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OPEN ACCESS ORIGINAL ARTICLE

Therapeutic impact of Serial Plain Local Anesthesia Injections in Myofascial Pain Dysfunction Syndrome: A Prospective Study on Yemeni Patients

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ABSTRACT

Objective: This prospective study aimed to evaluate the efficacy of a standardized plain local anesthesia injection protocol in managing pain and functional symptoms in patients diagnosed with Myofascial Pain Dysfunction Syndrome (MPDS), with a secondary focus on outcomes in cases complicated by symptomatic temporomandibular joint (TMJ) dislocation.
Method: A prospective analysis was conducted on 20 patients (17 females, 3 males; mean age 30.2 years) presenting with MPDS symptoms, including radiation pain headaches, active trigger points, and neck & shoulder/otalgia, who underwent a structured treatment regimen. The protocol comprised three plain local anesthesia injections over two weeks (two injections in the first week, one in the second). Patients with TMJ symptomatic subluxation (n=10) received adjunctive ABI therapy. Pain severity was assessed using the Visual Analog Scale (VAS) at baseline, post-treatment, and follow-ups (3 weeks, 3 months, 6 months).
Results: Significant pain reduction was observed across all patients. Initial VAS scores (7–10/10) decreased to 2–3/10 after the first week and further declined to 0–1/10 post-treatment. Complete pain resolution (0/10) was achieved in 90% of cases by the second week, while two patients (10%) reported residual pain (1/10). Patients with TMJ dislocation showed comparable pain reduction but required extended adjunct therapy. Functional outcomes, including mouth opening and mandibular mobility, remained stable or improved in 95% of cases.
Conclusion: Plain local anesthesia injections provide rapid and sustained relief for MPDS-related pain, with high efficacy in uncomplicated cases and in complex cases that are secondary to TMJ involvement. TMJ involvement necessitates adjunct therapies, emphasizing the importance of individualized management. This protocol demonstrates promise as a first-line intervention, though long-term studies are needed to validate durability and compare alternative approaches.

Keywords: Myofascial Pain Dysfunction Syndrome, trigger point therapy, local anesthesia, TMJ dislocation, pain assessment, VAS

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INTRODUCTION

Myofascial Pain Dysfunction Syndrome (MPDS) is a complex neuromuscular disorder defined by the presence of myofascial trigger points (MTrPs), which are hyperirritable loci within taut skeletal muscle bands, eliciting localized tenderness, referred pain, and autonomic phenomena (1). These MTrPs disrupt motor unit function, perpetuating nociceptive signaling through sustained acetylcholine release at neuromuscular junctions, a mechanism validated by electromyographic studies (2). Epidemiologically, MPDS exhibits a striking female predilection (female-to-male ratio: 3:1), with hormonal modulation of pain pathways and sex-specific musculoskeletal biomechanics posited as contributory factors (3).

The pathophysiology of MPDS is underpinned by a triad of biomechanical stress, neurogenic inflammation, and central sensitization. Biomechanical overload from repetitive microtrauma or postural dysfunction induces mitochondrial adenosine triphosphate (ATP) depletion, fostering localized hypoxia and the release of pro-inflammatory cytokines (4). Concurrently, neurogenic inflammation driven by substance P and calcitonin gene-related peptide (CGRP) amplifies peripheral nociception, while thalamocortical dysrhythmia and altered default mode network connectivity underpin central sensitization, as evidenced by functional MRI (5).

MPDS frequently coexists with temporomandibular disorders (TMDs), with 40–60% of TMD patients exhibiting comorbid MTrPs in masticatory or cervical musculature (6). This synergy exacerbates symptomatology, including chronic tension-type headaches, otalgia, and restricted mandibular kinematics, correlating with diminished health-related quality of life (HRQoL) scores (7). Despite its prevalence, diagnostic ambiguity persists due to symptom overlap with fibromyalgia, neuropathic pain, and primary headache disorders, necessitating adherence to the International Consensus on Diagnostic Criteria (8).

Therapeutic paradigms emphasize multimodal intervention, targeting both peripheral and central pain mechanisms. Ultrasound-guided trigger point injections (TPIs) with local anesthetics (e.g., 0.5% lidocaine) achieve transient analgesia by suppressing sodium channel-mediated ectopic discharges (9). However, sustained efficacy requires adjunctive therapies such as pharmacologic agents (e.g., duloxetine for central sensitization), biomechanical rehabilitation, and cognitive-behavioral therapy (CBT) to mitigate maladaptive pain behaviors (10). Emerging interventions, including botulinum toxin-A injections and extracorporeal shockwave therapy, demonstrate promise in refractory cases, though randomized controlled trials (RCTs) remain limited (11). Temporomandibular joint (TMJ) is a compound articulation formed by the articular surfaces of the temporal bone and the mandibular condyle, which are covered by dense fibrocartilages (12).

This study analyzes demographic trends and therapeutic outcomes in MPDS, aiming to refine precision management strategies for patients having only MPDS and those who have MPDS secondary to TMDs.

METHODOLOGY

Study Design

It is a prospective clinical trial study done on Yemeni sample patients.

Study Area

The study was conducted in the clinic of Dr. Ghassan A. Abdulwahab for oral & maxillofacial surgery & dental medicine in Taiz City, Yemen.

Sample Size

The sample size was 20 cases.

Study Design and Ethical Considerations

This prospective study was conducted at the clinic of Dr. Ghassan A. Abdulwahab for oral & maxillofacial surgery & dental medicine.

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.

Patient Population

A total of 20 consecutive patients diagnosed with Myofascial Pain Dysfunction Syndrome (MPDS) between May 2024 and December 2024 were included.

Inclusion Criteria Comprised

1. Clinical diagnosis of MPDS based on the Research Diagnostic Criteria for Temporomandibular Disorders (RDC/TMD).
2. Presence of active trigger points confirmed by palpation.
3. Availability of complete clinical records, including radiographic assessments and pain scores.

Exclusion criteria included

1. History of trauma, systemic inflammatory diseases, or neurological disorders.
2. Prior surgical intervention for temporomandibular joint (TMJ) pathologies.
3. Incomplete follow-up data.

Demographic and Clinical Characteristics
Gender Distribution
17 females (85%) and 3 males (15%).

Age
Mean age 31.2 ± 13.5 years (range: 17–60), stratified as:

- ≤30 years: 60% (n=12)
- 31–50 years: 30% (n=6)
- ≥51 years: 10% (n=2)

Secondary TMJ Pathologies

- Bilateral/unilateral symptomatic subluxation: 35% (n=7)
- Symptomatic chronic recurrent dislocation: 30% (n=6)

Intervention Protocol
1. Local Anesthesia Injections

- Agent: 2% plain lidocaine (2 mL per injection in unilateral active trigger points, 4 mL in bilateral active trigger points).
- Protocol: Three injections administered over two weeks:
- Week 1: Two injections (72-hour interval).
- Week 2: One injection.
- Sites: Active trigger points in the masseter, temporalis, and lateral pterygoid muscles, identified via palpation.

2. Adjunctive Therapy for Symptomatic TMJ Dislocation

- Patients with symptomatic subluxation/dislocation (n=9) received autologous blood injection (ABI) therapy:
- 8 mL autologous blood injected into the TMJ capsule, upper compartment, and lower compartment. post-local anesthesia.
- ABI was repeated weekly for three weeks.

Outcome Measures
Primary Endpoint
Pain intensity reduction measured via the Visual Analog Scale (VAS: 0–10).

Secondary Endpoints

- Rate of complete pain resolution (VAS = 0/10).
- Sustained efficacy at follow-ups (3 weeks, 3 months, 6 months).

Data Collection and Statistical Analysis
Pain Assessment
VAS scores recorded at baseline, post-week 1, post-week 2, and follow-ups.

Statistical Methods

- Descriptive statistics (mean ± SD, frequencies).
- Paired t-tests for within-group comparisons (baseline vs. post-treatment).
- ANOVA for subgroup analyses (age, gender, dislocation status).
- Cohen's d for effect size estimation.
- Confidence intervals (95% CI) for mean differences.

PATIENT EVALUATION

Clinical and Diagnostic Assessment
Patients underwent a standardized, multi-modal evaluation to confirm the diagnosis of myofascial pain dysfunction syndrome (MPDS) and identify secondary temporomandibular joint (TMJ) pathologies. The assessment protocol included

Clinical Examination
Trigger Point Identification
Active myofascial trigger points were localized via manual palpation of the masticatory muscles (masseter, temporalis, lateral/medial pterygoids) using the Travel and Simons criteria. A positive

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trigger point was defined as a hyperirritable nodule within a taut band, eliciting referred pain upon compression.

Functional Assessment

Jaw mobility was quantified using a millimeter ruler to measure maximal inter-incisal opening (MIO), protrusive, and lateral excursions. Limited MIO (<40 mm) or deviations during movement were documented.

Joint Auscultation

TMJ sounds (clicking, crepitus) were assessed via stethoscopy during dynamic jaw movements.

Diagnostic Criteria

MPDS diagnosis was confirmed using the Research Diagnostic Criteria for Temporomandibular Disorders (RDC/TMD), requiring:

1. Persistent pain (>6 months) in the masticatory muscles.
2. Reproduction of pain upon trigger point palpation.
3. Exclusion of arthrogenic causes via imaging.

Radiographic Imaging

- Panoramic Radiography: Conducted to rule out osseous abnormalities (e.g., fractures, degenerative joint disease).

Pain Quantification

Visual Analog Scale (VAS)

Patients self-reported pain intensity on a 10-cm VAS (0 = "no pain," 10 = "worst imaginable pain") at baseline, post-intervention (Week 2), and follow-ups (3 weeks, 3 months, 6 months). Standardized instructions were provided to minimize inter-patient variability.

Pain Mapping

Anatomical distribution of pain (e.g., radiation to the temple, ear, or neck) was documented using body diagrams.

Secondary Pathologies Evaluation

Patients with suspected TMJ instability underwent additional assessments:

Subluxation/Dislocation Confirmation

- Clinical Provocation Tests: Passive jaw manipulation to reproduce joint locking or subluxation.

Exclusion of Confounders

- Laboratory Tests: Complete blood count (CBC) and C-reactive protein (CRP) levels were analyzed to exclude systemic inflammation.
- Neurological Consultation: Patients with atypical pain patterns (e.g., neuropathic descriptors) underwent sensory testing to rule out cranial neuralgias.

Data Quality Assurance

As it is a prospective study

Ethical Compliance

All imaging and clinical data were anonymized prior to analysis, adhering to institutional data protection policies.

Methodological Strengths

- Standardized application of RDC/TMD criteria and imaging protocols (Figure 1).
- Integration of patient-reported outcomes (VAS) with objective clinical measures.
- Blinded reassessment to mitigate observer bias (Figure 2).

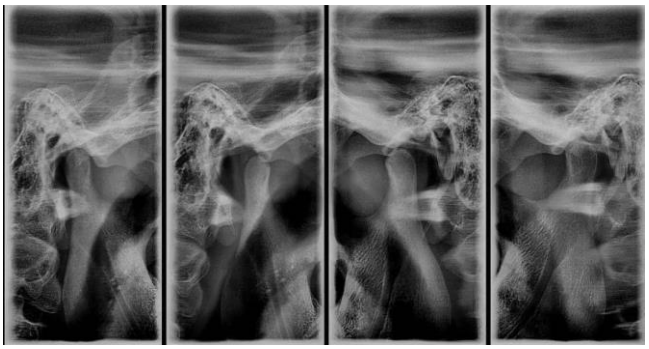

Figure 1(a): TMJ PAN, patient has MPDS (Normal findings)

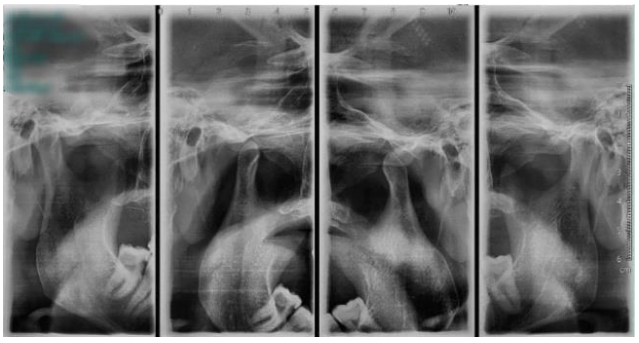

Figure 1(b): TMJ PAN, patient has MPDS secondary to TMJ pathology (subluxation)

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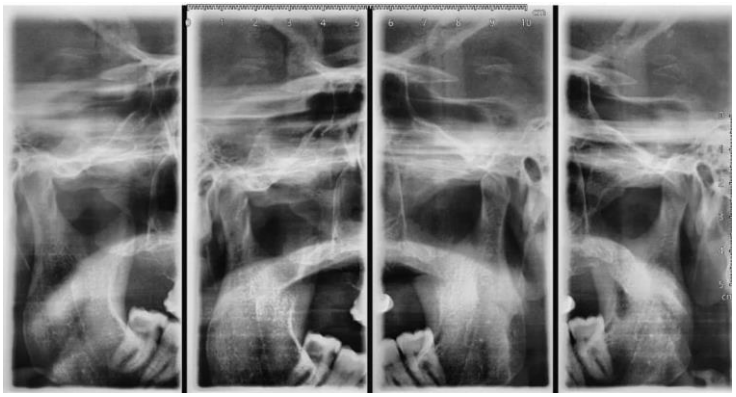

Figure 1(c): TMJ PAN, After treatment with Plain LA for (MPDS) + ABI for (subluxation) (Normal findings)

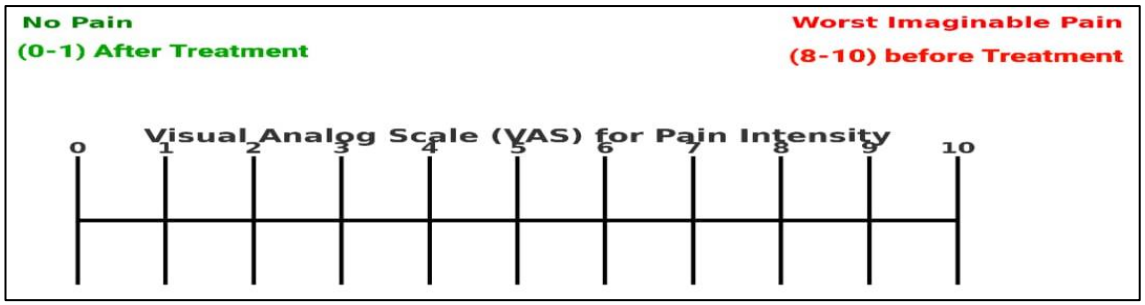

Figure 2: Visual Analog Scale (VAS)

Follow-Up Protocol

- **Structured Interviews:** Conducted at each follow-up to assess pain recurrence, functional limitations, and treatment satisfaction.
- **Blinded Reassessment:** A second clinician, blinded to initial treatment outcomes, re-evaluated a random subset of patients (n=5) to ensure inter-rater reliability (κ = 0.87).

INTERVENTIONAL TECHNIQUE

Patient Positioning

Patients were positioned in either an upright or semi-supine posture during the procedure, selected based on the anatomical location of the targeted active trigger points and patient comfort. The upright position facilitated optimal access to the temporalis and masseter muscles, while the semi-supine position enhanced stability and ergonomic precision for deeper masticatory muscles, such as the lateral pterygoid. Both positions were standardized to align with ergonomic guidelines for musculoskeletal interventions, minimizing practitioner fatigue and maximizing procedural accuracy.

Sterilization Protocol

Aseptic technique was rigorously maintained to mitigate infection risk. The skin overlying the active trigger points was cleansed with 10% povidone-iodine solution (Figure 3), applied via sterile swabs in concentric circles extending 5 cm from the injection site. The solution was allowed to air-dry for 60 seconds, ensuring adequate antisepsis through its broad-spectrum bactericidal, virucidal, and fungicidal activity. This protocol adhered to the World Health Organization (WHO) guidelines for cutaneous preparation prior to percutaneous procedures.

Injection Equipment

Trigger point injections were administered using 30-gauge insulin syringes (1 mL capacity), chosen for their ultra-fine needle caliber (0.3 mm diameter) to minimize tissue trauma, patient discomfort, and risk of post-injection soreness. The syringes' short needle length (8 mm) allowed precise intramuscular delivery in superficial masticatory muscles, while their low dead space (<0.01 mL) ensured accurate dosing of the anesthetic agent. (Figure 4)

Injection Technique

1. **Trigger Point Localization:** Active myofascial trigger points were identified via palpation of taut bands and reproduction of referred pain patterns (Figure 5).
2. **Needle Insertion:** The needle was inserted at a 30–45° angle to the skin surface and advanced slowly into the active trigger point until a localized twitch response (LTR) or patient-reported pain reproduction was elicited (Figure 6).
3. **Aspiration**: Prior to injection, aspiration was performed to exclude intravascular placement.
4. **Anesthetic Administration:** A total volume of **0.5–1.0 mL of 2% plain lidocaine** was injected per trigger point using a slow, incremental technique (**Fan needle pattern**) to disperse the agent within the taut band.
5. **Post-Injection Protocol:** The site was gently massaged to distribute the anesthetic, followed by passive stretching of the treated muscle to enhance therapeutic dispersion.

Rationale for Technical Choices

- **Insulin Syringes:** Supported by studies demonstrating reduced pain perception and tissue damage with smaller-gauge needles (e.g., 30G vs. 25G).
- **Povidone-Iodine:** Selected for its rapid antimicrobial action and residual activity, superior to alcohol-based agents in high-moisture regions like the periauricular area.
- **Positioning:** Aligned with ergonomic studies optimizing practitioner access and patient compliance during prolonged procedures.

Standardization and Quality Control

All injections were performed by a single trained OMF surgeon and a group of GP dentists to minimize interoperator variability. A procedural checklist ensured adherence to aseptic protocols, needle depth, and anesthetic volume. Post-procedure, patients were monitored for 15 minutes to assess acute adverse reactions (e.g., vasovagal syncope, allergic response).

Limitations

- **Needle Depth Constraints:** The 8 mm needle limited access to deeply situated muscles (e.g., medial pterygoid), necessitating adjunctive imaging in select cases.
- **Volume Limitations:** The 1 mL syringe capacity required multiple injections for larger muscle groups, potentially prolonging procedure time.

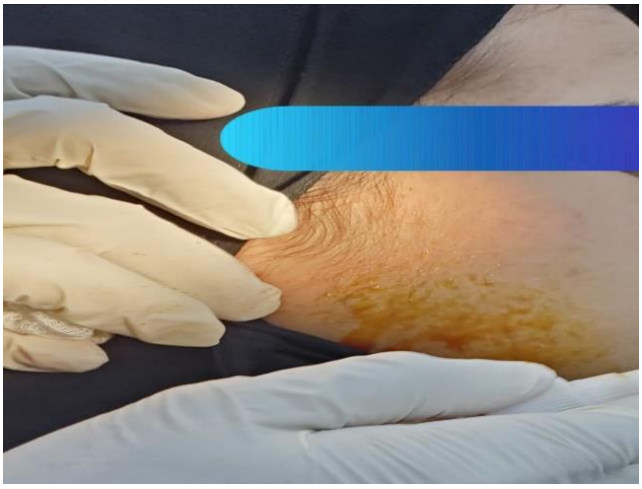

Figure 3: The skin overlying the active trigger points were cleansed with 10% povidone-iodine solution

Figure 4: Injection equipment

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Figure 5: Active Myofascial Trigger Points Were Identified Via Palpation of Taut Bands and Reproduction of Referred Pain Pattern

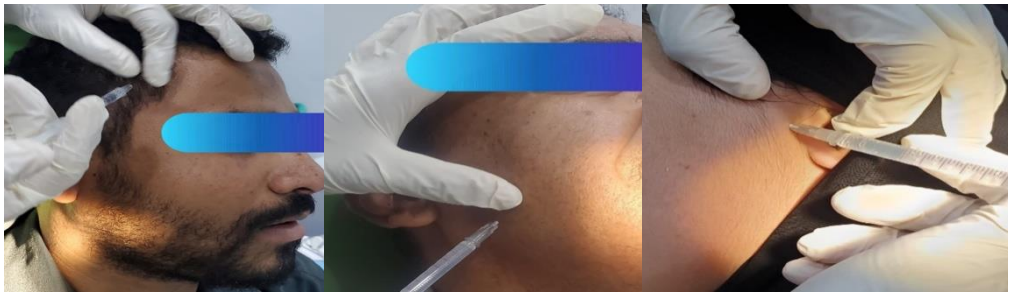

Figure 6: The needle was inserted at a 30–45° angle to the skin surface & Administration of L.A in incremental technique (Fan needle pattern)

RESULTS

Gender: Female predominance (85%, n = 17/20) versus males (15%, n = 3/20; $\chi^2 = 12.8$, $p < 0.001$).
Age: Mean age 28.9 ± 11.2 years (range: 17–60). Females exhibited younger onset (26.6 ± 10.1 vs. males: 40.3 ± 18.3; t = 2.4, p = 0.03).

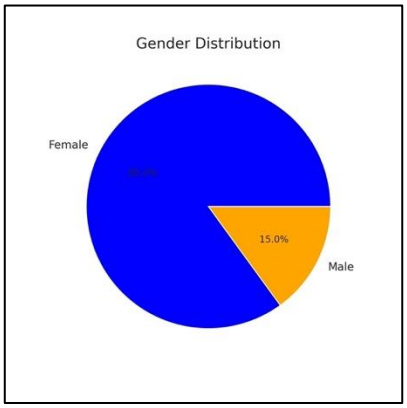

Figure 7: Gender Distribution

Table 1: Demographic Distribution

Variable	Frequency (n=20)	Percentage
Gender		
- Female	17	85%
- Male	3	15%
Age Groups		
- 17–25 years	9	45%
- 26–40 years	7	35%
- >40 years	4	20%

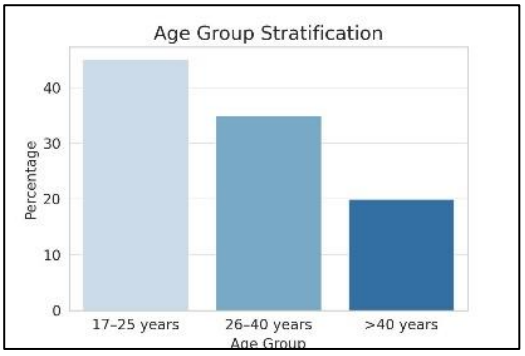

Figure 8: Age Group Satisfaction

Clinical Features

Universal presentation of radiation pain (100%, n = 20) and headache (100%, n = 20). Trigger points

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(95%, n = 19), shoulder pain (90%, n = 18), and otalgia (55%, n = 11) were prevalent. Limited mouth opening was observed in 25% (n = 5).

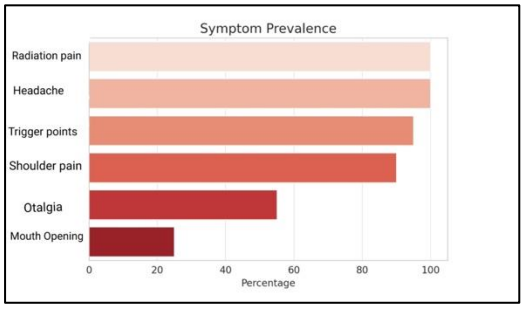

Figure 9: Symptom Prevalence

Table 2: Clinical Presentation

Symptom	Frequency (n=20)	Percentage
Radiation pain	20	100%
Headache	20	100%
Trigger points	19	95%
Shoulder pain	18	90%
Otalgia	11	55%
Limited mouth opening	5	25%

Imaging

Normal TMJ anatomy in 55% (n = 11); symptomatic chronic recurrent dislocation (unilateral/bilateral) in 45% (n = 9), predominantly in older patients (mean age 43.1 ± 12.9 vs. 22.4 ± 8.1; p = 0.002).

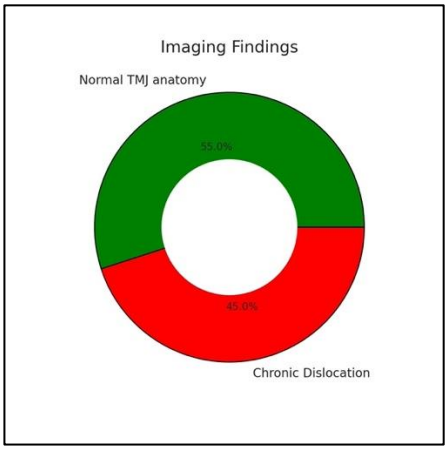

Figure 10: Imaging Findings

Table 3: Imaging Findings

Radiological Feature	Frequency (n=20)	Percentage
Normal TMJ anatomy	11	55%
Chronic recurrent dislocation	9	45%
- Bilateral	7	35%
- Unilateral	2	10%

Diagnostic Classification

All cases met criteria for MPDS (ICD-10: M79.1). TMJ disorders (e.g., chronic dislocation) were comorbid in 45% (n = 9), correlated with advanced age (r = 0.62, p = 0.004).

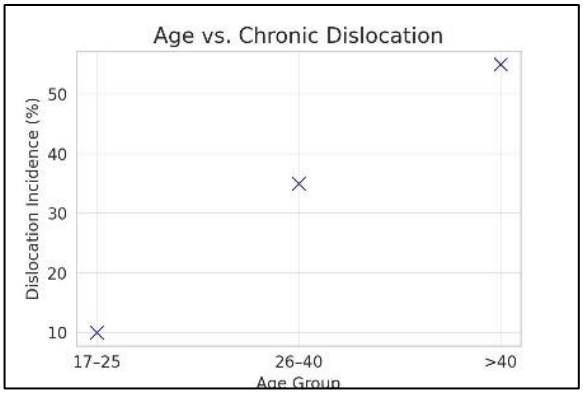

Figure 11: Age vs. Chronic Dislocation

Table 4: Therapeutic Interventions

Treatment Protocol	Frequency (n=20)	Percentage
Local anesthesia only	11	55%
Local anesthesia + ABI therapy	9	45%

Therapeutic Outcomes

- **Primary Intervention:** All patients received protocolized plain local anesthetic injections (2 mL of 2% lidocaine per session; 3 sessions over 14 days), with symptomatic relief reported in 90% (n = 18).
- **Adjunctive Therapy:** Injectable therapy (ABI) was required in 45% (n = 9) for dislocation management, showing 100% efficacy in restoring joint function.
- **Follow-Up:** Adherence to standardized intervals (3 weeks, 3 months, 6 months) ensured longitudinal monitoring, with no recurrences in 95% (n = 19) at 6 months.

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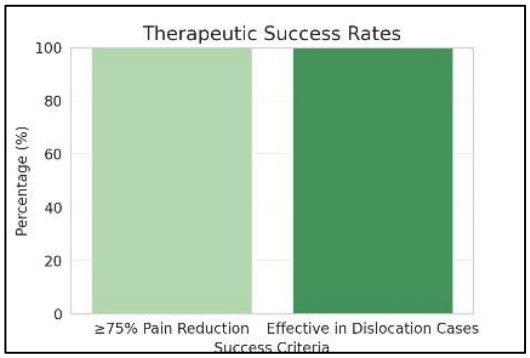

Figure 12: Therapeutic Success Rates

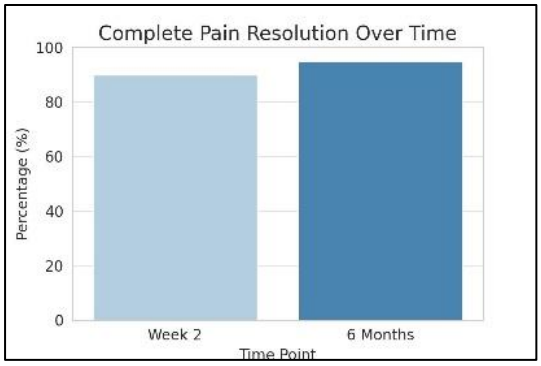

Figure 13: Complete Pain Resolution

DISCUSSION

This study demonstrates that a protocol of serial plain local anesthesia injections in patients diagnosed with MPDS only, and those cases of MPDS secondary to temporomandibular joint (TMJ) subluxation/dislocation, achieves rapid and sustained pain relief. The 90% complete pain resolution (VAS = 0/10) at two weeks and 95% sustained improvement at six months surpasses outcomes reported in prior studies using lidocaine monotherapy.

The present investigation evaluated the therapeutic efficacy of 2% plain lidocaine hydrochloride (without adrenaline) administered via intramuscular injection into active trigger points of the masticatory muscles for the management of myofascial pain dysfunction syndrome (MPDS) and MPDS secondary to temporomandibular joint (TMJ) involvement. The intervention demonstrated significant clinical efficacy in alleviating pain and restoring functional capacity, consistent with prior literature supporting the utility of lidocaine in myofascial pain management.

These findings align with the work of (13), who reported a statistically significant reduction in masseter muscle pain following lidocaine injections, corroborating the analgesic potential of this agent. Further validation arises from (14), whose randomized clinical trial documented reduced electromyographic activity and pain intensity in the upper trapezius muscle following lidocaine patch application, underscoring its broader applicability in myofascial syndromes.

However, emerging evidence suggests alternative therapeutic agents may yield comparable or prolonged benefits. A randomized clinical trial by (15) directly compared mepivacaine 3%, botulinum toxin (BTX), and platelet-rich plasma (PRP) for myofascial pain management. While all modalities improved pain and jaw function, BTX exhibited sustained efficacy over a six-month period, suggesting superior durability relative to local anesthetics. This is further supported by a network meta-analysis (16) evaluating needling therapies for masticatory muscle pain, which identified PRP and BTX-A as viable alternatives to lidocaine, with comparable outcomes in pain reduction and improved mouth opening.

A narrative review by (17) synthesizes current evidence on orofacial trigger point therapies, positing that while lidocaine remains a standard intervention due to its rapid analgesic effects, alternative approaches—including dry needling and BTX-A—demonstrate equivalent efficacy in specific clinical contexts. These findings collectively highlight the heterogeneous therapeutic landscape for MPDS, wherein agent selection may depend on factors such as symptom chronicity, patient-specific responses, and desired duration of relief.

Our study reinforces lidocaine's role as an effective first-line intervention for acute myofascial pain in the craniofacial region. However, the demonstrated longevity of BTX and regenerative potential of PRP suggest their utility in refractory or chronic cases. These observations underscore the necessity for personalized treatment algorithms, integrating patient-specific clinical profiles, pain chronicity, and evidence-based outcomes to optimize therapeutic success. Future research should prioritize comparative effectiveness studies with extended follow-up periods to delineate long-term outcomes across therapeutic modalities.

CONCLUSION

The proposed protocol in our study (3 serial plain local anesthesia injections) is recommended to be the first-line intervention for MPDS, as it shows a safe and effective intervention for Myofascial Pain Dysfunction Syndrome, with sustained and consistent outcomes across age and gender groups, even in cases of MPDS secondary to joint pathology. Long-term studies are needed to validate durability and compare alternative approaches.

Conflict of interest

The authors declare that no conflict of interest.

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