International Journal Dental and Medical Sciences Research
Volume 7, Issue 2, Mar - Apr 2025 pp 281-282 www.ijdmsrjournal.com ISSN: 2582-6018

Orthodontic Treatment and Its Association with Temporomandibular Joint Disorders: A Review of Current Evidence and Clinical Considerations.

Dr. Zela Margot Murray

Date of Submission: 10-04-2025 Date of Acceptance: 20-04-2025

ABSTRACT: Temporomandibular joint disorders (TMDs) are a complex group of musculoskeletal and neuromuscular conditions involving the temporomandibular joint (TMJ), masticatory muscles, and associated structures. The potential association between orthodontic treatment and the onset or exacerbation of TMD symptoms has long been a subject of debate. This review examines the current evidence regarding the relationship between orthodontic interventions and TMJ disorders. We explore pathophysiological mechanisms, diagnostic challenges, and clinical implications, aiming to provide guidance for practitioners in the diagnosis, treatment planning, and management of orthodontic patients at risk for TMDs.

I. INTRODUCTION

Temporomandibular joint disorders (TMDs) affect up to 25% of the population and are a common cause of non-dental orofacial pain. Symptoms include joint pain, joint sounds (clicking or crepitus), restricted mandibular movement, and muscle tenderness. Although orthodontic treatment aims to improve occlusal function and facial aesthetics, concerns persist regarding its potential to contribute to TMD onset or aggravation. Given the increasing demand for orthodontic care, especially among adolescents and young adults, a clear understanding of this relationship is crucial.

II. PATHOPHYSIOLOGY OF TMJ DISORDERS

The TMJ is a synovial joint susceptible to mechanical, psychological, and systemic influences. TMD etiology is multifactorial, encompassing parafunctional habits (e.g., bruxism), trauma, stress, anatomical predisposition, and occlusal factors. Orthodontic treatment may influence these elements by altering occlusion, condylar position, or masticatory muscle activity.

III. METHODS

This narrative review was conducted by analyzing published literature from 2000 to 2024. The search strategy included databases such as PubMed, Scopus, and Web of Science using the keywords: "orthodontics," "temporomandibular joint disorders," "TMD," "TMJ," "malocclusion," and "occlusion therapy."

Inclusion criteria:
-Peer-reviewed articles
-Systematic reviews, meta-analyses, clinical trials, and cohort studies
-Studies published in English
-Exclusion criteria:
-Case reports with <5 subjects
-Non-clinical theoretical papers
-Additionally, clinical data were collected retrospectively from 30 patients at the Department of Orthodontics between 2021 and 2023 who developed TMJ symptoms during or shortly after orthodontic treatment. Patients were assessed using the Diagnostic Criteria for Temporomandibular Disorders (DC/TMD).

IV. RESULTS

4.1 Literature Analysis

Out of 152 screened studies, 47 met the inclusion criteria. Most high-quality studies, including systematic reviews and meta-analyses (e.g., Manfredini et al., 2016; Luther, 1998), concluded:
-No causal link between orthodontic treatment and TMD onset

-Prevalence of TMD symptoms in orthodontic patients ranges from 5–20%
-Symptoms often present before treatment initiation

4.2 Clinical Observations

Of the 30 patients reviewed:
-21 (70%) had pre-treatment signs of TMD (e.g., joint clicking, pain, muscle tenderness)
-6 patients (20%) developed mild symptoms during treatment, which resolved post-treatment
-3 patients (10%) reported persistent TMD symptoms post-treatment; all had parafunctional habits (e.g., bruxism) or psychological stress factors
-No significant differences in symptom incidence were found between patients treated with fixed appliances and those using clear aligners.

V. ORTHODONTIC TREATMENT MODALITIES AND THEIR IMPACT ON TMJ

5.1 Orthodontic Treatment

-Evidence suggests that Orthodontic Treatment Modalities do not increase the risk of TMD.

5.2 Skeletal discrepancies Class II cases

-Used to correct skeletal discrepancies, particularly in Class II cases. Temporomandibular joint adaptations were transient in most patients without long-term consequences.

5.3 Clear Aligners

-Their removability and intermittent wear show less reported association with TMD flare-ups. However, longitudinal data remains limited.

VI. DIAGNOSTIC CONSIDERATIONS BEFORE ORTHODONTIC THERAPY

-TMJ and masticatory muscle examination
-Mandibular movement analysis
-Use of the DC/TMD questionnaire and imaging if indicated
-Screening for stress and parafunction

VII. MANAGEMENT STRATEGIES AND RECOMMENDATIONS

-Use gentle, biologically safe forces
-Avoid altering the condylar position without skeletal indication
-Implement stress management and habit counseling in high-risk patients
-Monitor TMJ signs at each follow-up
-Refer to a TMD specialist for persistent symptoms

VIII. CONCLUSIONS

While orthodontic treatment does not directly cause TMDs, certain biomechanical or psychological factors can influence symptom onset or aggravation. Identifying at-risk patients and modifying treatment protocols can help mitigate complications. Further longitudinal clinical studies are required to deepen our understanding of orthodontic impacts on TMJ health.

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