



Effect of Scapular Stabilization Exercises on Myofascial Pain Dysfunction Syndrome: A Randomized Controlled Trial

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ABSTRACT

Background: Myofascial Pain Dysfunction Syndrome (MPDS) is a common musculoskeletal disorder affecting the masticatory muscles and temporomandibular joint. Altered posture, cervical dysfunction, and impaired scapular stability have been associated with the persistence of pain and functional limitations. Scapular stabilization exercises may improve postural alignment, reduce muscle overload, and alleviate symptoms in individuals with MPDS. **Aim:** To evaluate the effect of scapular stabilization exercises on pain intensity, mandibular function, and quality of life in patients with MPDS. **Materials and Methods:** This prospective interventional study included 40 patients diagnosed with MPDS, randomly allocated into two groups (n = 20 each). Group A received conventional therapy, including jaw exercises, moist heat therapy, and patient education. Group B received conventional therapy combined with a structured scapular stabilization exercise program for six weeks. Outcome measures included pain intensity using the Visual Analog Scale (VAS), maximum mouth opening (MMO), pressure pain threshold (PPT), and jaw functional limitation assessed using the Jaw Functional Limitation Scale (JFLS). Assessments were performed at baseline and after six weeks. Statistical analysis was performed using paired and independent t-tests, with a significance level of $p < 0.05$. **Results:** Both groups demonstrated significant improvement after treatment; however, Group B showed significantly greater reductions in pain intensity and functional limitation, along with greater improvements in maximum mouth opening and pressure pain threshold compared with Group A ($p < 0.05$). **Conclusion:** Incorporating scapular stabilization exercises into conventional management of MPDS provides superior improvements in pain reduction, jaw function, and overall functional outcomes compared with conventional therapy alone. These findings support the integration of postural and scapular rehabilitation into the multidisciplinary management of patients with MPDS.

INTRODUCTION:

Myofascial Pain Dysfunction Syndrome is one of the most common musculoskeletal disorders affecting the

masticatory system and represents a major subgroup of temporomandibular disorders.^{1,2} It is characterized by pain in the masticatory muscles, muscle tenderness, restricted mandibular movements, joint dysfunction, and the presence of myofascial trigger points. The condition adversely affects mastication, speech, and daily activities, thereby reducing patients' quality of life. The etiology of MPDS is multifactorial and includes parafunctional habits, emotional stress, occlusal disturbances, muscle overuse, cervical dysfunction, and postural abnormalities.^{3,4}

Recent evidence suggests that the temporomandibular region functions as part of an integrated cranio-cervico-scapular complex rather than as an isolated anatomical unit.⁵ Alterations in head posture and cervical spine alignment can influence the biomechanics of the temporomandibular joint and masticatory muscles through interconnected muscular and fascial chains. Forward head posture and scapular dyskinesis are commonly observed in individuals with MPDS and are associated with increased muscle activity, reduced cervical stability, and persistent myofascial pain. Consequently, rehabilitation strategies targeting postural correction have gained increasing attention in the management of MPDS.^{6,7}

Conventional management of MPDS primarily includes patient education, behavioral modification, pharmacotherapy, moist heat therapy, jaw exercises, manual therapy, occlusal splints, and physiotherapy. Although these interventions effectively reduce symptoms in many patients, recurrence of pain and functional impairment remains common, particularly when underlying postural dysfunction is not addressed. Therefore, incorporating exercises that restore scapular stability may provide additional therapeutic benefits by improving neuromuscular control, optimizing cervical and shoulder girdle mechanics, and reducing excessive loading on the masticatory muscles.^{8,9}

Scapular stabilization exercises are designed to strengthen the scapular stabilizing muscles, particularly the serratus anterior, middle trapezius, and lower trapezius, while promoting proper scapular positioning and postural alignment. Improved scapular stability enhances cervical muscle function, decreases mechanical stress on the craniofacial musculature, and may contribute to reductions in pain and improvements in mandibular function. Despite the recognized biomechanical relationship between the scapula, cervical spine, and temporomandibular region, clinical evidence regarding the effectiveness of scapular stabilization exercises in patients with MPDS remains limited.^{10,11}

Therefore, the present study was undertaken to evaluate the effectiveness of scapular stabilization exercises as an

adjunct to conventional therapy in patients with Myofascial Pain Dysfunction Syndrome.

MATERIAL AND METHOD

This prospective, randomized, controlled interventional study was conducted to evaluate the effect of scapular stabilization exercises on patients with Myofascial Pain Dysfunction Syndrome (MPDS). The study was carried out in the Department of Physiotherapy in collaboration with the Department of Oral Medicine and Radiology at a tertiary care teaching hospital after obtaining approval from the Institutional Ethics Committee. Written informed consent was obtained from all participants before enrollment, and the study was conducted in accordance with the ethical principles of the Declaration of Helsinki.

A total of 40 patients aged between 18 and 50 years who were clinically diagnosed with MPDS according to the Research Diagnostic Criteria for Temporomandibular Disorders (RDC/TMD) were included in the study. Patients presenting with pain in the masticatory muscles for at least three months, tenderness on palpation, painful jaw movements, and reduced maximum mouth opening were considered eligible. Patients with a history of temporomandibular joint trauma or surgery, degenerative or inflammatory temporomandibular joint disorders, neurological diseases, cervical spine disorders requiring surgical management, pregnancy, or those undergoing physiotherapy for temporomandibular disorders were excluded from the study.

The participants were randomly allocated into two groups of 20 patients each using a computer-generated randomization sequence. Group A received conventional therapy consisting of patient education regarding postural correction and avoidance of parafunctional habits, moist heat application over the masticatory muscles for 15 minutes, jaw relaxation exercises, controlled mouth-opening exercises, isometric jaw exercises, and stretching exercises for the masticatory muscles. Group B received the same conventional therapy in addition to a structured scapular stabilization exercise program. The exercise protocol included scapular retraction, scapular depression, serratus anterior strengthening using wall push-up plus exercises, lower trapezius strengthening through prone Y raises, middle trapezius strengthening through prone T raises, resistance band rowing exercises, and postural correction exercises. Each exercise was performed in three sets of ten repetitions under the supervision of a physiotherapist. Treatment sessions were conducted three times per week for six weeks, and participants were instructed to continue the prescribed home exercise program throughout the study period.

Outcome measures were recorded at baseline and after

completion of the six-week intervention by an assessor blinded to the treatment allocation. Pain intensity was evaluated using the Visual Analog Scale (VAS), while maximum mouth opening was measured in millimeters using a digital Vernier caliper. Pressure pain threshold was assessed with a handheld pressure algometer. Functional disability was evaluated using the Jaw Functional Limitation Scale (JFLS), and neck-related disability was assessed using the Neck Disability Index (NDI). Scapular alignment and stability were assessed using the Lateral Scapular Slide Test.

The collected data were analyzed using SPSS version 26.0. Continuous variables were expressed as mean $\pm$ standard deviation. Within-group comparisons were performed using the paired t-test, while between-group comparisons were analyzed using the independent t-test. A p-value of less than 0.05 was considered statistically significant.

RESULTS

A total of 40 participants completed the study, with 20 participants in each group. No participant withdrew during the intervention period, and all patients were included in the final statistical analysis.

At baseline, there were no statistically significant differences between Group A (conventional therapy) and Group B (conventional therapy combined with scapular stabilization exercises) regarding age, sex distribution, pain intensity, maximum mouth opening, pressure pain threshold, Jaw Functional Limitation Scale (JFLS) score, Neck Disability Index (NDI) score, or scapular alignment ($p > 0.05$), indicating that both groups were comparable

before treatment.

Following the six-week intervention, both groups demonstrated significant improvements in all outcome measures compared with their respective baseline values ($p < 0.05$). However, participants in Group B exhibited significantly greater reductions in pain intensity measured by the Visual Analog Scale (VAS) than those in Group A ($p < 0.001$). Group B also showed a significantly greater increase in maximum mouth opening and pressure pain threshold, indicating improved mandibular mobility and reduced muscle tenderness ($p < 0.001$).

The Jaw Functional Limitation Scale scores decreased significantly in both groups, with the experimental group demonstrating a greater improvement in jaw function compared with the control group ($p < 0.001$). Similarly, Neck Disability Index scores showed a significantly greater reduction in Group B, reflecting improved cervical function and postural control ($p < 0.05$). Assessment of scapular alignment using the Lateral Scapular Slide Test also revealed a significant improvement in the experimental group compared with the control group ($p < 0.05$).

Overall, the addition of scapular stabilization exercises to conventional therapy resulted in superior clinical outcomes, including greater pain reduction, improved mandibular function, enhanced cervical function, and better scapular stability than conventional therapy alone. These findings suggest that scapular stabilization exercises are an effective adjunctive treatment in the rehabilitation of patients with Myofascial Pain Dysfunction Syndrome (Table 1).

Table 1. Comparison of Outcome Measures Between Groups at Baseline and After 6 Weeks

Outcome Measure	Group A (Conventional Therapy) Mean $\pm$ SD	Group B (Conventional + Scapular Stabilization) Mean $\pm$ SD	p-value
VAS Pain Score (Baseline)	7.24 $\pm$ 0.82	7.18 $\pm$ 0.79	0.812
VAS Pain Score (6 Weeks)	3.82 $\pm$ 0.74	1.76 $\pm$ 0.61	<0.001*
Maximum Mouth Opening (mm) (Baseline)	31.6 $\pm$ 3.4	31.9 $\pm$ 3.2	0.764
Maximum Mouth Opening (mm) (6 Weeks)	37.8 $\pm$ 2.8	42.5 $\pm$ 2.5	<0.001*
Pressure Pain Threshold (kg/cm ²) (Baseline)	2.36 $\pm$ 0.42	2.39 $\pm$ 0.40	0.841
Pressure Pain Threshold (kg/cm ²) (6 Weeks)	3.42 $\pm$ 0.38	4.18 $\pm$ 0.41	<0.001*
JFLS Score (Baseline)	38.5 $\pm$ 5.6	39.1 $\pm$ 5.2	0.726
JFLS Score (6 Weeks)	23.8 $\pm$ 4.3	14.6 $\pm$ 3.8	<0.001*
NDI Score (Baseline)	20.3 $\pm$ 3.8	20.7 $\pm$ 3.5	0.781
NDI Score (6 Weeks)	13.4 $\pm$ 2.9	8.2 $\pm$ 2.5	<0.001*
LSST Difference (cm) (Baseline)	1.42 $\pm$ 0.32	1.39 $\pm$ 0.29	0.752
LSST Difference (6 Weeks)	0.94 $\pm$ 0.21	0.48 $\pm$ 0.17	<0.001*

VAS: Visual Analog Scale; JFLS: Jaw Functional Limitation Scale; NDI: Neck Disability Index; LSST:

Lateral Scapular Slide Test.; *Statistically significant at $p < 0.05$.

DISCUSSION

The present study evaluated the effectiveness of scapular stabilization exercises as an adjunct to conventional therapy in patients with Myofascial Pain Dysfunction Syndrome (MPDS). The findings demonstrated that both conventional therapy alone and conventional therapy combined with scapular stabilization exercises significantly improved pain intensity, maximum mouth opening, pressure pain threshold, jaw function, neck disability, and scapular stability after six weeks. However, participants who received scapular stabilization exercises exhibited significantly greater improvements in all outcome measures, suggesting that addressing the scapulocervical complex enhances the overall management of MPDS.

The significant reduction in pain observed in the experimental group may be attributed to improved neuromuscular control of the scapular stabilizing muscles, resulting in better postural alignment and reduced overload of the cervical and masticatory muscles. Scapular stabilization exercises strengthen the serratus anterior and trapezius muscles, thereby improving scapular positioning and decreasing excessive muscle activity in the cranio-cervical region. This biomechanical improvement may reduce myofascial trigger point activation and muscle fatigue, leading to a reduction in pain intensity.¹²⁻¹⁴

The improvement in maximum mouth opening observed in the experimental group indicates enhanced mandibular mobility following correction of postural dysfunction. Abnormal head and shoulder posture has been shown to alter mandibular mechanics by increasing tension within the cervical musculature and associated fascial structures. Restoration of scapular stability may therefore improve the functional relationship between the cervical spine and temporomandibular region, facilitating more efficient jaw movements.

Participants receiving scapular stabilization exercises also demonstrated greater improvements in pressure pain threshold and Jaw Functional Limitation Scale scores, indicating reduced muscle tenderness and enhanced functional capacity. These findings suggest that rehabilitation directed at the scapulothoracic region not only decreases pain but also improves performance during activities such as chewing, speaking, and mouth opening. Similarly, the greater reduction in Neck Disability Index scores supports the concept that cervical dysfunction plays a significant role in the pathophysiology of MPDS and that improving cervical stability contributes to symptom relief.^{15,16}

The observed improvement in scapular alignment further confirms the effectiveness of the exercise protocol in restoring normal scapular biomechanics. Appropriate

activation of the scapular stabilizers provides a stable base for cervical muscle function and helps maintain optimal head posture. Since the cervical spine, scapula, and temporomandibular joint function as an integrated kinetic chain, correction of scapular dysfunction may reduce abnormal mechanical loading transmitted to the masticatory muscles and temporomandibular joint.

The findings of the present study are consistent with previous research demonstrating an association between forward head posture, cervical dysfunction, and temporomandibular disorders. Earlier studies have reported that physiotherapy interventions focusing on posture correction and cervical rehabilitation improve pain and jaw function in patients with MPDS. The present study extends these observations by demonstrating that a structured scapular stabilization exercise program provides additional clinical benefits when combined with conventional therapy.

The study has certain limitations. The sample size was relatively small, and the intervention period was limited to six weeks. Long-term follow-up was not performed to determine the persistence of treatment effects. Furthermore, electromyographic evaluation of scapular and masticatory muscle activity was not included. Future studies involving larger sample sizes, multicenter designs, longer follow-up periods, and objective biomechanical assessments are recommended to further establish the role of scapular stabilization exercises in the management of MPDS.

Overall, the findings indicate that incorporating scapular stabilization exercises into conventional treatment protocols provides superior outcomes in reducing pain, improving mandibular function, enhancing cervical function, and restoring postural stability in patients with MPDS. These results support the inclusion of scapular rehabilitation as an important component of multidisciplinary management for Myofascial Pain Dysfunction Syndrome.

CONCLUSION

The present study demonstrated that the addition of scapular stabilization exercises to conventional therapy resulted in significantly greater improvements in pain intensity, maximum mouth opening, pressure pain threshold, jaw function, neck disability, and scapular stability in patients with Myofascial Pain Dysfunction Syndrome compared with conventional therapy alone. These findings highlight the importance of addressing postural and scapulocervical dysfunction in the comprehensive management of MPDS.

Scapular stabilization exercises enhance neuromuscular

control, improve postural alignment, and reduce mechanical stress on the cervical and masticatory muscles, thereby contributing to improved functional outcomes. Incorporating these exercises into routine physiotherapy protocols may provide a simple, non-invasive, and cost-effective adjunctive treatment for patients with MPDS.

Further multicenter randomized controlled trials with larger sample sizes and long-term follow-up are warranted to confirm these findings and establish standardized rehabilitation protocols for the management of Myofascial Pain Dysfunction Syndrome.

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