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Comparison of Periodontal Status in Spaced Versus Crowded Dentition: A Retrospective Study

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KEYWORDS

Crowded Dentition, Spaced Dentition, Periodontal Indices, Malalignment, Gingival Health

ABSTRACT:

Background: Tooth alignment significantly affects oral hygiene and periodontal health. Crowding may hinder plaque removal, while spacing may predispose to food impaction. This study compares the periodontal status of patients with spaced and crowded dentition using retrospective data.

Aim: To assess and compare the periodontal status in spaced versus crowded dentition.

Materials and Methods: A retrospective study was conducted at Saveetha Dental College between January and March 2024. A total of 300 patient records were analyzed: 150 with spaced dentition and 150 with crowded dentition. Periodontal parameters including mean plaque index (PI), mean gingival index (GI), oral hygiene index-simplified (OHI-S), mean probing depth, mean clinical attachment level (CAL), bleeding on probing, and calculus presence were evaluated. Statistical analysis was performed using SPSS version 26.

Results: Patients with crowded dentition had significantly higher PI (1.48 ± 0.34), GI (1.51 ± 0.40), and CAL (2.34 ± 0.61 mm) than those with spaced dentition (PI: 0.91 ± 0.30, GI: 0.95 ± 0.33, CAL: 1.21 ± 0.47 mm) ($p < 0.001$). Bleeding on probing and moderate to severe calculus were significantly more frequent in the crowded group.

Conclusion: Crowded dentition is associated with poorer periodontal health compared to spaced dentition. Early orthodontic referral and customized oral hygiene are crucial in managing patients with malaligned dentition

1. Introduction

Periodontal disease is a multifactorial inflammatory condition that results in the destruction of the supporting structures of the teeth, including gingiva, periodontal ligament, and alveolar bone. Among the local contributing factors to periodontal disease, tooth alignment is often overlooked despite its significant role in oral hygiene effectiveness and plaque accumulation. Malaligned teeth, particularly crowding, create niches that are difficult to clean, increasing the risk of plaque retention and calculus formation, which are principal etiologic factors for gingival inflammation and periodontitis [1,2].

Crowded dentition occurs when there is insufficient space in the dental arch to accommodate all teeth in proper alignment. As a result, teeth overlap or rotate, forming plaque-retentive areas that are inaccessible to toothbrush bristles or floss [3]. These areas become breeding grounds for pathogenic bacteria, contributing to the initiation and progression of periodontal inflammation. Conversely, spaced dentition is characterized by gaps between teeth, which may improve access for cleaning but may also cause food impaction, leading to localized inflammation and periodontal breakdown [4].

The correlation between malocclusion and periodontal disease has been studied extensively. Several investigations have reported a higher prevalence of gingivitis and periodontitis in patients with dental crowding compared to those with well-aligned dentition [5–7]. Albandar [8] highlighted crowding as a modifying

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factor that increases susceptibility to plaque-induced periodontal destruction. In contrast, while spacing allows better access for oral hygiene, it may not always translate to better periodontal health due to poor compliance or food lodgment in interdental areas [9].

Furthermore, it is well-established that clinical indices such as the Plaque Index (PI), Gingival Index (GI), Oral Hygiene Index-Simplified (OHI-S), probing depth, and clinical attachment level (CAL) are reliable indicators for assessing periodontal health and disease severity [10]. Previous studies have assessed these parameters in different populations, but comparative data focusing exclusively on spaced versus crowded dentition are limited.

Understanding the periodontal implications of alignment anomalies is essential for clinicians to develop personalized preventive and therapeutic protocols. Orthodontic correction of crowding is often delayed for esthetic or financial reasons, but its periodontal consequences can be severe if not addressed early [11]. This study aims to provide evidence-based insights into how tooth alignment affects periodontal health, thus underscoring the need for early intervention.

This retrospective study analyzes and compares the periodontal health status of patients with spaced and crowded dentition based on existing clinical records. By using standardized periodontal indices and statistical analysis, this study aims to fill the knowledge gap regarding the periodontal risks associated with different types of malalignment and promote a multidisciplinary approach for patient management [12–15].

2. Materials and Methods

This retrospective observational study was conducted in the Department of Periodontics, Saveetha Dental College, from January to March 2024. Ethical clearance was obtained from the Institutional Review Board. The study included a total of 300 patients aged between 15 and 40 years, divided into two equal groups: 150 patients with spaced dentition and 150 patients with crowded dentition, based on documented clinical diagnosis. Patient records were retrieved from the digital database and included those with complete periodontal charting and pre-treatment photographs. Patients with prior orthodontic or periodontal therapy, systemic diseases known to affect the periodontium (such as uncontrolled diabetes), or incomplete clinical records were excluded.

Demographic details (age, gender), type of dentition (spaced or crowded), and the following clinical parameters were recorded: Plaque Index (Silness and Löe), Gingival Index (Löe and Silness), Oral Hygiene Index-Simplified (Greene and Vermillion), probing depth (in mm), and clinical attachment level (CAL, in mm). Categorical variables such as bleeding on probing and presence of calculus (graded as mild, moderate, or severe) were also noted. All data were tabulated and statistically analyzed using SPSS version 26. Independent t-tests were employed for comparison of continuous variables between the groups, while Chi-square tests were used for categorical variables. A p-value < 0.05 was considered statistically significant.

3. Results

The results indicate significantly poorer periodontal status in patients with crowded dentition compared to those with spaced dentition. Mean PI, GI, OHI-S, probing depth, and CAL were all significantly higher in the crowded group ($p < 0.001$), highlighting greater plaque accumulation, gingival inflammation, and tissue destruction. Additionally, a higher prevalence of bleeding on probing and moderate-to-severe calculus was noted in the crowded group, further corroborating the increased periodontal risk as shown in Table 1 & 2 and Figure 1 & 2.

Table 1: Comparison of Mean Periodontal Indices Between Spaced and Crowded Dentition

Parameter	**Spaced Dentition (n=150) Mean ± SD**	**Crowded Dentition (n=150) Mean ± SD**	***p*-value**
Plaque Index (PI)	0.91 ± 0.30	1.48 ± 0.34	< 0.001*
Gingival Index (GI)	0.95 ± 0.33	1.51 ± 0.40	< 0.001*
Oral Hygiene Index-Simplified	1.14 ± 0.34	1.63 ± 0.38	< 0.001*

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Parameter	Spaced Dentition (n=150) Mean ± SD	Crowded Dentition (n=150) Mean ± SD	*p*-value
Mean Probing Depth (mm)	2.42 ± 0.58	3.10 ± 0.67	< 0.01*
Mean CAL (mm)	1.21 ± 0.47	2.34 ± 0.61	< 0.001*

Table 2: Distribution of Bleeding on Probing, Calculus, and Periodontal Diagnosis in Spaced vs. Crowded Dentition

Parameter	Spaced Dentition (n=150)	Crowded Dentition (n=150)	*p*-value
Bleeding on Probing	28% (42 patients)	66% (99 patients)	< 0.001*
Moderate-Severe Calculus	33% (50 patients)	71% (107 patients)	< 0.001*
Diagnosed Periodontitis	21% (32 patients)	55% (83 patients)	< 0.001*

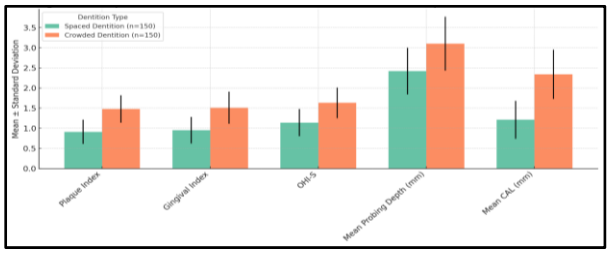

Figure 1: Comparison of Continuous Periodontal Parameters Between Spaced and Crowded Dentition — Plaque Index, Gingival Index, OHI-S, Mean Probing Depth, and Mean Clinical Attachment Loss—between patients with spaced and crowded dentition. Each bar represents the mean value ± standard deviation for the respective group (n = 150 per group). Crowded dentition exhibited significantly higher mean scores across all parameters, indicating greater plaque accumulation, gingival inflammation, poorer oral hygiene, deeper periodontal pockets, and more attachment loss compared to spaced dentition.

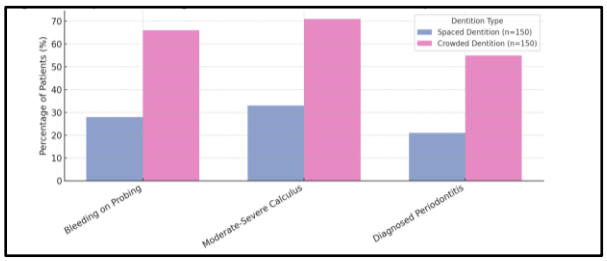

Figure 2: Comparison of Categorical Periodontal Parameters Between Spaced and Crowded Dentition - including the percentage of patients showing bleeding on probing, moderate-to-severe calculus, and diagnosed periodontitis in both dentition groups. Patients with crowded dentition showed a markedly higher prevalence of all three clinical indicators, with 66% exhibiting bleeding on probing, 71% with moderate-to-severe calculus, and 55% diagnosed with periodontitis, compared to 28%, 33%, and 21%, respectively, in the spaced dentition group. These findings underscore the adverse impact of dental crowding on periodontal health.

4. Discussion

This study confirms a significant association between dental crowding and compromised periodontal health. Patients with crowded dentition exhibited notably higher plaque and gingival index scores, greater probing depths, and more clinical attachment loss compared to those with spaced dentition. These findings are consistent with several studies that have highlighted the challenges of maintaining oral hygiene in malaligned teeth [1,5,6].

Crowded teeth present overlapping surfaces and tight interproximal areas that are inaccessible to conventional cleaning tools like toothbrushes and floss. This leads to chronic plaque retention and microbial colonization, which contribute to gingivitis and periodontitis [2,3]. In our study, over two-thirds of the crowded group had bleeding on probing and moderate to severe calculus, both signs of chronic inflammation and ineffective oral hygiene.

While spaced dentition allowed better access for hygiene, 21% of these patients still had periodontitis. This suggests that spacing is not protective per se and may, in fact, lead to food impaction and localized trauma

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if not managed properly [4,9]. Hence, even patients with spaced dentition require professional supervision and patient education on interdental cleaning.

Our findings corroborate those of Albandar [8], who emphasized the role of anatomical tooth position as a modifying factor in the development of periodontal disease. Ngom et al. [11] also reported increased periodontal destruction in malocclude teeth, especially in the anterior segment. Similarly, Van Gastel et al. [6] demonstrated that adolescents with crowded teeth showed significantly worse gingival scores than their counterparts.

Interestingly, the clinical attachment level was nearly twice as high in the crowded group, which indicates long-standing periodontal deterioration. Since CAL is a cumulative marker, this finding underscores the long-term impact of untreated mal-alignment on periodontal support structures [10].

The importance of early orthodontic assessment in reducing periodontal burden cannot be overstated. Orthodontic correction not only improves esthetics and function but also facilitates easier plaque control and long-term periodontal maintenance [13,14]. A multidisciplinary approach involving both periodontists and orthodontists can significantly enhance patient outcomes, especially in high-risk individuals [16-18].

The study's strength lies in its robust sample size and the use of standardized clinical parameters. However, limitations include its retrospective design, which inherently restricts control over confounding variables such as oral hygiene habits, socioeconomic status, and systemic health conditions.

Future research should focus on prospective, longitudinal studies that evaluate periodontal outcomes before and after orthodontic alignment, ideally with microbiological and radiographic correlations [15].

5. Conclusion

This study highlights that crowded dentition significantly predisposes individuals to poor periodontal health due to increased plaque retention, gingival inflammation, and clinical attachment loss. Spaced dentition, while more accessible for cleaning, also presents periodontal challenges. Early orthodontic assessment and personalized oral hygiene education are essential components in preventing the progression of periodontal disease in patients with malaligned teeth.

6. Conflict of Interest

The authors declare no conflict of interest.

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