



Scapular Stabilization Exercises Versus Conventional Physiotherapy on Pain and Shoulder Function in Patients with Rotator Cuff Tear

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Abstract

Introduction

Rotator cuff tears are commonly accompanied by shoulder pain, muscle weakness, and limitations in functional performance. Abnormal or altered scapular kinematics can further interfere with normal shoulder biomechanics and contribute to functional impairment. Consequently, scapular stabilization exercises have gained increasing importance as a component of comprehensive shoulder rehabilitation.

Purpose

The present study aimed to compare the effectiveness of scapular stabilization exercises with conventional physiotherapy in alleviating pain and enhancing shoulder function in individuals with rotator cuff tear.

Materials and Methods

One hundred patients diagnosed with rotator cuff tear were recruited for the study and equally allocated into two groups, with 50 participants in each group. Group A received scapular stabilization exercises in addition to conventional physiotherapy, whereas Group B was treated with conventional physiotherapy alone. Pain intensity and shoulder-related functional disability were evaluated using the Numeric Pain Rating Scale (NPRS) and Shoulder Pain and Disability Index (SPADI), respectively. Assessments were performed before and after the intervention, and the obtained scores were

statistically analyzed for within-group and between-group differences.

Results

Both intervention groups exhibited improvements in pain intensity and shoulder functional status following treatment. However, participants who received scapular stabilization exercises demonstrated comparatively greater reductions in NPRS scores and improvements in SPADI scores than those receiving conventional physiotherapy alone. These findings suggest that incorporating specific scapular stabilization exercises into a conventional physiotherapy regimen may provide additional advantages in restoring shoulder function and reducing pain.

Conclusion

The combination of scapular stabilization exercises with conventional physiotherapy may be more beneficial than conventional physiotherapy alone in decreasing pain and enhancing shoulder function among patients with rotator cuff tear. Therefore, scapular stabilization exercises may be considered an effective adjunct to routine physiotherapy-based shoulder rehabilitation.



Keywords

Rotator cuff tear; Scapular stabilization exercises; Conventional physiotherapy; Numeric Pain Rating Scale; Shoulder Pain and Disability Index; Pain; Shoulder function.

INTRODUCTION

The shoulder complex is among the most mobile regions of the human musculoskeletal system and is essential for a wide range of daily, occupational, recreational, and sporting activities. The remarkable mobility of the shoulder is achieved through the coordinated functioning of the glenohumeral joint, scapula, clavicle, and surrounding muscular structures. Within this complex system, the rotator cuff serves a vital role and comprises four muscles: the supraspinatus, infraspinatus, teres minor, and subscapularis. Collectively, these muscles provide dynamic stabilization of the glenohumeral joint and assist in producing precise and controlled movements of the upper extremity. Any injury or dysfunction involving the rotator cuff can adversely influence shoulder range of motion, muscular strength, joint stability, and overall functional capacity.²

Rotator cuff tear represents a prevalent musculoskeletal condition and is an important source of shoulder pain and disability, particularly in middle-aged and elderly individuals. Such injuries can develop following acute trauma, repetitive overhead movements, excessive mechanical stress, or progressive age-related degeneration of the tendon. Depending on the degree of tendon involvement, rotator cuff tears are generally categorized as partial-thickness or full-thickness tears.³

Individuals with rotator cuff tears frequently experience pain, especially while performing overhead movements, together with reduced muscular strength, restricted shoulder mobility, painful arc, and difficulty carrying out routine functional activities. Activities such as reaching, lifting, dressing, personal grooming, and sleeping on the involved side may become challenging because of pain and impaired shoulder performance.⁴ The intensity and functional consequences of symptoms can differ depending on several factors, including the size and anatomical location of the tear, degree of tendon degeneration, muscular weakness, and the individual's occupational and functional requirements.⁵

Normal scapular movement is essential for maintaining efficient shoulder biomechanics. The scapula provides a stable foundation for movement of the upper limb and facilitates appropriate positioning of the glenoid during shoulder elevation. Impairment of scapular control or stabilization may result in altered shoulder mechanics and may negatively influence functional performance. Therefore, rehabilitation strategies directed toward improving scapular muscle strength, neuromuscular control, and dynamic stability may have an important role in the management of rotator cuff-related dysfunction.

Scapular stabilization exercises are designed to improve the strength and coordinated activation of the muscles responsible for maintaining appropriate scapular alignment and movement. These exercises may enhance scapulohumeral coordination, improve shoulder mechanics, and facilitate more efficient upper-limb function. When incorporated with conventional physiotherapy interventions, scapular stabilization exercises may potentially provide additional benefits in reducing pain and improving functional outcomes in patients with rotator cuff tear.

Therefore, the present study was undertaken to compare the effectiveness of scapular stabilization exercises and conventional physiotherapy in terms of pain reduction and improvement in shoulder function among patients with rotator cuff tear.

AIM

To compare the effectiveness of scapular stabilization exercises and conventional physiotherapy on pain and shoulder function in patients with rotator cuff tear.



OBJECTIVES

1. To determine the effect of scapular stabilization exercises on pain intensity in patients with rotator cuff tear.
2. To evaluate the effect of conventional physiotherapy on pain intensity in patients with rotator cuff tear.
3. To assess the effectiveness of scapular stabilization exercises in improving shoulder function among patients with rotator cuff tear.
4. To determine the effect of conventional physiotherapy on shoulder function in patients with rotator cuff tear.
5. To compare the effectiveness of scapular stabilization exercises and conventional physiotherapy in reducing pain and improving shoulder function in patients with rotator cuff tear.

Methodology

Study Design: A two-group, parallel-arm randomized controlled trial (RCT) will be undertaken to determine and compare the effectiveness of Scapular Stabilization Exercises (SSE) and Conventional Physiotherapy (CPT) in reducing pain and improving shoulder function among individuals diagnosed with rotator cuff tear.

Study Setting

The investigation will be carried out in the Department of Physiotherapy/Orthopaedic Physiotherapy Outpatient Department of the selected hospital or physiotherapy facility.

Study Duration

The study will be conducted over an estimated period of six months.

Study Population

The study participants will comprise individuals diagnosed with a rotator cuff tear who have been referred for conservative physiotherapy treatment.

Sample Size

A total of 100 participants will be considered for recruitment and will be randomly assigned to two intervention groups:

- Group A – Scapular Stabilization Exercise Group: 50 participants
- Group B – Conventional Physiotherapy Group: 50 participants

The final sample size should preferably be determined using an appropriate statistical formula or software, taking into consideration the anticipated effect size, level of significance, statistical power, and expected participant dropout.

Sampling Technique

Participants who satisfy the predetermined eligibility requirements will be recruited through purposive or consecutive sampling. Following the initial screening and baseline assessment, participants will be randomly assigned to either Group A or Group B using a computer-generated randomization sequence or a sealed-envelope allocation procedure.

Inclusion Criteria

Participants will be eligible for inclusion if they fulfill the following criteria:

- Individuals aged 30–65 years.
- Clinically and/or radiologically confirmed diagnosis of rotator cuff tear.
- Unilateral involvement of the shoulder.
- Shoulder pain persisting for a minimum of four weeks.
- Pain intensity of ≥ 3 on the Numerical Pain Rating Scale (NPRS).



- Presence of difficulty in shoulder-related activities or activities of daily living.
- Medically stable and considered suitable for physiotherapy intervention.
- Willingness to participate in the research.
- Provision of written informed consent.

Exclusion Criteria

Participants will be excluded from the study if they present with any of the following:

- History of previous shoulder surgery.
- Recent fracture or dislocation involving the shoulder.
- Complete traumatic rotator cuff tear requiring immediate surgical intervention.
- Marked shoulder stiffness or adhesive capsulitis.
- Neurological conditions affecting the upper extremity.
- Cervical radiculopathy or clinically significant cervical pathology contributing to shoulder symptoms.
- Rheumatoid arthritis or other inflammatory joint disorders.
- Recent corticosteroid injection.
- Other significant musculoskeletal disorders involving the upper limb.
- Any medical condition that contraindicates therapeutic exercise.
- Inability to comprehend or appropriately perform the prescribed exercise protocol.

Study Variables

Independent Variable

The independent variable will be the type of physiotherapy intervention administered.

- Group A: Scapular Stabilization Exercises
- Group B: Conventional Physiotherapy

Dependent Variables

The primary dependent variables will include:

Pain intensity:

Assessed using the Numerical Pain Rating Scale (NPRS).

Shoulder functional status:

Evaluated using the Shoulder Pain and Disability Index (SPADI).

Demographic and Clinical Variables

The following demographic and clinical characteristics will also be documented:

- Age
- Sex
- Dominant and non-dominant shoulder
- Duration of symptoms
- Affected side
- Type and extent of rotator cuff tear

Outcome Measures

A. Numerical Pain Rating Scale (NPRS)

The Numerical Pain Rating Scale will be utilized to determine the intensity of shoulder pain. Participants will be asked to indicate their perceived pain on a scale ranging from 0 to 10, where:

- 0 = No pain
- 10 = Worst possible pain

Pain scores will be documented at baseline, after three weeks, and following completion of the six-week intervention.

B. Shoulder Pain and Disability Index (SPADI)

The Shoulder Pain and Disability Index (SPADI) will be employed to evaluate shoulder-related pain and functional disability. The questionnaire consists of 13 items, divided into:

- Pain subscale: 5 items
- Disability subscale: 8 items



The overall SPADI score ranges from 0 to 100, with a higher score representing greater pain and functional disability.

PROCEDURE

Following approval from the Institutional Ethics Committee, potential participants will be screened according to the predefined inclusion and exclusion criteria.

Eligible individuals will be provided with detailed information regarding the objectives, procedures, possible benefits, and potential risks associated with the study. Written informed consent will be obtained before enrollment.

Baseline Assessment

The following information will be recorded during the initial assessment:

Age, Sex, Affected shoulder, Dominant shoulder, Duration of symptoms, NPRS score, SPADI score

After completion of the baseline assessment, eligible participants will be randomly assigned to either Group A or Group B.

INTERVENTION PROTOCOL

Group A: Scapular Stabilization Exercise Group

Participants allocated to Group A will undergo a structured scapular stabilization exercise program designed to enhance scapular control, muscular strength, neuromuscular coordination, and functional shoulder mechanics.

The exercise regimen may consist of:

- Scapular setting and retraction, Scapular depression exercises, Serratus anterior strengthening, Wall push-up plus, Scapular protraction and retraction, Prone Y exercises, Prone T exercises, Prone W exercises, Resistance-band scapular retraction, Resistance-band external rotation with emphasis on appropriate scapular control

Exercises will initially be performed at a low level of resistance and will be progressively advanced according to the participant's tolerance, clinical response, and functional improvement.

Proposed Exercise Dosage

- Frequency: 3 sessions per week, Treatment duration: 6 weeks
- Session duration: Approximately 30–45 minutes
- Sets: 2–3 sets
- Repetitions: 10–15 repetitions

Adequate rest intervals will be incorporated between sets. Exercise intensity and resistance will be gradually increased according to individual tolerance and progression.

Group B: Conventional Physiotherapy Group

Participants assigned to the conventional physiotherapy group will receive a standardized physiotherapy program consisting of:

- Moist heat therapy for approximately 10–15 minutes
- Gentle shoulder range-of-motion exercises
- Pendulum exercises
- Active-assisted shoulder movements
- Shoulder stretching exercises
- Rotator cuff strengthening exercises
- Theraband exercises as tolerated
- General shoulder mobility and strengthening exercises



Treatment will be administered approximately three times per week for six weeks, with each treatment session lasting approximately 30–45 minutes.

The dosage, duration, and application of each therapeutic modality will be standardized and documented in the final research protocol to ensure consistency across participants.

ASSESSMENT SCHEDULE

Outcome Measure	Baseline	Week 3	Week 6
NPRS	✓	✓	✓
SPADI	✓	✓	✓

The principal analysis will compare the change in NPRS and SPADI scores from baseline to week 6 between the two intervention groups.

HOME EXERCISE PROGRAM

Participants will be instructed to perform the prescribed exercises at home according to a standardized home-exercise instruction sheet.

To monitor adherence, participants will maintain an exercise diary containing:

- Date of exercise
- Exercises completed
- Number of repetitions performed
- Pain experienced during exercise
- Any adverse symptoms or discomfort

Exercise adherence and compliance will be reviewed and monitored during each treatment session.

RANDOMIZATION AND ALLOCATION

Following completion of the baseline evaluation, participants will be randomly assigned to either Group A or Group B.

A computer-generated randomization sequence will be utilized for group allocation. Allocation concealment may be maintained through the use of sequentially numbered, opaque, sealed envelopes, prepared by an individual who is not involved in participant assessment or outcome evaluation.

Whenever feasible, the outcome assessor will remain blinded to the treatment allocation of the participants to minimize assessment bias.

Table 1. Demographic and baseline characteristics

Variable	SSE Group (n=50)	Conventional Group (n=50)
Age (years), Mean $\pm$ SD	48.6 $\pm$ 7.2	49.1 $\pm$ 6.9
Male, n (%)	29 (58%)	27 (54%)
Female, n (%)	21 (42%)	23 (46%)
Right shoulder affected, n (%)	31 (62%)	30 (60%)



Left shoulder affected, n (%)	19 (38%)	20 (40%)
Duration of symptoms (months)	5.4 ± 2.1	5.7 ± 2.3

Table 2. Comparison of Pain (VAS, 0–10) before and after intervention

Group	Pre-treatment Mean ± SD	Post-treatment Mean ± SD	Mean Change
Scapular Stabilization (n=50)	6.4 ± 1.1	2.8 ± 1.0	3.6
Conventional Physiotherapy (n=50)	6.3 ± 1.2	3.7 ± 1.1	2.6

Interpretation: Both groups demonstrate reduction in pain, with a greater reduction in the Scapular Stabilization Exercise group.

Table 3. Comparison of Shoulder Function (SPADI) before and after intervention

Group	Pre-treatment Mean ± SD	Post-treatment Mean ± SD	Mean Improvement
Scapular Stabilization (n=50)	61.8 ± 8.7	32.4 ± 7.6	29.4
Conventional Physiotherapy (n=50)	60.9 ± 9.1	40.1 ± 8.2	20.8

Interpretation: Functional improvement is greater in the Scapular Stabilization Exercise group.



Table 4. Between-group statistical comparison of treatment outcomes

Outcome	SSE Mean Change	Conventional Mean Change	Mean Difference	p-value	Interpretation
VAS Pain	3.6 ± 1.0	2.6 ± 1.1	1.0	<0.001	Significant
SPADI	29.4 ± 6.8	20.8 ± 7.2	8.6	<0.001	Significant

The sample data indicate that Scapular Stabilization Exercises may be more effective than Conventional Physiotherapy in reducing pain and improving shoulder function in patients with rotator cuff tear.

Discussion:

The present comparison between scapular stabilization exercises and conventional physiotherapy can therefore be interpreted in terms of both pain reduction and functional improvement. Conventional physiotherapy remains an effective approach because gradual restoration of range of motion and muscle strength can reduce disability and improve confidence in using the affected arm. However, scapular stabilization provides a more specific neuromuscular intervention. Rather than concentrating only on the glenohumeral joint, it attempts to correct or improve the movement pattern of the entire shoulder complex¹⁷.

Evidence from recent research supports this concept. A 2025 systematic review of 11 randomized controlled trials involving 565 participants with rotator cuff pathologies reported that, in conservatively treated patients, additional scapular stabilization exercises produced large effects for reducing pain and improving function. The review also found substantial effects on shoulder abduction range of motion. In postoperative patients, scapular training was particularly beneficial for functional improvement, while combining scapular exercises with scapular manual interventions demonstrated important effects on pain

Conclusions

scapular stabilization exercises can be considered an effective component of physiotherapy rehabilitation for patients with rotator cuff tear, particularly when incorporated into a comprehensive treatment program.

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