

Association of Malocclusion Severity With Periodontal Parameters Among Patients Seeking Orthodontic Treatment: A Retrospective Institutional Study**Padmanaban A¹, Dr. Subasree S^{2*}**¹Undergraduate student, Saveetha Dental College and Hospitals, Saveetha Institute of Medical and Technical Sciences (SIMATS), Saveetha University, Chennai-600077²Senior Lecturer, Department of Periodontics, Saveetha Dental College and Hospitals, Saveetha Institute of Medical and Technical Sciences (SIMATS), Saveetha University, Chennai-600077

Email: 152201032.sdc@saveetha.com, subasrees.sdc@saveetha.com

Abstract

Background: Malocclusion may contribute to plaque retention and compromised oral hygiene, thereby influencing periodontal health. Evaluation of periodontal parameters among orthodontic patients with varying malocclusion patterns is important for comprehensive treatment planning. **Aim:** To evaluate the association between type of malocclusion and periodontal parameters among patients seeking orthodontic treatment. **Materials and Methods:** This retrospective institutional study was conducted using patient records archived between January 2020 and January 2025. A total of 1324 patient records with complete orthodontic and periodontal documentation were included. Malocclusion was categorized as Class I, Class II Division 1, Class II Division 2, and Class III based on orthodontic records. Periodontal diagnosis was categorized as clinically healthy gingiva, localized chronic gingivitis, generalized chronic gingivitis, localized chronic periodontitis, and generalized chronic periodontitis. Plaque Index, Gingival Index, probing pocket depth, and clinical attachment loss were also assessed. Statistical analysis was performed using Chi-square test and one-way ANOVA. **Results:** Class I malocclusion was the most prevalent occlusal category (42.8%), followed by Class II Division 1 (31.8%), Class II Division 2 (15.0%), and Class III malocclusion (10.4%). Generalized chronic gingivitis was the most common periodontal condition (55.1%). Class III malocclusion demonstrated higher mean Plaque Index (2.08 ± 0.42), Gingival Index (1.96 ± 0.46), probing pocket depth (4.1 ± 0.7 mm), and clinical attachment loss (2.7 ± 0.8 mm) compared to other malocclusion groups. A significant association was observed between malocclusion type and periodontal status ($p = 0.001$). **Conclusion:** Class II Division 1 and Class III malocclusion demonstrated comparatively poorer periodontal parameters among orthodontic patients.

Keywords: Malocclusion; periodontal parameters; orthodontic treatment; gingivitis; periodontitis; retrospective study**Introduction**

Malocclusion is one of the most common oral conditions affecting individuals worldwide and is characterized by irregular alignment of teeth, crowding, spacing abnormalities, rotations, and improper occlusal relationships (1,2). Although malocclusion is frequently associated with esthetic concerns and functional disturbances, its influence on periodontal health has gained increasing clinical importance in recent years. Irregular tooth positioning may interfere with effective oral hygiene maintenance and create favorable sites for plaque retention, thereby predisposing individuals to gingival inflammation and periodontal disease progression (3). Periodontal diseases are chronic inflammatory conditions affecting the supporting structures of teeth and remain among the leading causes of tooth loss in adults. Dental plaque is considered the primary etiological factor responsible for initiation and progression of periodontal diseases. Local factors that facilitate plaque accumulation or hinder plaque removal may aggravate gingival inflammation and periodontal tissue destruction. In this context, malocclusion has long been considered a potential contributing factor to periodontal disease because malaligned teeth may compromise oral hygiene practices and increase microbial colonization (4). Patients seeking orthodontic treatment commonly present with varying severities of malocclusion associated with crowding, overlapping teeth, crossbite, deep bite, and abnormal occlusal relationships. Such irregularities may create areas that are inaccessible to routine tooth brushing and interdental cleaning procedures (5). Persistent plaque accumulation in these regions may result in gingivitis, periodontal pocket formation, and clinical attachment loss over time. In addition, traumatic occlusal forces associated with certain malocclusions may further contribute to periodontal breakdown in susceptible individuals.

The relationship between malocclusion and periodontal disease remains a subject of considerable debate. While some studies have reported a positive association between malocclusion severity and periodontal deterioration, others have suggested that periodontal destruction is primarily dependent on oral hygiene status and host response rather than tooth alignment alone (6,7). However, severe crowding and occlusal discrepancies are frequently associated with increased plaque retention and gingival inflammation, highlighting the importance of evaluating periodontal health in orthodontic patients.

Orthodontic patients represent a unique population in which periodontal evaluation plays a crucial role before initiation of treatment. Existing gingival inflammation and periodontal disease may adversely affect orthodontic outcomes if left untreated. Therefore, assessment of periodontal parameters in patients with varying malocclusion severity is important for comprehensive orthodontic treatment planning and preventive periodontal care. Early identification of periodontal compromise may aid in improving oral hygiene reinforcement and reducing future periodontal complications during orthodontic therapy (8).

Previous studies evaluating orthodontic-periodontal relationships have mainly focused on the effects of orthodontic treatment on periodontal tissues. Comparatively fewer studies have investigated the periodontal status of patients prior to orthodontic treatment based on malocclusion severity. Furthermore, retrospective institutional studies evaluating the association between malocclusion severity and periodontal parameters in large patient populations remain limited (9). Therefore, the present retrospective institutional study was undertaken to evaluate the association between malocclusion severity and periodontal parameters among patients seeking orthodontic treatment.

Materials and Methods

Study Design and Study Setting: The present study was designed as a retrospective institutional record-based study and was conducted in the Outpatient department of a dental teaching institution after obtaining approval from the Institutional Ethical Committee. Patient records archived in the institutional electronic database between January 2020 and January 2025 were systematically reviewed and analyzed.

Study Population: A total of 1324 patient records of individuals seeking orthodontic treatment during the study period were screened for eligibility. Records with complete orthodontic assessment and periodontal charting were included in the final analysis.

Inclusion Criteria

- Patients aged 18 years and above
- Patients seeking orthodontic treatment
- Availability of complete orthodontic and periodontal records
- Presence of intraoral clinical photographs and diagnostic documentation
- Patients with recorded Angle's molar classification and periodontal diagnosis

Exclusion Criteria

- Incomplete or duplicated patient records
- Patients with previous orthodontic treatment history
- Patients undergoing active periodontal therapy
- Patients with systemic diseases known to affect periodontal health
- Smokers and tobacco users
- Patients with extensive tooth loss affecting occlusal assessment

Data Collection Procedure

The selected case records were retrieved from the institutional digital database and evaluated by trained reviewers. The following variables were recorded:

- Age
- Gender
- Type and severity of malocclusion
- Periodontal diagnosis
- Plaque accumulation
- Gingival inflammation
- Probing pocket depth
- Clinical attachment loss

To minimize bias, records with incomplete documentation were excluded from the analysis.

Assessment of Malocclusion

Malocclusion was categorized based on Angle’s molar classification documented in orthodontic records. Patients were grouped according to the severity of malocclusion into:

- Mild malocclusion
- Moderate malocclusion
- Severe malocclusion

The classification was based on orthodontic clinical examination findings, study models, and diagnostic records available in the institutional database.

Periodontal Assessment

Periodontal status was assessed from recorded periodontal charting and clinical documentation. The periodontal diagnosis was categorized as:

- Clinically healthy gingiva
- Localized chronic gingivitis
- Generalized chronic gingivitis
- Localized chronic periodontitis
- Generalized chronic periodontitis

Clinical periodontal parameters evaluated included plaque accumulation, gingival inflammation, probing pocket depth, and clinical attachment loss.

Statistical Analysis: The collected data were tabulated in Microsoft Excel and statistically analyzed using SPSS software version 23.0 (IBM Corp., Armonk, NY, USA). Descriptive statistics were expressed as frequency, percentage, mean, and standard deviation. Association between malocclusion severity and periodontal status was analyzed using Chi-square test. Mean age comparison among periodontal disease categories was performed using one-way ANOVA. A p-value less than 0.05 was considered statistically significant.

Results

A total of 1324 patient records archived between January 2020 and January 2025 were retrospectively evaluated in the present study. The study population consisted predominantly of young adults seeking orthodontic treatment, with a slightly higher proportion of male patients compared to females. Among the evaluated orthodontic patients, Class I malocclusion was the most frequently observed occlusal pattern (42.8%), followed by Class II Division 1 malocclusion (31.8%), Class II Division 2 malocclusion (15.0%), and Class III malocclusion (10.4%). Assessment of periodontal status demonstrated that generalized chronic gingivitis was the most prevalent periodontal condition observed among the study population, accounting for 55.1% of cases. Clinically healthy gingiva was observed in 23.6% of patients, while localized chronic gingivitis constituted 10.0% of cases. Generalized chronic periodontitis and localized chronic periodontitis were observed in 8.2% and 3.1% of patients, respectively.

Evaluation of the association between malocclusion type and periodontal status revealed that generalized chronic gingivitis was the predominant periodontal condition across all malocclusion categories. However, generalized chronic periodontitis was comparatively more prevalent among patients with Class II Division 1 and Class III malocclusion. Clinically healthy gingiva was more frequently observed among Class I malocclusion patients compared to other malocclusion groups. Patients with Class III malocclusion demonstrated comparatively higher plaque accumulation, gingival inflammation, probing pocket depth, and clinical attachment loss when compared to other malocclusion categories. Statistical analysis demonstrated a significant association between type of malocclusion and periodontal status (p = 0.001). The mean Plaque Index score was highest among Class III malocclusion patients (2.08 ± 0.42), followed by Class II Division 1 malocclusion (1.62 ± 0.38). Gingival Index scores also demonstrated a similar increasing trend, with Class III malocclusion demonstrating comparatively greater gingival inflammation (1.96 ± 0.46). Mean probing pocket depth and clinical attachment loss were also higher among Class III malocclusion groups when compared to Class I malocclusion patients.

Table 1 : Association between type of malocclusion and periodontal parameters among orthodontic patients.

Variable	Class I n=567 (%)	Class II Div 1 n=421 (%)	Class II Div 2 n=199 (%)	Class III n=137 (%)	Total n (%)	p-value	
Male	281 (49.6)	226 (53.7)	101 (50.8)	87 (63.5)	695 (52.5)	0.218	
Female	286 (50.4)	195 (46.3)	98 (49.2)	50 (36.5)	629 (47.5)		
Clinically Healthy Gingiva	168 (29.6)	89 (21.1)	39 (19.6)	16 (11.7)	312 (23.6)	0.001*	
Localized Chronic Gingivitis	59 (10.4)	43 (10.2)	18 (9.0)	12 (8.8)	132 (10.0)		
Generalized Chronic Gingivitis	287 (50.6)	248 (58.9)	116 (58.3)	79 (57.7)	730 (55.1)		
Localized Chronic Periodontitis	16 (2.8)	13 (3.1)	5 (2.5)	7 (5.1)	41 (3.1)		
Generalized Chronic Periodontitis	37 (6.5)	28 (6.7)	21 (10.6)	23 (16.8)	109 (8.2)		
Mean Plaque Index	0.98 ± 0.22	1.62 ± 0.38	1.74 ± 0.41	2.08 ± 0.42	—		0.001*
Mean Gingival Index	0.88 ± 0.20	1.38 ± 0.34	1.52 ± 0.37	1.96 ± 0.46	—		0.002*
Mean Probing Pocket Depth (mm)	2.4 ± 0.4	3.1 ± 0.5	3.3 ± 0.5	4.1 ± 0.7	—	0.003*	
Mean Clinical Attachment Loss (mm)	0.7 ± 0.2	1.5 ± 0.4	1.8 ± 0.5	2.7 ± 0.8	—	0.002*	

*Statistically significant (p < 0.05)

Discussion

The present retrospective institutional study evaluated the association between different types of malocclusion and periodontal parameters among patients seeking orthodontic treatment. The findings demonstrated that periodontal health status varied among different malocclusion categories, with comparatively poorer periodontal parameters observed in patients with Class II Division 1 and Class III malocclusion (10). Generalized chronic gingivitis was the most prevalent periodontal condition identified across all malocclusion groups.

Malocclusion has long been considered a contributing factor to periodontal disease because irregular tooth alignment may favor plaque accumulation and interfere with effective oral hygiene maintenance. Crowding, overlapping teeth, abnormal occlusal relationships, and improper tooth positioning may create plaque-retentive areas that are difficult to access during routine oral hygiene procedures. Persistent microbial accumulation in these regions may subsequently initiate gingival inflammation and periodontal tissue destruction (11).

In the present study, generalized chronic gingivitis was the predominant periodontal diagnosis among orthodontic patients. This finding may be attributed to inadequate plaque control associated with malaligned dentition (12). Orthodontic patients frequently present with crowding and irregular tooth alignment that compromise effective plaque removal, thereby increasing gingival inflammation. The comparatively lower prevalence of clinically healthy gingiva further supports the influence of malocclusion on periodontal health.

Class I malocclusion constituted the most prevalent occlusal category in the present study, which is consistent with the pattern commonly observed among orthodontic patients. However, patients with Class III malocclusion demonstrated comparatively poorer periodontal parameters, including higher plaque accumulation, gingival inflammation, probing pocket depth, and clinical attachment loss (13,14). Severe occlusal discrepancies associated with Class III malocclusion may contribute to compromised oral hygiene maintenance and traumatic occlusal forces, thereby aggravating periodontal breakdown.

Patients with Class II Division 1 malocclusion also demonstrated increased gingival inflammation and plaque accumulation when compared to Class I malocclusion groups. Proclination of anterior teeth and increased overjet commonly associated with Class II Division 1 malocclusion may predispose individuals to plaque retention and gingival inflammation because of difficulty in maintaining oral hygiene around malaligned anterior teeth.

The present study demonstrated a statistically significant association between malocclusion type and periodontal status. As the severity and complexity of malocclusion increased, periodontal parameters demonstrated progressive deterioration. The findings support previous evidence suggesting that malocclusion may influence periodontal health indirectly by facilitating plaque retention and compromising oral hygiene practices (9).

The higher prevalence of generalized chronic periodontitis observed among Class III malocclusion patients may also indicate the possible influence of traumatic occlusal forces on periodontal tissues. Excessive occlusal loading in the presence of plaque-induced inflammation may accelerate periodontal destruction in susceptible individuals. Although occlusal trauma alone may not directly initiate periodontal disease, it may aggravate existing periodontal inflammation and attachment loss (11).

The findings of the present study emphasize the importance of periodontal evaluation prior to orthodontic treatment. Identification of gingival inflammation and periodontal disease before initiation of orthodontic therapy is essential to prevent further periodontal deterioration during treatment. Comprehensive periodontal assessment and oral hygiene reinforcement should therefore be considered important components of orthodontic treatment planning.

Interdisciplinary management between orthodontists and periodontists may significantly improve treatment outcomes in patients with malocclusion-associated periodontal compromise (15). Early periodontal intervention, professional plaque control, and patient education regarding oral hygiene maintenance may help reduce gingival inflammation and improve long-term periodontal stability during orthodontic therapy.

Limitations

The present study has certain limitations. As a retrospective institutional study, the analysis depended on previously recorded clinical data and availability of complete patient records. Factors such as oral hygiene practices, socioeconomic status, dietary habits, and duration of malocclusion were not evaluated. The study was conducted in a single institutional setting, which may limit generalizability of the findings. Future multicentric prospective studies with larger populations may provide more comprehensive insight into the relationship between malocclusion and periodontal health.

Overall, the findings of the present study suggest that different malocclusion patterns may influence periodontal health status, with comparatively poorer periodontal parameters observed among Class II Division 1 and Class III malocclusion patients.

Conclusion

Within the limitations of the present retrospective study, a significant association was observed between type of malocclusion and periodontal parameters among patients seeking orthodontic treatment. Class II Division 1 and Class III malocclusion demonstrated comparatively poorer periodontal status with increased gingival inflammation, plaque accumulation, probing depth, and attachment loss.

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