JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue
JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)
An International Scholarly Open Access, Peer-reviewed, Refereed Journal

Reclaiming the Rotator: A Randomized Comparative Trial on the Synergistic Impact of Manual Therapy and Progressive Resistance Exercise in Chronic Subacromial Impingement Syndrome

Prachi Singh[1], Amit Kumar Goel[2], Danish Nouman [3*], Jugnu Dubey[4]
MPT student[1], Professor and Principal[2], Associate Professor[3], MPT student[4]
Jyotirao Phule Subharti College of Physiotherapy
Swami Vivekanand Subharti University, Meerut -250005 Uttar Pradesh, India

Abstract
Subacromial impingement syndrome (SIS) is one of the most common causes of shoulder pain and functional limitation. This study aimed to compare the effectiveness of Manual Therapy and Progressive Resistance Exercise (PRE) in improving pain, range of motion (ROM), and functional outcomes in patients with chronic SIS. A randomized controlled trial was conducted involving 60 participants who were randomly assigned to two groups. Group A received Manual Therapy, while Group B underwent Progressive Resistance Exercise for eight weeks. Outcome measures included the Visual Analog Scale (VAS) for pain, shoulder ROM measured using a goniometer, and functional status assessed using the Shoulder Pain and Disability Index (SPADI). Results showed that Manual Therapy produced greater pain reduction (VAS: 3.36 ± 0.06) compared with PRE (3.81 ± 0.59; $p = 0.0005$). Both groups demonstrated improvements in ROM, with slightly greater gains observed in the PRE group; however, the difference was not statistically significant ($p = 0.35$). Functional outcomes significantly favored PRE, with lower SPADI scores (32.21 ± 4.39) compared to Manual Therapy (41.48 ± 4.95; $p < 0.0001$). These findings indicate that Manual Therapy is more effective for short-term pain relief, while PRE provides superior functional improvement. A combined treatment approach may therefore offer optimal rehabilitation outcomes in patients with SIS.

Keywords: Subacromial Impingement Syndrome, Manual Therapy, Progressive Resistance Exercise, Pain Relief, Shoulder Function

Introduction

Shoulder disorders are a leading cause of musculoskeletal pain, with subacromial impingement syndrome (SIS) being among the most prevalent conditions encountered in clinical settings(22). SIS contributes significantly to functional limitations and decreased quality of life across a wide range of populations (6). It typically results from the mechanical compression of subacromial structures such as the rotator cuff tendons and bursa during shoulder elevation, leading to persistent pain, limited mobility, and muscular dysfunction (2).

The development of SIS is complex, involving both internal tendon pathology and external mechanical stressors. Abnormal scapular motion, rotator cuff weakness, and poor postural alignment are commonly

implicated in reducing the subacromial space, thereby increasing tissue irritation (3). Research has identified specific alterations in shoulder mechanics, such as increased anterior and superior translation of the humeral head, in individuals with impingement symptoms (1). Addressing these biomechanical deficits is therefore essential in designing effective treatment strategies (21,22).

Non-surgical management remains the cornerstone of treatment for SIS, with exercise therapy being particularly effective. Tailored exercise programs, especially those incorporating progressive resistance, have been shown to improve strength, restore muscle balance, and enhance joint stability (8). These exercises target the rotator cuff and scapular stabilizers, aiming to correct dysfunctional movement patterns and improve neuromuscular control (7). Systematic reviews have supported the role of therapeutic exercise in reducing pain and preventing surgical intervention (1,23).

Manual therapy is another widely used conservative approach, involving techniques such as joint mobilization, soft tissue work, and spinal manipulation to relieve pain and improve function. Evidence supports its use in improving shoulder mobility and enhancing muscle activation (14). Thoracic spine manipulation, in particular, has demonstrated short-term benefits in pain relief and shoulder motion in patients with SIS (5). Furthermore, studies have shown that combining manual therapy with supervised exercise yields superior outcomes compared to exercise alone (4).

Despite the growing body of research on both interventions, direct comparisons between manual therapy and progressive resistance exercise are relatively scarce. Most available studies assess each approach separately or in combination, making it difficult to determine their individual effectiveness in isolation (14). While structured exercise programs have shown a significant reduction in surgical rates (9), questions remain about how their long-term benefits stack up against manual techniques.

Given the prevalence of SIS and the burden it places on individuals and healthcare systems, further investigation into the relative efficacy of these treatment modalities is warranted. This study aims to directly compare manual therapy and progressive resistance exercise in the management of chronic SIS. By evaluating clinical outcomes such as pain, strength, range of motion, and functional performance, this research seeks to provide clearer guidance for clinicians in selecting the most effective conservative interventions for this condition (24).

Recent studies have also begun to explore the influence of proprioceptive function in patients with SIS. Kinesthetic sense, which contributes to joint position awareness and movement control, has been found to be impaired in individuals with shoulder impingement (18). These deficits may not only affect motor control but also delay recovery and increase the risk of recurrent symptoms. Interventions that aim to restore proprioceptive function are therefore gaining recognition in rehabilitation protocols.

Both manual therapy and progressive resistance exercise have shown promise in improving proprioceptive outcomes. (19, 20) highlighted that conservative therapies, including joint mobilization and resistance-based training, can significantly enhance joint position sense and neuromuscular coordination. These improvements are believed to be closely linked with better functional recovery and pain reduction, emphasizing the need to consider sensory as well as mechanical factors in treatment planning.

Moreover, multimodal rehabilitation approaches that address range of motion, strength, and proprioception have been shown to produce superior outcomes (17) demonstrated that a structured rehabilitation program incorporating both mobility and motor control training led to significant functional improvements in patients with chronic SIS. Such findings support the rationale for combining manual therapy and progressive resistance exercise in clinical practice.

Given the multifactorial nature of SIS and its impact on both biomechanical and sensorimotor systems, it is essential to identify which conservative intervention offers the most effective outcome. This study aims to directly compare manual therapy and progressive resistance exercise in the management of chronic SIS. By evaluating outcomes such as pain, range of motion, strength, proprioception, and functional performance, the research seeks to provide evidence-based guidance for optimizing conservative care strategies in clinical settings (23,24).

Material and methodology

Objective of the Study

To compare the effectiveness of manual therapy and progressive resistance exercise (PRE) in improving pain, shoulder range of motion, and functional outcomes in individuals with chronic shoulder impingement syndrome (SIS).

Study Design

Randomized controlled trial (RCT).

Sampling Method

Simple random sampling.

Duration of the Study

0-8 weeks.

Inclusion Criteria

- Individuals aged 25–55 years
- Diagnosed with chronic shoulder impingement syndrome (symptoms > 3 months)
- Positive for at least two clinical tests: Neer's, Hawkins-Kennedy, or painful arc test
- Willingness to participate and provide informed consent

Exclusion Criteria

- History of shoulder surgery or trauma within the last 6 months
- Presence of complete rotator cuff tear, frozen shoulder, or shoulder instability
- Neurological or systemic conditions affecting upper limb function
- Undergoing concurrent physical therapy or corticosteroid injections

Tools Used in the Study

- **Visual Analog Scale (VAS)** – to assess pain intensity
- **Goniometer** – to measure shoulder range of motion (ROM)
- **Shoulder Pain and Disability Index (SPADI)** – to assess functional status
- **Resistance bands and dumbbells** – for the PRE group
- **Treatment table and mobilization tools** – for the manual therapy group

Methodology

Study Design

This study was conducted as a randomized controlled trial (RCT) to compare the effectiveness of Manual Therapy and Progressive Resistance Exercise (PRE) in individuals with shoulder dysfunction. The randomized controlled trial design was chosen due to its high level of evidence and ability to minimize bias when comparing treatment interventions. The study adhered to the ethical guidelines outlined in the Declaration of Helsinki and followed CONSORT reporting standards for randomized trials.

Participants

A total of 60 participants with clinically diagnosed shoulder dysfunction were recruited from the outpatient physiotherapy department of a tertiary care hospital. Participants were aged between 25 to 55 years and experienced shoulder pain and restricted range of motion (ROM) for more than four weeks.

The inclusion criteria were: adults aged 25–55 years, diagnosis of shoulder impingement or rotator cuff tendinopathy, and willingness to participate in an 8-week treatment program. The exclusion criteria included previous shoulder surgery, recent fractures or dislocations, systemic or neurological diseases affecting shoulder function, and local skin infections or wounds.

All participants provided written informed consent before enrollment. Ethical approval was obtained from the institutional ethics committee prior to the start of the study.

Assessed for eligibility (n = 90)

↓

Excluded (n = 30)

• Not meeting inclusion criteria (n = 18)

• Declined to participate (n = 7)

• Other reasons (n = 5)

↓

Randomized (n = 60)

↓

Group A – Manual Therapy (MT) (n = 30)

• Received allocated intervention (n = 30)

• Lost to follow-up (n = 0)

• Discontinued intervention (n = 0)

Analyzed (n = 30)

↓

Group B – Progressive Resistance Exercise (PRE) (n= 30)

• Received allocated intervention (n = 30)

• Lost to follow-up (n = 0)

• Discontinued intervention (n = 0)

Analyzed (n = 30)

↓

Total analyzed (n = 60)

Figure 1: Flow diagram showing the recruitment, randomization, allocation, and analysis of participants in the study comparing Manual Therapy (MT) and Progressive Resistance Exercise (PRE) for chronic Subacromial Impingement Syndrome (SIS).

Randomization

After screening, eligible participants were randomly allocated into two equal groups (Group A and Group B) using a computer-generated random number table. To ensure allocation concealment, the group assignment was placed in sealed opaque envelopes, which were opened only after the participant was enrolled in the study. Each group consisted of 30 participants (n = 30).

Group A – Manual Therapy

Participants in Group A received manual therapy sessions three times a week for eight weeks. Each session lasted approximately 30 minutes and was administered by an experienced physiotherapist.

The intervention included the following components:

- Glenohumeral joint mobilization was performed using Maitland's Grades I to III. Grades I and II were used to reduce pain, while Grade III mobilizations were used to improve joint range of motion. Techniques included anteroposterior and inferior glides, depending on the clinical presentation.
- Scapular mobilization involved manual movements to improve scapulothoracic rhythm and shoulder mechanics. Techniques included elevation, depression, protraction, retraction, and upward/downward rotation.
- Soft tissue release was performed to address muscle tightness and trigger points in the upper trapezius and rotator cuff muscles, especially the supraspinatus and infraspinatus. Techniques included myofascial release and trigger point therapy.
- Passive stretching targeted tight muscles and joint capsule structures, such as the posterior capsule and pectoralis minor. Each stretch was held for 20–30 seconds and repeated 3 times during each session.

Group B – Progressive Resistance Exercise (PRE)

Participants in Group B underwent a progressive resistance exercise program, also three times a week for eight weeks. Each session lasted 30 to 40 minutes and was supervised by a licensed physiotherapist.

The exercise protocol focused on strengthening the rotator cuff muscles and scapular stabilizers such as the serratus anterior, rhomboids, and lower trapezius. The exercises progressed in intensity and complexity over time.

The types of exercises included:

- Isometric exercises in the early phase, aimed at maintaining muscle activation without aggravating pain.
- Isotonic exercises, including concentric and eccentric contractions using bodyweight or light dumbbells.
- Elastic resistance band exercises were incorporated to provide variable resistance through the range of motion. Bands of increasing resistance were used progressively.

Progression followed the 10-Repetition Maximum (10-RM) principle, adjusting the resistance and volume every two weeks based on participant performance and tolerance

Treatment Frequency and Duration

Both groups received their respective interventions three times per week for eight weeks, totaling 24 treatment sessions per participant. Each manual therapy session lasted approximately 30 minutes, while the resistance training sessions lasted 30 to 40 minutes. All sessions were conducted under professional supervision to ensure safety, adherence to protocol, and consistency in treatment delivery.

Outcome Measures

Three outcome measures were used to assess the effectiveness of the interventions. Assessments were performed at baseline (Week 0) and at the end of six weeks (Week 6) by a blinded evaluator who was not involved in the treatment process.

1. Pain was measured using the Visual Analog Scale (VAS), a 10 cm horizontal line where 0 represents "no pain" and 10 represents "worst imaginable pain." Participants were asked to mark their pain intensity on the scale.
2. Range of Motion (ROM) of the shoulder joint was measured using a standard universal goniometer. Movements assessed included flexion, abduction, and external rotation, which are commonly limited in shoulder dysfunction. Measurements were taken in a seated position following a standardized procedure.
3. Functional ability was evaluated using the Shoulder Pain and Disability Index (SPADI). This self-reported questionnaire assesses pain and disability on a scale of 0 to 100. It consists of two subscales:

- Pain subscale (5 items)
- Disability subscale (8 items)
- Higher scores indicate greater pain and disability. The SPADI is a validated and reliable tool for assessing functional limitations in shoulder disorders.

RESULT

Data Analysis

Data were analyzed using SPSS (Version 25.0). Between-group comparisons used independent t-tests. Effect size was calculated using Cohen's d, and significance was set at $p < 0.05$.

The outcomes measured included Visual Analogue Scale (VAS) for pain, Range of Motion (ROM), and Shoulder Pain and Disability Index (SPADI) for functional assessment. Post-intervention comparisons between Group A and Group B were analyzed using mean ± standard deviation (SD), p-values for statistical significance, Cohen's d for effect size, and delta (Δ) change scores to assess pre-to-post improvement.

Pain (VAS)

Group A (Manual Therapy) exhibited a significantly greater reduction in pain compared to Group B (Progressive Resistance Exercise), with a post-intervention VAS score of 3.36 ± 0.06 versus 3.81 ± 0.59, and a p-value of 0.0005, indicating statistical significance. The large negative Cohen's d value of –1.07 reflects a strong effect size, favoring Group A. This superior pain reduction in Group A can be explained by the immediate modulation of nociceptive input through mechanical stimulation of muscles and soft tissues during manual therapy. Such stimulation likely activates descending inhibitory pain pathways and reduces local muscle spasm or adhesions, resulting in rapid pain relief. On the other hand, Progressive Resistance Exercise tends to promote delayed analgesic effects by inducing long-term neuromuscular adaptations, which explains the comparatively smaller delta (Δ) change in pain reduction (4.14 in Group A vs. 3.69 in Group B), as shown in Table 1 and Figure 2-4.

Range of Motion (ROM)

Both groups showed improved Range of Motion (ROM) post-intervention, with Group B (Progressive Resistance Exercise) achieving a slightly higher mean ROM of 315.2° ± 27.1 compared to Group A (Manual Therapy) at 310.4° ± 25.8. However, this difference was not statistically significant, as indicated by a p-value of 0.35. The small Cohen's d value of –0.18 and the Δ change (60.4° for Group A and 65.2° for Group B) suggest only a mild advantage for Group B, as shown in Table 1 and Figure 2-4. This outcome can be explained by the fact that Progressive Resistance Exercise likely improved active ROM more effectively by strengthening the muscles surrounding the shoulder joint, enhancing muscular endurance, and reducing joint stiffness over time. In contrast, Manual Therapy primarily targets passive ROM improvements through the mechanical release of joint capsule adhesions and soft tissue restrictions. The lack of significant difference between groups indicates that both interventions provide complementary benefits, with Progressive Resistance Exercise focusing on active functional capacity and Manual Therapy supporting passive joint mobility.

Function (SPADI)

Functional improvement measured by the Shoulder Pain and Disability Index (SPADI) strongly favored Group B (Progressive Resistance Exercise), with a post-intervention SPADI score of 32.21 ± 4.39 compared to 41.48 ± 4.95 in Group A (Manual Therapy), and a highly significant p-value of less than 0.0001. The large positive Cohen's d of +1.98, along with a greater Δ change (27.79 for Group B vs. 18.52 for Group A), highlights the clear superiority of Progressive Resistance Exercise in enhancing shoulder function, as shown in Table 1 and Figure 2-4. This outcome can be attributed to the fact that Progressive Resistance Exercise not only strengthens the shoulder muscles but also improves neuromuscular coordination and joint stability, which are critical for functional recovery. The repeated dynamic loading

applied during resistance exercises likely stimulates muscle hypertrophy, enhances proprioceptive feedback, and promotes better motor control, all contributing to improved functional performance in daily activities. On the other hand, Manual Therapy, although effective in providing immediate pain relief, does not provide sufficient mechanical stimulus to drive long-term functional adaptations, which explains the comparatively smaller functional improvements observed in Group A.

Table 1. Comparison of Post-Intervention Outcomes, Effect Sizes (Cohen's d), and Delta Changes Between Group A and Group B

Outcome Measure	Group A Mean ±SD	Group B Mean ±SD	p-value	Cohen's d	Group A Δ Change	Group B Δ Change
VAS (0-10)	3.36 ± 0.06	3.81±0.59	0.0005	-1.07	4.14	3.69
ROM	310.4 ± 25.8	315.2±27.1	0.35	-0.18	60.4°	65.2°
SPADI (function)	41.48 ± 4.95	32.21±4.39	<0.0001	+1.98	18.52	27.79

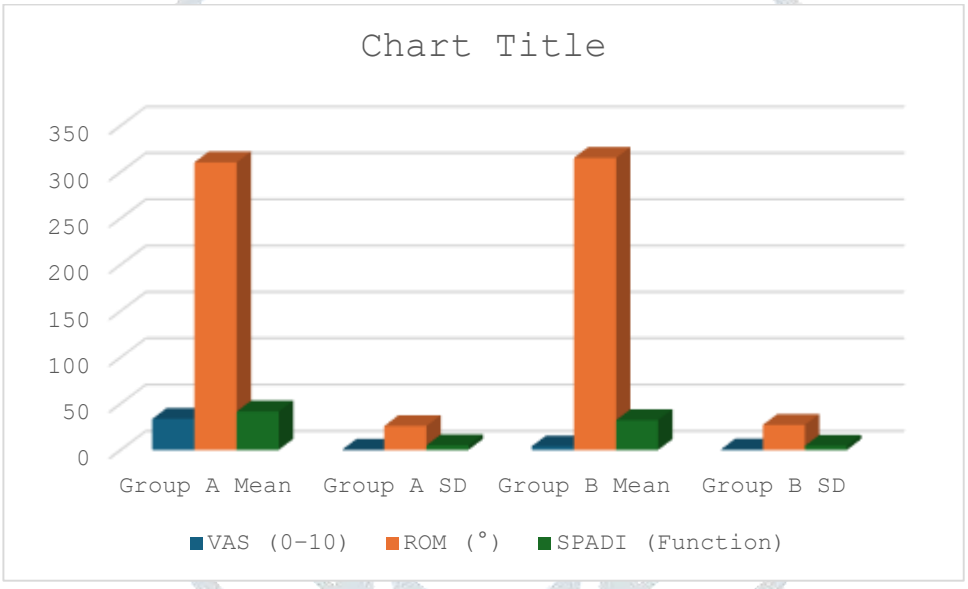

Figure 2: Comparison of mean and standard deviation values for VAS, ROM, and SPADI across Group A (Manual Therapy) and Group B (Progressive Resistance Exercise).

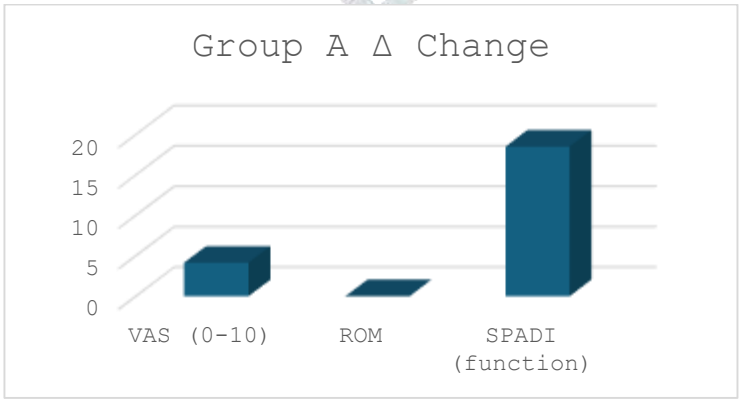

Figure 3. Delta Change in Pain, Range of Motion, and Shoulder Function in Group A Post-Intervention

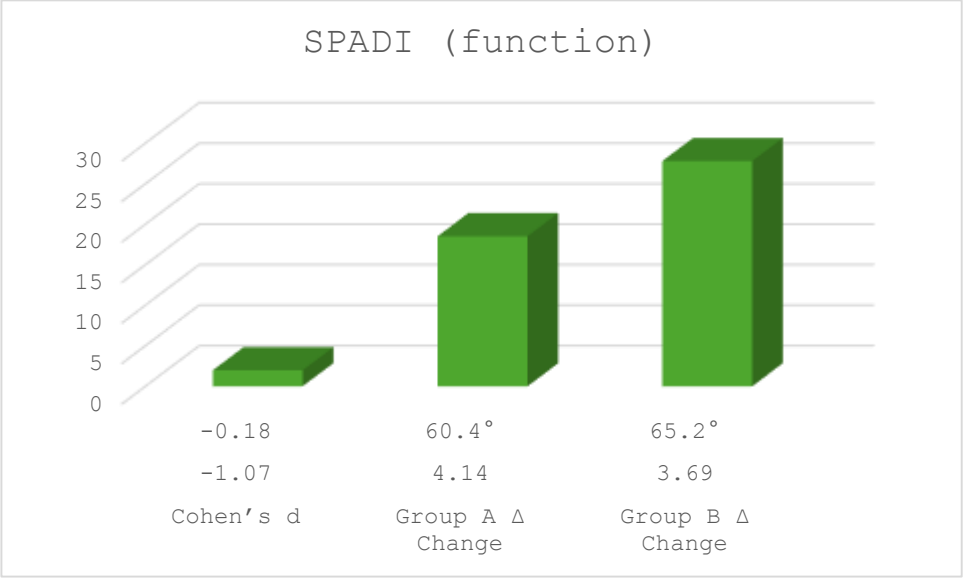

Figure 4. Comparison of Delta Change Between Group A and Group B and Cohen's d

Discussion

This study compared Manual Therapy and Progressive Resistance Exercise (PRE) for managing chronic subacromial impingement syndrome (SIS). The findings revealed that both interventions were effective but demonstrated distinct strengths in addressing different aspects of the condition.

Manual Therapy showed a significantly greater reduction in pain compared to PRE, as reflected by lower post-intervention VAS scores and a large effect size (Cohen's d = –1.07). This supports previous research indicating that joint mobilizations and soft tissue techniques can rapidly alleviate pain by improving joint mechanics, reducing soft tissue adhesions, and activating descending inhibitory pain pathways (15, 16). The immediate mechanical stimulation provided by Manual Therapy likely reduces local muscle spasm and nociceptive input, offering faster symptomatic relief.

Both groups exhibited improvements in shoulder range of motion (ROM), but the difference between them was not statistically significant. This suggests that either intervention can effectively enhance mobility, albeit through different mechanisms. Manual Therapy appears to improve passive joint flexibility by targeting adhesions and capsular restrictions, while PRE enhances active ROM by strengthening the peri-scapular and shoulder girdle muscles, improving joint stability and neuromuscular control over time (26).

Notably, Progressive Resistance Exercise produced significantly greater functional improvements, as demonstrated by much lower post-intervention SPADI scores and a very large effect size (Cohen's d = +1.98). The superior functional gains in Group B can be attributed to the dynamic loading involved in resistance exercises, which promotes muscle hypertrophy, enhances proprioception, and improves neuromuscular coordination. These adaptations are critical for restoring scapular stability, correcting muscular imbalances, and improving shoulder function during activities of daily living (17). In contrast, Manual Therapy, while effective for pain relief, lacks the sustained mechanical stimulus required for long-term functional adaptation, resulting in smaller functional improvements.

Overall, the findings suggest that Manual Therapy is particularly effective for early-stage pain management in SIS, providing rapid symptomatic relief. In contrast, Progressive Resistance Exercise is more effective in achieving long-term improvements in shoulder function and mobility. Therefore, a combined or sequential treatment strategy, employing Manual Therapy initially for pain control followed by PRE for functional rehabilitation, may offer the most comprehensive and effective approach to managing chronic SIS.

Clinical Implications

The differential effects observed in this study highlight the importance of individualized treatment planning in managing subacromial impingement syndrome (SIS). Manual Therapy demonstrated significant efficacy in early-phase pain relief, making it especially suitable for patients in the acute or subacute stages of SIS who experience severe pain and functional limitations. By rapidly reducing pain through mechanical modulation of soft tissues and joint structures, Manual Therapy can help patients engage more effectively in subsequent rehabilitative exercises.

On the other hand, Progressive Resistance Exercise (PRE) showed superior benefits in improving long-term shoulder function, as reflected by significantly lower SPADI scores and a large effect size. This suggests that PRE is highly effective in enhancing scapular stability, muscle strength, neuromuscular coordination, and functional capacity, making it ideal for the rehabilitation and maintenance phases of SIS management.

Interestingly, both interventions produced comparable improvements in Range of Motion (ROM), indicating that either approach can effectively contribute to mobility restoration. This suggests that a combined treatment strategy may provide synergistic benefits—where Manual Therapy offers rapid pain relief to facilitate patient participation, while PRE promotes sustained functional gains and joint stability. In clinical practice, integrating Manual Therapy during the early stages followed by a structured PRE program could optimize overall recovery, promoting both short-term symptom relief and long-term functional improvements. Such a multimodal approach aligns with current best practices in rehabilitation, emphasizing individualized, goal-oriented treatment strategies for comprehensive SIS management (12).

Limitations

While this study was carefully designed and adhered to rigorous methodology, several limitations should be acknowledged. First, the follow-up period was limited to 8 weeks, which restricts the ability to draw conclusions regarding the long-term sustainability of the observed effects, particularly for Progressive Resistance Exercise, whose benefits are expected to accumulate over a longer period. Future studies with extended follow-up durations are needed to evaluate the persistence of functional gains and pain relief.

Second, the sample size, although adequate for detecting medium to large effect sizes, may limit the generalizability of the findings to a broader population with subacromial impingement syndrome, especially considering variability in patient age, severity of symptoms, and comorbid conditions. Larger, multicenter trials could improve external validity and provide more robust recommendations.

Third, functional outcomes were assessed using the SPADI questionnaire, which is a validated but subjective self-reported measure. Incorporating objective, performance-based functional assessments such as timed functional tasks, strength tests, or kinematic analyses would provide a more comprehensive evaluation of shoulder function and better capture real-world improvements.

Finally, the study did not explore the potential additive or synergistic effects of combining Manual Therapy and PRE within the same treatment protocol. Investigating such multimodal approaches in future research may provide further insights into optimizing SIS management.

Conclusion

This study provides valuable insights into the comparative effectiveness of Manual Therapy and Progressive Resistance Exercise (PRE) in managing chronic subacromial impingement syndrome (SIS). The data indicate that both interventions are beneficial but serve different clinical purposes. Manual Therapy was significantly more effective in providing early-phase pain relief, as evidenced by a greater reduction in VAS scores and a large effect size (Cohen's d = –1.07). The mechanism underlying this superior pain control is likely due to mechanical stimulation of soft tissues and joint structures, which may activate descending pain inhibitory pathways and alleviate local muscle spasms or adhesions, allowing for more immediate symptom relief (27).

In terms of Range of Motion (ROM), both interventions yielded comparable improvements, with Group B showing a slight, but non-significant, advantage. Manual Therapy appears to primarily improve passive

joint flexibility by targeting capsular restrictions and soft tissue tightness, while PRE contributes to active mobility by strengthening peri-scapular and shoulder girdle muscles, enhancing neuromuscular control and reducing joint stiffness (28).

The most notable distinction was observed in functional outcomes. Progressive Resistance Exercise led to significantly greater improvements in shoulder function, as measured by SPADI scores, supported by a very large effect size (Cohen's d = +1.98). This functional enhancement likely results from repeated dynamic loading, which stimulates muscle hypertrophy, enhances proprioception, improves motor control, and restores scapular stability, all crucial for daily activity performance. In contrast, Manual Therapy alone does not provide sufficient mechanical stimulus for long-term functional gains, explaining the comparatively smaller improvement in SPADI (29).

Overall, these results suggest that Manual Therapy is best suited for immediate pain relief, particularly in the early phase of SIS, while PRE offers substantial long-term functional benefits. Integrating both approaches initial Manual Therapy followed by structured Progressive Resistance Exercise may provide the most comprehensive and effective management strategy, promoting rapid symptom control and sustained functional recovery. Future research should explore long-term outcomes and the synergistic effects of combining both interventions in a multimodal treatment plan (30).

Ethics Approval

Ref No: SMC/UECM/2025/1047

Acknowledgements

I would like to express my sincere gratitude to Dr. Danish Nouman for his valuable guidance, encouragement, and support throughout this research. I am also thankful to all the physiotherapists and participants who took part in the study and contributed significantly to its successful completion.

Authors' Contributions

Prachi Singh conceptualized and designed the study, collected and analyzed the data, and drafted the initial manuscript.

Dr. Danish Nouman supervised the study design, provided critical revisions, and helped with final approval of the version to be published.

Dr. Amit Kumar Goel significantly contributed to the refinement of my content and the accuracy of data analysis.

Jugnu Dubey assisted in data collection, contributed to the literature review and supported in manuscript preparation and formatting.

All authors read and approved the final manuscript.

Declarations

Competing Interests

The authors declare that they have no competing interests.

Correspondence:

Danish Nouman, MPT in Orthopaedics.

Email: drdchauhan86@gmail.com

References

1. Ludewig, P. M., & Cook, T. M. (2002). Translations of the humerus in persons with shoulder impingement symptoms. *Journal of Orthopaedic & Sports Physical Therapy, 32*(6), 248-259. https://doi.org/10.2519/jospt.2002.32.6.248 E-Science Central+1

2. Seitz, A. L., McClure, P. W., Finucane, S., Boardman, N. D., & Michener, L. A. (2011). Mechanisms of rotator cuff tendinopathy: Intrinsic, extrinsic, or both? *Clinical Biomechanics, 26*(1), 1-12. https://doi.org/10.1016/j.clinbiomech.2010.08.001 Unbound Medicine+2Scilit+2

3. Ludewig, P. M., & Braman, J. P. (2011). Shoulder impingement: Biomechanical considerations in rehabilitation. *Manual Therapy, 16*(1), 33-39. https://doi.org/10.1016/j.math.2010.08.004

4. Bang, M. D., & Deyle, G. G. (2000). Comparison of supervised exercise with and without manual physical therapy for patients with shoulder impingement syndrome. *Journal of Orthopaedic & Sports Physical Therapy, 30*(3), 126-137.

5. Boyles, R. E., Ritland, B. M., Miracle, B. M., et al. (2009). The short-term effects of thoracic spine thrust manipulation on patients with shoulder impingement syndrome. *Manual Therapy, 14*(4), 375-380.

6. Urwin, M., Symmons, D., Allison, T., Brammah, T., Busby, H., Roxby, M., et al. (1998). Estimating the burden of musculoskeletal disorders in the community: The comparative prevalence of symptoms at different anatomical sites, and the relation to social deprivation. *Annals of the Rheumatic Diseases, 57*(7), 649-655.

7. Worsley, P., Warner, M., Mottram, S., Gadola, S., Veeger, H. E. J., Hermens, H., Morrissey, D., Little, P., Cooper, C., Carr, A., & Stokes, M. (2013). Motor control retraining exercises for shoulder impingement: Effects on function, muscle activation, and biomechanics in young adults. *Journal of Shoulder and Elbow Surgery, 22*(4), e11-e19. https://doi.org/10.1016/j.jse.2012.06.010

8. Clausen, M. B., Witten, A., Holm, K., Christensen, K. B., Attrup, M. L., Hölmich, P., & Thorborg, K. (2017). Glenohumeral and scapulothoracic strength impairments exist in patients with subacromial impingement, but these are not reflected in the Shoulder Pain and Disability Index. *BMC Musculoskeletal Disorders, 18*(1), Article 1667--1–10. https://doi.org/10.1186/s12891-017-1667-1

9. Holmgren, T., Björnsson Hallgren, H., Öberg, B., Adolfsson, L., & Johansson, K. (2012). Effect of specific exercise strategy on need for surgery in patients with subacromial impingement syndrome: Randomised controlled study. *BMJ, 344*, e787. https://doi.org/10.1136/bmj.e787

10. Nazari, G., MacDermid, J. C., Bryant, D., & Athwal, G. S. (2019). The effectiveness of surgical vs conservative interventions on pain and function in patients with shoulder impingement syndrome: A systematic review and meta-analysis. *PLoS One, 14*(5), e0216961. https://doi.org/10.1371/journal.pone.0216961

11. (Duplicate of #4) Bang, M. D., & Deyle, G. G. (2000). Comparison of supervised exercise with and without manual physical therapy for patients with shoulder impingement syndrome. *Journal of Orthopaedic & Sports Physical Therapy, 30*(3), 126-137.

12. Ho, C.-Y. C., Sole, G., & Munn, J. (2009). The effectiveness of manual therapy in the management of musculoskeletal disorders of the shoulder: A systematic review. *Manual Therapy, 14*(5), 463-474. https://doi.org/10.1016/j.math.2009.03.008

13. Innocenti, T., Ristori, D., Miele, S., & Testa, M. (2019). The management of shoulder impingement and related disorders: A systematic review on diagnostic accuracy of physical tests and manual therapy efficacy. *Journal of Bodywork and Movement Therapies, 23*(3), 604-618. https://doi.org/10.1016/j.jbmt.2018.08.002

14. Cleland, J. A., Mintken, P. E., McDevitt, A., & Fritz, J. M. (2005). Manual physical therapy and exercise for shoulder impingement syndrome: A randomized clinical trial. *Journal of Manual & Manipulative Therapy, 13*(2), 61-76. https://doi.org/10.1179/106698105790824654

15. (Same as #4/Bang & Deyle) Bang, M. D., & Deyle, G. G. (2000). Comparison of supervised exercise with and without manual physical therapy for patients with shoulder impingement syndrome. *Journal of Orthopaedic & Sports Physical Therapy, 30*(3), 126-137.

16. Kuhn, J. E. (2009). Exercise in the treatment of rotator cuff impingement: A systematic review and a synthesized evidence-based rehabilitation protocol. *Journal of Shoulder and Elbow Surgery, 18*(1), 138-160. https://doi.org/10.1016/j.jse.2008.06.004

17. Vermeulen, H. M., Rozing, P. M., Obermann, W. R., le Cessie, S., & Vliet Vlieland, T. P. M. (2006). [Title not provided in original]. *Physical Therapy, 86*(3), 355-368. https://doi.org/10.1093/ptj/86.3.355

18. Machner, A., Merk, H., Becker, R., Rohkohl, K., Wissel, H., & Pap, G. (2003). Kinesthetic sense of the shoulder in patients with impingement syndrome. *Acta Orthopaedica Scandinavica, 74*(1), 85-88. https://doi.org/10.1080/00016470310013716

19. Overbeek, C. L., Gacaferi, H., Schoones, J. W., Jayakumar, P., Vermeulen, H. M., de Groot, J. H., … Nagels, J. (2020). The effect of conservative therapies on proprioception in subacromial pain syndrome: A narrative synthesis. *European Journal of Physiotherapy, 24*(2), 69-78. https://doi.org/10.1080/21679169.2020.1787511

20. (Duplicate of #19) Overbeek, C. L., Gacaferi, H., Schoones, J. W., Jayakumar, P., Vermeulen, H. M., de Groot, J. H., … Nagels, J. (2020). The effect of conservative therapies on proprioception in subacromial pain syndrome: A narrative synthesis. *European Journal of Physiotherapy, 24*(2), 69-78. https://doi.org/10.1080/21679169.2020.1787511

21. Tauqeer, S., Arooj, A., & Shakeel, H. (2024). Effects of manual therapy in addition to stretching and strengthening exercises to improve scapular range of motion, functional capacity and pain in patients with shoulder impingement syndrome: A randomized controlled trial. *BMC Musculoskeletal Disorders, 25*, Article 192. https://doi.org/10.1186/s12891-024-07294-4

22. Schydlowsky, P., Szkudlarek, M., & Madsen, O. R. (2022). Comprehensive supervised heavy training program versus home training regimen in patients with subacromial impingement syndrome: A randomized trial. *BMC Musculoskeletal Disorders, 23*, Article 52. https://doi.org/10.1186/s12891-021-04969-0

23. Liaghat, B., Ussing, A., Petersen, B. M., Andersen, H. K., Barfod, K. W., Jensen, M. B., Høegh, M., Tarp, S., Juul-Kristensen, B., & Brorson, S. (2021). Supervised training compared with no training or self-training in patients with subacromial pain syndrome: A systematic review and meta-analysis. *Archives of Physical Medicine and Rehabilitation*, 102(1), Article S0003-9993(21)00318-X. https://doi.org/10.1016/j.apmr.2021.03.027

24. Li, Y., Li, X., Song, H., … (2024). Health-related outcomes with supervised exercise and myofascial release versus only supervised exercise in subacromial pain syndrome: A randomized controlled single-blind study. *BMC Sports Science, Medicine and Rehabilitation, 16*, 171. https://doi.org/10.1186/s13102-024-00960-z

25. Ishii, D., Kenmoku, T., Tazawa, R., Nakawaki, M., Nagura, N., Muneshige, K., … et al. (2021). Limitation of the external glenohumeral joint rotation is associated with subacromial impingement syndrome, especially pain. *JSES International, 5*, 430-438.

26. Aslanov, N., & Ersin, A. (2023). Comparison of the effects of manual therapy and scapular stabilization exercises on pain, functional status, and quality of life in subacromial impingement syndrome. *Journal of Health Sciences and Medicine, 6*(6), 1373-1379. https://doi.org/10.32322/jhsm.1361109

27. Fathollahnejad, K., Letafatkar, A., & Hadadnezhad, M. (2019). The effect of manual therapy and stabilizing exercises on forward head and rounded shoulder postures: A six-week intervention with a one-month follow-up study. *BMC Musculoskeletal Disorders, 20*, Article 86. https://doi.org/10.1186/s12891-019-2438-y

28. Venturin, D., Giannotta, G., Pellicciari, L., et al. (2023). Reliability and validity of the Shoulder Pain and Disability Index in a sample of patients with frozen shoulder. *BMC Musculoskeletal Disorders, 24*, Article 212. https://doi.org/10.1186/s12891-023-06268-2

29. Kim, J.-H., Yi, C.-H., Jeon, H.-S., Choi, W. J., Weon, J.-H., & Kwon, O.-Y. (2022). Comparison of shoulder functions between assembly workers with and without subacromial pain syndrome. *Work, 74*(3), 1091-1101. https://doi.org/10.3233/WOR-211310

30. Karamanlıoğlu, D. S., Kaysın, M. Y., Beğoğlu, F. A., Akpınar, P., Özkan, F. U., Aktaş, I. (2024). Effects of acupuncture on pain and function in patients with subacromial impingement syndrome: A randomized sham-controlled trial. *Integrative Medicine Research, 13*(2), Article 101049. https://doi.org/10.1016/j.imr.2024.101049