



Current approaches and problems faced by orthopedic surgeons in all-inside arthroscopic meniscus repairs

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Abstract

Aim: All-inside meniscal sutures are frequently the treatment of choice in arthroscopic practice. However, the literature contains limited evidence of the technical issues experienced during the procedure. We aimed to evaluate the technical difficulties encountered during the placement of all-inside meniscal repair sutures according to the surgeon's experience and the success rate of the suture placement.

Materials and Methods: We invited orthopedic surgeons across the country to complete a questionnaire through an online platform. Participants were asked ten questions about their demographic information, general surgical approach to meniscal tears, and experience with intraoperative complications specific to all inside meniscus sutures.

Results: A total of 100 orthopedic surgeons participated in our study. Of these, 37% had been working as an orthopedic surgeon for more than ten years. Twenty-five per cent performed more than two arthroscopic knee surgeries per week. Fifty-six per cent of the surgeons were protective for the displaced red-white zone meniscal tears. Although 90% of the participants stated that the technique was more effortless, only 12% thought the clinical results were better than the other techniques. More than 50% of the participants indicated that they had difficulty when placing the sutures successfully. The most common problem was the inability to fix the meniscus sufficiently and the deformation of the instruments inside the joint. When we compared the complications according to the surgeon's experience, even among the surgeons who performed more than 100 arthroscopic surgeries per year, 34% had trouble applying these sutures successfully.

Conclusion: Although all-inside meniscus sutures are generally believed to decrease the operative time and be technically more straightforward, even the most experienced surgeons have difficulty applying these sutures, and the reliability of these sutures is low.

ARTICLE INFO

Keywords:

Arthroscopic
All-inside
Meniscus repairs
Survey study

Received: Sep 19, 2022

Accepted: Nov 09, 2022

Available Online: 27.02.2023

DOI:

[10.5455/annalsmedres.2022.09.288](https://doi.org/10.5455/annalsmedres.2022.09.288)



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Introduction

Treatment of meniscal tears has evolved rapidly in the last decade. Meniscal excision, one of the most frequently performed procedures in orthopedic surgery, may lead to early degenerative arthritis [1,2]. The long-term deleterious effects of partial meniscectomy led the meniscus-preserving techniques to gain popularity [3]. Decreased risk of neurovascular injury and cartilage abrasion are the benefits of all-inside meniscal repair. In addition to inside-out and outside-in techniques, surgeons frequently use many devices for all-inside repairs available in the market [4]. All-inside repairs are more straightforward than the other methods and provide a shorter period of surgery without the need for additional skin incisions. Furthermore, there is no significant difference in the functional results

[5]. However, there are some difficulties in using these devices in clinical applications. This study aims to analyze surgeons' perspectives on all-inside repairs and problems encountered in arthroscopic surgery practice.

Materials and Methods

Ethical approval was obtained for this study from the Istinye University Clinical Research Ethics Committee (03.03.2021, 2/2021.K-12). Orthopedic surgeons interested in arthroscopic knee surgery were invited to participate in the survey via the e-mail group, which has 2800 members under the management of the Turkish Orthopedics and Traumatology Association (TOTBID). Participants who have an interest and perform arthroscopic meniscal repairs were asked to fill out the questionnaire on an online platform between January to April 2021. Ten questions were asked.

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Table 1. Questionnaire Form.

Q1. How many years have you been working as an Orthopedic Surgeon?	Q6. Which implants do you prefer when repairing a meniscus tear? (Multiple answers may be preferred)
A. Less than 5 years B. 5-10 years C. 10 years and above	A. All-inside peek implant B. All-inside suture implant C. Inside-out sutures D. Outside-in sutures
Q2. How old are you?	Q7. In which part of the meniscus, you prefer all-inside sutures? (More than one answer can be chosen)
A. 25-34 B. 35-44 C. 45-54 D. 55-64 E. 65+	A. Root of Medial Meniscus B. Posterior of Medial Meniscus C. Corpus of Medial Meniscus D. Anterior of Medial Meniscus E. Root of Lateral Meniscus F. Posterior of Lateral Meniscus G. Corpus of Lateral Meniscus H. Anterior of Lateral Meniscus
Q3. What institution do you work for?	Q8. What do you think are the advantages when you compare all-inside sutures with inside-out sutures? (You can choose more than one answer).
A. Private Hospital B. State Hospital C. Training and Research Hospital D. University Hospital E. Private Practice	A. Easy surgical technique B. Safe C. Better clinical results D. Better cosmetic results E. Easier rehabilitation F. Shorter surgery time
Q4. What is the total number of your arthroscopic knee surgeries per year?	Q9. When applying an all-inside suture, what is your rate of successfully placing the suture exactly as you intended?
A. 0-25 (Monthly average 1-2) B. 25-50 (Average 1 per week) C. 50-100 (Average 1-2 per week) D. 100-200 (Average 2-4 per week) E. More than 200 (more than 4 on average per week)	A. Lower than %25 B. %25-50 C. %50-75 D. %75-100
Q5. What is your general approach to meniscus tears in patients without additional diseases under 50 years of age?	Q10. What are the complications and difficulties you encounter when using all-inside sutures? (You can choose more than one answer)
A. I prefer a partial meniscectomy regardless of the location and shape of the tear. B. If the torn is not displaced and it is in the red-red zone, I try to repair the meniscus. C. If the torn is displaced into the joint and it is the red-red zone (bucket handle, etc.) I try to reduce and repair. D. Whether the tear is displaced or in the red-white zone, I try to repair if there is a chance to be repair.	A. Sending both anchors at the same time while placing the anchors of the suture B. Needles of the all-inside suture instruments penetrate superficial soft tissues (such as iliotibial band, sartorial fascia) C. When stitching, both legs surround each other and prevent the knot from locking properly. D. Tear enlargement in the meniscus body due to the width of the peek or full suture anchors E. Damage to cartilage tissues during application due to the structure and size of the instruments F. Stacking of all-inside suture instruments to soft tissues while passing through portals. G. Bending or breaking of instruments in the knee H. Difficulty of accessing tears close to the root of the meniscus or anterior horn, due to the design of the instruments. I. Anchors do not hold the meniscus body at sufficient strength or at all.

The questionnaire

The first section of the questionnaire asked for the demographic information of the surgeon; the second asked questions about the experience and the general surgical preferences for the meniscal tears, and the third questions about the per-operative complications specific to all-inside meniscus sutures were asked (Table I). Participants' demographics were asked in the first three questions: the surgeon's arthroscopic knee surgery volume in the third question; and the treatment preference according to the region of the meniscus tears that appeared in the fourth and fifth questions. All inside and inside-out repair usage preferences were questioned from sixth to eighth. In the ninth question, the rates of successfully placing all inside sutures were asked; and in the tenth question, the problems they experienced while using all inside sutures were questioned.

Statistical analysis

Descriptive statistics for continuous variables; when using the non-parametric test they were expressed as median (interquartile range, Q3-Q1) [min-max] and numbers and percentages for categorical variables. Normality test for continuous variables was performed using Shapiro-Wilk Test. The chi-square test and the Fisher-Freeman-Halton test were used to compare categorical (ordinal and nominal) variables. $P < 0.050$ was selected as the statistical significance level. Data were analyzed using IBM SPSS version 22.0 (IBM Corporation, New York, USA).

Results

A total of 100 (%3,57) orthopaedic surgeons participated in our study. The number of surgeons actively performing arthroscopic knee surgery in the group is unclear. Also, all inside meniscal repairs cannot be used in secondary-level hospitals due to the policy of the Social Security Institution (SGK). At the same time, there are many residents in the group who continue the orthopedics and traumatology education and training. So, the exact power of our study remains controversial. Among the participants, 39% had been working as an orthopedic surgeon for more than ten years, 26% had worked for five to ten years, and the others worked for fewer than five years. The ages of

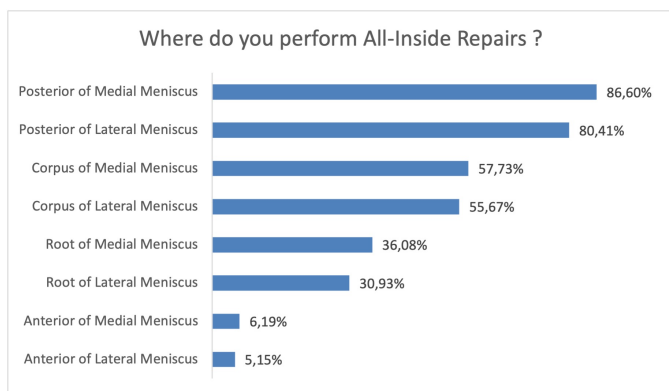


Figure 1. Anatomic zones of meniscal repair by All Inside Sutures.

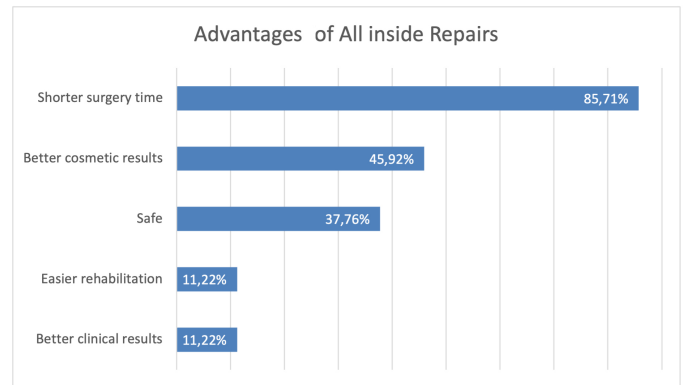


Figure 2. The reasons for preference of All inside sutures.

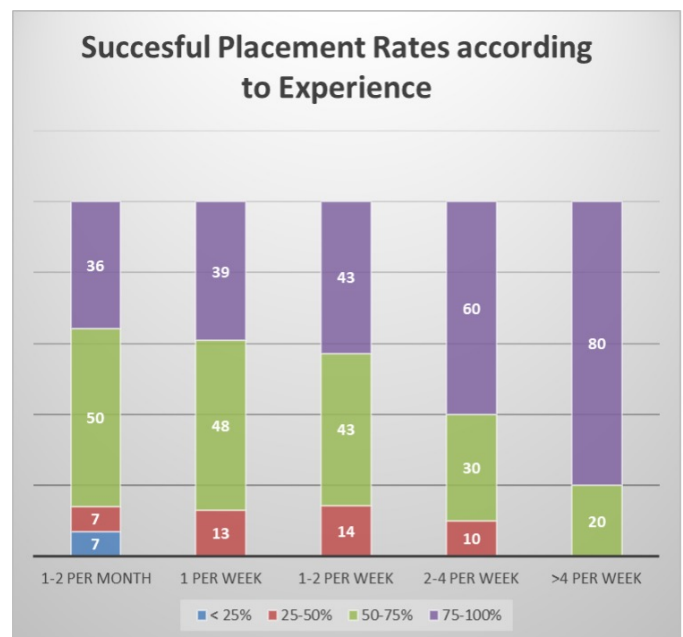


Figure 3. Rate of successfully placing the suture by case density.

43% of respondents ranged from 35 to 44. The distribution of the hospitals where the participants worked was in a similar range of private hospitals (28%), state hospitals (25%), and training and research hospitals (25%). 16% were in a university hospital, and 6% were in private practice. While 20 participants performed 100–200 arthroscopic knee surgeries yearly, 22 surgeons performed 50–100, 24 of them 25–50, 28 fewer than 50, and 5 had more than 200 yearly cases. Participants' general preference for displaced or red-white zone meniscus tears in less than 50 years-old patients was to protect the meniscus at a high rate. A similar distribution was observed in the preferred meniscus repair methods. All inside sutures were mostly preferred for medial and lateral meniscal posterior horn tears [Figure 1]. The participants chose all-inside sutures instead of inside-out sutures because of the shorter surgical time and ease of application. [Figure 2] Most of the surgeons stated that the rate of successful placement of all-inside sutures as they intended was 50%–75% or fewer [Figure 3]. Generally, the most common problems that surgeons experience during surgery were first, “the anchors

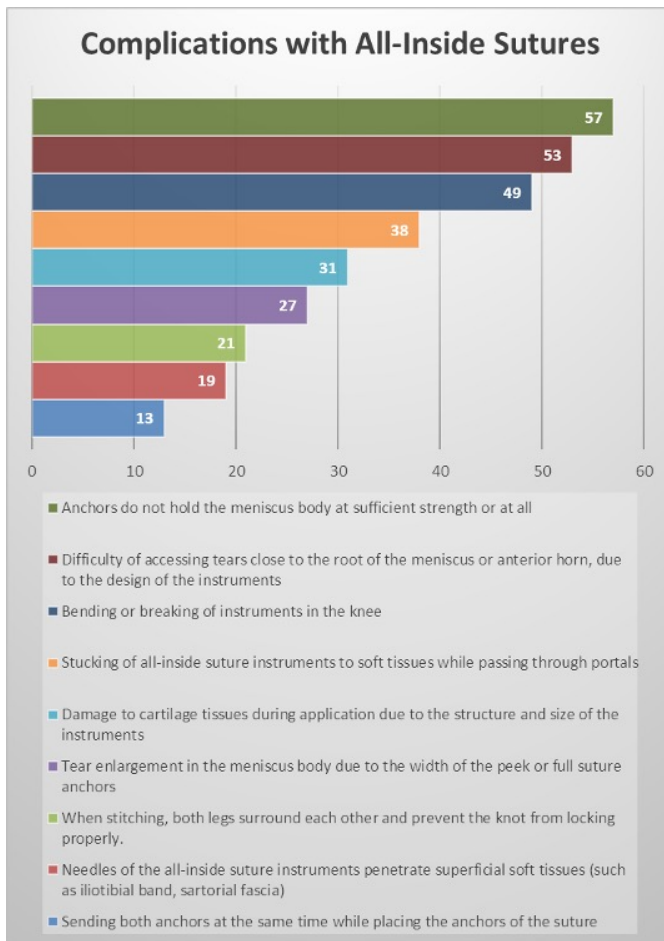


Figure 4. Problem encountered during All-Inside Repairs.

not holding the meniscus body with sufficient strength”, secondly “Difficulty in accessing tears close to the meniscus root or in the anterior horn due to the design of the instruments”, then thirdly “Bending, twisting, or breaking of instruments in the knee” [Figure 4]. A significant relationship was found between surgeons’ case density and meniscus protection habits ($p=0.003$). As the participants’ experience increased, so did the behaviour of protecting the meniscus.

Discussion

Arthroscopic meniscus repairs have become more common today in line with the meniscus-sparing approach of orthopedic surgeons. Even though the failure and reoperation rate of meniscal repair is higher than meniscectomy, it is still cost-effective in the long term [3,6]. Meniscal repairs have demonstrated superiority in leading to less osteoarthritis progression, less pain and better long-term function than the partial meniscectomy [7,8]. When possible, the meniscal repair is preferred over meniscectomy because of the risk of post-meniscectomy gonarthrosis [9].

The most preferred techniques are inside-out and all inside meniscus repairs; outside-in repairs are the treatment choice for anterior horn tears [7]. Inside-out sutures have been considered as the biomechanical gold standard [10]. Both methods have advantages over each other, and many studies are comparing these methods. For the inside-out

technique, the sutures are recovered outside the joint and tied over the joint capsule; therefore, an open approach is needed. Although the duration of surgery is prolonged, complications such as scar formation, neurovascular injury and joint stiffness can be seen due to the incision [11]. The meniscus’s posterior horn presents additional challenges regarding the proper approach to the tears and closeness to crucial neurovascular structures; therefore, all-inside repairs are practical and optimal when treating tears in this region [12]. In recent studies, no differences are observed when comparing these techniques regarding failure rate, functional outcomes and complications [13]. The failure rates are similar; nerve injuries are more frequent in inside-out techniques, while implant-related complications such as migration, breakage, soft tissue irritation or swelling are more frequent in all-inside techniques. Walgrave et al. identified 17 failures based on retrospective data obtained from 78 cases. They revealed that 22 of 190 all-inside anchors had a slippage through the capsule while tightening or failure of the anchor deployment [14].

In our study, we found that 58% of surgeons experienced problems because all inside anchors were not holding the meniscal body with sufficient strength or not at all. It has been observed that even experienced surgeons have trouble placing all-inside sutures as intended. Hengtao and Xuntong reported two complications related to the Fast-Fix all-inside repair device, anchor loosening or exfoliation into the joint space [15]. They were treated by overhauling the sutures and partial meniscectomy. To prevent anchor slippage, the needle tip must penetrate the surface of the meniscus fragments with a gentle oscillating movement through the body of the meniscus while preserving the anchors; if the meniscal fragment is too fragile to suture, we should not be reluctant to partial meniscectomy.

All-inside repairs are also used for medial meniscus root tears and have been reported to provide comparable results with other root repair techniques [16]. They were preferred over other methods because they were easier to apply and promise lesser operation time [5,17]. This is an acceptable reason for preference, but when things do not work, the failure of the implant causes an increase in the number of sutures used and a severe rise in treatment costs. Rocha de Faria et al. described an all-inside continuous meniscal suture technique which provides multiple sutures to the desired location with only one device for applying several sutures in the meniscus, with a minimal chance of breaking the device while reducing the cost of the repair [18].

The most important limitation of our study is the response rate. There are 2800 members in the e-mail group we conducted the survey; this group includes all orthopedic surgeons over the country. The number of inactive members or members who do not perform all inside meniscal repairs is unknown. We need prospective studies of a large case series regarding the intraoperative problems experienced in using all-inside implants.

As the arthroscopic procedure intensity of orthopedic surgeons increase, meniscus protection habits also increase. Thus, the use of all-inside sutures is also increasing, but orthopedic surgeons experience considerable problems applying these implants. There is a need for new and reusable designs to reduce implant placement problems and costs

related to wasted implants.

Ethics approval

This study was approved by Istinye University Clinical Research Ethics Committee (03.03.2021, 2/2021.K-12).

Availability of data and materials

This study does not contain any third material.

Consent for publication

All the authors approved the manuscript.

Competing interests

The authors declare that they have no competing interests.

Funding

There is no funding source.

Authors' contributions

KT and HÇ designed the study and wrote the paper. OGM has collected and analysed the data, and RER has drafted the work and revised the manuscript.

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