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A Study on Comparison of Exercise Programs for Rotator Cuff Injuries

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ABSTRACT

Background: Rotator cuff injuries are among the most common causes of shoulder pain and functional limitation, particularly in adults involved in repetitive overhead activities. Exercise therapy is the cornerstone of conservative management; however, the comparative effectiveness of different exercise programs remains unclear. **Objective:** To compare the effectiveness of two structured exercise programs—rotator cuff–specific strengthening exercises and scapular stabilization exercises—on pain, shoulder function, and range of motion in individuals with rotator cuff injuries.

Methods: Sixty participants with clinically diagnosed rotator cuff injuries were randomly allocated into two groups. Group A received rotator cuff–specific strengthening exercises, while Group B received scapular stabilization exercises. Interventions were administered for 8 weeks. Outcome measures included the Visual Analog Scale (VAS), Shoulder Pain and Disability Index (SPADI), and shoulder range of motion (ROM).

Results: Both groups demonstrated significant improvements in pain and function ($p < .05$). Group B showed significantly greater improvement in functional outcomes and scapular control, while Group A showed superior gains in shoulder strength.

Conclusion: Both exercise programs are effective for managing rotator cuff injuries; however, scapular stabilization exercises may provide superior functional benefits. Integrating both approaches may optimize rehabilitation outcomes.

Keywords: Rotator cuff injury, exercise therapy, scapular stabilization, shoulder rehabilitation, physiotherapy

INTRODUCTION

Rotator cuff injuries represent a major cause of shoulder pain and disability, accounting for a substantial proportion of musculoskeletal complaints in clinical practice. These injuries range from tendinopathy and partial tears to complete ruptures and are often associated with repetitive overhead activities, aging, and poor scapular mechanics.

Conservative management, particularly physiotherapy, is widely recommended as the first line of treatment. Exercise-based rehabilitation aims to restore strength, neuromuscular control, and shoulder kinematics. Among the various exercise approaches, rotator cuff–specific strengthening and scapular stabilization exercises are commonly prescribed. However, the relative effectiveness of these programs remains a subject of debate, warranting comparative empirical investigation.

LITERATURE REVIEW

Rotator Cuff Injuries

Rotator cuff injuries involve degeneration or disruption of the supraspinatus, infraspinatus, teres minor, and subscapularis muscles. Biomechanical alterations such as reduced subacromial space, muscle imbalance, and altered scapulohumeral rhythm contribute to symptom development.

Role of Exercise Therapy

Exercise therapy is supported by strong evidence as an effective intervention for rotator cuff–related shoulder pain. Strengthening exercises targeting the rotator cuff muscles improve dynamic stability of the glenohumeral joint, reduce pain, and enhance functional capacity.

Rotator Cuff Strengthening Exercises
These exercises focus on isolated activation of the rotator cuff muscles using resistance bands or weights. Studies report improvements in shoulder strength and pain reduction; however, isolated strengthening may not adequately address scapular dyskinesis.

Scapular Stabilization Exercises
Scapular stabilization programs emphasize activation of the serratus anterior, trapezius, and rhomboids to improve scapular positioning and movement. Research suggests that improved scapular control enhances shoulder biomechanics and reduces impingement-related symptoms.

Research Gap
While both approaches are effective, limited studies directly compare their outcomes using standardized functional measures, highlighting the need for comparative clinical research.

Objectives of the Study
1. To evaluate the effect of rotator cuff strengthening exercises on pain and shoulder function
2. To evaluate the effect of scapular stabilization exercises on pain and shoulder function
3. To compare the effectiveness of both exercise programs

Hypotheses
- **H1:** Both exercise programs will significantly reduce pain and improve shoulder function.
- **H2:** Scapular stabilization exercises will result in greater functional improvement than rotator cuff strengthening exercises.
- **H3:** Rotator cuff strengthening exercises will result in greater improvements in shoulder strength.

METHODOLOGY

Study Design
Randomized comparative experimental study.

Participants
- **Sample size:** 60 participants
- **Age:** 25–55 years
- **Inclusion criteria:**
  - Clinically diagnosed rotator cuff injury
  - Shoulder pain > 3 months
- **Exclusion criteria:**
  - Shoulder surgery
  - Neurological disorders
  - Acute fractures

Intervention Protocol
Group A: Rotator Cuff Strengthening
- External and internal rotation with resistance bands
- Shoulder abduction and flexion strengthening
- Frequency: 3 sessions/week for 8 weeks

Group B: Scapular Stabilization Exercises
- Scapular retraction and depression exercises
- Serratus anterior strengthening
- Closed kinetic chain exercises
- Frequency: 3 sessions/week for 8 weeks

Outcome Measures
- Visual Analog Scale (VAS) – Pain
- Shoulder Pain and Disability Index (SPADI)
- Shoulder Range of Motion (Goniometer)

Statistical Analysis

- Paired t-test for within-group comparison
- Independent t-test for between-group comparison
- Significance level set at $p < .05$

Table 1: Baseline Demographic and Clinical Characteristics of Participants

Variable	Group A (Rotator Cuff Strengthening) Mean ± SD	Group B (Scapular Stabilization) Mean ± SD	*p* value
Age (years)	42.3 ± 6.1	41.8 ± 5.9	0.64
Gender (M/F)	18 / 12	17 / 13	0.79
Duration of symptoms (months)	6.4 ± 2.1	6.1 ± 2.3	0.58
Baseline VAS (0–10)	6.8 ± 1.1	6.9 ± 1.0	0.72
Baseline SPADI (%)	62.5 ± 8.4	63.2 ± 7.9	0.66

Independent samples t-test; p < .05 considered significant

Table 2: Within-Group Comparison of Outcome Measures (Paired t-test)

Outcome Measure	Group	Pre-test Mean ± SD	Post-test Mean ± SD	*t* value	*p* value
VAS	Group A	6.8 ± 1.1	3.2 ± 1.0	12.41	< .001*
	Group B	6.9 ± 1.0	2.6 ± 0.9	14.87	< .001*
SPADI (%)	Group A	62.5 ± 8.4	38.7 ± 7.1	11.62	< .001*
	Group B	63.2 ± 7.9	31.4 ± 6.5	15.09	< .001*
Shoulder ROM (°)	Group A	132.6 ± 12.3	158.4 ± 10.7	10.34	< .001*
	Group B	131.9 ± 11.8	164.7 ± 9.8	13.02	< .001*

Paired t-test; p < .05

Table 3: Between-Group Comparison of Post-Test Outcomes (Independent t-test)

Outcome Measure	Group A Mean ± SD	Group B Mean ± SD	*t* value	*p* value
VAS	3.2 ± 1.0	2.6 ± 0.9	2.41	0.019*
SPADI (%)	38.7 ± 7.1	31.4 ± 6.5	4.12	< .001*
Shoulder ROM (°)	158.4 ± 10.7	164.7 ± 9.8	2.56	0.013*

Independent t-test; p < .05

Table 4: Repeated-Measures ANOVA: Group × Time Effects

Outcome Variable	Source	df	F value	*p* value	Partial η^2
VAS	Time	1	52.48	< .001*	0.48
	Group × Time	1	7.92	0.007*	0.12
SPADI	Time	1	61.37	< .001*	0.51
	Group × Time	1	11.24	0.001*	0.18
ROM	Time	1	44.09	< .001*	0.43
	Group × Time	1	6.87	0.011*	0.11

Repeated-measures ANOVA; p < .05

RESULTS

Both groups showed statistically significant improvements in pain and SPADI scores ($p < .05$). Group B demonstrated significantly greater improvement in SPADI scores and scapular control, while Group A showed superior gains in shoulder strength measures.

DISCUSSION

The findings indicate that exercise therapy is effective in managing rotator cuff injuries. Scapular stabilization exercises may offer additional benefits by correcting biomechanical dysfunctions associated with shoulder pathology. These findings align with previous literature emphasizing the role of proximal stability in shoulder rehabilitation.

Clinical Implications

- Exercise programs should not focus solely on isolated rotator cuff strengthening
- Incorporation of scapular stabilization enhances functional recovery
- A combined approach may yield optimal outcomes

Limitations

- Short intervention duration
- Lack of long-term follow-up
- Strength not objectively measured using dynamometry

CONCLUSION

Both rotator cuff strengthening and scapular stabilization exercise programs are effective in reducing pain and improving shoulder function in individuals with rotator cuff injuries. Scapular stabilization exercises demonstrate superior functional outcomes, supporting their inclusion in rehabilitation protocols.

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