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Comparative Efficacy of Magnesium Sulfate with versus without Local Anesthesia in Myofascial Pain Dysfunction Syndrome: A Prospective Study

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ABSTRACT

Background: Myofascial Pain Dysfunction Syndrome (MPDS) is a neuromuscular disorder characterized by myofascial trigger points—hyperirritable nodules within taut bands of skeletal muscle that cause localized or referred pain as well as autonomic symptoms.
Objective: This research aimed to evaluate magnesium sulfate's ($MgSO_4$) efficacy as a standalone treatment versus combination with conventional plain local anesthetic for myofascial pain dysfunction syndrome (MPDS). It also examined how demographic factors affected treatment results and compared them with the control group that had been administered standardized local anesthesia.
Method: A prospective study analysis is used for 40 patients (20 MPDS patients subdivided into $MgSO_4$ + anesthesia [n=10] and $MgSO_4$ monotherapy [n=10], alongside a control group [n=20]) assessed pain severity (Visual Analog Scale, VAS), functional recovery, and adverse events over a 9-month follow-up.
Results: Statistical analyses (ANOVA, chi-square) demonstrated that combined therapy resulted in complete symptom relief (VAS: 0/10) for all patients, matching the control group's 100% pain-free outcomes ($p>0.1$). Conversely, $MgSO_4$ alone achieved only partial relief (50–60% VAS reduction), and 90% of the patients reported transient injection-site discomfort. Those aged 18–30 showed better recovery (100% versus 85% in older age groups, $p=0.03$), while quitting habits like 'chat' chewing was observed in faster improvement ($p<0.01$).
Conclusion: The study confirms that $MgSO_4$ combined with anesthesia performs as effectively as the control protocol, supporting tailored multimodal approaches: adjunctive anesthesia maximizes pain relief & function recovery. These findings highlight the role of age and lifestyle modifications in MPDS management, making combined therapy the optimal strategy for long-term clinical success.

Keywords: Myofascial pain dysfunction syndrome, magnesium sulfate, local anesthesia, trigger point.

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INTRODUCTION

Myofascial Pain Dysfunction Syndrome (MPDS) is a neuromuscular disorder characterized by myofascial trigger points—hyperirritable nodules within taut bands of skeletal muscle that cause localized or referred pain as well as autonomic symptoms [1,2]. These MTrPs interfere with motor function and contribute to persistent pain signaling maintained by excessive acetylcholine release at the neuromuscular junction; electromyographic studies have confirmed this [3]. Epidemiologically, MPDS is much more common in females than males (3:1); possible explanations include hormonal influences on pain perception and musculoskeletal sex differences [4].

Three interconnected mechanisms underlie MPDS: biomechanical stress, neurogenic inflammation, and central sensitization. Repetitive strain or poor posture depletes cellular energy (ATP), leading to tissue hypoxia and the release of inflammatory mediators [5]. Neuropeptides like substance P and CGRP heighten pain transmission; central sensitization is demonstrated by an MRI study showing altered thalamocortical rhythms and impaired default mode network function [6]. MPDS often occurs alongside temporomandibular disorders (TMDs); studies report that 40–60% of TMD patients have trigger points in their jaw or cervical muscles [7]. This overlap worsens symptoms such as chronic headaches, ear pain, and limited jaw movement, which severely affects daily functioning [8].

Diagnosis is often difficult due to symptom overlap with fibromyalgia, neuropathic pain, and migraines; however, this emphasizes the need for unified diagnostic standards [9]. Treatment involves addressing both peripheral and central pain mechanisms. Ultrasound-guided injections of local anesthetics (e.g., lidocaine) into trigger points provide short-term relief by interrupting aberrant nerve activity [10]. Long-term management includes medications (e.g., duloxetine for central sensitization), physical therapy, and cognitive-behavioral techniques to alter pain-related behaviors [11]. Innovative therapies like botulinum toxin-A and shockwave therapy show potential for resistant cases, though further clinical trials are needed [12]. This research examines demographic trends and treatment response in MPDS patients with different materials.

METHODOLOGY

Study Design and Participants

A prospective study assessed magnesium sulfate ($MgSO_4$) as a treatment for Myofascial Pain Dysfunction Syndrome (MPDS) in Participants of 20 patients. Participants were stratified into two groups: 10 individuals underwent $MgSO_4$ therapy paired with local anesthetic (Group A), and 10 received $MgSO_4$ alone without adjunctive anesthesia (Group B). A control group (Group C) included 20 MPDS patients treated with a structured regimen of plain local anesthesia alone.

Inclusion criteria

(1) Confirmed MPDS diagnosis via clinical examination (active trigger points, radiation pain headaches, limited jaw mobility).
(2) Absence of systemic musculoskeletal or neurological disorders.
(3) Completion of a 9-month follow-up.

Exclusion criteria

(1) Prior surgical interventions or concurrent analgesic therapies.
(2) History of trauma, systemic inflammatory diseases, or neurological disorders.
(3) Incomplete follow-up.

Ethical Considerations

This prospective study was conducted at the clinic of Dr. Ghassan A. Abdulwahab for oral & maxillofacial surgery & dental medicine. The Medical Ethics Committee at University of Science and Technology, Aden, Yemen has approved the study (MEC/AD077). Informed consent was taken as it is a prospective nature of data collection. All procedures adhered to the Declaration of Helsinki guidelines for ethical medical research.

Treatment Methods

- Group A: ($MgSO_4$ + Plain L.A.): Patients got weekly shots of magnesium sulfate (10% solution) mixed with plain 2% lidocaine hydrochloride directly into trigger points. This was done once a week for 3 weeks.
- Group B: ($MgSO_4$ Only): Patients received the same magnesium sulfate injections but without any plain L.A. medication mixed with it.
- Group C: (Control Group): Patients received only 2% lidocaine hydrochloride injections (without

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epinephrine) (2 mL each)—two shots in the first week and one shot in the second week.

Pain and Functional Recovery Measurements

Pain levels were checked using a simple 0-10 rating scale (where 0 = no pain, 10 = worst pain). This was done before treatment, right after treatment, and again after 9 months. In addition, functional recovery (jaw mobility, oral function) and adverse events (e.g., injection-site pain) were observed.

Statistical Analysis

Data were analyzed using SPSS v.27. Continuous variables (age, VAS scores) were compared via one-way ANOVA with Tukey's post-hoc test. Categorical variables (gender, symptom resolution rates) were assessed using chi-square (χ^2) tests. Subgroup analyses (age stratification, habit cessation) employed logistic regression. Significance was set at $p<0.05$, with 95% confidence intervals (CI).

RESULTS

Demographics

The study included three groups with similar age ranges but varying gender distributions:

- Group A: 8 women and 2 men, average age 28.7 (±7.2 years, range 20–45).
- Group B: 7 women and 3 men, average age 29.8 (±8.1 years, range 18–42).
- Group C: 17 women and 3 men, average age 30.2 (±6.5 years).

Women made up 75% of participants (χ^2=12.4, $p<0.001$), which is consistent with the known female predominance in MPDS. Age distribution was similar across all groups (F=0.32, p=0.73), meaning no significant differences were found.

Table 1 : Demographics of Patients

Variable	Group A ($MgSO_4$ + Plain Anesthesia)	Group B ($MgSO_4$ Alone)	Group C (Control)	Test Statistic	p-value
Age (years)	7.2 ± 28.7	8.1 ± 29.8	6.5 ± 30.2	F=0.32	**0.73**
Gender (Female: Male)	(%20:%80) 8:2	(%30:%70) 7:3	(%15:%85) 17:3	χ^2 = 12.4	**0.001>**
Baseline VAS	8.2±1.1	1.3±8.0	1.0±8.1	F=0.18	**0.84**

Pain Severity (VAS)

- Starting Pain Levels: All groups began with similar pain scores (Group A: 8.2; Group B: 8.0; Group C: 8.1; no significant difference, p=0.84).
- After 9 Months of Treatment:
- Group A ($MgSO_4$ + Plain L.A.): Pain completely gone (0.0).
- Group B ($MgSO_4$ Only): Pain reduced by half (3.8, 53% improvement).
- Group C (Plain L.A. Only): Pain completely gone (0.0).

Table 2: Results for Pain Severity (VAS)

Group	Baseline VAS (Mean ± SD)	9-months VAS (Mean ± SD)	F-value	p-value	Post-Hoc Comparison (Tukey's Test)
Group A ($MgSO_4$ + plain Anesthesia)	1.1 ± 8.2	0.0 ± 0.0	214.6	0.001>	A = C (p =1.00)
Group B ($MgSO_4$ Alone)	1.3 ± 8.0	1.5 ± 3.8	-	-	B < A, B < C (p < 0.001)
Group C (Control)	1.0 ± 8.1	0.0 ± 0.0	-	-	C = A (p = 1.00)

Functional Recovery

- Group A: 100% achieved normal jaw mobility and pain-free function.
- Group B: 60% reported partial functional improvement (40–60% pain reduction).
- Group C: 100% restored jaw mobility.

Chi-square tests demonstrated significant differences in functional recovery rates (χ^2=38.9, p<0.001).

Table 3: Chi-Square Results for Categorical Outcomes

Outcomes	Group A	Group B	Group C	χ^2	df	p-value
Symptoms Resolution	(100)10/10	(50)10/5	(100)20/20	38.9	2	0.001>
Adverse Events	(0)0/10	(90)10/9	(0)0/20	29.7	2	0.001>

Subgroup and Adverse Event Analyses

Age Impact on Outcomes: Younger participants (18–30 years) in Group A had better results, with 100% symptom resolution compared to 85% in those aged 31–45 (OR=4.2, 95% CI: 1.1–16.3, p=0.03).

- Effect of Habit Changes: Patients in Group A who stopped contributing habits (such as chewing chat) recovered faster (OR=5.8, 95% CI: 1.3–25.9, p=0.008).

- Adverse Events: Transient injection-site pain occurred in 90% of Group B patients vs. 0% in Groups A and C (χ^2=29.7, p<0.001).

Table 4: Subgroup Analysis (Logistic Regression)

Predictor	Odds Ratio (OR)	%95 CI	p-value
Age ≤30 years	4.2	–1.1 16.3	0.03
Habit Cessation	5.8	–1.3 25.9	0.008

The combined $MgSO_4$-anesthesia protocol demonstrated non-inferiority to the control group, achieving equivalent pain resolution (100% vs. 100%, p>0.1) with no procedural discomfort. $MgSO_4$ monotherapy provided suboptimal efficacy (50–60% improvement) and higher adverse event rates, underscoring the necessity of adjunctive anesthesia. Age and behavioral modifications significantly influenced therapeutic success, advocating for personalized treatment algorithms in MPDS management.

DISCUSSION

Prior research and our results in this study confirm that magnesium sulfate ($MgSO_4$) is a good way to treat active myofascial trigger points (MTrPs) in the head and pain region (the head and pain region in the neck), especially when combined with other treatments according to patients' demands. In the presented trial, setting $MgSO_4$ with the local anesthetic had suppressed in ten patients all complaints after 9 months and had restored the jaw closed without pain. This parallels observations of [13], where $MgSO_4$ injections diminished pain and increased jaw mobility, but effects regressed after six months — the long-term gain of our combined approach. In contrast, the symptoms were improved to only 50–60% of the degree by $MgSO_4$ alone (10 patients), and all 90% showed transient pains at the point of injection. Similar limitations were observed in [14], where oral magnesium at high doses plus lifestyle modification is only partially effective, again demonstrating the need for dual therapy. Our findings are in accordance with [15], who showed that MgSO4 increases pain tolerance and function in neck muscles by enhancing circulation and interfering with the pain signals. Contrastingly, [16] found there was no statistical difference when comparing $MgSO_4$ against ultrasound treatment on neck pain, suggesting both methods similarly affect pain pathways. Our study, though, shows combining $MgSO_4$ with anesthesia works better than using it alone, likely due to faster absorption and stronger nerve-blocking effects. Notably, our control group (20 patients) using only anesthesia also achieved full pain relief, matching the success of the combined therapy (p > 0.1). This contrasts with [17], which

linked $MgSO_4$ to short-term pain relief but not chronic cases, whereas our approach proved effective for long-standing MTrPs.

Key factors influencing success included age and lifestyle changes: younger patients (18–30 years) had 100% recovery with combined therapy versus 85% in older groups ($p=0.03$), and quitting habits like khat chewing sped up healing ($p<0.01$). These trends mirror studies on tissue repair and habit impacts on chronic pain. Safety remains a priority, as seen in [18], where epinephrine-based injections caused muscle weakness. While our study had no major side effects, frequent injection-site pain with $MgSO_4$ alone calls for better delivery methods.

Finally, combining $MgSO_4$ with plain L.A. matches the gold standard for lasting results, while solo $MgSO_4$ falls short. This supports standardized treatments that include anesthesia, age-based adjustments, and behavior coaching for reliable outcomes.

CONCLUSION

This study confirms that magnesium sulfate ($MgSO_4$) paired with local anesthesia fully resolves Myofascial Pain Dysfunction Syndrome (MPDS) long-term, matching the success of anesthesia alone (100% pain-free after nine months). Using $MgSO_4$ by itself, however, provided only partial relief (50–60% improvement) and caused a notable incidence of transient injection-site discomfort (90%). Younger patients (18–30 years) and lifestyle changes (e.g., quitting habits) were key to recovery, highlighting the need for personalized care. Clinicians should prioritize combined $MgSO_4$-anesthesia protocols, refine injection methods, and educate patients to reduce recurrence and ensure consistent results.

Conflict of interest

The authors declare that no conflict of interest.

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