A Prospective Comparative Study between Arthroscopic Subacromial Decompression vs Conservative Management in Subacromial Impingement

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Abstract

Background

Subacromial impingement syndrome (SAIS) is one of the most common causes of shoulder pain and functional limitation in adults. Both arthroscopic subacromial decompression (ASD) and conservative management are widely used treatment options; however, the comparative effectiveness of these approaches remains debated.

Aim

To compare the functional outcomes of arthroscopic subacromial decompression and conservative management in patients with subacromial impingement syndrome.

Materials and Methods

This prospective randomized controlled study was conducted in the Department of Orthopedics at SRM Medical College Hospital and Research Centre between April 2024 and December 2025. Sixty patients aged 20–60 years with clinically and radiologically confirmed SAIS were included. Participants were randomized into two groups: Group A underwent arthroscopic subacromial decompression (n = 30), and Group B received conservative management including physiotherapy, non-steroidal anti-inflammatory drugs, activity modification, and subacromial steroid injections when required (n = 30). Functional outcomes were assessed at baseline, 1 month, 3 months, and 6 months using the Constant–Murley Score, American Shoulder and Elbow Surgeons (ASES) Score, and SF-36 health questionnaire. Statistical analysis was performed using SPSS software, with a p-value < 0.05 considered statistically significant.

Results

Baseline demographic and clinical characteristics were comparable between the two groups ($p > 0.05$). Both groups demonstrated significant improvement in functional outcome scores during follow-up. However, the arthroscopic decompression group showed significantly greater improvement in Constant–Murley, ASES, and SF-36 scores at 1, 3, and 6 months compared with the conservative management group ($p < 0.05$). Patients treated surgically experienced faster pain relief, improved shoulder strength, and better restoration of range of motion, leading to enhanced functional performance and quality of life.

Conclusion

Both arthroscopic subacromial decompression and conservative therapy effectively improve functional outcomes in patients with SAIS. However, arthroscopic decompression provides greater short-term improvement in shoulder function, pain relief, and quality of life. Conservative management should remain the first-line treatment, while surgical intervention may be considered in patients who fail to respond to structured rehabilitation.

Keywords

Subacromial impingement syndrome; Arthroscopic subacromial decompression; Conservative management; Shoulder function; Constant–Murley score; ASES score.

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Introduction

The shoulder is a highly mobile synovial joint that provides the greatest range of motion in the human body. This mobility is maintained through the coordinated interaction of osseous structures, capsuloligamentous tissues, and the rotator cuff musculature. The rotator cuff comprising the supraspinatus, infraspinatus, teres minor, and subscapularis plays a crucial role in stabilizing the humeral head within the glenoid fossa during shoulder motion. The subacromial space, located between the humeral head and the coracoacromial arch, contains the supraspinatus tendon and subacromial bursa and is particularly susceptible to mechanical compression during arm elevation. Variations in acromial morphology described by Bigliani as flat (Type I), curved (Type II), and hooked (Type III) have been associated with reduced subacromial space and an increased risk of rotator cuff pathology and impingement symptoms [1–3].

Subacromial impingement syndrome (SAIS) refers to compression of the rotator cuff tendons and subacromial bursa beneath the coracoacromial arch during shoulder elevation. It represents a spectrum of pathology ranging from reversible bursitis and tendinopathy to partial or full-thickness rotator cuff tears [4]. The pathogenesis of SAIS is multifactorial and can be broadly classified into primary and secondary impingement. Primary impingement results from structural abnormalities such as acromial spur formation, hooked acromion, or subacromial bursal hypertrophy, whereas secondary impingement arises due to functional disturbances including scapular dyskinesis, rotator cuff weakness, or glenohumeral instability [5,6].

SAIS is among the most common causes of shoulder pain, accounting for approximately 44-65% of shoulder complaints in adults and significantly affecting functional capacity and quality of life [7]. Patients typically present with pain during mid-range arm elevation, commonly described as a “painful arc” between 60° and 120°, along with night pain and difficulty performing overhead activities [8]. Diagnosis is primarily clinical and supported by imaging modalities such as radiography, ultrasound, and magnetic resonance imaging (MRI), which help identify structural abnormalities and associated rotator cuff pathology [9].

Conservative treatment including non-steroidal anti-inflammatory drugs, physiotherapy, and corticosteroid injections is generally considered first-line management and is effective in many patients [4,10]. However, individuals who fail to respond to conservative therapy may require arthroscopic subacromial decompression (ASD), a minimally invasive procedure aimed at increasing the subacromial space by performing bursectomy and acromioplasty. Although ASD has been widely performed, recent randomized trials have questioned its superiority over structured physiotherapy, highlighting the need for further comparative outcome studies [10].

Therefore, this study aims to compare the functional outcomes of arthroscopic subacromial decompression and conservative management in patients with subacromial impingement syndrome using validated assessment tools including the Constant Score, American Shoulder and Elbow Surgeons (ASES) score, and SF-36 quality-of-life questionnaire.

Aim and Objectives

Aim

To compare the functional outcomes of arthroscopic subacromial decompression vs conservative management in the management of subacromial impingement .

Objectives

- To assess the functional outcomes of arthroscopic subacromial decompression in treatment of subacromial impingement
- To assess the functional outcomes of conservative management in the treatment of subacromial impingement
- By using Constant Score, American Shoulder and Elbow Surgeons Score (ASES) and SF-36 questionnaire to assess the functional outcomes in patients with subacromial impingement

Materials and methods

Study design

- **Type of Study:** Prospective randomized controlled study
- **Study Population:** Adults aged 20–60 years diagnosed with subacromial impingement syndrome
- **Study Setting:** Department of Orthopedics, SRM Medical College Hospital and Research Centre
- **Study Duration:** April 2024 – December 2025
- **Follow-up Period:** 1 month, 3 months, and 6 months
- **Sample Size:** 60 patients
    - Group A: Arthroscopic subacromial decompression (n = 30)
    - Group B: Conservative management (n = 30)

Sample Size Calculation:

We assumed a minimal clinically important difference (Δ) of 10 points on the Constant–Murley score based on Khan et al., estimating the MID to be around 10.4 points in shoulder pathology outcome studies.

An estimated standard deviation (σ) of approximately 12 points was used, consistent with previously reported variability in Constant–Murley scores in Paavola et al [19].
Using formula

$$n = \frac{2 \cdot (Z_{\alpha/2} + Z_{\beta})^2 \cdot \sigma^2}{\Delta^2}$$

Where:

- n = sample size per group
- $Z_{\alpha/2}$ = Z-value for significance level (two-sided), e.g., 1.96 for α = 0.05
- Z_{β} = Z-value for desired power, e.g., 0.84 for 80% power
- σ = standard deviation of the outcome measure
- Δ= minimum clinically important difference (MCID) between groups

Sample size was calculated assuming a minimal clinically important difference of 10 points on the Constant score, with a standard deviation of 12, 5% significance level, and 80% power, resulting in 30 patients per group after adjusting for 20% potential dropout

Inclusion criteria

We included patient age between 20 and 60 years**,** Clinical and radiological (MRI) diagnosis of subacromial impingement syndrome**,** Neer subacromial impingement classification Type I–III**,** Shoulder pain persisting for more than 6 months**,** and those patients provided informed consent.

Exclusion criteria

We excluded patient with Radiographic evidence of glenohumeral osteoarthritis, Full-thickness rotator cuff tear, Previous surgery on the affected shoulder, History of fracture involving the affected shoulder, Calcific deposits >2 cm in rotator cuff tendons, Neurological or spinal disorders affecting shoulder function and, Uncontrolled diabetes mellitus,

Methodology

Patients presenting with shoulder pain for more than 6 months were undergone detailed clinical evaluation and MRI. Patients met the inclusion criteria were enrolled after obtaining informed consent. Participants were randomized into two groups using a computer-generated randomization method.

Group A: Arthroscopic Subacromial Decompression

- Standard arthroscopic decompression performed by experienced orthopedic surgeons
- Postoperative rehabilitation as per institutional protocol

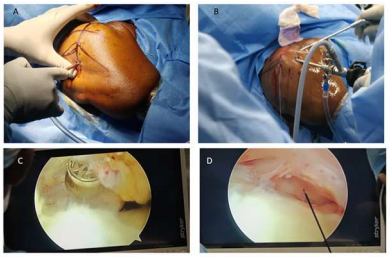


Figure 1: Arthroscopic Subacromial Decompression Procedure: A. Portal marking and initial skin incision for arthroscopy. B. Arthroscopic cannula and instruments inserted into the subacromial space. C. Intraoperative view showing subacromial bursa and impinging tissue under arthroscopic visualization. D. Arthroscopic probe identifying areas of impingement on the undersurface of the acromion.

Group B: Conservative Management

- Physiotherapy
- NSAIDs
- Activity modification
- Subacromial steroid injection if required

Outcome assessment

Functional outcomes was assessed at baseline, 1 month, 3 months, and 6 months using:

- Constant–Murley Score
- American Shoulder and Elbow Surgeons (ASES) Score
- SF-36 Health Questionnaire

Statistical analysis

Statistical analysis was performed using SPSS software, with continuous variables expressed as mean ± SD, categorical variables as frequency and percentage, and intergroup comparisons using independent t-tests or Mann–Whitney U tests, while repeated measures within groups will be analyzed using paired t-tests or repeated measures ANOVA. A p-value < 0.05 will be considered statistically significant.

Ethical Considerations

This study was conducted in accordance with the Declaration of Helsinki and Good Clinical Practice guidelines. Ethical approval will be obtained from the Institutional Ethics Committee (IEC) of SRM Medical College Hospital and Research Centre prior to the initiation of the study. Written informed consent were obtained from all participants after explaining the study objectives, procedures, potential risks, benefits, and the right to withdraw at any time without affecting their standard medical care. Confidentiality of patient information was strictly maintained, and data was anonymized for analysis and publication.

Results

The majority of patients in Group A and Group B belonged to the 31–45 years age group (60.0%), followed by the 46–60 years age group (36.7%), while only 3.3% of participants in each group were aged 20–30 years. The mean age of patients in Group A was 42.43 ± 6.68 years and in Group B was 42.63 ± 6.41 years. There was no statistically significant difference in age distribution between the two groups (p = 0.906), indicating that both groups were comparable with respect to age.

In Group A, 18 (60.0%) patients were male and 12 (40.0%) were female, whereas in Group B, 16 (53.3%) patients were male and 14 (46.7%) were female. There was no statistically significant difference in gender distribution between the two groups (p = 0.6054), indicating that both groups were comparable with respect to gender.

In Group A, 22 (73.3%) patients had involvement of the dominant shoulder, whereas 8 (26.7%) had involvement of the non-dominant shoulder. In Group B, 19 (63.3%) patients had dominant shoulder involvement and 11 (36.7%) had non-dominant shoulder involvement. There was no statistically significant difference between the two groups (p = 0.4090), indicating that both groups were comparable with respect to dominant shoulder involvement.

The mean duration of symptoms in Group A was 8.50 ± 1.83 months, while in Group B it was 8.93 ± 1.78 months. The difference between the groups was not statistically significant (p = 0.357), indicating that both groups were comparable with respect to duration of symptoms at baseline.

In Group A, 11 (36.7%) patients had Type I impingement, 11 (36.7%) had Type II, and 8 (26.7%) had Type III impingement. In Group B, 15 (50.0%) patients had Type I, 8 (26.7%) had Type II, and 7 (23.3%) had Type III impingement. There was no statistically significant difference in the distribution of Neer types between the two groups (p = 0.628), indicating comparable baseline disease severity.

Figure 1: Comparison of Constant–Murley Scores Between Groups

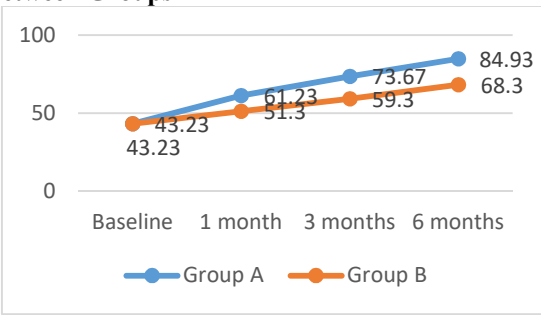
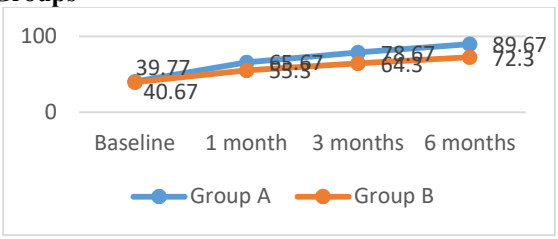


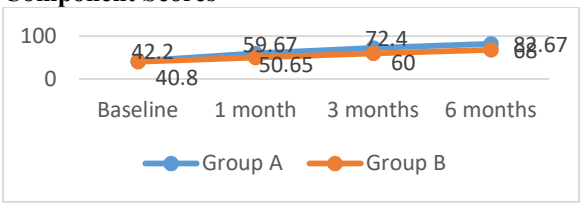
Figure 1 shows comparison of Constant–Murley scores between the arthroscopic decompression group (Group A) and conservative management group (Group B) at different follow-up periods. At baseline, there was no statistically significant difference between the groups (p = 0.937), indicating comparable pre-treatment functional status. However, at 1 month, 3 months, and 6 months follow-up, Group A demonstrated significantly higher Constant–Murley scores compared to Group B (p < 0.001 at all time points). These findings suggest that arthroscopic subacromial decompression resulted in significantly greater improvement in shoulder function compared to conservative management.

Figure 2: Comparison of ASES Scores between Groups



The mean ASES score at baseline was 40.67 ± 2.82 in Group A and 39.77 ± 2.69 in Group B, showing no statistically significant difference between the groups (p = 0.211). At 1 month follow-up, the mean ASES score increased to 65.67 ± 2.82 in Group A and 55.3 ± 3.24 in Group B, demonstrating a statistically significant difference (p < 0.001). At 3 months, the mean ASES score further improved to 78.67 ± 2.31 in Group A and 64.3 ± 3.31 in Group B, with a significant difference between the groups (p < 0.001). At 6 months, Group A showed a mean score of 89.67 ± 4.8, whereas Group B had 72.3 ± 6.2, which was also statistically significant (p < 0.001). Overall, Group A demonstrated greater improvement in ASES scores compared to Group B at all follow-up periods except baseline.

Figure 3: Comparison of SF-36 Physical Component Scores



The mean SF-36 physical component score at baseline was 42.2 ± 5.8 in Group A and 40.8 ± 6.0 in Group B, with no statistically significant difference between the groups (p = 0.408). At 1 month follow-up, the mean score increased to 59.67 ± 2.82 in Group A and 50.65 ± 3.1 in Group B, demonstrating a statistically significant difference (p < 0.001). At 3 months, the mean SF-36 physical component score further improved to 72.4 ± 2.86 in Group A and 60 ± 2.4 in Group B, showing a significant difference between the groups (p < 0.001). At 6 months, Group A showed a mean score of 82.67 ± 2.82, whereas Group B had 68

± 2.7, which was also statistically significant ($p < 0.001$). Overall, Group A demonstrated significantly greater improvement in SF-36 physical component scores compared to Group B at all follow-up periods except baseline.

Intragroup Comparison of Functional Scores

Arthroscopic Subacromial Decompression Group

Table 1: Intragroup Comparison of Functional Scores in Arthroscopic Subacromial

Outcome Measure	F value	p-value
Constant Score	984.15	<0.001
ASES Score	1677.14	<0.001
SF-36 Score	1270.62	<0.001

In the arthroscopic subacromial decompression group, intragroup comparison of functional outcome scores over different follow-up periods showed statistically significant improvement. The Constant score demonstrated a significant change over time with an F value of 984.15 ($p < 0.001$). Similarly, the ASES score showed a highly significant improvement with an F value of 1677.14 ($p < 0.001$). The SF-36 score also revealed a statistically significant change with an F value of 1270.62 ($p < 0.001$). These findings indicate significant functional improvement within the arthroscopic subacromial decompression group during the follow-up period.

Decompression Group

Table 2: Intragroup Comparison of Functional Scores in Conservative Management Group

Outcome Measure	F value	p-value
Constant Score	328.55	<0.001
ASES Score	603.53	<0.001
SF-36 Score	678.43	<0.001

In the conservative management group, intragroup comparison of functional outcome scores over different follow-up periods demonstrated statistically significant improvement. The Constant score improved significantly over time, with an F value of 328.55 ($p < 0.001$). Similarly, the ASES score showed significant enhancement with an F value of 603.53 ($p < 0.001$), and the SF-36 physical component score increased significantly with an F value of 678.43 ($p < 0.001$). These results indicate that although patients in the conservative management group experienced improvement in shoulder function over time, the magnitude of change was less than that observed in the arthroscopic decompression group.

Overall Outcome at 6 Months

At 6 months follow-up, the overall functional outcome differed significantly between the two groups. In Group A (arthroscopic subacromial decompression), 18 patients (60%) achieved an excellent outcome, 9 (30%) had good results, and 3 (10%) had fair results, with no patients in the poor category. In contrast, in Group B (conservative management), only 6 patients (20%) achieved excellent outcomes, 12 (40%) had good outcomes, 8 (26.7%) had fair outcomes, and 4 (13.3%) were classified as poor. The difference between groups was statistically significant ($p < 0.001$), indicating superior overall functional recovery in patients undergoing arthroscopic subacromial decompression compared to conservative management at 6 months.

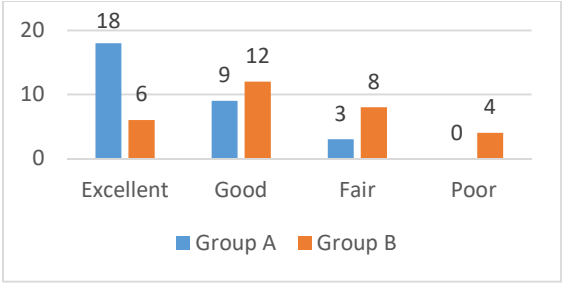


Figure 4: Overall Functional Outcome at 6 Months between Groups

Complications and Treatment Failure

In the arthroscopic subacromial decompression group, postoperative shoulder stiffness was observed in 2 patients (6.7%), which improved with physiotherapy and rehabilitation. However, 3 patients (10%) continued to have persistent symptoms despite surgery, suggesting incomplete functional recovery. In the conservative management group, 3 patients (10%) developed recurrence of symptoms after initial improvement during follow-up. Due to persistent pain and functional limitation, 3 patients from the conservative group subsequently underwent arthroscopic surgical decompression.

Table 3: Complications Observed in Both Treatment Groups

Complication	Group A (Mean ± SD)	Group B (Mean ± SD)	P - Value
Postoperative stiffness	2 (6.7%)	0 (0%)	0.0584
Persistent shoulder pain	3 (10%)	3 (10%)	
Recurrence of symptoms	0 (0%)	3 (10%)	
Surgical re-intervention	0 (0%)	3 (10%)	

Time taken for improvement:

The mean time taken for functional improvement was significantly shorter in the arthroscopic subacromial decompression group (Group A), with a mean of 5 ± 0.87 months, compared to the conservative

management group (Group B), which had a mean of 8.77 ± 1.72 months. This difference was statistically significant ($p < 0.001$), indicating that patients undergoing arthroscopic decompression experienced faster improvement in shoulder function compared to those managed conservatively.

Table 4: Time Taken for Improvement between Groups

Time taken for improvement (months)	Group A (Mean ± SD)	Group B (Mean ± SD)	P-Value
	5±0.87	8.77±1.72	<0.001

Cost of treatment

The mean cost of treatment in the arthroscopic subacromial decompression group (Group A) was ₹172,646.67 ± 39,712.52 with a range of ₹82,300 to ₹240,600, whereas in the conservative management group (Group B), the mean cost was ₹38,267 ± 6,528.01 with a range of ₹25,240 to ₹50,000. The difference between the two groups was statistically significant ($p < 0.001$), indicating that arthroscopic surgery was substantially more expensive than conservative management despite better functional outcomes and faster recovery.

Table 5: Comparison of Cost of Treatment between Groups

Cost of treatment (Rupees)	Group A (Mean ± SD)	Group B (Mean ± SD)	P-Value
	172646.67±39712.52 (82300 – 240600)	38267±6528.01 (25240 – 50000)	<0.001

Discussion

The present prospective randomized controlled study compared the functional outcomes of arthroscopic subacromial decompression (ASD) and conservative management in patients with subacromial impingement syndrome (SAIS). The findings demonstrate significant functional improvement in both groups, with greater improvement observed in the arthroscopic group across multiple outcome measures. Baseline demographic and clinical characteristics including age, gender, dominant shoulder involvement, duration of symptoms, and Neer classification were comparable between the two groups ($p > 0.05$). This indicates adequate randomization and reduces potential confounding bias, thereby strengthening the internal validity of the study. Similar baseline comparability has been reported in major randomized controlled trials such as the CSAW trial by Beard et al. and the FIMPACT trial, which ensured balanced demographic and clinical characteristics between treatment groups to allow reliable comparison of outcomes [10,11]. Such homogeneity supports the interpretation that the observed differences in functional outcomes are attributable to the interventions rather than baseline differences.

Both treatment groups demonstrated significant improvement in Constant–Murley scores during follow-up, indicating that arthroscopic decompression and conservative therapy are effective in improving shoulder function. However, the magnitude of improvement was significantly greater in the arthroscopic group at 1, 3, and 6 months. The Constant-Murley score evaluates pain, daily activities, strength, and range of motion; therefore, higher scores in the surgical group reflect improved biomechanical function following removal of mechanical impingement. Arthroscopic decompression relieves compression of the rotator cuff tendons within the subacromial space, thereby improving shoulder kinetics and reducing inflammation. Similar improvements in Constant scores following arthroscopic intervention have been reported in previous studies, supporting the effectiveness of surgical decompression in restoring shoulder function [11].

The American Shoulder and Elbow Surgeons (ASES) score also improved significantly in both groups, with greater improvement observed in the arthroscopic group at all follow-up intervals except baseline. The ASES score assesses pain and functional performance; therefore, higher scores in the surgical group indicate improved pain control and better ability to perform daily activities. These findings may be explained by restoration of normal shoulder biomechanics following decompression of the subacromial space and removal of inflamed bursal tissue, which reduces tendon irritation and improves rotator cuff function. Previous studies evaluating arthroscopic shoulder procedures have similarly demonstrated significant improvements in patient-reported functional outcomes [12].

Quality of life, as assessed by the SF-36 physical component score, also improved in both groups, with significantly greater improvement in the arthroscopic group during follow-up. Reduced pain, improved mobility, and restoration of functional capacity after arthroscopic decompression likely contribute to enhanced physical health and overall well-being. Prospective studies evaluating arthroscopic shoulder interventions have reported similar improvements in SF-36 scores, reflecting better functional status and patient satisfaction after surgical treatment [11,12].

Intragroup analysis further demonstrated that both treatment modalities contributed to pain reduction and functional recovery over time. However, the greater

magnitude of improvement observed in the arthroscopic group suggests that surgical decompression provides more rapid and pronounced functional gains. The procedure mechanically removes sources of impingement, reduces subacromial inflammation, and restores glenohumeral biomechanics, thereby facilitating improved tendon gliding, strength, and range of motion. Clinical studies such as those by Salunkhe et al. have also reported progressive improvement in Constant and ASES scores following arthroscopic decompression [13].

Despite these findings, the role of ASD remains debated. Large randomized trials including the CSAW and FIMPACT studies have reported no clinically significant long-term difference between arthroscopic decompression and structured exercise therapy [10,11]. These results suggest that improvements after surgery may partly reflect non-specific effects such as postoperative rest and rehabilitation. Nevertheless, minimally invasive arthroscopic procedures may provide faster short-term recovery in selected patients. Similar to the results of Lähdeoja et al. (2020), [14] a proportion of patients continued to experience persistent symptoms following surgical intervention, indicating that decompression may not guarantee complete functional recovery in all cases. The incidence of postoperative stiffness observed in our study is also consistent with earlier reports, where temporary stiffness improved with structured physiotherapy. In the conservative group, recurrence of symptoms and eventual need for surgical intervention aligns with findings from trials such as the CSAW trial and FIMPACT trial, which reported no significant long-term superiority of surgery over non-operative management. Additionally, the crossover of patients from conservative to surgical treatment reflects real-world clinical decision-making seen in prior comparative studies. Overall, both treatment modalities demonstrate variable outcomes, emphasizing the importance of individualized patient selection and rehabilitation.

Cost considerations are also relevant, as ASD is generally more expensive than conservative treatment. In resource-limited settings, conservative therapy should remain the initial approach, reserving surgery for patients who fail to respond to structured rehabilitation. Shared decision-making considering patient expectations, occupational demands, and available resources is essential for optimizing treatment strategies in SAIS.

Strengths and Limitations

The strengths of this study include its prospective randomized design, comparable baseline characteristics between groups, and the use of validated functional outcome measures such as the Constant–Murley score, ASES score, and SF-36 questionnaire. These standardized tools allow comprehensive assessment of pain, shoulder function, and quality of life.

However, several limitations should be acknowledged. The study had a relatively short follow-up period, which may limit assessment of long-term outcomes. Additionally, the sample size was modest and conducted in a single institution, which may affect generalizability. Future multicenter studies with larger sample sizes and longer follow-up periods are needed to better evaluate the long-term comparative effectiveness of surgical and conservative treatments.

Clinical Implications

Both arthroscopic decompression and conservative therapy were effective in improving functional outcomes in patients with SAIS. However, ASD demonstrated greater improvement in shoulder function, pain relief, and quality of life during the follow-up period. Conservative management should remain the initial treatment strategy, particularly in resource-limited settings, while surgical intervention may be considered in patients who fail to respond to structured rehabilitation or require faster functional recovery due to occupational demands.

Recommendations

1. Larger multicentric studies with longer follow-up periods are recommended to validate the long-term effectiveness of arthroscopic subacromial decompression.
2. Future studies should evaluate cost-effectiveness by including both direct and indirect treatment costs.
3. Conservative management may be considered as first-line treatment in mild cases due to lower cost, while arthroscopic decompression may be preferred in patients requiring faster recovery or those not responding to conservative therapy.
4. Further research comparing different conservative treatment modalities and rehabilitation protocols is recommended.
5. Studies assessing patient satisfaction, quality of life, and long-term recurrence rates are warranted.

Conclusion

Arthroscopic subacromial decompression provides significantly better functional outcomes, faster recovery, and superior overall shoulder function compared to conservative management in patients with subacromial impingement syndrome. Although both treatment modalities resulted in significant improvement, arthroscopic decompression demonstrated greater improvement in Constant–Murley, ASES, and SF-36 scores at all follow-up periods beyond baseline. However, the procedure is

associated with significantly higher treatment costs. Therefore, arthroscopic subacromial decompression represents an effective treatment option, particularly in patients requiring rapid functional recovery or those who fail conservative management.

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