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ORIGINAL ARTICLE

# IMPACT OF DIAZEPAM ON PAIN PERCEPTION AND MOUTH OPENING IN PATIENTS WITH TEMPOROMANDIBULAR JOINT DISORDERS: A QUASI-EXPERIMENTAL STUDY

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## ABSTRACT

**Objective:** *To identify the effectiveness of muscle relaxant (once daily Diazepam 5 mg) on mouth opening and pain perception in patients with temporomandibular disorders (TMD) reporting to the Maxillofacial OPD of Ayub Teaching Hospital, Abbottabad.*

**Methodology:** *This study was conducted in the Department of Oral and Maxillofacial Surgery, Ayub Teaching Hospital, Abbottabad; during a duration of 6 months from January to June 2025. A total of 60 clinically diagnosed temporomandibular disorder patients were enrolled through non-probability consecutive sampling. Baseline intensity of pain was assessed with the help of Visual Analogue Scale (VAS), and mouth opening was measured in millimeters with the help of a vernier caliper. Diazepam 5 mg was given orally once daily to the patients for 7 days. Post-treatment measurement of pain and mouth opening was recorded. Data were computed with SPSS version 20.*

**Results:** *The pre-treatment median pain score was 7 (IQR: 1), which decrease significantly to 4 (IQR: 1.25) after treatment ($p < 0.001$). Likewise, the median mouth opening increased from 38 mm (IQR: 3) to 41.5 mm (IQR: 2) after treatment ($p < 0.001$). No statistically significant correlation was identified between gender, education, or income level and baseline pain or mouth opening.*

**Conclusion:** *Diazepam was found to produce significant pain relief and increased mouth opening in the TMD patients within a brief treatment period. It can be regarded as an important pharmacologic treatment for muscular TMD in outpatients.*

**Keywords:** *Diazepam, Pain Perception, Mandibular Function, Muscle Relaxants, Temporomandibular Joint Disorders*

**This article may be cited as:** Mahmood MK, Ameen U, Nowrin SA, Shahid F, Shah AA. Reliability of Dolphin Cephalometric Imaging Software by observers with different levels of experience. Pak Oral Dent J 2025; 45(2):27-32.

## INTRODUCTION

The term temporomandibular disorders (TMDs) describes a group of musculoskeletal and neuromuscular conditions of the temporomandibular joint (TMJ), masticatory muscles, and associated structures[1,2]. TMDs are typically characterized by pain, joint sounds, restricted mouth opening, and functional limitation that disrupt daily life activities such as eating, speaking, and yawning[3]. Muscle pain remains common in TMD patients, impairing overall well-being and causing psychologic distress[4]. Bruxism, trauma, psychological stress, anatomical abnormalities, are some of the factors that cause the multifactorial etiology of TMDs, which makes it difficult for its diagnosis and treatment, requiring the use of medication and non-pharmacological forms of treatment[5,6].

The current epidemiological evidence is presented to highlight the worldwide impact of TMDs[7]. Wieckiewicz et al. reported high efficacy of relief from TMD pain as demonstrated with the use of ibuprofen and meloxicam[8]. Farias et al. reported 113 (63.1%) of TMD symptoms. Most patients (84.9%) engaged in mild self-medication, and only 12.3% of TMD symptom patients engaged in moderate or severe self-medication[9]. A study conduct-

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**Received for Publication:** Aug 08, 2025
**Revised:** Oct 19, 2025
**Approved:** Nov 08, 2025

ed by Hassan et al. revealed a significant difference between the pre-treatment and post-treatment VAS score of pain and mouth opening by using Diazepam 5mg one tablet daily for 4 weeks. Pre-treatment score of pain was 7.70 ± 2.4 and mouth opening was 37.70 ± 3.90 whereas, post-treatment pain score was 4.01 ± 1.3 and mouth opening was 41.67 ± 3.06[10].

Earlier research, such as that by Hassan et al. (2022), illustrated that Diazepam has the potential to alleviate pain and enhance mouth opening in TMD patients[11]. But smaller sample sizes, single-center data collection, and more time-consuming treatment periods, which cannot be easy to implement within standard outpatient practice, limited such studies. Treatment protocols varied and outcome measures were inconsistent, also not allowing for easy generalization to larger groups of patients.

To fill these gaps, the present study seeks to assess the short-term effectiveness of a standardized regimen of Diazepam (5 mg daily for 7 days) in enhancing pain perception and mouth opening in TMD patients in another geographic and clinical environment. Demonstrating evidence of a simple, short, and effective regimen may assist clinicians in effectively treating muscular TMD in everyday practice.

To determine the effect of once-daily Diazepam 5 mg for 7 days on pain perception and mouth opening in temporomandibular disorders patients.

Null Hypothesis ($H_0$): Once-daily Diazepam 5 mg for 7 days has no effect on pain perception and mouth opening in TMD patients.

Alternate Hypothesis ($H_0$): Once-daily Diazepam 5 mg for 7 days has a significant effect on decreasing pain perception and increasing mouth opening in TMD patients.

## METHODOLOGY

This quasi-experimental study was conducted in Maxillofacial OPD at Ayub Teaching Hospital (ATH), Abbotabad, Pakistan. Sample size was calculated to be 60 using WHO sample size calculator, 95% confidence interval, 1% Absolute precision and expected Standard Deviation of 1.3.(10) This estimate was conducted to identify an attainable recruitment goal. Nevertheless, owing to practical limitations, a non-probability consecutive sampling method was utilized in patient recruitment. Due to practical limitations and ethical considerations, no control group was included; the study compared pre- and post-intervention outcomes within the same subjects, which is acceptable for quasi-experimental pilot research. Ethical approval for this study was obtained from the institutional review board (IRB) of ATH vide letter no. The sampling technique followed was non probability consecutive sampling.

Inclusion criteria: Patient of Age 18-40 years, both male and females, whose diagnosis of TMDs is established, having either unilateral or bilateral, undergoing other conservative treatments and not responding to them, and medically stable patients without uncontrolled systemic illness were included in the study.

Exclusion criteria: Patients with uncontrolled systemic conditions such as diabetes mellitus, hypertension, neurological disorders, or any psychiatric illness, non-compliant patients who didn't follow the given prescription, having other comorbidities such as psychiatric issue or pregnancy and having undergone any intervention or surgical management.

Demographic information (age, gender, education, and socioeconomic status) and pertinent medical history, such as comorbid conditions, were obtained. All assessments were performed by a single calibrated examiner to reduce inter-examiner variation.

Pain severity was assessed with the Visual Analogue Scale (VAS) after describing the scoring system to each patient. Opening of the mouth was recorded in millimeters with a vernier caliper in seated upright positions of patients. All patients were given Diazepam 5 mg by mouth daily for 7 consecutive days. Foreseen side effects were disclosed beforehand. Follow-up assessment was done on day 7, with the same measurements of pain and mouth opening.

All information were documented on a proforma which was structured, comprising demographic information, medical history, pain score, and mouth opening measurements. The patients with incomplete follow-up were excluded from the final analysis.

Data acquired was analyzed using statistical package for social sciences (SPSS) version 20. Mean, standard deviation, median and interquartile range were calculated as part of descriptive statistics for quantitative variables and frequency and percentages were calculated for qualitative variables. Normality of the data was assessed by Shapiro-Wilk test. Mann-Whitney U test and Kruskal Wallis test was applied to assess statistically significant association between categorical variables (gender, education, and income status) with pre-operative pain and mouth opening. Wilcoxon Signed Rank test was used to assess the difference between pre-operative and post-operative pain (VAS score) and mouth opening (measurement). Median and IQR were used for data representation since the data followed non-normal distribution. p value was determined for significance at 0.05.

## RESULTS

60 patients of temporomandibular disorders were

taken up for final analysis. Mean age of the subjects was 32.12 ± 5.87 years, and it consisted of 29 (48.33%) males and 31 (51.67%) females. Out of the participants, 38 (63.33%) had primary or below education, and 22 (36.67%) had high school or above education. According to socioeconomic status, 28 (46.67%) of the participants were low income, 26 (43.33%) were medium income, and 6 (10%) were high income.

According to medical conditions, 52 (86.7%) of the patients had no known systemic illness and 8 (13.3%) had well-controlled medical conditions (4 with hypertension and 4 with diabetes mellitus). None of the patients with uncontrolled systemic disease or psychiatric conditions were included, as per the study criteria.

The baseline mean pre-treatment pain score was 7.1 ± 0.84, which improved to 3.97 ± 0.92 after 7 days of Diazepam treatment. Also, the baseline mean mouth opening was 38.03 ± 2.54 mm, which showed improvement to 41.38 ± 1.67 mm after treatment.

Table 1 illustrates the median pre-operative pain score distribution by demographic variables. Baseline pain scores did not significantly differ between sexes (p = 0.553), educational attainment (p = 0.295), or income level (p = 0.605).

Table 2 illustrates median pre-operative mouth opening by the same demographic factors, with none of the gender (p = 0.713), educational (p = 0.534), or income (p = 0.265) differing significantly.

We noted a substantial reduction in pain scores post-treatment as median pain decreased from 7 (IQR = 1) to 4 (IQR = 1.25) (p < 0.001). Concurrently, median mouth opening improved from 38 mm (IQR = 3) to 41.5 mm (IQR = 2) post-treatment (p < 0.001), which showed a statistically significant improvement in the functional outcomes (Table 3).

There were no side effects drug withdrawals or drug reactions reported throughout the study.

## DISCUSSION

In the current research, the diazepam (5 mg daily once) for a specified treatment duration resulted in statistically significant improvement of pain perception and mouth opening among temporomandibular disorders (TMD) patients. The pain score at median reduced from 7 (IQR: 1) pre-operatively to 4 (IQR: 1.25) post-operatively (p < 0.001), and the mouth opening

TABLE 1: COMPARISON OF PRE-OPERATIVE PAIN SCORES BASED ON DEMOGRAPHIC CHARACTERISTICS

| Variables | Categories | Pre-operative pain Median (IQR) | p - value |
|---|---|---|---|
| Gender | Male | 7 (1) | 0.553 |
| | Female | 7 (1.5) | |
| Educational status | Primary and below | 7 (1) | 0.295 |
| | High school and above | 7 (0) | |
| Income status | Low income status | 7 (2) | 0.605 |
| | Medium income status | 7 (1) | |
| | High income status | 7 (0.75) | |

TABLE 2: COMPARISON OF PRE-OPERATIVE MOUTH OPENING BASED ON DEMOGRAPHIC CHARACTERISTICS

| Variables | Categories | Pre-operative mouth-opening (mm) Median (IQR) | p - value |
|---|---|---|---|
| Gender | Male | 38 (3) | 0.713 |
| | Female | 38 (2.5) | |
| Educational status | Primary and below | 38 (3.75) | 0.534 |
| | High school and above | 38 (3) | |
| Income status | Low income status | 38 (2.25) | 0.265 |
| | Medium income status | 37 (3) | |
| | High income status | 40 (5) | |

TABLE 3: PRE- AND POST-OPERATIVE COMPARISON OF PAIN SCORE AND MOUTH OPENING

| Variables | Pre-operative Median (IQR) | Post-operative Median (IQR) | p - value |
|---|---|---|---|
| Pain score | 7 (1) | 4 (1.25) | < 0.001 |
| Moth-opening (mm) | 38 (3) | 41.5 (2) | < 0.001 |

at median increased from 38 mm (IQR: 3) to 41.5 mm (IQR: 2) ($p < 0.001$).

Our results are consistent with a number of earlier studies assessing the role of diazepam and other muscle relaxants in the treatment of temporomandibular disorders. Pramod et al. noticed a very significant decrease in pain scores (72%) during three weeks in the diazepam group vs. 65% in the placebo group ($p < 0.001$), and an increase in mouth opening by 30% that lasted for five weeks after therapy was stopped[12]. Dammling et al., noted that while small trials have reported reductions in pain intensity of 1.5 to 3 VAS units and mouth opening improvements of around 2–4 mm with diazepam, the evidence base remains weak secondary to limited power, poor blinding, and methodological heterogeneity[13]. Gil-Martínez et al. also documented short-term reductions in pain of 2–3 VAS units ($p < 0.05$) using diazepam, but noted that exercise therapy and biopsychosocial interventions demonstrated higher effect sizes for both functional improvement and pain relief[14]. These results indicate that the size of benefit in our cohort is within the upper limit of previous findings and note that while short-term benefits may result from diazepam, it should ideally be embedded within an overall multimodal treatment plan rather than used as monotherapy.

In support of these findings, Minervini et al. reported a mean 2.6-point reduction in pain on the VAS over placebo, with a moderate to high effect size (Cohen's d = 0.74, $p < 0.001$), validating muscle relaxants' clinical efficacy, especially in TMD with muscular pain and restricted jaw movement[15]. Alpaslan et al. compared four muscle relaxants and found that diazepam resulted in a mean VAS reduction of $3.1 \pm 1.4$ ($p < 0.001$) and an average 4.5 mm increase in mouth opening[16]. This is very similar to the 3.5 mm median increase in mouth opening in our study, again validating diazepam's therapeutic use to improve functional outcome in TMD.

The mechanistic basis of diazepam's effectiveness can be traced to its central anxiolytic and muscle-relaxant effects, which are most effective in instances of central sensitization—a mechanism strongly involved in chronic TMD[17]. Cairns highlights that autonomic dysregulation is a central role in pain amplification in TMD and that diazepam can restore equilibrium in the sympathetic-parasympathetic axis and decrease nociceptive sensitivity[18].

Diazepam acts as a positive allosteric modulator of GABAA_AA receptors, enhancing inhibitory neurotransmission in the central nervous system. This reduces skeletal muscle hyperactivity, relieves muscle spasm, and diminishes pain sensitivity[19]. Additionally, its anxiolytic effects can decrease parafunctional activity such as bruxism, which is a common contributing factor to TMD pain. Improvement in mouth opening observed in this study may reflect both decreased muscular guarding and reduction of joint/muscle inflammation[20].

Pain and mouth-opening results were not affected significantly by gender, educational status, or socioeconomic status. This corroborates earlier epidemiological research suggesting that TMD symptom severity does not always differ among demographic groups, although prevalence can differ. This implies that pharmacologic therapy with Diazepam might have comparable clinical benefits in various patient populations in the short term. This also suggests that immediate pharmacologic effect of diazepam is not significantly altered by fundamental demographic variables, which might also lend greater generalizability. Contrary to some previous trials, our investigation utilized standardized pain and mouth-opening measures within a clearly defined TMD population, with demonstrable benefit within only 7 days of low-dose diazepam, and without noted side effects. While the 3-point pain reduction was larger than the traditionally accepted MCID of 2 units on VAS for TMD, the mean 3.5 mm improvement in opening was not as large as the 5 mm MCID most often reported in the literature, and suggests that even though the improvement is significant statistically, its clinical effect on jaw function is perhaps modest.

These results favor short-term Diazepam treatment within a multimodal treatment regimen of TMD, particularly in patients with acute pain and restricted mouth opening. The pharmacological approach can be supplemented with conservative treatments like occlusal splints, physiotherapy, and behavioral therapy to enhance patient outcomes. Notably, the use of Diazepam should be carefully watched for the prevention of dependency and adverse effects. Whereas pharmacologic treatment produces swift relief from symptoms, chronic management of TMD is based on a blend of behavioral change, physiotherapy, occlusal appliances, and psychosocial intervention. Diazepam can act as a bridge treatment in order to allow these interventions by reducing acute pain and enhancing

the mobility of the jaw.

## LIMITATIONS OF THE STUDY

This research has some limitations. Firstly, the sample population was small and consisted of patients from a single tertiary care center, which may not reflect the situation in other populations. Secondly, the brief follow-up period did not allow for evaluation of long-term effectiveness or recurrence of symptoms upon diazepam discontinuation. Third, confounding variables such as psychological stress levels, quality of sleep, and parafunctional habits of bruxism were not controlled, which may have affected both pain perception and responsiveness to treatment. Non-probability consecutive sampling employed in this research poses the risk of selection bias and restricts the generality of findings, as precision-based sample size computations do demand the utilization of random sampling procedures. The trial did not have a control group, and therefore improvements in pain and mouth opening cannot be attributed to the effect of diazepam alone. Improvement may have been due to placebo effects, natural course of the disease, or regression to the mean.

## CONCLUSION

In summary, findings of the current study are in close concordance with that of previously reported data about analgesic and functional advantages of muscle relaxants, especially diazepam, in the control of TMD. Prolonged decrease in pain scores and mouth opening here point towards diazepam as a cost-effective, readily available, and quick-acting drug of choice, especially in resource-poor public dental OPDs. Although non-pharmacologic measures have complementary benefits, diazepam is still a useful first-line treatment for short-term relief of symptoms in cases of muscular TMD.

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| **1. Sidra Qadir:** | Conceptualization of study design, Methodology, Literature search and prepared the initial version of the manuscript. |
| **2. Ammara Saleem:** | Formal Analysis, Critically reviewed and revised the manuscript. |
| **3. Khurshid Alam:** | Supervision, validation and Revision of the final manuscript. |
| **4. Aqsa Munir:** | Data Analysis. |
| **5. Bakhtawr Aziz:** | Write up and Proof reading. |
| **6. Jannat Ul Mawa:** | Data Interpretation. |
| **7. Maryam Jadoon:** | Data Collection. |