RESEARCH PAPER

Effect of Scapular Mobilization Versus Scapular Stabilization Exercises on Grip Strength and Shoulder Function Among Construction Site Workers with Subacromial Impingement Syndrome

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ABSTRACT

Subacromial impingement syndrome (SIS) causes shoulder pain and functional debilitation and is often associated with altered scapular biomechanics and reduced shoulder function. Rehabilitation programs incorporate various interventions that mainly focus on the scapular region; however, comparative evidence regarding the effectiveness of scapular mobilization and stabilization exercises remains limited. The study was conducted as a randomized controlled trial involving 30 participants diagnosed with subacromial impingement syndrome. Following enrollment, participants were randomly distributed into two groups. Group A (n = 15) was the control group and performed scapular mobilization exercises, while Group B (n = 15) formed the intervention group and engaged in scapular stabilization exercises. Each participant attended a supervised exercise session of 30 minutes, held three times per week over six weeks. Shoulder function was assessed with the Shoulder Pain and Disability Index (SPADI), and hand-grip strength was evaluated using a hand-held dynamometer. Baseline parameters were noted prior to the intervention and reassessed post the completion of the exercise program. Statistical analysis was done using paired and independent t-tests, with a significance level set at $p < 0.05$. Both groups showed significant improvements in shoulder function and hand grip strength following the intervention ($p < 0.05$). However, participants in the scapular stabilisation group demonstrated greater improvement in hand grip strength (4.8 ± 1.5 kg) than those in the scapular mobilisation group (2.5 ± 1.2 kg). Similarly, improvement in SPADI scores was greater in the stabilisation group (25.7 ± 6.4) than in the mobilisation group (15.3 ± 5.2), with a statistically significant between-group difference ($p < 0.05$). These findings suggest that although both scapular mobilization and stabilization exercises improved shoulder function and grip strength in individuals with subacromial impingement syndrome, stabilization exercises produced greater improvements in these outcomes.

Keywords: Subacromial impingement syndrome, Scapular mobilization, Scapular stabilization, Shoulder Pain, Disability Index, Grip strength, Randomized controlled trial

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Introduction

One major reason for shoulder pain and disability is subacromial impingement syndrome (SIS), which is associated with a loss of grip strength and limitations in the shoulder joint range of motion[1]. Subacromial impingement syndrome affects both the intrinsic and the extrinsic mechanisms of the shoulder rotator cuff. The current rehabilitation approaches involves scapula-specific exercises, including proprioception- and stabilization -based programs[2].

Scapular mobilization is a therapy aimed at managing shoulder joint disorders. It increases the range of shoulder mobility and also reduce mechanical restrictions by manually moving the scapula[3]. In contrast, scapular stabilization exercises aim to strengthen the muscles, encouraging proper positioning and various movement control[4]. The purpose of this research was to compare how scapular mobilization, including stabilization workouts affect shoulder flexibility, including grip endurance, in people with SIS. Based on the existing evidence and the clinical importance of optimizing rehabilitation strategies for subacromial impingement syndrome, this study was designed to test the hypothesis that scapular stabilization exercises would result in greater improvements in shoulder function and hand grip strength compared with scapular mobilization exercises.

Methodology

The present study was designed as a prospective randomized controlled trial conducted over a period of six weeks. It compares the effects of scapular mobilisation and stabilisation exercises on the shoulder function and hand-grip strength in individuals with subacromial impingement syndrome (SAIS). Ethical approval was obtained from the Departmental Ethics Committee (SOPT/VISTAS/DEC/070/2025), and well-informed written consent was obtained from all participants prior to enrolment. The sample size for this study was determined based on feasibility within the pre-determined study period and availability of the eligible participants. A total of 30 participants aged 18 years and above with unilateral shoulder pain of less than six weeks' duration were included in the study. Allocation of the participants was done using a sealed-envelope method. Thirty opaque, sealed envelopes containing group allocation labels (15 for the scapular mobilization group and 15 for the scapular stabilization group) were prepared before the starting the study by an independent researcher. After baseline assessment, each participant selected one envelope, and group assignment was determined accordingly. The diagnosis of SAIS was confirmed based on clinical examination, with participants required to present ≥2 of the following findings: a painful arc between 60° and 120°, a positive Neer's impingement test[5]or pain during resisted external rotation. Participants were excluded if they had a history of shoulder surgery, fracture, instability, traumatic onset of symptoms, type I/II diabetes mellitus, peripheral vascular disease, neurological or rheumatological disorders, or any condition that could interfere with the intervention or outcome assessment. Baseline measurements of shoulder function and hand grip strength were recorded prior to the intervention. Following baseline assessment, participants were randomly allocated into two equal groups as illustrated in Figure 1.

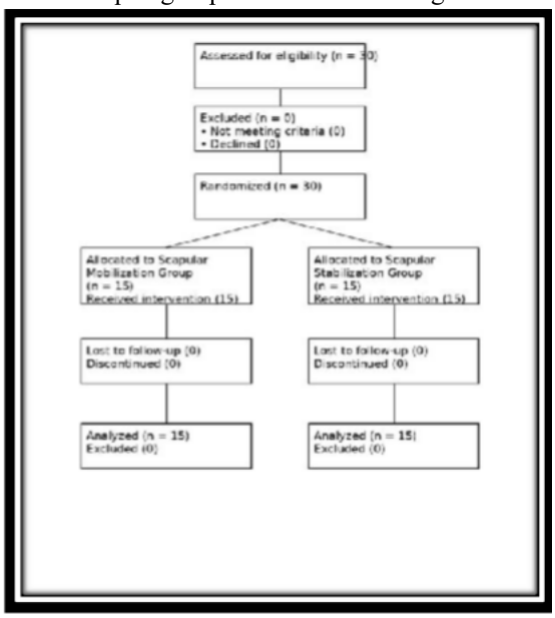

FIGURE 1: Flow diagram illustrating participant recruitment, randomization, allocation, follow-up, and analysis.

Participants in **Group A (the control group) received scapular mobilisation exercises in combination** with basic shoulder range-of-motion exercises. (**Figures 2** and **Figure 3**).

FIGURE 2- A Scapular Distraction **FIGURE 3: Inferior and superior glide**

Participants in Group B (the intervention group) underwent stabilization exercises which was designed to improve the strength, endurance, and neuromuscular control of the scapular stabilizing muscles (Figures 4 and 5).

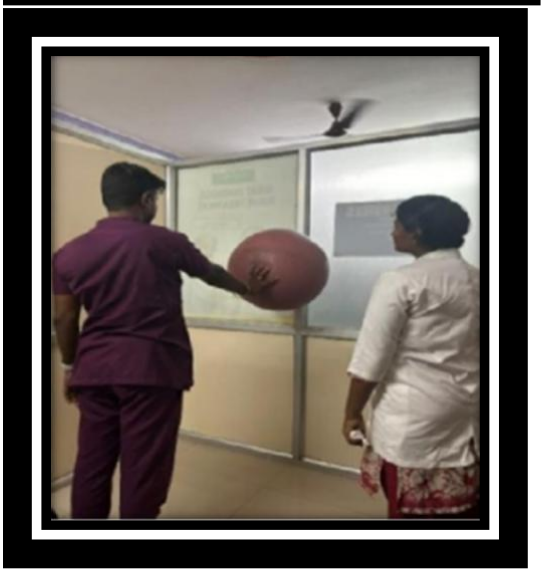

FIGURE 4: Angel wings **FIGURE 5: Physio Ball Scapular Exercise**

Both the groups received supervised sessions lasting 30 minutes, three times per week, for a total duration of six weeks. The shoulder function was assessed using the "Shoulder Pain and Disability Index" (SPADI)[6], a validated 13-item tool that evaluates pain and any functional limitation. Strength of hand-grip was measured using a handheld dynamometer while the patients were seated with the shoulder in a neutral position, and with the elbow flexed to 90 degrees; three maximal contractions were recorded with adequate rest between trials, and the mean of all the three readings was used for analysis[7,8] Statistical analysis was carried out using SPSS, with descriptive statistics computed for all variables. Comparisons with in the group were performed using paired t-tests, and between-group comparisons were analyzed using independent t-tests, with p-values < 0.05 considered statistically significant.

Results

30 participants completed the study, with 15 participants in each group. Baseline measurements of hand-grip strength with shoulder function were comparable between the two groups. Participants in Group A demonstrated a significant improvement in hand grip strength following the intervention. The mean increase in grip strength from pre-test to post-test was 2.5 ± 1.2 kg, and this change was significant statistically (p = 0.04). The comparison of pre- and post-intervention grip strength values for Group A is shown in Table 1. Similarly, shoulder function assessed using the "Shoulder Pain and Disability Index" (SPADI) showed a significant improvement following the six-week scapular mobilization program. The mean reduction in SPADI score was 15.3 ± 5.2, with the within-group difference reaching statistical significance (p = 0.02). The pre- and post-test comparison for SPADI scores in Group A is shown in Table 2.

Table 1: Compare the mean difference in Grip Strength pre-test and post-test for the Scapular Mobilization Exercise Group (GROUP A)

Outcome Measure	Pre-Test (Mean ± SD)	Post-Test (Mean ± SD)	Mean Difference	p value
Grip Strength (kg)	18.2 ± 3.1	20.7 ± 3.1	+2.5	0.01

Table 2: Compare the mean difference in SPADI score pre-test and post-test for the Scapular Mobilization Exercise Group (GROUP A)

Outcome Measure	Pre-Test(Mean ± SD)	Post-Test(Mean ± SD)	Mean Difference	p-value
SPADI Score (%)	65.1 ± 7.3	49.8 ± 6.9	15.3	0.02

Participants in Group B also showed significant improvements in both outcome measures following the intervention. Hand grip strength increased by a mean value of **4.8 ± 1.5** from pre-test to post-test which was significant statistically (**p = 0.01**).

The within-group comparison of grip strength values for Group B is presented in **Table 3**.

Shoulder function assessed using the SPADI demonstrated a significant improvement in Group B following the stabilization exercise program. The mean reduction in SPADI score was **25.7 ± 6.4**, with a statistically significant difference observed between pre- and post-intervention values (**p = 0.01**). These results are depicted in **Table 4**.

Outcome Measure	Pre-Test (Mean ± SD)	Post-Test (Mean ± SD)	Mean Difference	p-value
Grip Strength (kg)	18.4 ± 3.6	23.2 ± 3.3	+4.8	0.001

Table 3: Comparison of the mean difference in grip strength be t w e e n the pre and post-test for the Scapular mobilization

Outcome Measure	Pre-Test(Mean ± SD)	Post-Test(Mean ± SD)	Mean Difference	p-value
SPADI Score (%)	65.2 ± 7.1	40.5 ± 6.4	25.7	0.001

Table 4: Compare the mean difference in SPADI score between the pre-test and post-test for the Scapular Stabilization Exercise Group (GROUP B).

The post-intervention comparison between the two groups showed statistical significant differences in the strength of the hand grip and shoulder function.

The mean improvement in grip strength was greater significantly in the scapular stabilization group (**4.8 ± 1.5 kg**) compared to the scapular mobilization group (**2.5 ± 1.2 kg**), with the between-group difference reaching statistical significance (**p = 0.03**). The comparison of post-test grip strength values between the two groups is presented in **Table 5** and illustrated in **Figure 6** .

The mean improvement in hand grip strength was significantly greater in the scapular stabilization group (**4.8 ± 1.5 kg**) compared to the scapular mobilization group (**2.5 ± 1.2 kg**), with the between-group difference reaching statistical significance (**p = 0.03**). The comparison of post-test grip strength values between the two groups is presented in **Table 5** and illustrated in **Figure 6** .

Similarly, the improvement in shoulder function as measured by SPADI was significantly higher in the scapular stabilization group (**25.7 ± 6.4**) compared to the scapular mobilization group (**15.3 ± 5.2**), and the between-group difference was also significant (**p = 0.01**). These findings are presented in **Table 6**.

TABLE 5: Presentation of post-test mean along with standard deviation(SD) for hand-grip strength for both groups.

Outcome Measure	**SMG (Mean ± SD)**	**SSEG (Mean ± SD)**	**p-Value**
Grip Strength (kg)	**+2.5 ± 1.2**	**+4.8 ± 1.5**	<0.05

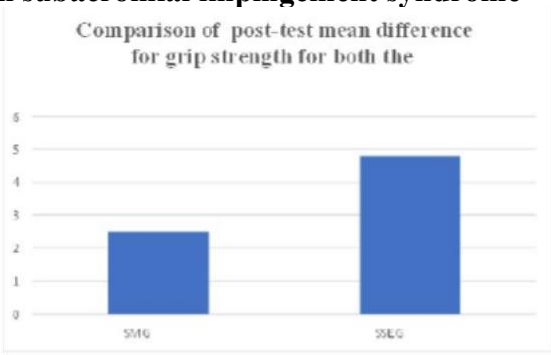

FIGURE 6: Hand grip strength mean difference between Scapular mobilization and stabilization exercises

TABLE 6: Presentation of post-test mean and standard deviation for SPADI SCORE for both the groups

Outcome Measure	SMG (Mean ± SD)	SSEG (Mean ± SD)	p-Value
SPADI Score (%)	15.3 ± 5.2	**25.7 ± 6.4**	<0.05

According to studies, scapular mobilization therapy is intended to minimize pain and improve range of motion, leading to better shoulder functioning[9,10]. These exercises decompress the subacromial space and allow the tendons to move more freely, indirectly improving grip strength by reducing pain. Studies such as Kibler et al. (2008)[2] are important for addressing scapular kinematics but provide little robust evidence of clinically meaningful differences in grip strength or functional outcomes. The present study was based on the hypothesis that rehabilitation strategies targeting scapular stability would produce greater improvements in functional outcomes compared with interventions primarily focused on improving scapular mobility.

This assumption was grounded in the understanding that strengthening and improving neuromuscular control of the scapular stabilizers can enhance shoulder biomechanics and reduce mechanical stress on subacromial structures [11,12]. Studies show that these exercises can improve grip strength and shoulder function significantly. Struyf et al. (2013)[3] found that partisan control of scapular stabilization is associated with a considerable increase in muscle strength and its performance. Scapular stabilization exercises work to strengthen the muscles surrounding the scapula, in particular the serratus anterior and the lower trapezius. Improved strength of these muscles further improves the scapular positioning and improved control of various range of shoulder movements. Earlier studies have reported that such exercises help reduce abnormal scapular motion, which has a significant role in the pathophysiology of subacromial impingement syndrome.[13,14]

The results of the present study suggest that adding scapular stabilization therapies into the rehabilitation programs for patients with SIS may lead to improved functional outcomes and reduced symptoms. These findings are consistent with

contemporary rehabilitation approaches that emphasize restoration of normal scapular kinematics in the management of shoulder disorders. [15]

The findings of this study have important implications for clinical practice in the rehabilitation of individuals with subacromial impingement syndrome. The greater improvements observed with scapular stabilization exercises suggest that these rehabilitation programs should place increased emphasis on strengthening and neuromuscular control of the scapular stabilizing muscles, particularly the serratus anterior and lower trapezius. Incorporating structured stabilization exercises into routine physiotherapy protocols may enhance functional recovery and improve grip strength, which is particularly relevant for individuals engaged in manual or occupational tasks.

Despite all the positive aspects, this study has certain limitations. First is the relatively small sample size, which may limit the findings to a broader population. The study focused solely on short-term outcomes following a six-week intervention, and long-term effects were not assessed. In addition to a lack of imaging techniques to aid diagnosis, the outcomes were limited to shoulder function and hand grip strength, and other clinically relevant measures, such as range of motion, muscle activation patterns, or work-related functional outcomes, were not evaluated. Further studies with a larger sample size, longer follow-up periods, and inclusion of additional outcome measures are recommended to validate and expand upon these findings.

Conclusion

The present study indicates that both scapular mobilization and stabilization exercises improve both shoulder function and improves grip strength . In individuals with subacromial entrapment condition, the study emphasizes the advantages of scapular stabilization workouts over scapular mobilization in terms of enhancing shoulder function, including grip strength.

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Conflicts of interest:

Authors declare of no conflicts of interest.

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