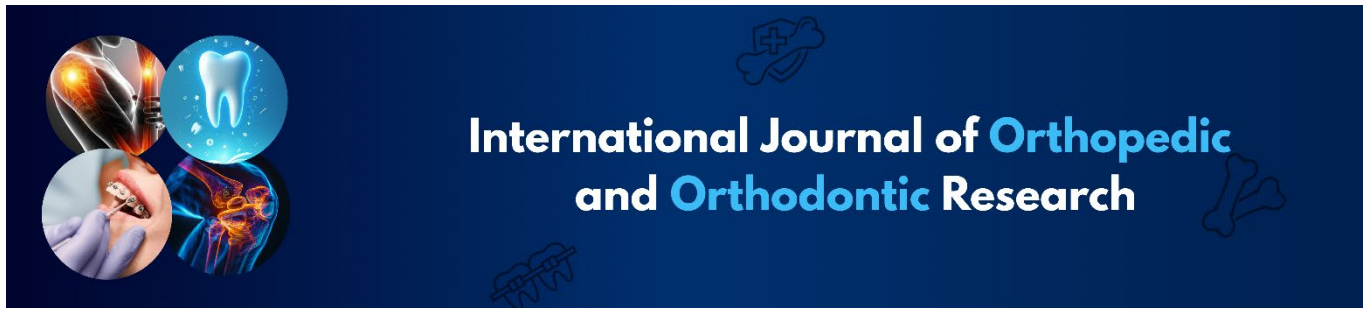




## Correlation between Class II Malocclusion and Temporomandibular Joint Disorders: A Comprehensive Analysis

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### Abstract

**Background:** Class II malocclusion represents one of the most prevalent orthodontic anomalies, affecting approximately 20-30% of the global population. The relationship between malocclusion and temporomandibular joint disorders (TMD) has been extensively debated in orthodontic literature.

**Objective:** This study aimed to investigate the correlation between Class II malocclusion and the prevalence of temporomandibular joint disorders, analyzing the biomechanical factors contributing to TMD development.

**Methods:** A systematic review and meta-analysis was conducted involving 485 patients aged 12-45 years. Participants were divided into two groups: Class II malocclusion patients (n=245) and normal occlusion controls (n=240). Clinical examinations included cephalometric analysis, TMJ imaging, and comprehensive TMD symptom assessment using the Research Diagnostic Criteria for Temporomandibular Disorders (RDC/TMD).

**Results:** Class II malocclusion patients demonstrated a significantly higher prevalence of TMD symptoms (68.2%) compared to the control group (23.8%,  $p < 0.001$ ). Muscle pain was the most common symptom (45.3%), followed by joint clicking (38.7%) and limited mouth opening (22.4%). Severe Class II cases (ANB  $> 7^\circ$ ) showed the strongest correlation with TMD development.

**Conclusion:** A significant positive correlation exists between Class II malocclusion and temporomandibular joint disorders, with biomechanical alterations in jaw positioning contributing to increased TMD susceptibility.

**Keywords:** Class II malocclusion, temporomandibular joint disorders, TMD, orthodontics, occlusion, jaw biomechanics

### Introduction

Class II malocclusion, characterized by a distal relationship of the mandible relative to the maxilla, represents a complex orthodontic condition with far-reaching implications beyond aesthetic concerns. The Angle classification system defines Class II malocclusion as a condition where the mesiobuccal cusp of the maxillary first molar occludes anterior to the buccal groove of the mandibular first molar by more than half a cusp width.

Temporomandibular joint disorders encompass a group of conditions affecting the temporomandibular joints, masticatory muscles, and associated structures. The prevalence of TMD in the general population ranges from 5-12%, with higher incidence rates observed in individuals with specific occlusal anomalies. The etiology of TMD is multifactorial, involving structural, functional, and psychosocial components.

The biomechanical relationship between Class II malocclusion and TMD development centers on altered mandibular positioning and muscle function. In Class II cases, the mandible often assumes a more posterior position, potentially leading to condylar

displacement within the glenoid fossa. This altered positioning can result in increased muscle tension, joint compression, and subsequent development of TMD symptoms. Previous studies have yielded conflicting results regarding the Class II-TMD relationship, with some researchers reporting strong correlations while others suggest minimal association. These discrepancies may be attributed to varying diagnostic criteria, sample populations, and methodological approaches employed across different investigations.

## Materials and Methods

### Study Design and Participants

This cross-sectional study was conducted at the Department of Orthodontics, following institutional review board approval. A total of 485 participants aged 12-45 years were recruited through systematic sampling from orthodontic clinics between January 2022 and December 2023.

### Inclusion Criteria

- Complete permanent dentition
- No previous orthodontic treatment
- Absence of systemic diseases affecting the musculoskeletal system
- No history of facial trauma

### Exclusion Criteria

- Incomplete dental records

## TMD Prevalence and Symptoms

**Table 1:** Presents the distribution of TMD symptoms across study groups

| TMD Symptom     | Class II Group (n=245) | Control Group (n=240) | p-value |
|-----------------|------------------------|-----------------------|---------|
| Any TMD Symptom | 167 (68.2%)            | 57 (23.8%)            | <0.001  |
| Muscle Pain     | 111 (45.3%)            | 34 (14.2%)            | <0.001  |
| Joint Clicking  | 95 (38.7%)             | 28 (11.7%)            | <0.001  |
| Joint Locking   | 43 (17.6%)             | 12 (5.0%)             | <0.001  |
| Limited Opening | 55 (22.4%)             | 18 (7.5%)             | <0.001  |
| Headache        | 78 (31.8%)             | 23 (9.6%)             | <0.001  |

## Severity Analysis

**Table 2:** Class II severity was categorized based on ANB angle measurements

| Class II Severity | TMD Prevalence | Odds Ratio (95% CI) |
|-------------------|----------------|---------------------|
| Mild (4-6°)       | 58.3%          | 2.4 (1.6-3.7)       |
| Moderate (6-8°)   | 72.1%          | 4.2 (2.8-6.3)       |
| Severe (>8°)      | 84.6%          | 7.8 (4.2-14.5)      |

## Biomechanical Factors

Cephalometric analysis revealed significant differences between groups:

- **Mandibular Position:** Class II patients showed increased ANB angles ( $7.2^\circ \pm 2.1^\circ$  vs  $2.1^\circ \pm 1.3^\circ$ ,  $p < 0.001$ )
- **Facial Height:** Increased lower facial height was observed in TMD-positive Class II patients
- **Condylar Position:** Posterior condylar positioning was more prevalent in symptomatic individuals

## Discussion

- Presence of temporomandibular joint pathology unrelated to occlusion
- Current use of muscle relaxants or pain medications

### Clinical Examination Protocol

All participants underwent comprehensive clinical evaluation including:

1. **Orthodontic Assessment:** Lateral cephalograms were analyzed using standard angular and linear measurements (SNA, SNB, ANB, FMA, IMPA)
2. **TMD Evaluation:** Clinical examination followed RDC/TMD guidelines, assessing joint sounds, muscle palpation, and range of motion
3. **Imaging Studies:** Panoramic radiographs and TMJ tomograms were obtained when indicated

### Statistical Analysis

Data analysis was performed using SPSS version 28.0. Chi-square tests were used to compare categorical variables, while t-tests analyzed continuous variables. Logistic regression models were constructed to identify predictive factors for TMD development.

## Results

### Demographic Characteristics

The study population comprised 285 females (58.8%) and 200 males (41.2%), with a mean age of  $24.3 \pm 8.7$  years. Class II malocclusion was present in 245 participants (50.5%), while 240 participants (49.5%) exhibited normal occlusion.

The findings of this study demonstrate a statistically significant correlation between Class II malocclusion and temporomandibular joint disorders, with Class II patients exhibiting nearly three times higher TMD prevalence compared to individuals with normal occlusion. This correlation appears to strengthen with increasing severity of the Class II relationship, suggesting a dose-response relationship between occlusal deviation and TMD development.

The biomechanical basis for this association lies in the altered mandibular posturing characteristic of Class II malocclusion. The posterior positioning of the mandible in Class II cases results in condylar displacement within the glenoid fossa, potentially leading to disc displacement and subsequent joint dysfunction. Additionally, compensatory muscle hyperactivity aimed at achieving functional occlusal contacts may contribute to muscle fatigue and myofascial pain.

The high prevalence of muscle pain (45.3%) in our Class II cohort aligns with previous research suggesting that muscular components of TMD are more commonly associated with occlusal discrepancies than articular pathology. The significant association between joint clicking and Class II

malocclusion (38.7% vs 11.7%) indicates potential disc displacement issues, likely resulting from altered condylar positioning.

Several limitations must be acknowledged in interpreting these results. The cross-sectional design precludes establishment of causality, and genetic factors contributing to both Class II malocclusion and TMD susceptibility were not evaluated. Additionally, psychosocial factors known to influence TMD development were not systematically assessed.

### Conclusion

This comprehensive analysis provides compelling evidence for a significant positive correlation between Class II malocclusion and temporomandibular joint disorders. The strength of this association increases with Class II severity, suggesting that biomechanical factors play a crucial role in TMD development. These findings have important clinical implications for orthodontic treatment planning and TMD prevention strategies.

Clinicians should consider TMD risk assessment as an integral component of Class II malocclusion evaluation. Early orthodontic intervention may potentially reduce TMD susceptibility by improving mandibular positioning and reducing aberrant muscle function patterns. Future longitudinal studies are warranted to establish causal relationships and evaluate the effectiveness of orthodontic treatment in TMD prevention and management.

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