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Original Research Article

Comparative Analysis of Functional Outcomes Following Arthroscopic Meniscal Repair and Partial Meniscectomy in Young Adults in Tertiary Care Hospital

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Abstract:

Background: Meniscal injury is a common intra-articular knee disorder in young adults, usually due to sporting injury. Arthroscopic partial meniscectomy (APM) and meniscal repair are frequent surgical procedures with varying short- and long-term results. Although APM provides more rapid symptomatic improvement, meniscal repair is potentially more likely to preserve joint health.

Objective: This prospective observational study compares functional outcomes, patient satisfaction, and complications after arthroscopic meniscal repair versus APM in young adults aged 18–40 years.

Methods: Ninety-eight symptomatic meniscal tears patients received either meniscal repair (n=49) or APM (n=49). Patient-reported outcomes (Lysholm Knee Score, KOOS4) and Patient Acceptable Symptom State (PASS) were measured preoperatively and at 3, 6, and 12 months after surgery. Statistical analysis compared functional recovery and complication rates between groups.

Results: APM produced significantly improved KOOS4 and Lysholm scores at 3 months ($p<0.01$), reflecting earlier rapid recovery. Meniscal repair, however, showed better function and greater PASS positivity at 12 months ($p<0.05$). Complication rates were low and similar between groups.

Conclusion: Partial meniscectomy allows for faster short-term improvement, but repair provides better long-term knee function and patient satisfaction. Meniscal tissue preservation is the preferred option in young adults with repairable tears to achieve optimal joint health, even at the cost of slower early recovery.

Keywords: Arthroscopic Meniscal Repair, Functional Outcomes, Knee Joint Preservation, Meniscal Injury, Partial Meniscectomy.

Introduction

Meniscal injury is one of the most prevalent intra-articular knee disorders in young adults and often arises due to sports trauma or torsional injury [1]. The meniscus contributes significantly to knee biomechanics as a load distributor, shock absorber, and joint stabilizer. Meniscal integrity has traditionally been viewed as an absolute requirement to defend articular cartilage and prevent degenerative change [2]. Therefore, surgical treatment of meniscal tears, especially in young patients, has changed to find a balance between short-term functional restoration and long-term joint preservation [3]. Two main arthroscopic methods are used: meniscal repair and arthroscopic partial meniscectomy (APM). Meniscal repair is focused on maintaining meniscal tissue and restoring native anatomy, potentially decreasing the risk of future osteoarthritis (OA). However, repair is more technically challenging, with longer rehabilitation periods and increased reoperation rates. In contrast, APM offers quicker relief of symptoms and earlier return to activity but is invariably linked to increased rates of knee OA as well as even knee replacement on long-term follow-up studies [4]. Such trade-offs have created much controversy over the best treatment strategy in young adults.

Short-term functional results of meniscal repair compared with APM are of special interest because they have a direct impact on patient satisfaction, return to activity, and quality of life. The evidence indicates that APM tends to be associated with more improvement in patient-reported outcomes during the initial postoperative year than repair [5]. In a prospective cohort study with large numbers of patients, 18–40-year-old patients undergoing APM had more improvement in the Knee Injury and Osteoarthritis Outcome Score (KOOS) pain, symptoms, sport and recreation, and quality-of-life

domains (together KOOS4) than those treated with repair at one year and five years after surgery. Those results indicate a clinically significant short- to mid-term benefit of APM for functional recovery [6].

However, long-term consequences of surgical preference cannot be discounted. Preservation of meniscal tissue is highly recommended in younger patients since APM, even with initial advantages, hastens degenerative patterns. Several observational studies documents increased radiographic OA incidences and higher knee replacement chances after meniscectomy versus repair [7]. Repair, while providing worse early functional results, could be protective against structural decline. This poses a clinical dilemma: maximizing short-term recovery using APM risks long-term joint health, while choosing repair means accepting slower recovery and possible reoperation. The superlative available evidence is still weak and a little inconsistent. Several studies comparing the two are retrospective, heterogeneous in design, or do not control for change over time in outcomes [8]. Although systematic reviews have hinted at equivalent long-term function between repair and APM, stronger evidence supports that APM patients have more rapid symptom improvement but potentially at the expense of joint preservation. Randomized controlled trials are few, and most of the studies are confounded by indication, since surgical technique choice usually is based on tear type, location, and quality of the tissue.

The increasing frequency of meniscal repair procedures, backed by contemporary consensus guidelines, highlights the importance of understanding their functional outcomes compared with APM, especially in young adults with high expectations for knee function. Patient-reported outcomes, return-to-sport rates, and quality of life are important to be evaluated while making surgical decisions. In addition, determining how soon functional differences develop over years of follow-up is crucial to place the short-term disadvantages of repair into perspective versus the possible protective benefit [9]. The purpose of this study is to compare the functional results after arthroscopic meniscal repair and arthroscopic partial meniscectomy in young adults. By concentrating on functional recovery and patient-reported outcomes, it aims to establish whether the early benefits of APM outweigh its long-term complications, or whether meniscal repair, though with slower early recovery, represents a better balance between function and joint preservation. This evidence is crucial to maximize surgical decision-making and counsel young meniscal injury patients about their management.

Methodology

Study design and duration: This research was conducted as a prospective observational study. The total duration of the study was one year. Patients were enrolled consecutively as they present to the outpatient and emergency services of the Department of Orthopaedics, GMERS Medical College, Morbi, Gujarat, India.

Study setting: All participants were recruited and treated at the Department of Orthopaedics, GMERS Medical College, Morbi, a tertiary care teaching hospital serving both urban and rural populations of Gujarat. The department has established arthroscopic surgical facilities, allowing for standardized surgical interventions and uniform postoperative rehabilitation.

Study population: The study population included young adult patients between the ages of 18 and 40 years who are diagnosed with symptomatic meniscal tears requiring arthroscopic intervention. Diagnosis was established on the basis of clinical evaluation (history and examination) and confirmed by magnetic resonance imaging (MRI).

Sample size and grouping: A total of 98 patients meeting the eligibility criteria were enrolled. Based on intraoperative findings and surgeon decision-making, patients were allocated into two groups:

- **Group A (Meniscal Repair):** Patients undergoing arthroscopic meniscal repair ($n \approx 49$).
- **Group B (Partial Meniscectomy):** Patients undergoing arthroscopic partial meniscectomy ($n \approx 49$).

This sample size is considered adequate for detecting clinically significant differences in patient-reported outcomes, while also being feasible within the study duration and institutional resources.

Eligibility criteria

Inclusion criteria:

1. Patients aged between 18 and 40 years.
2. Patients with symptomatic meniscal tears confirmed by MRI.
3. Patients undergoing arthroscopic meniscal repair or partial meniscectomy as definitive treatment.
4. Patients willing to provide written informed consent and comply with scheduled follow-up visits.

Exclusion criteria:

1. Patients with concomitant ligamentous injuries requiring reconstruction (e.g., ACL or PCL).
2. Degenerative meniscal tears or knees with advanced osteoarthritis (Kellgren–Lawrence grade ≥ 3).
3. Prior history of surgery on the ipsilateral knee.
4. Associated fractures in the affected lower extremity.

5. Patients with systemic conditions precluding surgery or rehabilitation.
6. Patients unwilling or unable to participate in postoperative follow-up.

Surgical intervention: All surgeries were performed arthroscopically by orthopaedic surgeons experienced in sports medicine and arthroscopic techniques. The choice of procedure (repair vs. meniscectomy) was based on tear morphology, vascular zone involvement, and tissue quality.

- **Meniscal repair:** Tears located in the red–red or red–white vascular zones, and amenable to fixation, was repaired using standard arthroscopic techniques such as all-inside or inside-out suturing devices.
- **Partial meniscectomy:** Irreparable tears, complex degenerative tears, or tears located in avascular zones was managed with arthroscopic partial meniscectomy, aiming to preserve as much functional meniscal tissue as possible.

Rehabilitation protocol

Postoperative rehabilitation was tailored to the surgical procedure but standardized within each group.

- Patients undergoing meniscal repair followed a more conservative rehabilitation protocol, with initial restrictions on weight-bearing and knee flexion to allow biological healing. Partial weight-bearing with crutches were permitted in the early weeks, progressing gradually to full weight-bearing and functional activities over 3–4 months.
- Patients undergoing meniscectomy followed an accelerated protocol, with early weight-bearing as tolerated, rapid progression in range of motion exercises, and earlier return to normal activities.

Outcome measures

Functional outcomes were assessed using validated patient-reported and clinician-assessed measures:

1. **Knee Injury and Osteoarthritis Outcome Score (KOOS):** with subscales for pain, symptoms, sport/recreation, and knee-related quality of life. The KOOS4 composite score were the primary outcome.
2. **Lysholm Knee Scoring Scale:** to evaluate stability, pain, and functional activity.
3. **Patient Acceptable Symptom State (PASS):** to determine patient-perceived satisfaction with knee function.

Assessments were performed at baseline (preoperatively), and postoperatively at 3 months, 6 months, and 12 months.

Data collection: Demographic information (sex, age, BMI), details of injury (side, mechanism of injury, symptom duration), surgical details, and intraoperative findings was recorded in a standard case record form. PROMs (KOOS, Lysholm, PASS) were completed in the patient's chosen language, and responses were recorded in a secure database for analysis.

Statistical analysis: Statistical analysis was done with SPSS software version 27. Continuous data was presented as mean ± standard deviation (SD), and categorical data as proportions. Between-group differences were tested with independent t-tests (or Mann–Whitney U test if data are not normally distributed). Within-group change over time points were tested with paired t-tests or repeated measures ANOVA. Chi-square tests were used for categorical variables like patient satisfaction (PASS). Statistical significance was evaluated if the p-value is < 0.05.

Results

98 patients were included in the study, 49 of whom had meniscal repair (Group A) and 49 of whom had partial meniscectomy (Group B). The groups were compared in terms of baseline characteristics, functional outcomes, patient satisfaction, and postoperative complications. Patients were followed up at 3, 6, and 12 months to assess both clinical and patient-reported outcomes. The results are presented in the tables below.

Table 1 below shows the baseline demographic and clinical characteristics of patients in the meniscal repair (Group A) and partial meniscectomy (Group B) groups. There were no statistically significant differences between the two groups in any of the variables, reflecting well-matched cohorts. The mean age (27.3 ± 5.6 vs. 28.1 ± 6.2 years; $p = 0.48$), BMI (24.7 ± 3.1 vs. 25.1 ± 3.3 kg/m²; $p = 0.45$), and symptom duration (7.4 ± 2.3 vs. 8.1 ± 2.6 weeks; $p = 0.18$) were similar. Sex split (M/F: 34/15 vs. 33/16; $p = 0.82$), side of injury (right/left: 29/20 vs. 26/23; $p = 0.51$), and cause of injury (sports-related: 57.1% vs. 53.1%; non-sports trauma: 42.9% vs. 46.9%; $p = 0.69$) were comparable as well. This baseline comparability favors subsequent outcome comparison between the two surgical groups.

Table 1: Baseline Demographic and Clinical Characteristics			
Variable	**Group A (Meniscal Repair) (n=49)**	**Group B (Partial Meniscectomy) (n=49)**	**p-value**
Age (years), mean ± SD	27.3 ± 5.6	28.1 ± 6.2	0.48
Sex (M/F)	34 / 15	33 / 16	0.82
BMI (kg/m²), mean ± SD	24.7 ± 3.1	25.1 ± 3.3	0.45
Affected side (Right/Left)	29 / 20	26 / 23	0.51
Duration of symptoms (weeks)	7.4 ± 2.3	8.1 ± 2.6	0.18
Mechanism of injury			
Sports-related	28 (57.1%)	26 (53.1%)	0.69
Traumatic (non-sports)	21 (42.9%)	23 (46.9%)	

Table 2 illustrates the changes in KOOS4 functional outcome scores over time for both groups. Preoperatively, the scores were similar between the meniscal repair group (Group A: 48.2 ± 6.5) and the meniscectomy group (Group B: 49.1 ± 6.2), with no significant difference (p = 0.42). At 3 months, Group B showed significantly higher scores (68.9 ± 6.8) than Group A (62.5 ± 7.3), indicating faster early recovery (p = 0.001). At 6 months, the difference narrowed, with Group B maintaining a slight advantage (p = 0.05). However, by 12 months, Group A demonstrated significantly better outcomes (84.6 ± 5.9) compared to Group B (78.1 ± 6.3), with a highly significant difference (p < 0.001). These results suggest that while partial meniscectomy leads to quicker short-term improvements, meniscal repair offers superior long-term functional recovery.

Table 2: Functional Outcome Scores (KOOS4) Over Time			
Time Point	**Group A (Repair) Mean ± SD**	**Group B (Meniscectomy) Mean ± SD**	**p-value**
Preoperative	48.2 ± 6.5	49.1 ± 6.2	0.42
3 months	62.5 ± 7.3	68.9 ± 6.8	0.001
6 months	72.8 ± 6.7	75.4 ± 6.5	0.05
12 months	84.6 ± 5.9	78.1 ± 6.3	<0.001

Table 3 presents the progression of Lysholm Knee Scores in both treatment groups over time. Preoperatively, the scores were comparable between the meniscal repair group (Group A: 52.6 ± 5.9) and the meniscectomy group (Group B: 53.8 ± 6.2), with no significant difference (p = 0.36). At 3 months, Group B showed significantly better functional improvement (71.5 ± 6.9) compared to Group A (65.2 ± 7.1), with a statistically significant difference (p = 0.002). However, by 6 months, the difference narrowed and was not statistically significant (p = 0.08). At 12 months, Group A demonstrated superior functional outcomes (88.2 ± 5.6) compared to Group B (81.7 ± 6.1), with a highly significant difference (p < 0.001). These findings suggest that while meniscectomy provides quicker short-term improvement, meniscal repair results in better long-term knee function.

Table 3: Lysholm Knee Score Over Time			
Time Point	**Group A (Repair) Mean ± SD**	**Group B (Meniscectomy) Mean ± SD**	**p-value**
Preoperative	52.6 ± 5.9	53.8 ± 6.2	0.36
3 months	65.2 ± 7.1	71.5 ± 6.9	0.002
6 months	75.9 ± 6.5	78.3 ± 6.4	0.08
12 months	88.2 ± 5.6	81.7 ± 6.1	<0.001

Table 4 shows the proportion of patients in each group who achieved the Patient Acceptable Symptom State (PASS) at different follow-up intervals. At 3 months, 53.1% of patients in the meniscal repair group (Group A) and 65.3% in the meniscectomy group (Group B) reported acceptable symptom states, with no statistically significant difference (p = 0.21). By 6 months, the PASS positivity increased to 77.5% in Group A and 79.6% in Group B, again showing no significant difference (p = 0.78). However, at 12 months, a significantly higher proportion of patients in Group A (89.8%) reported a satisfactory symptom state compared to Group B (75.5%), with a statistically significant difference (p = 0.04). This suggests that while short-term satisfaction was comparable, meniscal repair resulted in superior patient-perceived outcomes at one year.

Table 4: Patient Acceptable Symptom State (PASS) at Follow-up			
Time Point	**Group A (PASS Positive)**	**Group B (PASS Positive)**	**p-value**
3 months	26 (53.1%)	32 (65.3%)	0.21
6 months	38 (77.5%)	39 (79.6%)	0.78
12 months	44 (89.8%)	37 (75.5%)	0.04

Table 5 compares postoperative complications between the meniscal repair group (Group A) and the partial meniscectomy group (Group B). Superficial infection occurred in 1 patient (2.0%) in each group, with no significant difference (p = 1.0). Reoperation was slightly more frequent in Group A (6.1%) compared to Group B (2.0%), while joint stiffness was reported in 2 patients (4.1%) in Group A and none in Group B; however, both differences were not statistically significant (p = 0.31 and p = 0.15, respectively). Overall, the complication rates were low in both groups, indicating that both procedures are safe and well-tolerated when performed in appropriately selected patients.

Table 5: Postoperative Complications			
Complication	**Group A (n=49)**	**Group B (n=49)**	**p-value**
Infection (superficial)	1 (2.0%)	1 (2.0%)	1
Reoperation (e.g., revision meniscectomy)	3 (6.1%)	1 (2.0%)	0.31
Joint stiffness	2 (4.1%)	0 (0%)	0.15

Discussion

The prospective comparative study compared ˙the clinical, functional, and patient-relevant outcomes after meniscal repair and partial meniscectomy in a matched group of 98 patients with meniscal lesions. The key findings are that partial meniscectomy is associated with quicker short-term functional recovery as seen with significantly higher KOOS4 and Lysholm scores at 3 months after surgery. But at 12 months, meniscal repair had better functional results and greater patient satisfaction, implying more lasting benefits. Both groups had low complication rates that were not significantly different from one another, emphasizing the comparative safety of each operation when properly indicated.

During the early postoperative period, our findings clearly show that patients have undergone partial meniscectomy have more rapid recovery of knee function. This is consistent with multiple prior studies. Paxton et al. (2011), in a systematic review, pointed out that meniscectomy leads to symptom relief immediately by removing the torn tissue, which decreases mechanical irritation and inflammation [10]. Likewise, Zaslav et al. (2022) stated that meniscectomy resulted in pain relief and functional improvement more quickly in the initial 3 months after surgery in comparison to meniscal repair [11]. This quicker recovery is probably due to the less invasive procedure of meniscectomy with an abbreviated and less stressful rehabilitation protocol. Thus, patients are able to return to activities earlier, a factor possibly contributing to the greater early KOOS4 and Lysholm scores of our meniscectomy group.

In contrast, meniscal repair, though linked with gradual early recovery, does seem to impart enormous benefit in the long run. At follow-up at 12 months, our findings reflect significantly improved functional results in the repair group on several validated measures, such as KOOS4 and Lysholm scores. Moreover, there was a greater percentage of meniscal repair patients who achieved the Patient Acceptable Symptom State (PASS) and hence reported better subjective satisfaction with their knee function. These observations support the increasing evidence pointing to the significance of meniscus preservation for knee joint homeostasis. Merrild et al. (2022) highlighted that meniscal repair allows for the restoration of the load-distributing and shock-absorbing capabilities of the meniscus, which are essential in preventing progressive degeneration of cartilage and osteoarthritis [12]. The better long-term results in our repair group could be the result of improved joint biomechanics and lower risk of degenerative alterations, which meniscectomy might hasten by destroying meniscal tissue.

Our results, while differing somewhat from those of Svantesson et al. (2018), who did not find statistically significant differences in 1-year functional scores between repair and meniscectomy groups, can be explained by variations in patient selection, tear type, and rehabilitation protocols postoperatively [13]. Our analysis contained only repairable meniscal tears and closely similar baseline characteristics, thus reducing confounding variables and rendering a more precise evaluation of treatment outcomes. The longer-term advantages of meniscal repair may also occur beyond one year, which was not investigated in some earlier studies.

In terms of safety and complications, both surgical methods revealed positive profiles with low rates of superficial infections, reoperations, and joint stiffness. While a greater numerical incidence of stiffness and reoperations was observed in the meniscal repair group, these were not statistically significant. This is as would be predicted from

current literature; Paxton et al. (2011) mentioned that meniscal repair does involve an increased risk of postoperative stiffness and potential for the necessity of revision surgery owing to the healing process being complex, but these are offset by better joint preservation. The lack of statistically significant differences in rates of complications supports the inference that both procedures are safe when undertaken by skilled surgeons and patients are chosen according to proper tear characteristics and general health of the knee.

The implications of these findings are clinically pertinent. Meniscal repair needs to be taken as the preferred surgical method in active young patients with a repairable meniscal tear, where one wants to save meniscal tissue and enhance ultimate joint function. The more rapid short-term recovery must be weighed against the ability to avoid premature osteoarthritis and to prevent loss of knee stability [14]. However, partial meniscectomy is still an acceptable choice in patients with irreparable tears or where quick relief of symptoms is warranted, for example, in older individuals or with less demanding functions.

Conclusion

This present research demonstrates that partial meniscectomy yields quicker short-term functional gain, while meniscal repair allows for better long-term functional results and patient satisfaction at the 12-month follow-up. Both procedures have low rates of complications, assuring their safety when properly indicated. The results provide evidence in favor of meniscal repair as the treatment of choice for those with potentially repairable tears, especially younger, more active patients, owing to its ability to maintain knee joint integrity and postpone degenerative changes. Long-term follow-up and improved imaging should be part of future studies to further prove these results and guide clinical practice.

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