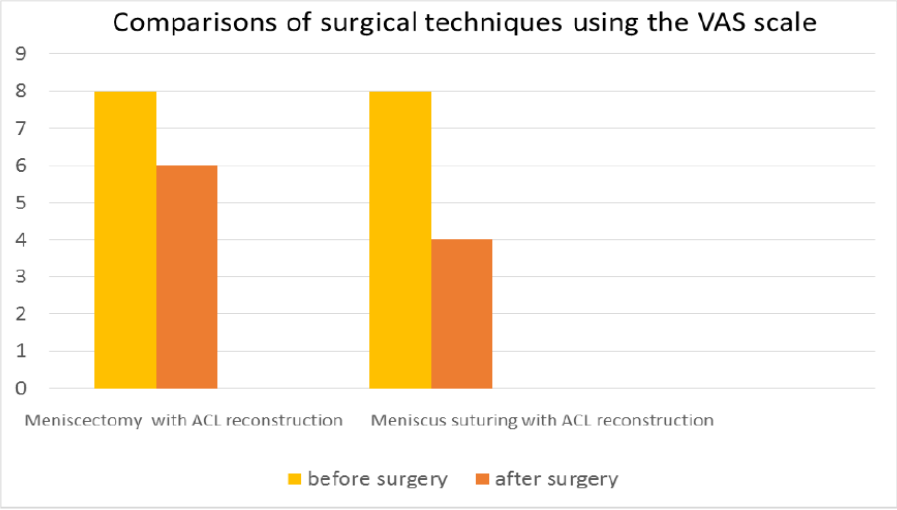


Fig. 4: Comparison of surgical techniques based on the VAS scale.

Group (VAS)	Before surgery	After 12-24 months.
Meniscectomy	8	4
Meniscus suturing	8	6

DISCUSSION

The menisci perform a critically important role in load distribution within the knee joint, contributing to shock absorption and joint stabilization.

Studies have shown that even partial meniscectomy significantly increases contact pressure in the joint: removal of just 15–34% of meniscal tissue can raise pressure up to 350% of normal levels.

Over the past two decades, there has been significant progress in the development of surgical techniques and tools for meniscal repair (meniscorrhaphy), resulting in a sharp increase in the number of such procedures. For instance, in 1996, approximately 136,000 meniscal repair surgeries were performed in the United States, increasing to 200,000 by 2000, with the "all-inside" technique being used in 43% of cases. One important factor influencing the rate of postoperative complications—such as hemarthrosis, hematoma, and arthrofibrosis—is whether the procedure is combined with anterior cruciate ligament (ACL) reconstruction. According to E.S. Kotsovolos et al., 7% of patients (4 out of 58) experienced difficulties in regaining range of motion during the early postoperative period (Kotsovolos E.S. et al., 2006).

Factors affecting the success of meniscal healing include age, sex, location and extent of the tear, as well as the time interval between injury and surgical intervention. According to several sources, the best outcomes are achieved in younger patients when the procedure is performed in the acute phase following injury. In our study, similar to the data presented by E.S. Kotsovolos et al., no statistically significant differences were found based on sex or age of the patients, which may be due to the limited sample size (Kotsovolos E.S. et al., 2006).

Meniscal repair using the all-inside technique is recognized as an effective method for treating meniscal injuries. A meta-analysis conducted by C. Xu and colleagues showed that long-term outcomes in patients undergoing meniscal repair are superior to those in patients who underwent resection. It is important to consider that the meniscus may decrease in width by 9–15% after suturing, which should be taken into account when evaluating long-term outcomes and the risk of osteoarthritis progression. From 2005 to 2011, the number of meniscal repairs doubled, particularly in cases involving isolated meniscal injuries. Today, surgeons have access to a wide range of next-generation fixation devices. In this study, the FiberWire (Arthrex) device, developed by Arthrex (USA) and introduced into clinical practice in 2001, was used. Its effectiveness has been confirmed by numerous clinical observations. For example, G.R. Barrett et al. reported satisfactory results in 81–92% of cases one year post-surgery, depending on tear location. In follow-up periods of at least 2.5 years, good outcomes were achieved in 83% of patients. Similar results were reported by researchers from Brazil, where satisfactory long-term results were observed in 73% of patients (16 out of 22) (Barrett G.R. et al., 2007).

In our study, three revision arthroscopies were performed due to arthrofibrosis and re-injury. In all cases, the repaired menisci remained intact and showed signs of complete healing. Similar outcomes were reported by Y. Tachibana et al., where follow-up arthroscopy after ACL reconstruction and meniscal repair revealed healed menisci in 74% of patients, which was considered a successful outcome in 83 cases (38%) (Tachibana Y. et al., 2010).

A key observation was the absence of complications such as implant migration, suture rupture, or mechanical damage to the implant when using FiberWire. It is important to emphasize that the reduction in meniscal width after repair must be considered when predicting long-term osteoarthritis progression.

CONCLUSIONS

Simultaneous meniscal repair during arthroscopic ACL reconstruction is an effective treatment method that allows for good functional outcomes and reduces the long-term risk of osteoarthritis. Careful patient selection, strict adherence to indications, and rigorous implementation of the rehabilitation protocol are key factors for success.

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