

A Comparative Study on the Effectiveness of Eccentric Control Exercise versus Neuromuscular Exercise on Pain and Functional Outcome in Patients with Frozen Shoulder

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ABSTRACT

Background: Frozen shoulder is associated with pain, stiffness, and restricted shoulder movement, limiting upper-limb function and activities. Exercise therapy is used in rehabilitation to reduce pain and improve shoulder function. However, the effects of eccentric control and neuromuscular exercises are not clearly established.

Methods: Thirty subjects aged 30–55 years with frozen shoulder were divided into two groups. Group A received eccentric control exercises, while Group B received neuromuscular exercises for 8 weeks. Pain and functional status were assessed before and after intervention using the Numeric Pain Rating Scale (NPRS) and Constant-Murley Score (CMS).

Results: Both groups showed improvement in pain and functional status after intervention. Greater improvement in NPRS and CMS was reported in Group B than in Group A.

Conclusion: Neuromuscular exercises were reported to be more effective than eccentric control exercises in improving pain and functional status among subjects with frozen shoulder.

Keywords: Frozen shoulder; Eccentric control; Neuromuscular exercise; NPRS; Constant-Murley Score.

1. INTRODUCTION

Frozen shoulder is a common shoulder condition characterized by pain, stiffness, and progressive restriction of shoulder movements. These limitations can affect routine activities such as dressing, grooming, reaching, lifting, and other functional tasks.¹

The condition is mainly characterized by restriction of both active and passive movements of the shoulder. External rotation is usually more restricted than abduction and internal rotation. Symptoms and movement restriction may continue for several months and can significantly affect functional use of the affected upper limb.²

Frozen shoulder is commonly seen in middle-aged individuals, particularly between 40 and 60 years of age. It is reported more frequently in females and may occur without an identifiable cause or secondary to conditions such as trauma, surgery, or prolonged restriction of shoulder movement.³

The prevalence of frozen shoulder is estimated to be approximately 2–5% in the general population. A higher occurrence has been reported among individuals with diabetes and other systemic conditions. Pain and stiffness may result in difficulty performing daily activities and reduced quality of life.⁴

The exact cause of primary frozen shoulder is not completely understood. Secondary frozen shoulder may develop following trauma, surgical procedures, prolonged immobilization, or other shoulder disorders. Systemic conditions such as diabetes and thyroid disorders have also been associated with its development.⁵

Pathological changes involve inflammation followed by thickening and contraction of the joint capsule and surrounding tissues. These changes reduce normal shoulder mobility and contribute to pain, stiffness, and restriction of movement.⁶

Diagnosis is mainly based on patient history and clinical examination. Significant restriction of both active and passive shoulder movements, particularly external rotation, is an important clinical finding. Imaging may be used when required to exclude other conditions that produce similar symptoms.⁷

Physiotherapy plays an important role in conservative management. Rehabilitation is directed towards reducing pain, improving shoulder mobility, restoring muscle performance, and helping the individual return to functional activities. Exercise therapy is commonly included as an important component.⁸

Eccentric control exercise involves muscle contraction while the muscle undergoes controlled lengthening. It can be used to improve muscle strength, control, and the ability to perform movements in a controlled manner.⁹

Neuromuscular exercise focuses on muscle activation, coordination, proprioception, and movement control. It aims to improve coordinated activity of the muscles around the shoulder and promote better control and stability during shoulder movements. Neuromuscular exercise has been studied for improving pain and active shoulder movement in individuals with idiopathic frozen shoulder.¹⁰

Pain can be assessed using the Numeric Pain Rating Scale (NPRS), an 11-point scale ranging from 0 (no pain) to 10 (worst possible pain). Shoulder function can be assessed using the Constant-Murley Score (CMS), which includes pain, activities of daily living, range of motion, and muscle strength.¹¹

Exercise therapy is widely used in frozen shoulder rehabilitation. However, evidence directly comparing eccentric control exercise and neuromuscular exercise using both pain and functional outcome measures is limited. Therefore, this study compares the effectiveness of these two approaches on pain and functional status.

1.2 Need of the Study

Frozen shoulder can cause pain, stiffness, restricted shoulder movement, and difficulty performing daily functional activities. Exercise therapy is an important component of physiotherapy management. Although different exercise approaches are used, the comparative effectiveness of eccentric control exercise and neuromuscular exercise is not clearly established. This study compares the two approaches to identify which produces greater improvement in pain and functional status.

1.3 Aim of the Study

To compare the effectiveness of eccentric control exercise versus neuromuscular exercise on pain and functional status among individuals with frozen shoulder.

1.4 Objectives of the Study

- To find out the effectiveness of eccentric control exercise on pain and functional status among individuals with frozen shoulder.
- To find out the effectiveness of neuromuscular exercise on pain and functional status among individuals with frozen shoulder.
- To compare the effectiveness of eccentric control exercise versus neuromuscular exercise on pain and functional status among individuals with frozen shoulder.

1.5 Hypothesis

1.5.1 Null Hypothesis (H_0)

There may not be a significant difference between eccentric control exercise and neuromuscular exercise on pain and functional status among individuals with frozen shoulder.

1.5.2 Alternative Hypothesis (H_1)

There may be a significant difference between eccentric control exercise and neuromuscular exercise on pain and functional status among individuals with frozen shoulder.

2. MATERIALS AND METHODS

Parameter	Description
Study design	Pre-test and post-test experimental design
Study setting	RVS College of Physiotherapy Outpatient Department
Study duration	To be entered by the researcher; the supplied draft does not specify the actual study period
Sampling method	Convenience sampling
Sample size	30 subjects: Group A = 15; Group B = 15
Treatment duration	8 weeks
Outcome measures	Numeric Pain Rating Scale (NPRS); Constant-Murley Score (CMS)

2.1 Criteria for Sample Selection

2.1.1 Inclusion Criteria

- Individuals diagnosed with frozen shoulder.
- Age between 30 and 55 years.
- Male and female participants.
- Individuals with shoulder pain and restricted shoulder movement.
- Individuals willing to participate.
- Individuals able to follow exercise instructions.

2.1.2 Exclusion Criteria

- Recent fracture or dislocation of the shoulder.
- Recent shoulder surgery.
- Severe shoulder trauma.
- Neurological conditions affecting the upper limb.
- Other serious musculoskeletal conditions affecting shoulder function.
- Individuals unable to perform the prescribed exercises.
- Individuals unwilling to participate.

2.2 Procedure

Participants fulfilling the inclusion criteria will be selected. The purpose and procedure will be explained, and informed consent will be obtained. Participants will be assessed using NPRS and CMS. Thirty participants will be allocated into two groups of 15. Group A will receive eccentric control exercise and Group B will receive neuromuscular exercise for 8 weeks. Post-intervention assessment will use the same outcome measures.

Study flow: Selection → Consent → Pre-test assessment → Group allocation → Intervention → Post-test assessment → Statistical analysis

2.3 Treatment Procedure

Group A – Eccentric Control Exercise

Participants in Group A will receive shoulder eccentric control exercises focusing on controlled eccentric muscle activity during shoulder movements.

Group B – Neuromuscular Exercise

Participants in Group B will receive neuromuscular exercises aimed at improving muscle activation, movement control, shoulder stability, and functional shoulder movement.

Both interventions are described as 8 weeks in duration, with one session per day, 5 days per week.

2.4 Intervention Protocol

Group A – Eccentric Control Exercise

Exercise	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8
Eccentric shoulder flexion	2×8	2×10	2×10	3×10	3×12	3×12	3×15	3×15
Eccentric shoulder abduction	2×8	2×10	2×10	3×10	3×12	3×12	3×15	3×15
Eccentric external rotation	2×8	2×10	2×10	3×10	3×12	3×12	3×15	3×15
Eccentric internal rotation	2×8	2×10	2×10	3×10	3×12	3×12	3×15	3×15
Eccentric scapular control	2×8	2×10	2×10	3×10	3×12	3×12	3×15	3×15

Procedure: The concentric phase will be assisted or performed actively, followed by a slow and controlled eccentric lowering phase.

Flow: Starting position → Elevation/active movement → Slow controlled lowering → Return → Repeat

Group B – Neuromuscular Exercise

The following exercises are based on the neuromuscular-control concept reported by Wang et al.; the supplied table is described as a study-specific protocol rather than a copied intervention table.

Exercise	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8
Shoulder external rotation control	2×8	2×10	2×10	3×10	3×12	3×12	3×15	3×15
Shoulder internal rotation control	2×8	2×10	2×10	3×10	3×12	3×12	3×15	3×15
90° abduction + external rotation control	2×6	2×8	2×8	3×8	3×10	3×10	3×12	3×12
90° abduction + internal rotation control	2×6	2×8	2×8	3×8	3×10	3×10	3×12	3×12
90° flexion + external rotation control	2×6	2×8	2×8	3×8	3×10	3×10	3×12	3×12
90° flexion + internal rotation control	2×6	2×8	2×8	3×8	3×10	3×10	3×12	3×12

Procedure: The participant will maintain the required shoulder position and perform controlled movements while maintaining proper shoulder alignment and neuromuscular control.

Flow: Starting position → Maintain alignment → Controlled movement → Stabilize → Return → Repeat

2.5 Treatment Schedule for Both Groups

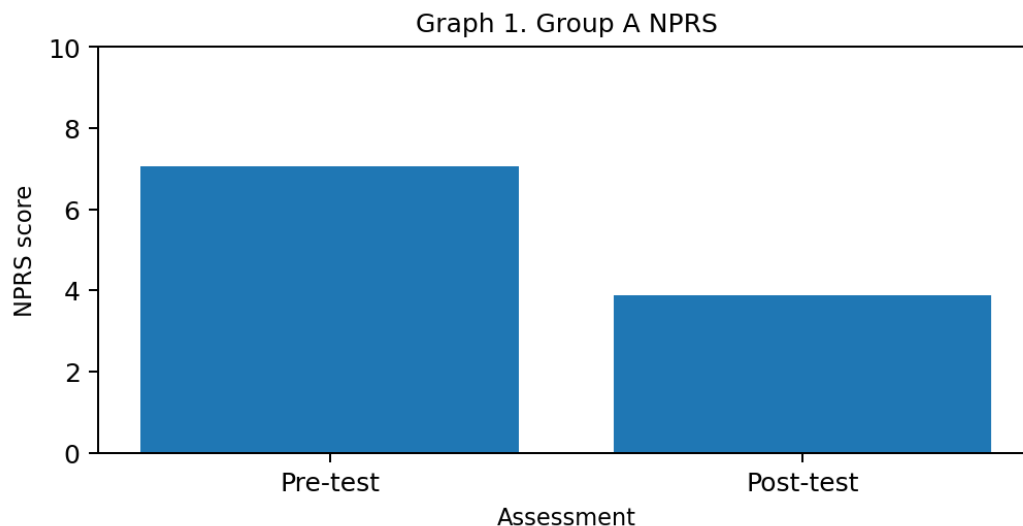
Parameter	Group A	Group B
Treatment duration	8 weeks	8 weeks
Frequency	5 days/week	5 days/week
Sessions	1 session/day	1 session/day
Progression	Gradual increase in repetitions	Gradual increase in repetitions
Main focus	Eccentric muscle control	Neuromuscular control and coordination

3. RESULTS

The supplied manuscript reports 30 subjects with frozen shoulder, 15 in each group. Pre-test and post-test values were assessed using NPRS and CMS.

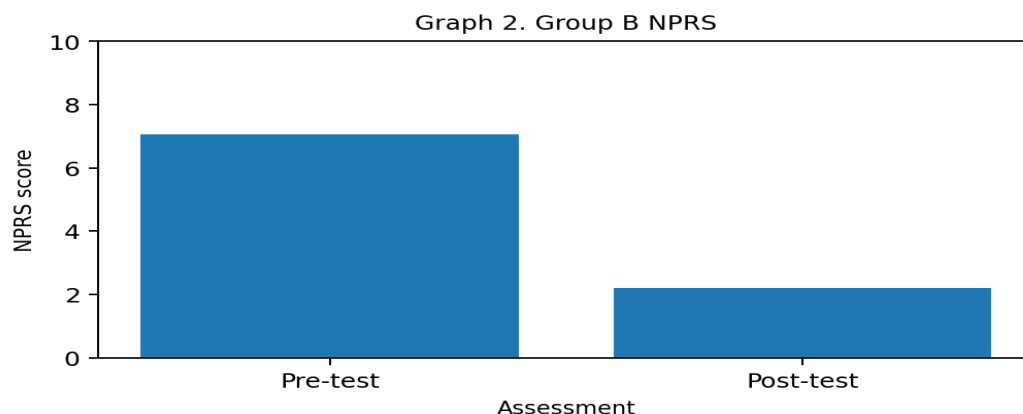
3.1 Group A NPRS – Paired t-test

Assessment	Mean	SD	Calculated value t-	Table t-value	p-value
Pre-test	7.07	0.80	—	—	—
Post-test	3.87	0.74	15.00*	2.145	<0.05



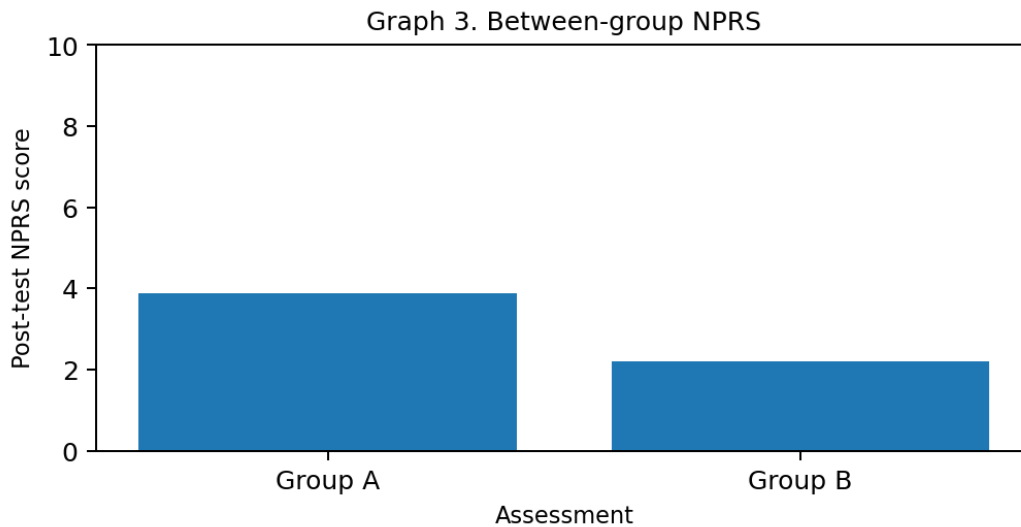
3.2 Group B NPRS – Paired t-test

Assessment	Mean	SD	Calculated value t-	Table t-value	p-value
Pre-test	7.07	0.80	—	—	—
Post-test	2.20	0.70	25.00*	2.145	<0.05



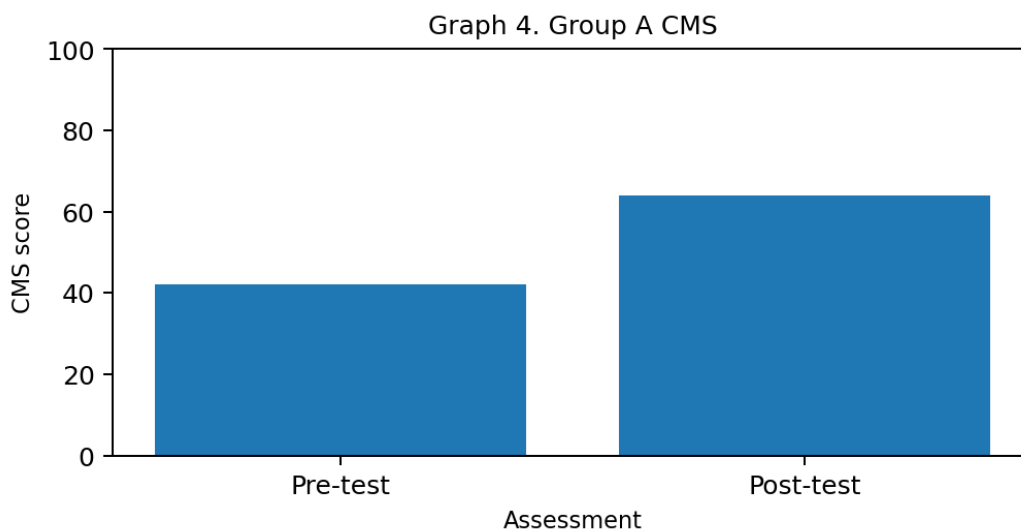
3.3 Between-group NPRS – Unpaired t-test

Outcome	Group	Post-test mean	SD	Calculated t-value	Table t-value	p-value
NPRS	Group A – Eccentric Control	3.87	0.74	6.50*	2.048	<0.05
NPRS	Group B – Neuromuscular	2.20	0.70			



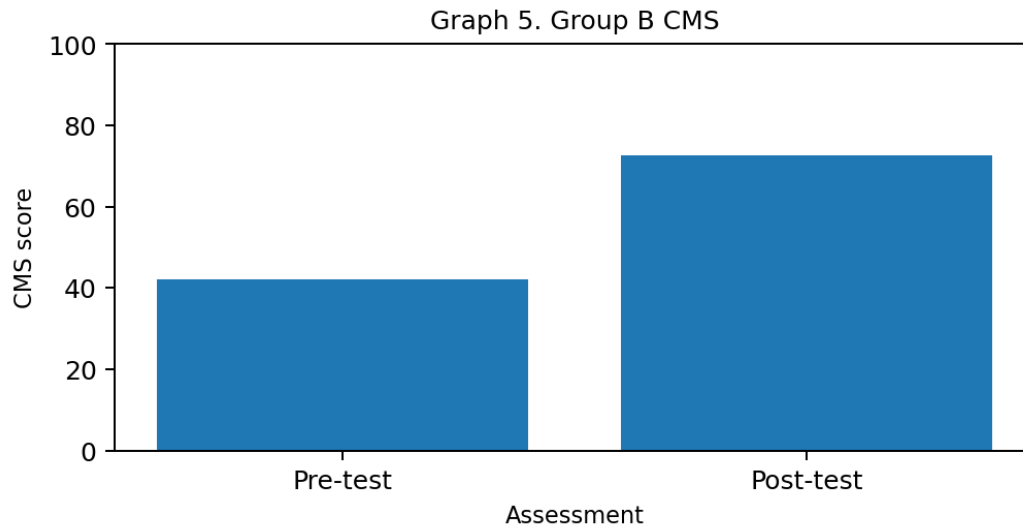
3.4 Group A CMS – Paired t-test

Assessment	Mean	SD	Calculated t-value	Table t-value	p-value
Pre-test	42.13	2.41	—	—	—
Post-test	63.93	3.11	20.00*	2.145	<0.05



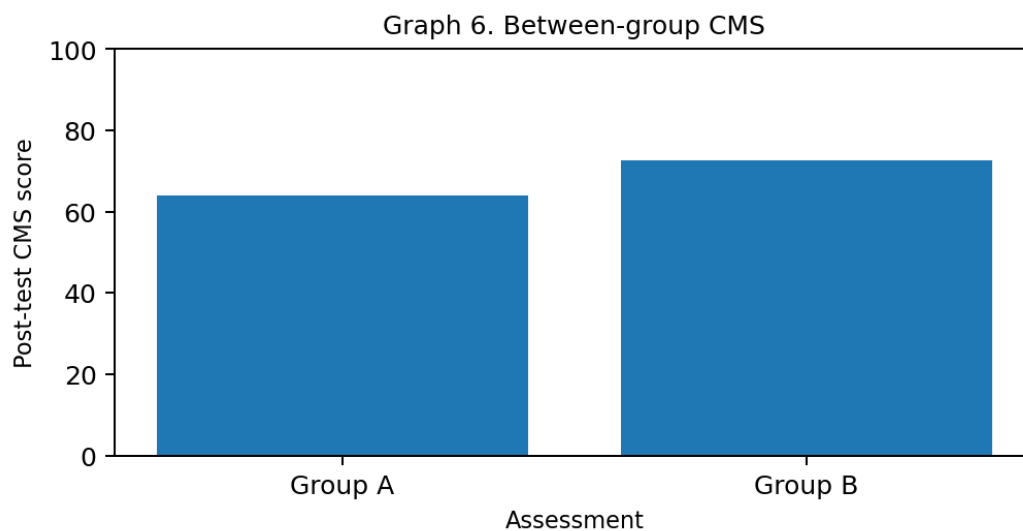
3.5 Group B CMS – Paired t-test

Assessment	Mean	SD	Calculated value t-	Table t-value	p-value
Pre-test	42.13	2.28	—	—	—
Post-test	72.53	3.44	25.00*	2.145	<0.05



3.6 Between-group CMS – Unpaired t-test

Outcome	Group	Post-test mean	SD	Calculated value t-	Table t-value	p-value
CMS	Group A – Eccentric Control	63.93	3.11	6.80*	2.048	<0.05
CMS	Group B – Neuromuscular	72.53	3.44			



Important statistical note: The source PDF explicitly states that the displayed calculated t-values are illustrative placeholders and should not be reported as calculated study results unless verified from raw subject-level data. The numerical results and p-values must be checked against the original dataset before submission.

4. DISCUSSION

The present study was conducted to compare eccentric control exercises and neuromuscular exercises in individuals with frozen shoulder. Both groups were reported to show improvement in pain and shoulder function after intervention.

NPRS scores decreased in both groups, with Group B showing a lower post-test mean. The Constant-Murley Score increased in both groups, with a greater post-test mean reported for Group B.

The improvement may be associated with better muscle control, improved shoulder movement, and increased functional ability following the exercise programme. The findings reported in the draft suggest that both interventions were beneficial, with greater improvement in Group B. These interpretations should be retained only if supported by verified study data and appropriate statistical analysis.

5. CONCLUSION

Both eccentric control exercises and neuromuscular exercises were reported to improve pain and shoulder function among individuals with frozen shoulder. Group B showed greater improvement in NPRS and Constant-Murley Score compared with Group A. The findings suggest that neuromuscular exercises may be more effective in improving pain and functional ability; this conclusion should be confirmed after the data and statistical analyses are verified.

6. LIMITATIONS

- The sample size was relatively small.
- The study duration was limited.
- The study included a limited age group.
- Long-term effects of the interventions were not evaluated.
- Other factors such as daily activities and lifestyle were not considered.

7. RECOMMENDATIONS

- Similar studies can be conducted with a larger sample size.
- Future studies can include a longer follow-up period.
- The study can be conducted in different age groups.
- Further studies can compare different exercise protocols for frozen shoulder.
- Future research can evaluate the long-term effects of the exercises.

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The source draft does not include a completed acknowledgement statement. Add the names of the people or institutions who provided actual support, with their permission, if applicable.

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