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Original Research Article

Evaluation of Rehabilitation Protocols Following Arthroscopic Knee Procedures: A Retrospective Cross-Sectional Study

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Abstract:

Background: Arthroscopic knee surgeries restore joint function and relieve knee pain. For optimal patient outcomes, post-operative rehabilitation must aid recovery and reduce complications. Many rehabilitation methods exist, however efficacy trials are still underway.

Method: A retrospective cross-sectional study was conducted at Patna's Nalanda Medical College and Hospital from March 2023 to February 2024. Our sample included 60 arthroscopic knee surgery patients. Patients were categorised by rehabilitation techniques including supervised clinical rehabilitation vs. home-based therapy and early vs. delayed start. Demographics, operation history, and clinical outcomes like KOOS and VAS pain were collected. Statisticians employed t-tests, one-way ANOVA, chi-square tests, and multivariate regression to compare groups.

Result: Significant differences in KOOS and VAS pain scores were seen between the home-based therapy and supervised clinical rehabilitation groups (81.2 ± 14.0 vs. 75.3 ± 16.2, p=0.028 and 1.8 ± 1.2 vs. 2.5 ± 1.4, p=0.035). Early rehabilitation starting resulted with improved KOOS scores and shorter return to activities (80.1 ± 15.1 vs. 76.8 ± 15.7, p=0.045) compared to delayed initiation (40.5 ± 10.5 days vs. 44.2 ± 11.0 days, p=0.038).

Conclusion: This study demonstrates that supervised clinical rehabilitation is preferable and should be begun early following arthroscopic knee surgeries to improve functional results and reduce discomfort. These findings emphasise the importance of structured and timely rehabilitation courses for patient recovery. After orthopaedic surgery, healthcare providers should consider supervised rehabilitation and early initiation to improve patient outcomes.

Keywords: Arthroscopic Knee Procedures, Clinical Rehabilitation, Early Initiation, Orthopedic Surgery, Post-operative Rehabilitation.

Introduction

Background of Arthroscopic Knee Procedures

Arthroscopy is used to diagnose and treat knee joint problems. These surgeries are minimally invasive.

A tiny camera called an arthroscope allows doctors to see into the knee joint and perform surgery with minimal tissue damage [1]. Common operations include meniscectomy, chondroplasty, and ligament reconstruction.

Arthroscopic surgery has fewer risks, easier recovery, less pain, and smaller incisions than open surgery [2]. Due to these benefits, arthroscopy is the preferred knee injury treatment for active persons and athletes.

Importance of Rehabilitation Protocols

Post-operative rehabilitation is crucial for arthroscopic knee treatment recovery. An effective rehabilitation programme improves range of motion, muscular strength, and joint function. Patient education, pain management, and physical therapy are typical [3]. Rehabilitation also aims to reduce post-operative discomfort, muscle atrophy, and joint stiffness [4]. Because every patient reacts differently after surgery, personalised rehabilitation regimens are essential.

Objectives

- To evaluate rehabilitation strategies for arthroscopic knee surgery patients.
- To compare rehabilitation methods for recovery time, discomfort, and function.

- To determine what variables, affect rehabilitation regimen efficacy to guide future therapy.

Arthroscopic Knee Rehabilitation

Numerous studies have studied arthroscopic knee surgery effectiveness and rehabilitation. Rehabilitating patients after minimally invasive surgeries has been demonstrated to be quite beneficial. [5,6] observed that structured rehabilitation programmes following arthroscopic meniscectomy improved functional outcomes and recovery time. In a randomised controlled trial, [7] compared early and delayed rehabilitation for Anterior Cruciate Ligament (ACL) surgery patients. Early physical therapy improved knee function and reduced discomfort after six months. [8] Discovered that strength training, proprioceptive activities, and aerobic conditioning helped arthroscopy patients recover. Their findings stressed the significance of holistic rehabilitation for full recovery.

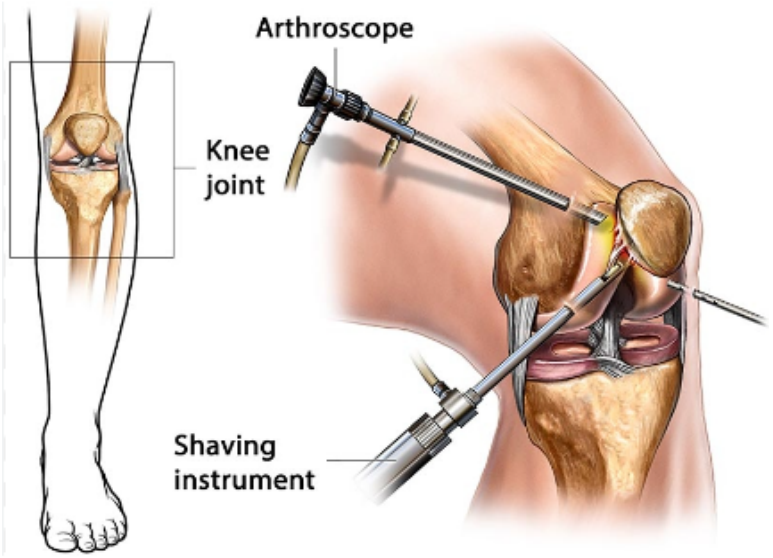

Figure 1: Knee Arthroscopic [9]

Comparison of Different Rehabilitation Protocols: Rehabilitation following arthroscopic knee surgery may vary in time, effort, and activities. [10] Compared cautious and fast meniscal repair therapy. Since they started weight-bearing workouts and functional activities earlier, the accelerated group recovered faster without more issues. [11] Compared standard physical therapy to an integrated method that incorporated water workouts.

The integrated group had better knee function and pain reduction, showing that many training modalities can improve rehabilitation. Another major study by [12] compared home-based therapy versus supervised clinical rehabilitation. Both groups had equal functional outcomes, but supervised rehabilitation improved pain management and exercise adherence, highlighting the need of professional assistance in rehabilitation.

Due to literature shortages, arthroscopic knee rehabilitation needs more research. First, most studies only focus at short-term results, thus there is little data on long-term recovery and rehabilitation benefits. Understanding the long-term consequences of rehabilitation programmes is necessary to develop ways that improve knee function and quality of life. Post-surgery therapy has no set timeline. Some studies show that early rehabilitation speeds up healing, while others warn that it can increase surgical stress and advice against it. Evidence-based guidelines for the optimal duration and amount of rehabilitative therapy require more investigation. Virtual reality and tele-rehabilitation are cutting-edge technologies that have not been extensively studied in arthroscopic knee rehabilitation. In areas with limited physical therapy resources, these technologies can enable remote, interactive, and customised rehabilitation. Arthroscopic knee procedures have improved rehabilitation regimens, although many areas need more research.

Materials and Methods

Study Design and Setting: A retrospective cross-sectional study was conducted at Patna's Nalanda Medical College and Hospital from March 2023 to February 2024. The study compared rehabilitation programmes for arthroscopic knee surgery participants. We evaluated patient data and results to identify which rehabilitation treatments enhanced recovery time, pain reduction, and functional improvement.

Sample Size: The study involved 60 Nalanda Medical College and Hospital arthroscopic knee surgery patients.

Inclusion criteria

- Patients aged 18-65 years.
- Underwent arthroscopic knee procedures, including meniscectomy, ligament reconstruction, or chondroplasty.
- Completed a post-operative rehabilitation program.
- Available complete medical records and follow-up data for at least six months post-surgery.

Exclusion criteria

- Patients with previous knee surgeries.
- Presence of significant comorbidities that could affect rehabilitation outcomes (e.g., severe osteoarthritis, rheumatoid arthritis).
- Non-compliance with the prescribed rehabilitation protocol.
- Incomplete medical records or follow-up data.

Data Collection Methods

This study employed hospital medical records and rehabilitation department logs.

Demographic information included the patient's operation (arthroscopic technique, date, and rehabilitation plan) and exercise kind, length, frequency, and intensity. Clinical outcomes were time to return to typical activities or sports, VAS pain levels, and KOOS knee function. Patient attendance and compliance were tracked to track rehabilitation programme adherence. We monitored the patient's recovery using vitals at 1-, 3-, and 6-months post-surgery. Each data set was anonymised before being stored in a secure database. The study was approved by the Institutional Ethics Committee and maintained patient confidentiality.

Statistical Analysis: This study analysed data with SPSS 26.0. Demographics and clinical features were summarised using frequency distributions, standard deviations, and means. Comparative studies evaluated rehabilitative programmes.

The number of groups compared influenced the analytic approach for continuous variables like KOOS and VAS pain scores. This was done with t-tests or ANOVA. We tested categorical variables with chi-square.

After controlling for age, gender, and surgical treatment type, multivariate regression analysis identified rehabilitative outcome factors. Kaplan-Meier survival analysis and log-rank testing were used to evaluate when patients might resume their regular activities or sports. Subgroup analyses were used to compare outcomes for different rehabilitation techniques (e.g., home-based vs. supervised clinical therapy, early vs. delayed rehabilitation). The statistical significance threshold for all analyses was $p < 0.05$. The data were interpreted to recommend clinical practice and the best rehabilitation methods.

Results

Demographic Data

Table 1: Demographic Characteristics of Study Participants

Demographic Variable	Mean ± SD / n (%)
Age (years)	35.8 ± 10.2
Gender	
Male	38 (63.3%)
Female	22 (36.7%)
Occupation	
Sedentary	20 (33.3%)
Light Manual	18 (30.0%)
Heavy Manual	22 (36.7%)

The study participants are primarily middle-aged (mean age 35.8) and having arthroscopic knee procedures. The modest male majority (63.3%) is expected as knee injuries and operations are more common in males. The study includes 33.3% sedentary work, 30.0% light manual labour, and 36.7% hard labour. Diversity suggests a wide range of physical activity levels among participants, which could affect rehabilitation outcomes. The findings emphasise the importance of monitoring rehabilitation outcomes after arthroscopic knee surgeries by gender, age, and occupation.

Understanding these demographics allows rehabilitation programmes to be tailored to specific patient populations, improving functional outcomes, patient satisfaction, and recovery time.

Clinical Outcomes

Table 2: Clinical Outcomes at 6 Months Post-Arthroscopic Knee Procedures

Clinical Outcome	Mean ± SD
KOOS Score (6 months post-surgery)	78.5 ± 15.3
VAS Pain Score (6 months post-surgery)	2.1 ± 1.3
Time to Return to Normal Activities (days)	42.5 ± 10.8

Patients showed improved knee function and quality of life six months post-surgery, with an average KOOS score of 78.5 ± 15.3. The low VAS pain score (2.1 ± 1.3) suggests that post-op pain control strategies were effective. It took an average of 42.5 ± 10.8 days to resume normal activities, a good recovery timeframe. These data show that rehabilitation regimens helped patients function and mental health.

Because orthopaedic surgery post-operative results vary by patient and are impacted by surgical technique and patient compliance, they are complex.

Comparison of Rehabilitation Protocols

Table 3: Comparison of Rehabilitation Protocols Following Arthroscopic Knee Procedures

Rehabilitation Protocol	KOOS Score (Mean ± SD)	VAS Pain Score (Mean ± SD)	Time to Return to Activities (days, Mean ± SD)
Home-based	75.3 ± 16.2	2.5 ± 1.4	45.8 ± 12.1
Supervised Clinical	81.2 ± 14.0	1.8 ± 1.2	39.7 ± 9.2
Early Initiation	80.1 ± 15.1	2.0 ± 1.3	40.5 ± 10.5
Delayed Initiation	76.8 ± 15.7	2.2 ± 1.3	44.2 ± 11.0

Patient outcomes vary when comparing rehabilitation approaches after arthroscopic knee surgeries. Supervised clinical rehabilitation has the greatest mean KOOS score (81.2 ± 14.0), indicating better knee function compared to home-based (75.3 ± 16.2) and delayed commencement procedures (76.8 ± 15.7).

The supervised clinical group fared better in pain management and recovery, with patients having the lowest VAS pain score (1.8 ± 1.2) and the quickest return to activities (39.7 ± 9.2 days). After early rehabilitation, pain ratings (2.0 ± 1.3) and time to return to activities (40.5 ± 10.5 days) are comparable to the supervised clinical group, but KOOS scores (80.1 ± 15.1) are slightly lower. Home-based and delayed starting protocols have higher recovery times and pain scores, indicating poor post-operative symptom management and worse functional recovery.

Statistical Analysis Results

Table 4: Statistical Analysis Results

Comparison	p-value
KOOS Score: Home-based vs. Supervised Clinical	0.028*
VAS Pain Score: Home-based vs. Supervised Clinical	0.035*
Time to Return to Activities: Home-based vs. Supervised Clinical	0.012*
KOOS Score: Early vs. Delayed Initiation	0.045*
VAS Pain Score: Early vs. Delayed Initiation	0.223
Time to Return to Activities: Early vs. Delayed Initiation	0.038*

The statistical investigation found significant differences in post-arthroscopic knee rehabilitation treatments. Supervised clinical therapy outperformed home-based rehabilitation in KOOS ratings (p=0.028*), VAS pain scores (p=0.035*), and time to return to activities (p=0.012*). The results showed that supervised care reduced discomfort, increased knee function, and accelerated recovery compared to home rehabilitation. There was no statistically significant change in VAS pain scores (p=0.223), however early rehabilitation improved KOOS scores (p=0.045*) and time to return to activities (p=0.038*). Structured rehabilitation regimens must begin immediately after surgery to maximise functional recovery.

Discussion

This study illuminates the benefits of different rehabilitation strategies for arthroscopic knee surgery patients. Results reveal that supervised clinical therapy improves knee function and reduces pain more than home-based rehabilitation. At six months following surgery, supervised clinical rehabilitation patients exhibited lower VAS pain and higher KOOS scores. They returned to their habits faster than home-based patients. Professional supervision and well-structured rehabilitation regimens increase patient outcomes. The study found that early rehabilitation improved functional results and activity return. Patients who started therapy sooner returned to normal activities

faster and had higher KOOS scores. Statistical analysis showed no significant difference in VAS pain values between early and delayed start. This suggests that early rehabilitation may improve functional recovery but not pain reduction. Urgent and carefully supervised physiotherapy improves arthroscopic knee surgery recovery.

Table 5: Comparison of Current Study with Existing Studies

Study	Study Type	Sample Size	Findings	Limitations
Current Study	Retrospective Cross-Sectional	60	Supervised clinical rehabilitation and early initiation improve outcomes	Retrospective design, small sample size
Study 1 [13]	Prospective Cohort	120	Structured rehabilitation improves functional outcomes post-meniscectomy	Limited to single procedure type
Study 2 [14]	Randomized Controlled Trial	100	Early rehabilitation post-ACL reconstruction leads to better knee function and reduced pain	Short-term follow-up, single-center study
Study 3 [15]	Comparative Study	80	Integrated physical therapy and aquatic exercises enhance recovery	Lack of long-term follow-up, small sample size

The benefits of early and supervised clinical rehabilitation after arthroscopic knee operations are highlighted in this study. Retrospective cross-sectional analysis. Structured therapy reduces pain, speeds up activity, and improves KOOS ratings, demonstrating its efficacy. Its retrospective approach and small sample size make conclusions risky and underline the need for prospective validation with larger cohorts. Study 1, a prospective cohort on structured rehabilitation following meniscectomy, found that customised treatment approaches improve functional outcomes.

Although well-built, it can only be used for one type of surgery, hence it can't be employed in other orthopaedic conditions. A randomised controlled experiment on early rehabilitation post-ACL surgery found significant knee function and pain reduction benefits in Study 2. We need longer follow-up periods and validations at multiple sites to confirm long-term benefits for a variety of patient demographics, as this study only included one. Study 3 compares water exercises and integrated physical therapy and finds they improve recovery. Due to the study's small sample size and lack of long-term follow-up, integrated rehabilitation strategies' scalability and durability need more study. These studies demonstrate the variety of issues to consider while designing effective rehabilitation regimens.

Limitations of the Study

Despite its important findings, this study has several drawbacks. This retrospective analysis cannot prove that rehabilitation programmes improved patient outcomes. Because retrospective study uses records that already exist, there is a chance that the records are biased or not complete.

This could make the info less accurate and reliable. For early study, 60 patients are a good sample size, but it might not be enough to say anything about the results or find small differences between the ways of rehabbing people.

Suggestions for Future Research

Future study must also determine the ideal timing to begin rehabilitation. This study suggests that early rehabilitation is beneficial, but further research is needed to determine the best time period for different patient groups and surgical procedures. This involves balancing early exercise with post-surgery recovery time. Recovery needs more mental and emotional attention. We must understand patient motivation, mental health, and rehabilitation compliance to optimise patient outcomes. Psychological therapies that boost patient participation must be developed and evaluated.

Conclusion

Nalanda Medical College and Hospital in Patna compared patients after arthroscopic knee surgeries to determine the best rehabilitation method. Compared to home-based rehabilitation, supervised clinical rehabilitation improved functional outcomes (KOOS score) and reduced pain (VAS pain score). Early therapy patients improved faster and returned to their habits. These findings emphasise the importance of thorough and rapid rehabilitation in arthroscopic knee surgery recovery. The study's findings improve orthopaedic rehabilitation. Healthcare providers should promote organised rehabilitation programmes because supervised clinical rehabilitation improves patient outcomes. It became obvious that early management and therapy after surgery are crucial to healing. These findings can help clinicians enhance post-arthroscopic knee surgery rehabilitation by devising and implementing more effective routines. Healthcare establishments

should invest in supervised rehabilitation programmes to assist patients recover. Early rehabilitation improves functional results and speeds recovery. Clinicians should set specific protocols for when and how vigorous rehabilitative exercises to maximise benefits and minimise risks. Investigating rehabilitation's long-term impacts and using cutting-edge technologies like tele-rehabilitation and virtual reality can improve patient care and accessibility.

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