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COMPARATIVE STUDY OF MUSCLE RELAXANTS AND NSAIDS IN TEMPOROMANDIBULAR JOINT DYSFUNCTION SYNDROME

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Abstract

Background: Temporomandibular joint dysfunction (TMJD) affects the joint and associated musculoskeletal structures, often causing pain and functional limitation. NSAIDs and muscle relaxants are commonly used for symptom relief, but few comparative studies exist.

Aim: To assess and compare the clinical efficacy of ibuprofen (NSAID) and diazepam (muscle relaxant) in TMJD treatment.

Methods: This observational study included 54 patients diagnosed with TMJD. Group A received ibuprofen 400 mg twice daily, and Group B received diazepam 5 mg once daily. Baseline and one-month follow-up assessments included pain (VAS score) and maximal mouth opening (MMO). Statistical analysis employed paired t-tests, independent t-tests, and chi-square tests. Significance was set at $p<0.05$.

Results: There were no significant differences in age, sex distribution, or baseline VAS/MMO scores between groups. Both treatments significantly reduced pain and improved MMO. Post-treatment VAS was lower in the NSAID group (2.48 ± 1.01) compared to the diazepam group (3.59 ± 1.00),

with a significant difference (p=0.00009). MMO improvement was not significantly different between groups (p=0.06).
Conclusion: Both NSAIDs and muscle relaxants are effective for TMJD symptom relief, with ibuprofen showing superior pain reduction. NSAIDs may be preferred as first-line pharmacotherapy in TMJD.

Keywords: Temporomandibular joint dysfunction, NSAIDs, muscle relaxant, ibuprofen, diazepam

INTRODUCTION

Temporomandibular joint dysfunction syndrome (TMJDS) affects the TMJ and surrounding structures, manifesting as pain, restricted movement, and joint sounds. Prevalence ranges from 10% to 15%, with higher incidence among females aged 20–40 years. TMJD has multifactorial etiology including trauma, bruxism, stress, malocclusion, and systemic conditions. Diagnosis relies on clinical assessment and imaging. Although most cases resolve spontaneously, pharmacologic therapy remains a primary management strategy. NSAIDs are commonly used for inflammation and pain, while muscle relaxants like diazepam are prescribed for muscular tension. However, comparative evidence is limited, warranting this investigation. Temporomandibular joint dysfunction syndrome (TMJDS), also known as Temporomandibular Disorder (TMD), is a condition that affects the temporomandibular joint (TMJ) along with the associated musculoskeletal and neuromuscular structures. It can result in jaw pain, clicking or popping sounds, stiffness, and restricted jaw movement. The incidence in the adult population ranges from 10% to 15%, with the highest occurrence in individuals aged 20 to 40 years [1]. TMJDS exhibits a significant gender disparity, with a female-to-male ratio of 4:1 [2]. This dysfunction has been associated with a variety of systemic and comorbid conditions, including fibromyalgia, chronic headaches, psychiatric disorders, sleep apnea, and immunological illnesses [1]. The precise pathophysiology of TMJDS is still not fully understood and shows substantial variability among patients. The etiology is widely accepted as multifactorial, involving a combination of local and systemic factors. Contributing elements include biologic, emotional, environmental, social, and cognitive influences [3]. Physical causes, such as trauma, infection, and inflammation like secondary synovitis, are also implicated. In addition, TMJDS can be associated with internal derangement of the joint, particularly disc dysfunction, with or without displacement [4]. Diagnosis is established through a detailed clinical assessment, including medical history, physical examination, and imaging techniques such as radiography and arthrography [5,6]. Notably, only 5% to 10% of patients require active intervention, as approximately 40% experience spontaneous remission [7]. Conservative treatment has proven successful in 50% to 90% of cases, and multidisciplinary management is sometimes necessary for complex or chronic presentations [8]. An online registry involving 1,500 patients documented treatment modalities, showing that 73% received anti-inflammatory medications, 56% took nonprescription pain relievers, 50% used antidepressants, 48% were prescribed opioids, 41% took anxiolytics, and 40% received muscle relaxants [9]. Treatment is primarily noninvasive, incorporating patient education, self-care strategies, cognitive behavioral therapy, physical therapy, pharmacotherapy (such as Nonsteroidal Anti-Inflammatory Drugs (NSAIDS) and muscle relaxants), acupuncture, occlusal splints, benzodiazepines, and antidepressants [4,10,11]. Oral appliances, such as stabilizing splints, are commonly used; however, their effectiveness remains controversial [12,13]. The use of intra-articular injections, including corticosteroids and sodium hyaluronate, is on the rise due to their anti-inflammatory effects. Corticosteroids suppress prostaglandin synthesis by inhibiting the release of arachidonic acid, thereby reducing inflammation [1,13]. Botulinum toxin injections have also demonstrated effectiveness in reducing muscle-related symptoms [13]. Diazepam is frequently used in managing muscle spasms, anxiety, and sleep disturbances due to its muscle relaxant properties. It enhances gamma-aminobutyric acid (GABA) activity in the brain and spinal cord but is associated with side effects such as drowsiness, confusion, and cognitive impairment. Withdrawal symptoms may appear after 4 to 6 weeks of use [14]. NSAIDs are standard pharmacological agents in TMJDS treatment, yet there is a lack of trials directly comparing NSAIDs with muscle relaxants [15]. Hence,

this study aims to compare the efficacy of nonsteroidal anti-inflammatory medicines with that of muscle relaxants in adult patients diagnosed with temporomandibular joint dysfunction.

METHODOLOGY & MATERIALS

The study is Observational, comparative study conducted from December 2023 to November 2024 at Dhaka Dental College. The study period spans from 1st December 2023 to 30th November 2024. 54 adults with TMJD were enrolled using purposive sampling. Inclusion criteria included clinical diagnosis, age >18, and informed consent. Exclusion criteria included contraindications to either drug, TMJ surgery history, radiographic pathology, psychiatric illness, and pregnancy. A purposive consecutive sampling technique was used to select participants who met the inclusion criteria and were willing to participate in the study. Participants were divided into two treatment groups:
Group A: Ibuprofen 400 mg twice daily.
Group B: Diazepam 5 mg once daily.

Inclusion Criteria

- Patients diagnosed with temporomandibular joint dysfunction (TMJD).
- Adults aged 18 years and above.
- Both male and female patients.
- Willingness to participate and provide written informed consent.

Exclusion Criteria

- Patients with contraindications to NSAIDs.
- Patients with contraindications to diazepam.
- History of temporomandibular joint surgery.
- Presence of abnormal pathological findings on orthopantomogram (OPG).
- Presence of psychological or psychiatric disorders.
- Pregnant or lactating women.

Ethical Considerations

Ethical approval for this study was obtained from Obtained from the Institutional Review Board of BSMMU. The objectives, procedures, potential risks, and benefits of the study were explained to all participants. Participation was voluntary, and confidentiality was ensured. Participants had the right to withdraw at any time without consequence. Minimal physical, psychological, social, and legal risks were involved during examinations and radiological evaluations.

Operational Definitions

Temporomandibular Joint (TMJ): A synovial joint enabling complex movements necessary for mastication and speech. It is formed primarily by the mandibular condyles, glenoid fossa of the temporal bone, articular disc, and joint capsule.

Temporomandibular Joint Dysfunction (TMJD): A group of conditions affecting the TMJ, associated anatomical structures, and masticatory muscles. Common symptoms include orofacial pain, restricted mandibular movements, and joint sounds.Nonsteroidal Anti-Inflammatory Drugs (NSAIDs): Drugs used for their analgesic, anti-inflammatory, and antipyretic properties. They include various chemical groups such as acetylated and non-acetylated salicylates, propionic acids, acetic acids, enolic acids, anthranilic acids, naphthylalanine, and selective COX-2 inhibitors.Muscle Relaxants: Drugs used to relieve muscle spasms and stiffness. They include antispasmodics (acting on the central nervous system) and antispastics (acting on the spinal cord or skeletal muscles). Diazepam, a benzodiazepine, is commonly used for severe muscle spasms.Baseline: The initial measurement or status of a health parameter (e.g., pain score or MMO) before treatment, used as a reference for post-treatment comparisons.

Data Collection

The independent variables considered in this study included age, sex, side of temporomandibular joint (TMJ) involvement, etiological factors, and the presence of bruxism, malocclusion, and stress. The dependent variables were the pain score and maximal mouth opening (MMO), assessed both before and after treatment. Pain score was measured using the Visual Analog Scale (VAS) on a 0 to 10 numerical rating scale, and MMO was measured in millimeters based on the inter-incisal distance.
Data were collected prospectively using structured interviews and clinical examinations. After obtaining informed consent, a detailed history was recorded and baseline measurements of pain score and maximal mouth opening were taken. After one month of treatment, follow-up assessments were conducted to record changes in pain score and MMO. All findings were documented using a pre-designed data entry sheet for subsequent statistical analysis.

Statistical Analysis

Data was processed and analyzed by Statistical Package for Social Science (SPSS) version 26 (IBM Corporation, Armonk, NY, USA). Demographic variables are presented by means of frequency and percentages. Paired t-test was used to compare observations between before and after treatment of a group. Independent sample t test and Chi-squaresummarized data was presented as mean, standard deviation, percentages and ratio and presented on table and diagram.

RESULT

The mean age was 47.15 ± 12.19 years in Group A and 48.93 ± 9.84 years in Group B. Most participants in both groups were within the 51–60 age range. No significant age difference was observed between the groups (p=0.279). Gender distribution was also similar, with males comprising 59.26% of Group A and 55.55% of Group B, showing no statistically significant difference (p=0.783) (Table 1). In Group A, 22.22% had right TMJ involvement, 18.52% had left TMJ involvement, and 59.26% had bilateral involvement. In Group B, 14.81%, 22.22%, and 62.96% had right TMJ involvement, left TMJ involvement, and bilateral involvement, respectively (Table 2). Among the etiological factors of TMJD, stress was the most common in Group A (33.33%), while malocclusion was slightly more frequent in Group B (29.62%). Bruxism was reported in 18.51% of Group A and 22.22% of Group B. Other factors were noted in 25.92% of Group A and 22.22% of Group B (Table 3). In Group A, the VAS score decreased from 6.48 ± 1.5 to 2.48 ± 1.01, while in Group B it reduced from 6.7 ± 1.49 to 3.59 ± 1.0 (p=0.00001 for both). Maximal mouth opening increased from 29.67 ± 8.58 mm to 44.85 ± 9.37 mm in Group A, and from 29.44 ± 7.34 mm to 41.11 ± 8.25 mm in Group B (p=0.00001 for both), indicating statistically significant improvement in both parameters (Table 4). At baseline, there were no significant differences between Group A and Group B in VAS scores (p=0.29) or maximal mouth opening (p=0.46). After 4 weeks, Group A showed a significantly greater reduction in VAS scores compared to Group B (p=0.00009). Although both groups showed improvement in maximal mouth opening, the difference between the groups after 4 weeks was not statistically significant (p=0.06) (Table 5).

Table 1: Demographic characteristics of the study population (N=54)

Variables	Group A (n=27)		Group B (n=27)		P-value
	n	%	n	%	
Age (years)					
21-30	4	14.81	1	3.70	0.279
31-40	4	14.81	3	56.25	
41-50	5	18.52	10	37.03	
51-60	10	37.03	12	44.44	
>60	4	14.81	1	3.70	
Mean±SD	47.15±12.19		48.93±9.84		
Gender					
Male	16	59.26	15	55.55	0.783
Female	11	40.74	12	44.44	

Table 2: Distribution of TMJD by side of involvement (N=54)

Group	Distribution of TMJD by side of involvement			
	n	Right TMJ, n (%)	Left TMJ, n (%)	Both TMJ, n (%)
Group A	27	6 (22.22%)	5 (18.52%)	16 (59.26%)
Group B	27	4 (14.81%)	6 (22.22%)	17 (62.96%)

Table 3: Etiological factors of TMJD of the study subjects (n=54)

Etiological factors	Group A (n=27)		Group B (n=27)	
	n	%	n	%
Bruxism	5	18.51	6	22.22
Malocclusion	6	22.22	8	29.62
Stress	9	33.33	7	25.92
Others	7	25.92	6	22.22

Table 4: VAS score of pain and maximal mouth opening in both groups at baseline and after 4 weeks

Variables	Group A (Mean±SD)	Group B (Mean±SD)
VAS score		
Baseline	6.48±1.5	6.7±1.49
After 4 weeks	2.48±1.01	3.59±1.0
P-value	0.00001	0.00001
Maximal mouth opening		
Baseline	29.67±8.58	29.44±7.34
After 4 weeks	44.85±9.37	41.11±8.25
P-value	0.00001	0.00001

Table 5: Comparison of VAS score of pain and maximal mouth opening between two groups at baseline and after 4 weeks

Variables	Baseline (Mean±SD)	After 4 weeks (Mean±SD)
VAS score		
Group A	6.48±1.5	2.48±1.01
Group B	6.7±1.49	3.59±1.0
P-value	0.29	0.00009
Maximal mouth opening		
Group A	29.67±8.58	44.85±9.37
Group B	29.44±7.34	41.11±8.25
P-value	0.46	0.06

DISCUSSION

Regarding clinical presentation of Temporomandibular joint dysfunction, one of the most common symptoms was pain. Besides pain restricted jaw movement was also a common symptom. Most of the symptoms of Temporomandibular joint dysfunction settle over time without specific treatment, but in some patients, this may take several years. Treatment was directed to reduction of pain and improvement of masticatory function. The pharmacological treatment of the patients with TMID is usually effective and evidence based. In this study, there was no significant difference in age (p=0.279) or gender distribution (p=0.783) between the two groups. The majority of patients in both groups presented with bilateral TMJ involvement. The mean baseline VAS pain score was 6.48 ± 1.50 in the NSAID group (Group A) and 6.70 ± 1.49 in the muscle relaxant group (Group B), with no

significant difference between the groups (p = 0.29376). Similar findings were reported by Rehman et al, who observed mean pre-treatment VAS scores of 6.15 ± 1.12 in Group A and 6.25 ± 1.00 in Group B, also showing no statistically significant difference [16]. Following treatment, the mean VAS score significantly decreased to 2.48 ± 1.01 in Group A and 3.59 ± 1.00 in Group B (p=0.00009), indicating greater pain reduction in the NSAID group. Rehman et al similarly found post-treatment pain scores of 2.15 ± 1.12 in the ibuprofen group and 3.20 ± 1.04 in the diazepam group, with a significant difference between the two [16]. These findings support the effectiveness of both treatments in reducing pain, with NSAIDs showing a good outcome. The current study also demonstrated significant within-group reductions in VAS scores from baseline in both groups ($p<0.05$). Pramod et al reported similar results, showing a 72% reduction in pain with diazepam over three weeks ($p<0.001$) compared to a 65% reduction in the placebo group [17]. Minervini (2024) noted that NSAIDs are the most commonly prescribed drugs for orofacial pain, typically taken for at least two weeks [18]. Dammling et al also emphasized that NSAIDs remain the first-line treatment for inflammatory pain [19]. Kulkarni et al supported this, reporting that NSAIDs can effectively relieve pain and improve mouth opening in TMJD patients [15]. However, contrasting findings were reported by Singer and Dionne (1997), who observed significant pain reduction in the diazepam group but not in the ibuprofen or placebo groups [20]. Virdee (2018) also suggested that short-term use of diazepam may aid in muscle relaxation during the acute phase of TMJD [21]. In terms of functional improvement, the present study found no significant difference in maximal mouth opening between the groups at baseline (p = 0.29376). After treatment, both groups showed significant improvement (p = 0.00001), with mean mouth opening increasing to 44.85 ± 9.37 mm in Group A and 41.11 ± 8.25 mm in Group B. Although the difference in post-treatment mouth opening between the groups was not statistically significant (p = 0.06286), Group A demonstrated better improvement. Kulkarni et al also observed enhanced mouth opening with NSAID therapy [15]. Pramod et al reported a 30% improvement in mouth opening in the diazepam group, which was significantly greater than in the placebo group [17]. Muscle relaxants, such as diazepam, are often used alone or in combination for TMJD treatment [22]. Their mechanism involves reducing skeletal muscle tone, which helps relieve chronic orofacial pain. Ouanounou et al reported that muscle relaxants could reduce muscle activity and relieve TMJD symptoms [23]. Both NSAIDs and muscle relaxants have potential adverse effects. NSAIDs may cause gastrointestinal and cardiovascular complications, hepatic and renal impairment, clotting issues, and respiratory problems [24]. To mitigate gastrointestinal risks, co-administration of gastroprotective agents such as proton pump inhibitors, H2-receptor antagonists, or misoprostol is recommended [25,26]. Diazepam can cause side effects like drowsiness, confusion, memory impairment, and coordination difficulties. Long-term use is discouraged due to the risk of tolerance and dependence. Sudden discontinuation may lead to withdrawal symptoms, including agitation, anxiety, seizures, and insomnia. It is contraindicated in patients with myasthenia gravis and glaucoma. According to the American Academy of Orofacial Pain (AAOP), TMJD is broadly classified into myogenous and arthrogenous types. Myogenous TMJD, more common, is typically due to myofascial pain and dysfunction associated with stress, bruxism, and dental factors. Arthrogenous TMJD involves structural changes in the joint, often visible on radiographs [27]. The findings of this study suggest that NSAIDs are effective in reducing pain and improving mouth opening in TMJD patients. Therefore, ibuprofen remains a first-line treatment for TMJD-related pain and restricted function, particularly in cases involving inflammation. Continued NSAID therapy over several weeks may be needed to achieve optimal results. Diazepam may be beneficial for muscle-related TMJD symptoms and can be considered a secondary treatment option when NSAIDs are contraindicated.

Limitations of the study:

- No placebo or combination was included. For the comparison of two groups more controlled study will be needed.
- Any adverse effects of drugs were not assessed.
- Cost-effectiveness of muscle relaxants and NSAIDS was not assessed.

- Study sample size was smaller. Study with bigger sample size may differ the result.

CONCLUSION AND RECOMMENDATIONS

Both ibuprofen and diazepam improved pain and function in TMJD. Ibuprofen demonstrated a significantly greater reduction in pain, supporting its use as a first-line therapy. Muscle relaxants may be reserved for patients with contraindications to NSAIDs or predominant muscular symptoms.

Recommendation:

- Use NSAIDs as first-line pharmacologic therapy in TMJD.
- Larger randomized controlled trials with placebo/control arms are needed.
- Monitor for adverse drug reactions.
- Incorporate psychological assessments in TMJD diagnosis.

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