

## Relationship Between Crossbite and Periodontal Status

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### Abstract

Crossbite is one of the most common types of malocclusion. It is a potential cause of trauma from occlusion, and it can be a cofactor of periodontal diseases. However, research on the effects of crossbite on periodontium is still rare. This study aimed to analyze the relationship between crossbite and periodontal status. This cross-sectional study examined the dental records of 68 subjects with normal bite and 68 subjects with crossbite obtained from the Universitas Indonesia's dental teaching hospital from 2010–2015. Data was statistically analyzed using the Mann-Whitney U test. There were no statistically significant differences ( $p>0.05$ ) in the mean values for gingival recession, loss of attachment, and gingival bleeding between the normal bite group and the crossbite group. A statistically significant difference ( $p<0.05$ ) between the two groups was found for the mean values of pocket depth. There is no correlation between crossbite and gingival recession, loss of attachment, and gingival bleeding; but, there is a correlation between crossbite and pocket depth.

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### Introduction

Malocclusion is the misalignment of the jaw or teeth from their normal condition.<sup>1</sup> Malocclusion is affected by genetic and environmental factors.<sup>2</sup> Malocclusion occurs widely throughout the world. According to the World Health Organization, malocclusion is the third most prevalent among oral pathologies, after dental caries and periodontal disease.<sup>3</sup>

Many patients with malocclusion seek dental care for esthetic improvement.<sup>4</sup> However, untreated malocclusion can lead to oral function problems.<sup>1</sup> Malocclusion is a potential cause of dysfunction in speech and mastication as well as dysfunction of the temporomandibular joint; moreover, people with malocclusion are more susceptible to dental caries and periodontal tissue destruction.<sup>5</sup>

The prevalence of malocclusion in individual varies.<sup>1</sup> Crossbite is a type of malocclusion that commonly occurs in individuals. It was reported that Anterior crossbite has been

found to occur in 4-5% of the population, whereas posterior crossbite prevalence occurs in 7-23% of the population.<sup>6</sup> Crossbite occurs when the relationship between the maxilla and the mandible is reversed; the teeth on the maxilla are lingual to the mandibular teeth. Crossbite can cause occlusal trauma due to occlusion, food impaction, and gingival recession.<sup>7</sup>

Individuals with malocclusion are more susceptible to gingivitis and periodontal disease than individuals with normal occlusion.<sup>8</sup> Periodontal disease is a multifactorial disease caused by bacterial infection that causes host response resulting in inflammation.<sup>9</sup> Periodontal destruction from malocclusion happens because of difficulties in plaque removal or trauma from occlusion.<sup>5</sup> This theory is supported by previous research, who found that teeth with trauma from occlusion have more severe loss of attachment, increased pocket depth, and alveolar bone destruction.<sup>10</sup> However, Kolawole reported there is no relationship between malocclusion and periodontal disease.<sup>11</sup>

The studies mentioned above reported different results. However, studies about the direct relationship between crossbite and periodontal tissues are still rare. Therefore, this present study aimed to analyze the relationship between crossbite and periodontal status.

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This study was performed using the dental records of patients who attended a dental teaching hospital in Jakarta, Indonesia from 2010 to 2015. This study is expected to provide more information about the relationship between anterior and posterior crossbite and periodontal status. Its findings can increase awareness about and draw attention to this condition and help dentists analyze patients with periodontal issues who also have malocclusion, especially crossbite.

### Materials and methods

This research consisted of a cross-sectional study with secondary data analysis. The subjects were obtained from the dental records of patients in the Universitas Indonesia's dental teaching hospital, from 2010 to 2015, who had anterior and/or posterior crossbite. The sample size was calculated by using a cross-sectional study formula and 68 dental records of normal bite and 68 dental records of crossbite were obtained. The inclusion criteria were: dental records with clear and complete periodontal status. Patients with systemic disease, who smoked cigarettes, who were pregnant, who were using orthodontic appliances, or who had a history of orthodontic treatment were excluded. This study compared periodontal status (gingival bleeding, gingival recession, loss of attachment, and pocket depth status) between crossbite and normal bite subjects.

This study was approved by ethics committee at Faculty of Dentistry, Universitas Indonesia, Jakarta. Complete information from the patients' records, including identity, crossbite condition, and periodontal status, were processed using SPSS V.20. The Kolmogorov-Smirnov test was used to check for normality and the Mann-Whitney U test was used to analyze the difference in the mean of periodontal status between the normal bite and crossbite subjects.

### Results

Data from 538 complete and clear dental records were obtained from August to September 2016. The study sample was divided into two groups: crossbite subjects and normal bite subjects. From the 538 dental records, 113 subjects were identified as having crossbite occlusion. From

those 113 subjects, purposive sampling was used to select 68 crossbite occlusion subjects that met the study's inclusion criteria. The normal bite group consisted of 216 normal subjects who met the inclusion criteria. After the 216 normal bite subjects were identified, blind sampling was used to select 68 subjects, which were used as comparison data. In all, this study sample included 68 crossbite subjects and 68 normal bite subjects. The characteristics of the samples are presented in Table 1.

Most of the subjects in this study were females, both in the normal bite group and the crossbite group. Most of the subjects were in the 46–55 age group, and most subjects had poor oral hygiene. The subjects were divided into six age groups. In the normal bite group, most of the subjects were in the 36–45 and the 46–55 age group. In the crossbite group, most of the subjects were in the 46–55 age group. The information presented in Table 1 also shows that the majority of normal bite subjects had poor oral hygiene status, while the majority of the crossbite subjects had a moderate or poor oral hygiene status.

This study used bivariate analysis to analyze the mean difference in periodontal status (pocket depth, gingival recession, loss of attachment, and gingival bleeding) between the crossbite and normal bite subjects. As shown in Table 2, the periodontal status mean with the highest value in the normal bite subjects was loss of attachment; in the crossbite subjects it was pocket depth.

Variable	Normal bite	Crossbite	Total
Gender			
Male	13 (19.1%)	18 (26.5%)	31 (22.8%)
Female	55 (80.9%)	50 (73.5%)	105 (77.2%)
Age			
Late adolescent (17–25)	14 (20.6%)	10 (14.7%)	24 (17.6%)
Early adulthood (26–35)	10 (14.7%)	16 (23.5%)	26 (19.1%)
Late adulthood (36–45)	16 (23.5%)	8 (11.8%)	24 (17.6%)
Early elderly (46–55)	16 (23.5%)	20 (29.4%)	36 (26.5%)
Late elderly (56–65)	9 (13.2%)	11 (16.2%)	20 (14.7%)
Elderly (>65)	3 (4.4%)	3 (4.4%)	6 (4.4%)
Oral Hygiene Status			
Good	6 (8.8%)	8 (11.8%)	14 (10.3%)
Moderate	27 (39.7%)	30 (44.1%)	57 (41.9%)
Poor	35 (51.5%)	30 (44.1%)	65 (47.8%)

**Table 1.** Demographic variables distribution of the normal bite, crossbite and total sample.

	Mean ± SD		p-value
	Normal bite	Crossbite	
Pocket Depth	3.32 ± 0.71	3.86 ± 1.22	0.020
Gingival Recession	1.51 ± 1.02	1.34 ± 1.29	0.240
Loss of Attachment	3.56 ± 0.93	3.78 ± 1.51	0.713
Gingival Bleeding	0.98 ± 0.80	1.16 ± 0.76	0.111

**Table 2.** Comparison of periodontal health between normal bite and crossbite subjects.

The Mann-Whitney U test results for the mean difference in pocket depth between the normal bite and crossbite subjects was 0.020 ( $p < 0.05$ ). Thus, there is a significant difference in the pocket depth between the normal bite and crossbite subjects. The p-value for gingival recession was 0.240. The p value for loss of attachment was 0.713 and the p-value for gingival bleeding was 0.111. Thus, because the  $p > 0.05$ , it can be said that, statistically, there is no significant mean difference in gingival recession, loss of attachment, and gingival bleeding between the normal bite and crossbite subjects.

## Discussion

This cross-sectional study analyze the relationship between pocket depth, gingival recession, loss of attachment, and gingival bleeding by comparing two subject groups: a crossbite group and a normal bite group. In this study, there was a significant mean difference in the periodontal pocket depth between the crossbite and normal bite subjects. This finding is in agreement with Glickman's theory, which explains that malocclusion can cause trauma in periodontal tissues and lead to alveolar bone destruction that will be more severe than if no malocclusion occurs.<sup>12</sup>

The statistical results show no significant mean difference in gingival recession, loss of attachment, and gingival bleeding between the crossbite subjects and the normal bite subjects. This finding is different from the results reported by Philstrom et al., who found that teeth with malocclusion having trauma from occlusion had deeper probing depth, more clinical attachment loss and more severe alveolar bone destruction.<sup>10</sup> The same finding was also reported by Nakatsu et al.<sup>13</sup> and Branschofsky et al.,<sup>14</sup> where alveolar bone destruction and loss of

attachment were found to be more severe in inflammation accompanied by occlusal trauma.

The differences in the findings reported in these studies and the present study might be due to the fact that individual periodontal status is affected by several factors. Those factors are age, malocclusion, oral hygiene status, teeth brushing technique, bad habits, and systemic conditions.<sup>6</sup> This present study only focused on the periodontal condition in crossbite and normal bite subjects. Thus, the results of this present study are different from the findings reported by previous studies. Therefore, further investigation is needed to determine the factors that impact the differences in the results found in this study and the results reported in previous studies. This study has several limitations.

The data were collected through dental records (secondary data); this causes a limitation in the depth and scope of information in comparison to data collected directly from patients (primary data). Not all the data recorded in dental records were complete, and it is possible that, sometimes, the author misinterpreted the data.

This study also only analyzed the periodontal status of crossbite occlusion subjects and normal bite subjects, and there were no controls for other factors that could have played a role in individual periodontal status. Therefore, this study suggests that better control of other factors that affect the condition of periodontal tissue should be included in future research.

## Conclusions

There was a significant mean difference in pocket depth between the normal bite and crossbite subjects. This demonstrates that there is a correlation between crossbite and pocket depth. There was no significant mean difference in gingival recession, loss of attachment, and gingival bleeding between the normal bite and crossbite subjects. This demonstrates that there is no correlation between crossbite and gingival recession, loss of attachment, and gingival bleeding.

## Declaration of Interest

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