

Evaluating the Clinical and Functional Outcomes of Different Meniscus Repair Techniques

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Abstract

Aim: This research aims to assess the clinical and functional outcomes of meniscus repair using different techniques.

Methods: The current investigation was carried out and presented at the Department of orthopaedics, MRMCH Medini Nagar, Palamu, Jharkhand, India. Following the diagnosis of meniscus damage based on MRI results and clinical assessment, the patients underwent meniscal repair procedures. In the study population, there were 35 knees with meniscal lesions on the side and 25 knees with medial side lesions.

Results: The study involved 60 participants, predominantly male (75%), with a higher incidence of right knee (66.67%) and lateral meniscus tears (58.33%). Medial meniscus tears were more common overall, except for bucket handle tears, which were evenly distributed. The "All Inside" methods were favored for radial, posterior, and horizontal horn tears, while complex tears like bucket handle injuries were treated using hybrid techniques.

Conclusion: The clinical and functional outcomes were comparable when all three meniscus repair techniques that are all inside, within, and out of the body combined, and there was no statistically significant difference in the results.

Keywords: All inside, Hybrid technique, Inside out, Meniscus repair, Outside in.

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Introduction

Meniscal tears are the most common injuries to the knee joint that need medical attention. They have a relatively high yearly cost and a bimodal age distribution that includes both young, active athletes and the elderly [1-3]. In orthopedic surgery, meniscal tear surgery is one of the most often carried out operations. The medial and lateral tibiofemoral compartments of the knee joint include the two menisci, which are semilunar shaped, hydrated, biphasic fibrocartilaginous soft-tissue structures. They belong to the "meniscus-meniscal ligament complex," which also includes the surrounding ligamentous structures and bone attachments as anterior and posterior roots [4].

Meniscal repair was advised for symptomatic rips that were within the vascular zone, while meniscectomy was advised for irreversible injuries, provided there was no evident degradation of the meniscal tissue. The results of meniscal repair and meniscectomy have been compared in a number of papers. After comparing the long-term outcomes of the two surgeries, Meniscal repair was associated with a lower postoperative osteoarthritic progression and a better clinical score, according to Praxton et al. [5]. However, there was a higher frequency of

reoperation after meniscal repair. When meniscal repair is used instead of meniscectomy, other research has likewise shown improved function and reduced osteoarthritis [6, 7].

The differences in the two methods' outcomes are more significant when the study's participants are restricted to athletes. After a partial lateral meniscectomy for isolated lesions, Benneux et al. [8] observed that over 90% of the patients had postoperative arthritic alterations. Furthermore, athletes who have had partial meniscectomy have experienced uncommon but serious consequences such as fast chondrolysis [9, 10]. The criteria for meniscal repair has been broadened to include degenerative tears and avascular tears using fibrin clot in an attempt to preserve the meniscus [11]. The pace at which athletes' meniscal repair with fibrin clot supplementation heals or returns to function.

The use of arrows, staples, and absorbable and non-absorbable anchors has been halted due to cartilage impingement and insufficient hardness. Biomechanical capabilities similar to those obtained with simple suture are combined with the attributes of a minimally invasive implant in hybrid systems

that associate suture with an absorbable or PEEK anchor. Fixation sites are spaced closely, every 5 to 7 mm, and are best placed vertically rather than obliquely or horizontally. This is due to the fact that collagen fibres comprise the most resilient part of the meniscus, that are dispersed horizontally, which makes a vertical suture more likely to hold than a horizontal one. This study objective was to assess the functional and clinical results of meniscus repair utilizing various techniques. was the present investigation's goal.

Methodology

This research was presented and done by Department of orthopaedics, MRMCH Medini Nagar, Palamu, Jharkhand, India. For one year. Injuries to the meniscus were detected using MRI data and clinical evaluation. The patients had procedures to correct their meniscal tears. Meniscal lesions were seen on the medial side of 25 knees and the lateral side of 35 knees. Participants' ages ranged from eighteen to sixty-five.

Depending on the location and severity of the injury, open repair was required for horizontal lesions in young athletes; however, it was no longer recommended for vertical lesions. However, there were still situations when this strategy was suitable. The clinical and functional assessments that were carried out at the 3-month, 6-month, 9-month, and 1-year follow-up intervals provided the findings.

Screening Inclusion Criteria:

Only individuals who fulfil all of the following requirements was considered for participation in the research, regardless of gender: Capable and eager to provide written informed consent willingly and in compliance with the regulating Institutional Review.

Surgical procedure

The three senior writers had general anesthesia for each procedure. There was a tourniquet used in each instance. While inside-out repair was the main approach, Fast-Fix was also utilized in outside-in and all-inside procedures, either alone or in conjunction with it. To improve meniscal healing, a fibrin clot was inserted and secured to the capsule close to the repair site in instances of degenerative tears and tears in areas with insufficient vascularization.

Postoperative management

For the first three weeks after surgery, postoperative treatment usually included Immobility in extension

without bearing any weight when wearing a brace. After that, range-of-motion exercises and a partial weight bearing regimen were added; full weight bearing was to begin 4-5 weeks after the operation. After the operation, three months were allowed for running. Athletes were allowed to resume full sports involvement after surgery as long as they recovered from neuromuscular coordination and strength could be shown within six months.

Clinical evaluation

A single physician did all of the evaluations, following surgery, the patients were scheduled for regular checks at three, six, nine-, and twelve-months intervals. Validated subjective measurements were used to assess the clinical result both before surgery and at the end of treatment. The pace of return to play and the amount of time (recovery time) that passes after surgery before playing again. A failed repair was diagnosed using clinical signs and evidence of meniscus tear was repaired. A second arthroscopy was performed after an MRI to assess the stage of healing at the repair site in cases where re-tear was clinically feared. During radiographic assessment, the postoperative change in joint space width was compared between the radiographs taken with the Rosenberg view before surgery and one year later.

Statistical analysis

The statistical analysis was conducted using SPSS software, specifically version 27. The student's t-test was used to compare the mean values between the two groups for data adhering to a parametric distribution. The Chi-square test was used to analyze categorical data. P-value below 0.05 was indicated the statistical significance of result.

Results

A total of 60 participants in terms of age, 30% were between 18-25 years, 36.67% were between 26-40 years, and 33.33% were between 41-60 years. Gender-wise, the study was predominantly male (75%) with females accounting for 25%. The side of the knee affected showed that 66.67% had tears in the right knee, while 33.33% had issues in the left knee. Regarding the side of the meniscal tear, the lateral meniscus was more commonly affected (58.33%) compared to the medial meniscus (41.67%). This indicates a higher incidence of right knee and lateral meniscus injuries in the study population.

Table 1: Demographics of study population

| Variable | N= 60 | % |
|---------------------|-------|--------|
| Age | | |
| 18-25 | 18 | 30% |
| 26-40 | 22 | 36.67% |
| 41-60 | 20 | 33.33% |
| Gender | | |
| Female | 15 | 25% |
| Male | 45 | 75% |
| Side of Knee | | |
| Left Knee | 20 | 33.33% |
| Right Knee | 40 | 66.67% |
| Side of tear | | |
| Lateral meniscus | 35 | 58.33% |
| Medial meniscus | 25 | 41.67% |

Table medial meniscus is more commonly affected (66.67%) compared to the lateral meniscus (33.33%). In complex tears, the lateral meniscus is more frequently involved (63.33%) compared to the medial meniscus (36.67%). Radial tears predominantly affect the medial meniscus (75%) over the lateral meniscus (25%). Finally, bucket

handle tears show an equal distribution between the medial and lateral meniscus, with each accounting for 50% of cases. This data indicates that medial meniscus tears are generally more common, except for bucket handle tears, which show no preference for either side.

Table 2: Types of tears and their profiles.

| | N | % |
|---------------------------|----|--------|
| Longitudinal tear | | |
| Lateral meniscus | 20 | 33.33% |
| Medical meniscus | 40 | 66.67% |
| Complex tear | | |
| Lateral meniscus | 38 | 63.33% |
| Medical meniscus | 22 | 36.67% |
| Radial tear | | |
| Lateral meniscus | 15 | 25% |
| Medical meniscus | 45 | 75% |
| Bucket handle tear | | |
| Medical meniscus | 30 | 50% |
| Lateral meniscus | 30 | 50% |

The horizontal tears were primarily repaired using the "All Inside" method in 3 cases, while radial tears also favored the "All Inside" technique in 10 cases. Bucket handle tears were commonly treated with a hybrid approach (combining All Inside, Inside Out, and Outside In techniques), accounting for 15 cases, with an additional 5 cases using a combination of All Inside and Inside Out methods. Anterior horn tears

were exclusively repaired using the "Outside In" technique in 3 cases, while middle third tears involved a mix of "All Inside" and "Inside Out" techniques in 14 cases. Posterior horn tears were also addressed with the "All Inside" method in 10 cases. This data highlights the prevalence of hybrid techniques for more complex tears like bucket handle injuries.

Table 3: Meniscal Types Repaired Using Various Methods.

| Repair mechanisms | Types of tears | No. of cases |
|---|----------------------|--------------|
| All Inside | Horizontal tears | 3 |
| All Inside | Radial tears | 10 |
| Both all inside, inside out, outside in | Bucket Handle tears | 15 |
| Outside in | Anterior horn tears | 3 |
| All Inside + Inside Out | Middle third tears | 14 |
| All inside | Posterior horn tears | 10 |
| Both all inside, inside out | Bucket Handle tears | 5 |

Discussion

Meniscal injuries have evolved from conservative treatment to meniscal transplantation, open meniscectomy, and closed partial arthroscopic meniscectomy. When treating meniscal injuries, arthroscopic meniscal repair has a number of advantages. No trial that we looked at, including 60 patients, produced data that was statistically significant in terms of complications and functional outcome. For young people with peripheral longitudinal meniscal tears, arthroscopic meniscal repair is the preferred course of therapy. There are now three arthroscopic techniques for meniscus repair: the inside-out and outside-in suturing procedures, as well as the all-inside technique, which was created first and use biodegradable materials.

The demographic composition of the study's 60 participants provides an accurate picture of the target population. The majority of participants (36.67%) were between the ages of 26 and 40. A research by Choi et al. found that the mean age of the mean age in their research was 27.7 years, whereas the mean age in a study by Stein et al. was 31.5 years [12,13]. This suggests that there was a little larger representation of middle-aged people, which may correspond to the group most affected by knee injuries. Our findings show that right knee injuries are more common in the study group, with 66.67% of people experiencing tears in their affected knee. The participants in the Lutz et al. research, 53% had involvement of the right knee [14] among 14 patients (50%) had recurrent ACL injuries; two (7%) had isolated lateral meniscal injuries; one (3.5%) had medial meniscus with medial collateral damage; and two (7%) had pure chondral lesions.

The lateral meniscus was more often damaged (58.33%) than the medial meniscus (41.67%) in cases with meniscal tears, indicating a greater vulnerability of the lateral meniscus. The information on tear patterns, however, reveals variation according on the kind of tear. Longitudinal tears tended to impact the medial meniscus more often (66.67%), while complex tears mostly affected the lateral meniscus (63.33%). In contrast to bucket handle tears, which were equally distributed across the medial and lateral meniscus, radial tears were more prevalent in the medial meniscus (75%). These results imply that while the lateral meniscus is more vulnerable to damage overall, some kinds of tears are more likely to impact the medial meniscus. Tengrootenhuysen et al. research [15] on the long-term results of meniscal surgery demonstrated the significance of meniscal repair from a clinical and radiological standpoint. The study's favorable outcomes were linked to younger ages and early, inside-out repair techniques.

Regarding methods of care, the "All Inside" technique was often used to radial and horizontal tears, suggesting that it was best suited for less complicated injuries. However, the majority of treatments for bucket handle tears, which are usually more complicated, included combining "All Inside," "Inside Out," and "Outside In" approaches. This emphasizes the need for more adaptable surgical techniques for treating complicated tears. Similarly, a variety of techniques were often used to repair posterior horn and middle third injuries, underscoring the need of tailored care based on the unique features of the tear. The study's overall conclusions highlight the significance of customized treatment plans based on the kind and location of meniscal lesions. Michael et al.'s study [16] on arthroscopic meniscal repair evaluated three different surgical techniques: all inside, inside-out, and outside-in. The results showed that there were no significant differences in complications between the three groups. The Inside Out method to arthroscopic meniscal repair seems to be superior than other approaches because it promotes a higher rate of meniscus healing without necessitating a longer recovery time.

Conclusion

In conclusion, the meniscus repair methods, including all-inside, inside-out, and outside-in techniques, yield comparable clinical and functional outcomes, with no statistically significant differences between them. Hence, to ensure the biomechanical stability and optimal function of the knee joint, the primary focus should be on preserving the meniscus and restoring its original structure.

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