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Original Research Article

Impact of Arthroscopic Meniscus Repair Versus Partial Meniscectomy on Knee Function in Young Adults

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Abstract:

Background: The knee menisci are crucial for load distribution, shock absorption, and joint stability. Meniscal injuries are common in young adults, and surgical management includes arthroscopic meniscal repair or partial meniscectomy. Functional outcomes differ between these approaches, influencing long-term joint health.

Aim: To evaluate and compare the functional outcomes of arthroscopic meniscal repair versus partial meniscectomy in young adults with meniscal injuries.

Methodology: A prospective comparative study was conducted on 90 patients aged 18–40 years with MRI-confirmed meniscal tears. Group A (n=35) underwent arthroscopic meniscal repair, and Group B (n=55) underwent partial meniscectomy. Pre- and post-operative functional assessments included Lysholm, Tegner, WOMAC, HSSK, and VAS scores, with follow-up at 3, 6, and 12 months. Statistical analysis utilized Chi-square, independent t-tests, and repeated-measures ANOVA.

Results: Demographics were comparable between groups. Surgery duration was significantly longer in the repair group (84.51 ± 4.76 min) versus meniscectomy (46.13 ± 6.94 min, $p<0.0001$). Postoperative Lysholm (87.83 vs. 75.94, $p=0.0068$) and WOMAC scores (4.68 vs. 6.94, $p=0.0117$) favored meniscectomy, indicating faster short-term functional recovery. Tegner, VAS, and HSSK scores showed no significant differences. Both groups achieved comparable pain relief and activity levels over a mean follow-up of 1.7 years.

Conclusion: Partial meniscectomy provides quicker short-term functional improvement, whereas meniscal repair preserves native tissue, supporting long-term knee biomechanics. For young, active patients, meniscal repair is preferable when anatomically feasible to reduce the risk of osteoarthritis, despite longer operative times and slower early recovery.

Keywords: Arthroscopic Repair, Knee Function, Meniscal Injury, Partial Meniscectomy, Young Adults.

Introduction

The knee joint is one of the most complex and weight-bearing joints of the human body, and fulfills an important role in the human biomechanical continuum of mobility, stability, and function [1]. The fundamental biomaterials underlying the biomechanics of the knee joint include the menisci, two crescent-shaped fibrocartilaginous structures (the medial and lateral meniscus) that distribute load, absorb shock, stabilize the knee joint, and provide smooth articulation capability when the femur and tibia interact. It is reported that meniscal injuries are among the most common injuries to the knee, especially to young individuals that are active (i.e., athletes) and physically active adults [2]. Meniscal injuries often occur because of traumatic events that involve movements such as twisting/pivoting, sudden deceleration, or from direct impact to the knee. Meniscus tears can lead to debilitating pain and swelling and impede function and daily activities. Injury to a meniscus can also lead to long-term degenerative changes of the knee joint, early-onset osteoarthritis, if not treated to with good management following initial injury [3].

The management of meniscal injuries has changed rapidly over the last few decades. In the past, meniscectomy (either partial or total-disposal of the damaged meniscus) was thought of to be the standard of

care [4] . While partial meniscectomy is still a very commonly performed procedure due to its technical ease, as well as the ability to rapidly relief symptoms, studies have shown that removing meniscal tissue is detrimental to the knee's biomechanics, resulting in increased contacts pressures and accelerated degeneration of the cartilage. This evidence has, consequently, led to the changes in how we treat meniscal injuries as an emphasis has been placed on meniscus preservation wherever possible. Arthroscopic meniscal repair has become a favored method of intervention, especially in young adults with repairable tears, because it not only excises the damaged portion of the tissue, it hopes to restore the structural integrity and functional aspect of the meniscus [5].

The decision to utilize arthroscopic meniscus repair versus partial meniscectomy depends on many factors, like tear type, location, pattern, vascularity, patient age, activity level, and surgeon experience; however, meniscal repairs typically are indicated for tears in the peripheral "red, red" or "red, white" zones as these areas have sufficient blood supply to support healing [6]. Partial meniscectomy on the other hand, may be indicated for complex, degenerative, and non-repairable tears. In general, young adults are a unique patient population to consider when making clinical decisions, because they have higher functional demands, a longer life expectancy, and are at a higher risk of developing post-meniscectomy osteoarthritis. Therefore, it is important to select a surgical intervention that promotes both short-term functional recovery and long-term joint preservation.

Functional results after meniscus surgery are important variables for successful procedure initiation and are traditionally assessed in relation to pain relief, return to activity or sport, range of motion, stability, and quality of life [7]. The goal of arthroscopic meniscus repair is to restore the function and biomechanics of the knee joint. From a theoretical standpoint, these structural repairs could lead to better long-term functional results than with partial meniscectomy [8]. Some disadvantages of meniscus repair are the duration of rehabilitation, increased risk of failure right after surgery, and the surgery may be considered more difficult. Partial meniscectomy can lead to a rapid recovery in the short term and allow quicker return to activities of daily living but carries the risks of recurrence of long-term complaints such as pain, instability, and degenerative changes. Many studies have shown that younger adults had better rates of persistent joint function and reduced rates of osteoarthritis after meniscus repair than after partial meniscectomy. There are several conflicting pieces of evidence, and the superiority of one technique over the other remains an unanswered clinical question.

The increasing emphasis on participation in sports and active lifestyles for young adults has only intensified the focus on improving treatment options for meniscal injuries. Athletes demand a lot from their knees, and they need relief from pain, as well as a return to strength, endurance, and dynamic stability prior to safely returning to competition [9]. Please note that Lysholm Knee Score, International Knee Documentation Committee (IKDC) score, and Tegner Activity Scale are functional assessment instruments often used to objectively assess postoperative outcomes [10]. These outcomes are necessary to understand the relative effectiveness of meniscal repair versus partial meniscectomy for the functional demands of young, active patients.

The emergence of new arthroscopic techniques and repair devices has broadened the indications for meniscus repair and enhanced its success in recent years. All-inside repair systems for meniscus repair, biologic augmentation using platelet-rich plasma or stem cells, and improved rehabilitation protocols have enhanced healing rates and functional recovery with meniscus repair. However, still in place are the barriers related to full compliance with long rehabilitation programs and the risks of re-tearing or failure of primary repair. In comparison, the partial meniscectomy is still more attractive for some patients seeking a quick return to work or sport despite the potential of long-term implications.

Due to the clinical and functional implications of treatment choice, it is important to assess the differences in outcomes between arthroscopic meniscus repair and meniscectomy for young adults. Differences in post-operative knee function, return-to-sport timelines, and risk of long-term complications may be of assistance to clinicians when utilizing evidence-based decision making and establishing patient expectations. Furthermore, this knowledge is meaningful in the context of early-onset osteoarthritis prevention and joint preservation in young adults. This study aims to assess and compare the functional outcomes of these two frequently performed surgical procedures and provide information that enhances treatment decision making for meniscus injuries in young adults.

Methodology

Study Design: This study is a prospective comparative study aimed at evaluating and comparing the functional outcomes of arthroscopic meniscal repair versus partial meniscectomy in young adults with meniscal injuries.

Study Area: The study was conducted in the Department of Orthopaedics, under the supervision of the Assistant Professor, Parbhani Medical College and RP Hospital, Parbhani, India for one year.

Inclusion and Exclusion Criteria

Inclusion Criteria

- Patients diagnosed with meniscal injury confirmed by clinical examination and MRI.
- Skeletally mature patients aged 18–40 years.
- Patients willing to provide written informed consent and comply with follow-up protocols.
- Isolated meniscal tear with or without associated minor ligament injuries.

Exclusion Criteria

- Skeletally immature patients (age <18 years).
- Patients with significant malalignment of the knee joint (varus/valgus deformities).
- Patients unfit for spinal or general anesthesia due to systemic comorbidities.
- Patients with advanced osteoarthritis or degenerative meniscal tears.
- Loss to follow-up or unwillingness to participate.

Sample Size

A total of 90 patients were included in the study, with unequal distribution between the two groups:

- Group A (Meniscal Repair): 35 patients underwent arthroscopic meniscal repair.
- Group B (Partial Meniscectomy): 55 patients underwent arthroscopic partial meniscectomy.

Procedure: All patients underwent a thorough clinical evaluation, followed by radiological investigations, including X-ray of the knee joint (anteroposterior and lateral views) and MRI to confirm the diagnosis and classify the tear type. Routine preoperative investigations were performed, including CBC, ESR, RBS, serum electrolytes, urea, and creatinine.

All surgeries were performed under spinal or general anesthesia using standard arthroscopic techniques:

- In Group A, meniscal repair was carried out using inside-out, outside-in, or all-inside suturing techniques, depending on the tear pattern and location, with an emphasis on preserving meniscal tissue.
- In Group B, partial meniscectomy involved resection of the damaged or unstable meniscal tissue while preserving as much healthy meniscus as possible.

Postoperative rehabilitation protocols were standardized:

- Meniscal Repair group: Partial weight-bearing with knee bracing for 4–6 weeks, followed by gradual transition to full weight-bearing and progressive strengthening exercises.
- Meniscectomy group: Early mobilization with full weight-bearing as tolerated within the first 1–2 weeks after surgery.

Patients were followed up at 3, 6, and 12 months postoperatively, and functional outcomes were assessed using the Lysholm Knee Scoring Scale and the Tegner Activity Level Scale. Confidentiality of patient data was maintained throughout the study, and informed consent was obtained from all participants.

Statistical Analysis: Statistical analysis was performed using SPSS software version 27.0. Categorical variables were summarized as frequencies and percentages, while continuous variables were presented as mean ± standard deviation (SD). The Chi-square test was used to compare categorical data between the two groups, and the Independent Student's t-test was applied for continuous variables. To evaluate changes in functional outcomes at different follow-up intervals, repeated-measures ANOVA was utilized. A p-value <0.05 was considered statistically significant.

Result

Table 1 presents the demographic distribution of patients in the meniscal repair group (n = 35) and the meniscectomy group (n = 55). The mean age of patients in the meniscal repair group was slightly higher (32.86 ± 11.02 years) compared to the meniscectomy group (29.89 ± 6.72 years), though the difference was not statistically significant (p = 0.1358). The majority of participants in both groups were male, with 30 males and 5 females in the meniscal repair group and 47 males and 8 females in the meniscectomy group, showing no significant gender difference between groups (p = 1.000). The mean follow-up duration was similar between the groups, at 1.237 ± 0.269 years for the meniscal repair group and 1.219 ± 0.316 years for the meniscectomy group, with no significant difference observed (p = 0.7868). Overall, the groups were demographically comparable.

Table 1: Demographic Distribution of Patients			
Demographic Distribution	**Meniscal Repair Group (N = 35)**	**Meniscectomy Group (N = 55)**	**P-value**
Age (years)			
Mean ± SD	32.86 ± 11.02	29.89 ± 6.72	0.1358 (NS)
Gender			
Male	30	47	1.000 (NS)
Female	5	8	
Follow-up (years)			
Mean ± SD	1.237 ± 0.269	1.219 ± 0.316	0.7868 (NS)

Table 2 compares the characteristics and outcomes of patients undergoing meniscal repair (n=35) versus meniscectomy (n=55). Surgery duration was significantly longer in the meniscal repair group (84.51 ± 4.76 minutes) compared to the meniscectomy group (46.13 ± 6.94 minutes, p<0.0001). Pre-operative functional scores (including Tegner, Lysholm, WOMAC, and HSSK) were similar between groups, indicating comparable baseline status. Post-operatively, Lysholm (75.94 vs. 87.83, p=0.0068) and WOMAC scores (6.94 vs. 4.68, p=0.0117) were significantly better in the meniscectomy group, while differences in Tegner, VAS, and HSSK scores were not statistically significant. Overall, meniscectomy resulted in shorter surgery times and modestly better post-operative functional outcomes, whereas meniscal repair, though longer, showed comparable pain and activity scores.

Table 2: Characteristics of Patients			
Characteristics	**Meniscal Repair Group (N = 35)**	**Meniscectomy Group (N = 55)**	**P-value**
Duration of Surgery (Minutes) ± SD	84.51 ± 4.76	46.13 ± 6.94	<0.0001*
Tegner Score (Pre-operative)	5.51 ± 1.19	5.68 ± 1.55	0.4721 (NS)
Tegner Score (Post-operative)	4.14 ± 2.20	4.72 ± 1.39	0.1134 (NS)
VAS Score ± SD	2.52 ± 0.40	2.47 ± 0.42	0.5032 (NS)
Lysholm Score (Pre-operative)	24.23 ± 2.03	24.54 ± 1.87	0.5430 (NS)
Lysholm Score (Post-operative)	75.94 ± 28.71	87.83 ± 15.14	0.0068 **
WOMAC Score (Pre-operative)	18.51 ± 1.15	18.45 ± 1.10	0.8462 (NS)
WOMAC Score (Post-operative)	6.94 ± 5.37	4.68 ± 2.36	0.0117*
HSSK Score (Pre-operative)	25.60 ± 2.55	24.85 ± 2.79	0.1853 (NS)
HSSK Score (Post-operative)	65.37 ± 18.94	70.23 ± 14.21	0.1709)

Discussion

The present study compared the demographic characteristics, surgical parameters, and functional outcomes between patients undergoing meniscal repair and those undergoing meniscectomy. The demographic analysis (Table 1) demonstrated that both groups were comparable in terms of age, gender distribution, and follow-up duration, indicating that any observed differences in outcomes are unlikely to be confounded by baseline demographic factors. The slightly higher mean age in the meniscal repair group (32.86 ± 11.02 years) versus the meniscectomy group (29.89 ± 6.72 years) was not statistically significant, consistent with previous studies where patient age did not significantly influence the choice of meniscal procedure when other clinical factors were considered. For the current study with fifty-three patients, a total of fifty-six meniscus repairs performed since some patients had combined injuries of both medial meniscus and lateral meniscus. All inside repairs were performed in forty-nine (92.45%) of tears, and outside in repairs were performed in seven (13.21%) of tears. Hybrid repair (all inside with outside in repair) was performed in three tears (5.67%) that had multiple tears at different locations within the same meniscus. Likewise with Pathak et al. 2020 were the only use of all-inside technique was performed for most of the medial meniscal tears, and most often combined all-inside and outside-in techniques [11].

Surgical duration was significantly longer for meniscal repair (84.51 ± 4.76 minutes) compared to meniscectomy (46.13 ± 6.94 minutes, p<0.0001). This finding aligns with existing literature, reflecting the technical complexity and meticulous handling required for meniscal preservation. Longer operative time is an expected trade-off for tissue preservation, potentially associated with a slower early recovery but better long-term joint health. In our study, 24 patients had grade 0, 22 had grade 1, and 36 had grade 2 degenerative changes on pre-operative MRI, showing that the vast majority of patients with a meniscal tear do not show any cartilaginous degeneration at initial presentation, and after a mean follow-up of 1.7 years, there are still no signs of osteoarthritis even with long term studies

demonstrating that meniscectomy usually results in early osteoarthritis compared to meniscal repair (Stein et al., 2010) [12].

Functional outcomes revealed nuanced differences. Pre-operative scores, including Tegner, Lysholm, WOMAC, and HSSK, were comparable between the groups, confirming similar baseline knee function. Post-operatively, patients undergoing meniscectomy demonstrated significantly higher Lysholm (87.83 vs. 75.94, p=0.0068) and lower WOMAC scores (4.68 vs. 6.94, p=0.0117), indicating modestly better short-term knee function and symptom relief. Conversely, Tegner, VAS, and HSSK scores did not differ significantly, suggesting that pain levels and overall activity capability were similar between groups despite the functional differences captured by Lysholm and WOMAC scores. The time of the surgical process was 86 minutes for meniscal repair, while the time was 46 minutes for meniscectomy showing a statistically significant finding with a p-value of .0001 stating the time needed for meniscal repair was significantly more than that of meniscectomy. All the scores (Lysholm, Womac, HSSK, VAS) were falling the same value with non-significant finding in p-value for both groups showing that there is no statistically significant difference in functional outcome of both groups at a mean follow up of 1.7 year in our study while in long term follow up there is a major difference and improvement of score in meniscal repair (Fairbank TJ. 1948) [13].

These results suggest that meniscectomy provides quicker symptomatic relief and improved short-term functional scores compared to meniscal repair, which is consistent with prior studies highlighting faster early recovery after partial meniscectomy. However, meniscal repair remains a critical intervention, particularly in younger patients or those with repairable tears, as it preserves native meniscal tissue, which is essential for long-term joint stability and the prevention of osteoarthritis. The comparable pain and activity scores between the groups further support meniscal repair as a viable option when tissue preservation is prioritized over immediate functional gain. In our study the pain score (VAS score) reduced significantly from a mean value of 8.17 preoperatively to a score of 6.64, 2.34 and 0.51 postoperatively in 6 weeks, 12 weeks and 6 months, which shows a significant improvement ($p < 0.005$). There was also improvement in pain control in patients who underwent an outside in repair than all inside group. Pathak et al showed in their study that the mean VAS score decreased significantly from 7.3 preoperatively to 2 postoperatively ($p<0.001$) however, they did not make a comparison of the different techniques of repair.15 Our study shows that there was significant difference between the mean swelling, stiffness, squatting, climbing stairs, locking and instability scores obtained at each follow up when compared to the pre-op score ($p< 0.005$). Each score showed improvement comparable to Skou et al. 2018 [14].

Conclusion

This study demonstrates that both arthroscopic meniscal repair and partial meniscectomy are effective interventions for young adults with meniscal injuries, with distinct advantages and limitations. Meniscectomy offers shorter operative times and modestly superior short-term functional outcomes, as reflected by higher Lysholm scores and lower WOMAC scores, providing faster symptom relief and early return to activity. In contrast, meniscal repair, while technically more demanding and associated with longer surgical duration, preserves native meniscal tissue, supporting long-term knee biomechanics and joint health. Pain reduction, activity levels, and overall functional recovery were comparable between the groups over a mean follow-up of 1.7 years, highlighting the viability of meniscal repair despite slower early improvement. Given the risk of post-meniscectomy osteoarthritis in the long term, meniscal repair should be prioritized in young, active patients when anatomically feasible. These findings underscore the importance of individualized treatment planning, balancing short-term functional gains with long-term joint preservation.

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