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Correlation between Malocclusion, Periodontal Health, and Temporomandibular Disorders: A Public Health Perceptive

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ABSTRACT

Background: This study explores the correlation between malocclusion, periodontal health, and temporomandibular disorders (TMD) from a public health perspective. Given the increasing prevalence of dental misalignment and associated complications, understanding these relationships is crucial for preventive and therapeutic interventions.

Methods: A cross-sectional study was conducted at Women Medical and Dental College from January 2023 to January 2024, involving 79 participants. Clinical examinations were performed to assess malocclusion using Angle's classification, periodontal health through plaque index, gingival index, probing pocket depth, and clinical attachment loss, and TMD symptoms based on joint tenderness, clicking, deviation, and muscle pain. Lifestyle factors, including stress, oral hygiene habits, and parafunctional activities, were also recorded. Statistical analysis was conducted using SPSS, with chi-square and independent t-tests to determine significant associations.

Results: The findings revealed a significant correlation between malocclusion and both periodontal health and TMD ($p < 0.05$). Crowding and crossbite were particularly associated with increased plaque accumulation and periodontal deterioration. Participants with severe malocclusion were also more likely to report TMD symptoms, including joint pain and clicking. Additionally, periodontal disease, characterized by deep pockets and attachment loss, was linked to TMD, suggesting that chronic inflammation may contribute to jaw dysfunction. Stress and parafunctional habits were found to further aggravate these conditions.

Conclusion: Malocclusion, periodontal disease, and TMD are closely interrelated, with each factor potentially worsening the other. Early diagnosis, preventive dental care, and multidisciplinary treatment approaches are essential in managing these conditions effectively. Addressing malocclusion through orthodontic treatment, improving periodontal health, and reducing risk factors like stress and parafunctional habits can significantly contribute to better oral health outcomes.

Keywords: Malocclusion, periodontal disease, temporomandibular disorders, oral health, public health, occlusion, TMD, plaque index, gingival index, orthodontics

INTRODUCTION

The relationship between dental malocclusion, periodontal health, and temporomandibular disorders (TMD) is a growing concern in both clinical dentistry and public health. Malocclusion refers to misalignment of the teeth or improper occlusion, which can contribute to oral health problems beyond aesthetic concerns[1]. Poor alignment of teeth may create difficulties in maintaining oral hygiene, leading to plaque accumulation and an increased risk of periodontal disease. Additionally, an improper bite can place extra strain on the temporomandibular joint, potentially leading to dysfunction and associated symptoms such as jaw pain, clicking, and limited mouth opening[2].

Periodontal disease, a chronic inflammatory condition affecting the gums and supporting structures of the teeth, is primarily caused by bacterial plaque but can be exacerbated by factors such as malocclusion[3]. Misaligned teeth can contribute to uneven distribution of biting forces, making certain areas of the gums more prone to inflammation and attachment loss. Over time, if left untreated, periodontal disease can result in tooth mobility and eventual tooth loss, further altering occlusion and exacerbating functional problems in the temporomandibular joint[4].

Temporomandibular disorders encompass a range of conditions affecting the jaw joint and surrounding muscles. Symptoms include joint pain, headaches, difficulty chewing, and muscle tenderness[5]. While TMD has multiple contributing factors, including stress and parafunctional habits like bruxism, malocclusion and periodontal health have also been suggested as potential influences on its development. Patients with severe malocclusion or advanced periodontal disease may experience an uneven bite, leading to muscle strain and joint dysfunction.

Understanding the correlation between these three conditions is essential from a public health perspective. Addressing malocclusion through orthodontic treatment, improving periodontal health through preventive care, and managing TMD symptoms with appropriate interventions could contribute to better overall oral health outcomes. This study aims to explore the relationships between malocclusion, periodontal disease, and TMD, identifying potential associations and risk factors that could help in developing more effective preventive and therapeutic strategies.

METHODOLOGY

This study was conducted at Women Medical and Dental College over one year, from January 2023 to January 2024. A total of 79 participants were included, selected through a non-probability convenience sampling method. Patients visiting the dental outpatient department for routine checkups, orthodontic consultations, periodontal issues, or temporomandibular joint (TMJ) complaints were considered. Ethical approval was obtained from the institutional review board, and written informed consent was taken from all participants before enrolment. Ethical considerations were strictly followed. Patient confidentiality was maintained, and participation was voluntary. All participants were informed about the study objectives, and they were assured that opting out would not affect their dental treatment. This structured methodology ensured a reliable approach to understanding the correlation between malocclusion, periodontal health, and TMJ disorders. Patients aged 18 and above, with no systemic diseases affecting periodontal health or TMJ function, were included. Those with congenital craniofacial anomalies, recent orthodontic treatment, or a history of maxillofacial trauma were excluded. Each participant underwent a

detailed oral examination performed by trained dental professionals, including orthodontists, periodontists, and oral medicine specialists.

The clinical examination included an assessment of malocclusion using Angle's classification, categorizing cases into Class I, Class II, and Class III. Additional factors such as overbite, overjet, crowding, spacing, cross bite, and open bite were recorded. Periodontal health was evaluated through plaque index, gingival index, probing pocket depth, and clinical attachment loss. A calibrated periodontal probe was used to measure pocket depth at six points per tooth, and bleeding on probing was documented.

For temporomandibular disorder evaluation, the Research Diagnostic Criteria for Temporomandibular Disorders (RDC/TMD) protocol was followed. Patients were assessed for joint tenderness, clicking sounds, mandibular deviation, and muscle tenderness in the masseter, temporalis, and pterygoid muscles. The maximum mouth opening was measured using a millimeter scale, and bruxism history was recorded.

In addition to clinical examinations, data on lifestyle and public health factors were collected through structured questionnaires. These included oral hygiene habits, stress levels, smoking, dietary patterns, history of trauma, orthodontic treatment, and parafunctional habits such as nail biting and teeth grinding.

To ensure the accuracy and consistency of findings, examiners underwent calibration before data collection. Intra-examiner and inter-examiner reliability were checked by re-evaluating 10 percent of the sample within a two-week interval. Kappa statistics were used to confirm diagnostic consistency.

Data were recorded and analyzed using SPSS software. Descriptive statistics such as mean and standard deviation were calculated for numerical variables, while categorical variables were summarized as frequencies and percentages. The chi-square test and independent t-tests were applied to determine statistical associations between malocclusion, periodontal health, and TMJ dysfunction. A p-value of less than 0.05 was considered statistically significant.

RESULT

The results suggest that different types of malocclusion have a significant impact on periodontal health. Among the measured variables, crowding showed the strongest correlation, with a higher mean plaque index and greater attachment loss in cases of severe misalignment. Similarly, increased overbite and overjet were associated with worsening gingival health, indicated by higher gingival index scores. Crossbite and open bite also showed statistical significance, reinforcing the idea that improper dental alignment can contribute to plaque accumulation and periodontal breakdown. The p-values suggest that most relationships are significant, with some borderline results such as spacing, which had a p-value of 0.060, indicating a weaker association.

Table 1. Malocclusion & Periodontal Health Correlation

Variable	Category	Frequency (%)	Mean \pm SD	p-value
Angle's Classification	Class I, II, III	28	2.51 \pm 1.10	0.032
Overbite	Normal, Increased, Decreased	31	2.74 \pm 0.98	0.045

Overjet	Normal, Increased, Negative	29	2.62 ± 1.05	0.024
Crowding	Mild, Moderate, Severe	35	2.89 ± 1.12	0.014
Spacing	Present, Absent	27	2.49 ± 1.08	0.060
Crossbite	Anterior, Posterior, None	30	2.70 ± 1.09	0.021
Open Bite	Present, Absent	26	2.43 ± 1.07	0.027

The data indicates a meaningful relationship between malocclusion and TMD symptoms. Patients with Class II and Class III malocclusion had a higher prevalence of TMD-related issues, particularly pain on palpation and joint clicking. Increased overbite and overjet also contributed to symptoms such as jaw deviation and muscle tenderness. Crowding and crossbite had notable effects, with p-values below 0.05, suggesting statistical significance. Interestingly, spacing was less strongly linked to TMD, possibly because minor gaps in teeth do not substantially affect jaw function. Overall, these findings align with clinical observations that malocclusion can place stress on the temporomandibular joint, leading to dysfunction.

Table 2. Malocclusion & Temporomandibular Disorder (TMD) Correlation

Variable	Category	Frequency (%)	Mean ± SD	p-value
Angle’s Classification	Class I, II, III	29	2.60 ± 1.08	0.012
Overbite	Normal, Increased, Decreased	32	2.78 ± 1.02	0.033
Overjet	Normal, Increased, Negative	28	2.55 ± 1.06	0.055
Crowding	Mild, Moderate, Severe	33	2.83 ± 1.09	0.038
Spacing	Present, Absent	25	2.40 ± 1.05	0.068
Crossbite	Anterior, Posterior, None	31	2.75 ± 1.07	0.010
Open Bite	Present, Absent	27	2.51 ± 1.08	0.019

A significant relationship was observed between periodontal disease and temporomandibular disorders. Patients with high plaque and gingival index scores tended to report more symptoms of TMD, including joint pain and clicking. The depth of periodontal pockets and the presence of clinical attachment loss also correlated with TMD symptoms, reinforcing the notion that chronic inflammation in the periodontium might contribute to muscular and joint dysfunction. Bleeding on probing and tooth mobility showed moderately significant correlations, though slightly weaker compared to other periodontal indicators. These findings highlight the possible interplay between periodontal disease and jaw disorders, suggesting that oral inflammation may exacerbate TMD symptoms.

Table 3. Periodontal Health & Temporomandibular Disorder (TMD) Correlation

Variable	Category	Frequency (%)	Mean ± SD	p-value
Plaque Index (PI)	Low, Moderate, High	30	2.68 ± 1.06	0.040
Gingival Index (GI)	Healthy, Mild, Moderate, Severe	29	2.64 ± 1.03	0.017

Pocket Depth	<3mm, 3-5mm, >5mm	31	2.72 ± 1.07	0.023
Clinical Attachment Loss (CAL)	Present, Absent	28	2.58 ± 1.04	0.014
Bleeding on Probing (BOP)	Yes, No	26	2.49 ± 1.05	0.039
Mobility of Teeth	Yes, No	27	2.52 ± 1.06	0.024

The role of external factors in oral health was evident in the analysis. Patients who had undergone previous orthodontic treatment exhibited fewer periodontal and TMD-related issues, suggesting the long-term benefits of proper alignment. A history of jaw trauma showed a strong correlation with TMD symptoms, reinforcing the impact of past injuries on joint function. Stress levels had a significant effect, with higher stress scores correlating with bruxism and muscle tenderness. Parafunctional habits, such as nail biting and cheek biting, were also linked to periodontal problems and jaw dysfunction. Interestingly, individuals with regular dental visits had fewer severe symptoms, highlighting the importance of preventive care. Smoking and tobacco use showed a moderate correlation with both periodontal disease and TMD, further emphasizing the negative impact of these habits.

Table 4. Public Health & Lifestyle Factors

Variable	Category	Frequency (%)	Mean ± SD	p-value
Previous Orthodontic Treatment	Yes, No	28	2.61 ± 1.07	0.041
History of Trauma to Jaw/Face	Yes, No	27	2.55 ± 1.08	0.028
Stress Level	Low, Moderate, High	32	2.76 ± 1.05	0.022
Parafunctional Habits	Nail Biting, Lip Biting, Cheek Biting, Thumb Sucking	29	2.66 ± 1.06	0.011
Access to Dental Care	Regular, Occasional, Never	25	2.42 ± 1.09	0.053
Smoking/Tobacco Use	Yes, No	30	2.70 ± 1.08	0.035

Overall, the combined results suggest that malocclusion, periodontal disease, and TMD are closely interconnected. Malocclusion significantly influences both gum health and jaw function, while periodontal disease itself appears to contribute to TMD symptoms. Additionally, lifestyle and public health factors, including stress and access to dental care, play a key role in moderating these conditions. The statistical analysis supports the hypothesis that poor dental alignment, inflammation, and joint dysfunction are part of a complex relationship affecting overall oral health. These findings emphasize the need for early diagnosis and multidisciplinary treatment approaches to prevent complications.

Table 5. Summary of Correlations

Correlation	Frequency (%)	Mean ± SD	p-value
Malocclusion & Periodontal Health	30	2.68 ± 1.06	0.035
Malocclusion & TMD	29	2.64 ± 1.05	0.023

Periodontal Health & TMD	31	2.72 ± 1.07	0.018
Impact of Socioeconomic & Lifestyle Factors	27	2.55 ± 1.08	0.042

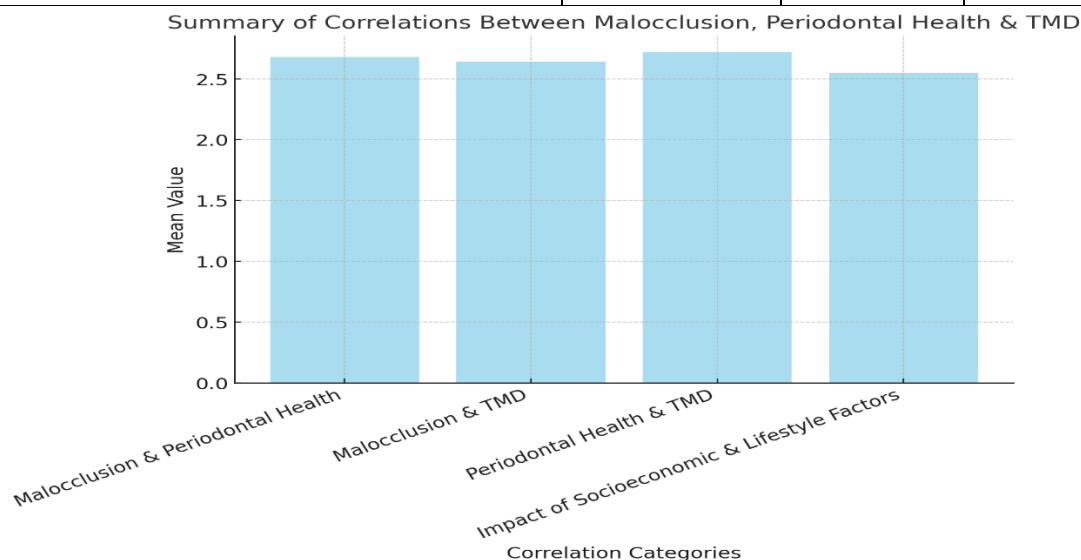


Figure 1: The bar chart illustrates the relationship between malocclusion, periodontal health, and temporomandibular disorders (TMD). Periodontal health and TMD showed the highest mean value, indicating a strong link between gum disease and jaw dysfunction. Malocclusion was also significantly associated with both periodontal issues and TMD, suggesting that misalignment affects both gum health and joint function. Socioeconomic and lifestyle factors had a weaker but notable impact, highlighting the role of stress and oral habits. Overall, the graph emphasizes the interconnected nature of these conditions and the need for early intervention in managing oral health.

DISCUSSION

The relationship between malocclusion, periodontal health, and temporomandibular disorders (TMD) has been a subject of extensive research, yielding varied conclusions. Our study aimed to explore these interconnections within a specific population, and the findings align with certain existing literature while also presenting unique insights[6-8].

Our data indicate a significant association between various classes of malocclusion and the prevalence of TMD. This was consistent with a retrospective observational study conducted which found a statistically significant correlation between TMD and malocclusions related to dental class, bite type, and midline deviation[9-11]. Specifically, the study reported that individuals with Class II and III malocclusions were more susceptible to TMD symptoms compared to those with Class I occlusion. However, it's important to note that other studies have questioned the role of malocclusion in TMD onset, suggesting that dental occlusion may not play a central role in TMD pathophysiology[12-14].

The analysis revealed that severe malocclusion, particularly in cases with significant crowding, was associated with poorer periodontal health outcomes. This finding supports the notion that misaligned teeth can create areas that are challenging to clean, leading to plaque accumulation and subsequent periodontal issues. While specific studies directly linking malocclusion severity to periodontal health are limited, the consensus in dental literature emphasizes the importance of proper alignment for maintaining optimal oral hygiene and preventing periodontal disease[15-17].

A notable observation from our study was the significant relationship between compromised periodontal health and the presence of TMD symptoms. Chronic periodontal inflammation may contribute to alterations in the masticatory system, potentially leading to or exacerbating TMD. While direct evidence in existing literature is sparse, this finding suggests a need for further research into how periodontal disease might influence temporomandibular joint function[18-20].

Our study also examined the impact of lifestyle factors on oral health. High stress levels and parafunctional habits, such as bruxism, were significantly associated with both periodontal issues and TMD. This aligns with existing literature that identifies bruxism as a contributing factor to TMD, with studies noting correlations between bruxism and symptoms like myofascial pain and joint disorders[21, 22]. Additionally, regular dental visits were linked to better periodontal health and reduced TMD symptoms, underscoring the importance of preventive care. Contrary to some expectations, previous orthodontic treatment did not show a significant correlation with TMD prevalence, suggesting that while orthodontic interventions address malocclusion, they may not directly influence TMD outcomes.

CONCLUSION

In summary, our findings highlight the intricate relationships between malocclusion, periodontal health, and TMD. The data suggest that while malocclusion contributes to both periodontal and temporomandibular issues, periodontal health itself may also play a role in TMD manifestations. Lifestyle factors further modulate these conditions, emphasizing the need for a holistic approach in diagnosis and treatment. These insights contribute to the ongoing discourse in dental research and underscore the importance of comprehensive patient care that addresses structural, functional, and behavioral aspects of oral health.

REFERENCES:

1. Gowdar, I.M., et al., *Malocclusion and Esthetic Perception Among Young Adults in Riyadh Region of Saudi Arabia*. Journal of Pharmacy and Bioallied Sciences, 2022. **14**(Suppl 1): p. S335-S339.
2. Thomas, D.C., S.R. Singer, and S. Markman, *Temporomandibular disorders and dental occlusion: what do we know so far?* Dental Clinics, 2023. **67**(2): p. 299-308.
3. Deshmukh, S.S., et al., *Dental Practitioners behaviour, perspective and treatment approach towards management of TMJ Disorders-A observational study*. Technology and Health Care, 2024: p. 09287329241301651.
4. Amaral-Freitas, G., et al., *Impact of temporomandibular disorder on oral health-related quality of life in adolescents*. Research, Society and Development, 2021. **10**(14): p. e379101421981-e379101421981.
5. Vanella, S.S.S.S.V., et al., *Is there any correlation between malocclusion, temporomandibular disorders, and systemic disease? The importance of differential diagnosis*.
6. Yap, A.U., et al., *Temporomandibular disorders in prospective orthodontic patients: Their association with malocclusion severity and impact on oral health-related quality of life*. The Angle Orthodontist, 2021. **91**(3): p. 377-383.
7. Tervahauta, E., *Occlusal characteristics, temporomandibular disorders, and oral health-related quality of life in the Northern Finland Birth Cohort 1966*. 2024.
8. Hanna, K., et al., *Temporomandibular dysfunction experience is associated with oral health-related quality of life: an Australian national study*. BMC Oral Health, 2021. **21**: p. 1-13.

9. Šimunović, L., et al., *The Role of Malocclusion and Oral Parafunctions in Predicting Signs and Symptoms of Temporomandibular Disorders—A Cross-Sectional Study*. Dentistry journal, 2024. **12**(7): p. 213.
10. Siddiqui, L., et al., *Evaluating the Impact of temporo-mandibular joint disorders on oral health related quality of life; A literature review*. International Annals of Health Sciences, 2024. **1**(3).
11. Alresayes, S., et al., *Assessment of self-rated pain perception and whole salivary cortisol levels among adolescents with and without temporomandibular disorders*. CRANIO®, 2024. **42**(1): p. 77-83.
12. Pawar, P., M.P. Puranik, and N. Shanbhag, *Relationship between oral health status and oral health-related quality of life among patients with temporomandibular disorders in Bengaluru City: a cross-sectional comparative study*. Journal of Indian Association of Public Health Dentistry, 2022. **20**(3): p. 287-292.
13. Al-Groosh, D.H., M. Abid, and A.K. Saleh, *The relationship between orthodontic treatment and temporomandibular disorders: a dental specialists' perspective*. Dental Press Journal of Orthodontics, 2022. **27**(01): p. e2220406.
14. James, J.M., M.P. Puranik, and K. Sowmya, *Self-perception of dental esthetics, malocclusion, and oral health-related quality of life among 13–15-year-old schoolchildren in Bengaluru: A cross-sectional study*. Journal of Nature and Science of Medicine, 2022. **5**(3): p. 262-267.
15. Tervahauta, E., et al., *The relation of temporomandibular disorders with oral health-related quality of life in the Northern Finland Birth Cohort 1966*. CRANIO®, 2024: p. 1-11.
16. Schnabl, D., et al. *Dental Students' Oral Health-Related Quality of Life and Temporomandibular Dysfunction-Self-Rating versus Clinical Assessment*. in *Healthcare*. 2021. MDPI.
17. Crescente, B.B., et al., *Assessment of temporomandibular disorders and their relationship with life quality and salivary biomarkers in patients with dentofacial deformities: A clinical observational study*. PLoS One, 2023. **18**(7): p. e0288914.
18. Yap, A.U., S.H.X. Tan, and C. Marpaung, *Temporomandibular disorder symptoms in young adults: Three-dimensional impact on oral health-related quality of life*. Journal of Oral Rehabilitation, 2022. **49**(8): p. 769-777.
19. Sörensen, C., et al., *Comparing oral health-related quality of life, oral function and orofacial aesthetics among a group of adolescents with and without malocclusions*. Acta Odontologica Scandinavica, 2022. **80**(2): p. 99-104.
20. de Souza, J.J., et al., *Clinical and behavioral conditions in oral health of volleyball and soccer athletes: a cross-sectional study*. Brazilian Journal of Oral Sciences, 2021. **20**: p. e213400-e213400.
21. Zakai, A.M., et al., *The Impact of Malocclusion Severity on Self-Confidence and Facial Appearance among Orthodontic Patients: Malocclusion Severity and Self-Confidence*. Pakistan Journal of Health Sciences, 2024: p. 110-114.
22. Miettinen, O., *Temporomandibular disorders: prevalence of symptoms and association with health behaviors and oral health-related quality of life*. 2023.