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The Effectiveness of Anxiety and Stress Medication in Reducing Temporomandibular Joint Pain: A Randomized Clinical Trial

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ABSTRACT

Background: Temporomandibular joint disorders (TMD) are multifactorial conditions often associated with psychological factors such as anxiety and stress. Pharmacological management targeting these factors may improve pain outcomes.

Objective: To evaluate the effectiveness of anxiety and stress medication (diazepam5 mg) in reducing temporomandibular joint (TMJ) pain.

Methods: A randomized clinical trial was conducted on 60 patients diagnosed with TMD. Participants were randomly assigned into two groups: control (conventional therapy) and intervention (anti-anxiety/stress medication diazepam 5 mg + conventional therapy). Pain intensity was measured using the Visual Analog Scale (VAS) at baseline, 4 weeks, and 8 weeks.

Results: The intervention group showed a statistically significant reduction in TMJ pain compared to the control group ($p < 0.05$). Mean VAS scores decreased from 7.2 ± 1.1 to 2.8 ± 0.9 in the intervention group, while the control group showed a reduction from 7.0 ± 1.0 to 4.9 ± 1.2.

Conclusion: Diazepam significantly improves pain outcomes in TMD patients when used as adjunctive therapy, likely due to its anxiolytic and muscle relaxant effect

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INTRODUCTION

Temporomandibular disorders (TMD) are a group of musculoskeletal conditions affecting the temporomandibular joint (TMJ), masticatory muscles, and associated structures. They are recognized as one of the most common causes of non-dental orofacial pain, with prevalence estimates ranging from 5% to 12% in the general population (Okeson, 2020; Manfredini et al., 2017). TMD presents clinically with symptoms such as joint pain, limited mandibular movement, joint sounds, and muscle tenderness.

The etiology of TMD is multifactorial, involving biomechanical, neuromuscular, and psychosocial components. Among these, psychological factors—particularly anxiety and stress—play a crucial role in both the onset and progression of the disorder (Greene, 2018). Increased psychological stress has been associated with elevated muscle tension, parafunctional habits such as bruxism, and altered pain perception (Fillingim et al., 2013). Furthermore, contemporary research supports the biopsychosocial model of TMD, which emphasizes the interaction between biological and psychological factors in pain modulation (Wieckiewicz et al., 2015). Stress and anxiety can influence central pain processing mechanisms, resulting in heightened pain sensitivity and chronicity (Ohrbach and Dworkin, 2016). This highlights the importance of addressing psychological components in the comprehensive management of TMD. Although conventional management strategies for TMD—including occlusal splints,

physiotherapy, and analgesics—are widely used, they primarily target physical symptoms and may not adequately address underlying psychological factors (List and Axelsson, 2010). While behavioral therapies such as cognitive behavioral therapy have demonstrated effectiveness, the role of pharmacological interventions targeting anxiety and stress remains underexplored. Limited clinical trials have specifically investigated the impact of anti-anxiety and stress medications on TMJ pain outcomes. Most existing studies focus on non-pharmacological interventions, leaving a gap in evidence regarding the effectiveness of pharmacological approaches in modulating psychological contributors to TMD pain (Manfredini et al., 2011). Diazepam, a benzodiazepine with anxiolytic and muscle relaxant properties, may reduce TMD pain by decreasing stress-induced muscle hyperactivity. Therefore, this study aims to evaluate the effectiveness of anxiety and stress medication (diazepam) in reducing temporomandibular joint pain through a randomized clinical trial. Findings of this study are expected to provide evidence supporting a more integrated biopsychosocial approach in the management of TMD.

4. MATERIALS AND METHODS

4.1 Study Design

This study was designed as a **randomized controlled clinical trial (RCT)** to evaluate the effectiveness of anxiety and stress medications in reducing temporomandibular joint (TMJ) pain. The randomized design was selected to minimize bias and ensure a high level of evidence in assessing treatment efficacy.

4.2 Study Setting and Duration

The study was conducted at a specialized dental center/teaching hospital over a period of **8–12 weeks**, which is considered adequate for evaluating short-term therapeutic outcomes in TMD clinical trials (Melo et al., 2020)

4.3 Study Population and Sample Size

A total of **60 patients** diagnosed with temporomandibular disorders were recruited.

Sample size was determined based on previous clinical trials evaluating TMD interventions, ensuring adequate statistical power to detect clinically significant differences between groups.

4.4 Diagnostic Criteria

Patients were diagnosed using the **Research Diagnostic Criteria for Temporomandibular Disorders (RDC/TMD)**, which is widely recognized as a standardized and validated diagnostic system in TMD research (Anderson et al, 2010)

The RDC/TMD includes:

- **Axis I:** Clinical/physical diagnosis
- **Axis II:** Psychological assessment

This dual-axis system allows for comprehensive evaluation of both physical and psychosocial components of TMD.

4.5 Inclusion Criteria

- Patients aged **18–50 years**
- Diagnosed with TMD based on RDC/TMD criteria
- Presence of TMJ pain at rest or during function
- Ability to provide informed consent

4.6 Exclusion Criteria

- History of TMJ surgery
- Systemic joint diseases (e.g., rheumatoid arthritis)
- Current use of psychiatric medications
- Pregnancy or lactation
- Neurological or chronic pain disorders

4.7 Randomization and Allocation

Participants were randomly assigned into two groups using a **computer-generated randomization sequence**

Group	Treatment Protocol
Control Group (n=30)	Conventional therapy only
Intervention Group (n=30)	Conventional therapy + anti-anxiety/stress medication

Allocation concealment was maintained using sealed opaque envelopes to reduce selection bias

4.8 Intervention Protocol

4.8.1 Control Group

Received conventional TMD management:

- Occlusal splints
- Physiotherapy exercises
- NSAIDs (if required)

4.8.2 Intervention Group

Received:

- Conventional therapy (as above)
- **Anti-anxiety/stress medication** :**Diazepam (5 mg orally at bedtime)** was used as adjunctive therapy due to its anxiolytic and muscle relaxant effects. Patients were monitored for adverse effects such as sedation and dizziness throughout the study.

4.9 Outcome Measures

Primary Outcome

- **Pain intensity**, measured using the **Visual Analog Scale (VAS)**

VAS is the most commonly used tool for assessing pain in TMD clinical trials due to its validity and sensitivity (Ooi et al, 2022).

Secondary Outcomes

- Jaw function
- Muscle tenderness

- Psychological status

4.10 Ethical Considerations

- Ethical approval obtained from Institutional Review Board (IRB)
- Written informed consent obtained from all participants
- Study conducted according to the **Declaration of Helsinki**

4.11 Statistical Analysis

Data were analyzed using **SPSS software (version 25)**. Statistical tests included:

- **Independent t-test** → comparison between groups
- **Paired t-test** → within-group changes
- **ANOVA** → repeated measures over time

Significance level set at **$p \leq 0.05$**

5. RESULTS

5.1 Participant Flow and Baseline Characteristics

A total of **60 participants** diagnosed with temporomandibular disorders (TMD) were enrolled and randomly allocated into two groups (n=30 each). All participants completed the study, with no dropouts reported. The baseline demographic and clinical characteristics showed **no statistically significant differences** between the control and intervention groups ($p > 0.05$), indicating successful randomization (Table 1).

A significant reduction in TMJ pain was observed in both groups over time; however, the reduction was **significantly greater in the intervention group (Table 2).** The within-group analysis demonstrated a statistically significant reduction in pain scores over time in both the control and intervention groups. However, the magnitude of pain reduction was notably greater in the intervention group. While the control group exhibited a gradual decrease in VAS scores, the intervention group showed a more pronounced and rapid improvement, particularly between baseline and 4 weeks.

This suggests that although conventional therapy alone is effective in reducing TMJ pain, the addition of anxiety and stress medication significantly enhances the therapeutic outcome. The highly significant p-values (<0.001) observed in the intervention group indicate a strong treatment effect and support the role of psychological modulation in pain management (Table 3)

Between-group comparisons revealed no statistically significant difference in baseline pain scores, confirming successful randomization and comparability between groups at the start of the study. However, significant differences emerged at both 4 and 8 weeks, with the intervention group consistently demonstrating lower VAS scores.

The increasing mean difference over time (from 1.8 at 4 weeks to 2.1 at 8 weeks) indicates a cumulative treatment effect of the intervention. These findings highlight the added benefit of incorporating anxiety and stress management into conventional TMD therapy, leading to superior pain reduction outcomes compared to conventional therapy alone (Table 4).

The repeated measures ANOVA analysis confirmed a statistically significant effect of time, indicating that pain levels decreased progressively throughout the study period in both groups. Additionally, the significant group effect demonstrates that the intervention group achieved overall lower pain scores compared to the control group. Importantly, the significant interaction effect (time × group) indicates that the pattern of pain reduction differed between the two groups, with the intervention group experiencing a more rapid and substantial improvement. The reported partial eta squared (η^2) values suggest a moderate to large effect size, reinforcing the clinical relevance of the findings (Table 5).

Table 1. Baseline Characteristics of Study Participants

Variable	Control Group (n=30)	Intervention Group (n=30)	p-value
Age (years)	28.4 ± 6.2	29.1 ± 5.8	0.63
Gender (F/M)	18/12	19/11	0.79
Baseline VAS	7.0 ± 1.0	7.2 ± 1.1	0.52

Table 2. Comparison of VAS Scores Over Time

Time Point	Control Group	Intervention Group	p-value
Baseline	7.0 ± 1.0	7.2 ± 1.1	>0.05
4 weeks	5.8 ± 1.2	4.0 ± 1.0	<0.01
8 weeks	4.9 ± 1.2	2.8 ± 0.9	<0.001

Table 3. Within-Group Changes in VAS Scores

Group	Baseline (Mean ± SD)	8 Weeks (Mean ± SD)	Mean Difference	p-value
Control Group	7.0 ± 1.0	4.9 ± 1.2	-2.1	<0.01
Intervention Group	7.2 ± 1.1	2.8 ± 0.9	-4.4	<0.001

Table 4. Between-Group Comparison of VAS Scores

Time Point	Control Group (Mean ± SD)	Intervention Group (Mean ± SD)	Mean Difference	p-value
Baseline	7.0 ± 1.0	7.2 ± 1.1	0.2	>0.05
4 Weeks	5.8 ± 1.2	4.0 ± 1.0	-1.8	<0.01
8 Weeks	4.9 ± 1.2	2.8 ± 0.9	-2.1	<0.001

Table 5. Repeated Measures ANOVA Results

Effect	F-value	p-value	Partial η^2	Interpretation
Time Effect	32.6	<0.001	0.18	Significant decrease over time
Group Effect	9.8	<0.01	0.12	Intervention superior
Time × Group Interaction	7.5	<0.01	0.15	Different rate of improvement

DISCUSSION

The present randomized clinical trial demonstrated that the adjunctive use of **diazepam (5 mg)** significantly enhanced pain reduction in patients with temporomandibular disorders (TMD) compared to conventional therapy alone. The intervention group exhibited a greater and more rapid decrease in pain intensity, indicating the important role of anxiety reduction and muscle relaxation in TMD management. These findings support the **biopsychosocial model of TMD**, which emphasizes that pain is influenced not only by peripheral joint and muscle dysfunction but also by psychological factors such as stress and anxiety (Ohrbach and Dworkin, 2016; Schiffman et al., 2014). In this context, diazepam offers a pharmacological approach that directly targets these contributing factors.

The observed reduction in pain may be explained by the **anxiolytic and muscle relaxant effects of diazepam**, which acts by enhancing gamma-aminobutyric acid (GABA) activity in the central nervous system. This leads to decreased neuromuscular excitability, reduced muscle hyperactivity, and a consequent reduction in parafunctional habits such as clenching and bruxism, which are known contributors to TMJ overload and pain. These findings are consistent with previous studies that have highlighted the role of stress and muscle tension in the pathophysiology of TMD. For instance, **Wieckiewicz et al. (2020)** reported that stress-related bruxism significantly contributes to TMD symptoms, while **Gauer and Semidey (2021)** emphasized that muscle tension associated with anxiety is a major factor in TMJ pain.

Furthermore, psychological factors have been strongly associated with increased pain perception and chronicity in TMD patients. **Ooi et al. (2022)** demonstrated that anxiety and psychological distress are significantly correlated with higher pain intensity and functional limitation, supporting the rationale for using anxiolytic medications in TMD management.

The significant interaction effect observed in this study suggests that the rate of pain reduction differed between groups, with the diazepam group showing a faster and more pronounced improvement. This may be attributed to the rapid onset of action of benzodiazepines in reducing muscle tension and anxiety-related symptoms. The large effect size observed in the present study further confirms the **clinical relevance** of the findings, indicating that the observed improvements are meaningful in clinical practice. This is particularly important given the significant impact of TMD on quality of life. Unlike conventional therapies that primarily target peripheral symptoms, diazepam addresses **psychological stress and neuromuscular dysfunction simultaneously**, which may explain the superior outcomes observed in the intervention group.

Clinical Implications

The findings of this study suggest that:

- **Diazepam (5 mg)** can be used as an effective **short-term adjunctive therapy** in the management of TMD
- Targeting **anxiety and muscle hyperactivity** improves treatment outcomes
- Patients with **stress-related TMD or bruxism** may particularly benefit from anxiolytic therapy
- A **multidisciplinary approach** combining pharmacological and conventional therapies is recommended

However, due to the potential risks associated with benzodiazepines, including sedation and dependence,

diazepam should be prescribed with caution and limited to short-term use under clinical supervision.

Limitations

Despite the positive findings of this study, several limitations should be acknowledged. The relatively small sample size may limit the generalizability of the results to broader populations. Additionally, the short follow-up period restricts the ability to evaluate the long-term effectiveness and safety of diazepam in TMD management. Furthermore, the study did not control for potential confounding factors such as parafunctional habits (e.g., bruxism and clenching), which may influence TMJ pain severity. Psychological status was not stratified according to severity levels, which may affect individual responses to anxiolytic therapy. Finally, the potential risk of sedation and dependence associated with benzodiazepines should be considered when interpreting the findings.

Future Directions

Future research should focus on:

- Including larger and more diverse populations to improve generalizability
- Extending follow-up periods to assess long-term efficacy and safety of diazepam
- Comparing diazepam with other pharmacological and non-pharmacological interventions (e.g., cognitive behavioral therapy and physiotherapy)
- Investigating the role of objective biomarkers of stress and inflammation in TMD
- Evaluating individualized treatment approaches based on psychological profiles and severity of symptoms
- Assessing optimal dosing strategies and duration of benzodiazepine use to minimize adverse effects

CONCLUSION

Diazepam (5 mg) significantly improves pain outcomes in patients with temporomandibular disorders when used as adjunctive therapy to conventional treatment. Its anxiolytic and muscle relaxant properties contribute to reducing stress-related muscle hyperactivity and TMJ pain. These findings highlight the importance of addressing psychological and neuromuscular factors in the comprehensive management of TMD.

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