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Effect of Malocclusion on Gingival Enlargement among Orthodontic and Non-Orthodontic Patients

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Abstract

Background: The periodontium can be harmed by certain types of malocclusions, such as deep bite that damages the gingiva on maxillary incisors. Fixed orthodontic appliances can correct malocclusions but can also facilitate plaque accumulation and the consequent development of generalised moderate hyperplastic gingivitis. This study aimed to explore the effects of Angle's classification of occlusion and the severities of overbite and overjet on the occurrence of gingival enlargement (GE) among orthodontic and non-orthodontic patients.

Materials and Methods: This cross-sectional observational study was conducted on 200 patients selected from the Department of Orthodontics and Department of Restoration of Tongji Medical College, Huazhong University of Science and Technology, Wuhan, China. The participants were categorised into orthodontic and non-orthodontic groups. Clinical examinations included GE index and simplified oral hygiene index. Data were analysed using SPSS version 17 with Kruskal–Wallis test. Significance level was set at $P \leq 0.05$.

Results: Statistical significance was found between the overjet and GE scores in the non-orthodontic group. The difference between Angle malocclusion, overbite and GE scores was not statistically significant in both groups.

Conclusion: Overjet severity influenced the occurrence of GE in the non-orthodontic group. Angle malocclusion class and overbite severity did not affect the occurrence of GE in both groups.

Keywords: *Angle malocclusion; Overjet; Overbite; Gingival enlargement; Fixed orthodontic treatment*

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Introduction

Malocclusion is defined as the loss of an association between the upper and lower arches or the abnormal teeth alignment (1). This condition is highly prevalent in all age groups in most populations and may also give rise to pain by causing gingival and mucosal trauma (2, 3). Early diagnosis of any type of abnormal tooth position and malocclusion can guide direct treatment (4). Orthodontic treatment is a double-action procedure involving periodontal tissues and is highly important in increasing periodontal health status but may also be harmful and lead to several types of periodontal complications, namely, gingival recessions, gingival enlargement (GE), gingival invaginations and gingival pocket formation (5-7). Gingivitis and GE are the main short-term effects of orthodontic bands on the periodontium. Gingival enlargement may occur at the interdental papillae 1–2 months after placing a fixed orthodontic appliance placing (8, 9). However, this enlargement quickly improves after the removal of the fixed orthodontic appliance (9-12).

The enlargement of the interdental papillae during orthodontic treatment may be explained by certain factors, such as the application of compressive forces, unfavourable forces on the tooth and supporting structure. Furthermore, direct injury to the gingiva as a result of overextended bands and plaque accumulation may occur due to the complex nature of orthodontic appliances (13). The relationship between overjet and overbite with periodontal status has been previously assessed (14-16). However, to our knowledge, studies on adult dentitions that compare occlusion based on Angle's criteria, overjet or overbite with GE among orthodontic patients are limited. Thus, the present work aimed to determine the effect of Angle's malocclusion classification and the severities of overjet and overbite on the occurrence of GE among orthodontic and non-orthodontic patients.

Materials and Methods

This descriptive cross-sectional hospital-based study was conducted at the outpatient clinic of the Department of Orthodontics and Department of Restorations, Tongji Medical College, Huazhong University of Science and Technology, Wuhan, China from July 2017 to April 2018. The selected patients and their parents were provided with information about the study, and voluntary informed consent was obtained. The inclusion criteria were as follows: patients aged 11–24 years old who received buccal fixed pre-adjusted orthodontic appliances in both dental arches for 3 to 24 months and in the space closing stage of orthodontic treatment. The exclusion criteria were as follows: pregnant, smokers and patients with any systematic disease or use drugs that might cause GE, who had fiberotomy or surgical exposure of impacted teeth and who underwent professional scaling in the past 5 months.

The patient's Angle malocclusion class and overjet and overbite degree were obtained from the orthodontic records. The patient's overjet in the non-orthodontic group was measured using a millimetre ruler. Clinical examination was conducted systemically by the same examiner using a dental mirror and a manual probe beginning from the right maxillary sextant in a dental unit. All permanent, fully erupted teeth, excluding the third molars, were dried with a blast of air. GE degree in facial and lingual/palatal aspects was scored as follows: 0 = no signs of GE; 1 = gingival hyperplasia confined to the interdental papilla; 2 = hyperplasia of the interdental papilla and marginal gingiva; and 3 = gingival hyperplasia covering at least three-quarters of the tooth crowns (17). Plaque and calculus were graded on a numeric scale from 0 to 3 on the index tooth (16, 11, 26, 36, 31 and 46) depending on the severity and extent of the deposits. Debris scores were summed and divided by the number of surfaces scored for each individual to yield the debris index. The same methods were used to obtain the calculus index. Average age-group debris and calculus index scores were combined to obtain the simplified oral hygiene index (OHI-S) (18).

The GE index and OHI-S were recorded in the appropriate box for each patient. The GE scores were added and divided by the number of surfaces scored for each individual to obtain the overall patient GE score. The OHI-S values ranged from 0 to 6, and the scores were categorised as good, fair or poor at scores of 0.0–1.2, 1.3–3.0 or 3.1–6.0, respectively. All patients with fair and poor OHI-S scores were excluded. Statistical analysis was performed with SPSS* software program version 17 (IBM Corp., Armonk, NY, USA). All comparisons were conducted with the Kruskal–Wallis test. Significance level was set at ≤0.05.

Results

A total of 200 patients, 120 females and 80 males within the age group of 11–24 years (mean age of 19 years) participated in this study. Among them, 100 were orthodontic patients and 100 were non-orthodontic patients. Detailed distribution of patients is shown in Table 1.

Variables	Variable Degree	Orthodontic Group	Non-Orthodontic Group
Overjet	0–3 mm	32	44
	3.1–5 mm	28	29
	5.1–7 mm	23	14
	>7 mm	17	13
Overbite	Less than 1/3 coverage	47	46
	1/3–2/3 coverage	27	27
	More than 2/3 coverage	26	27
Angle's malocclusion	Class I	57	66
	Class II	28	14
	Class III	15	20

Table 1: *Description of the study sample*

As shown in Table 2, the mean values and standard deviations for patient GE scores decreased whenever the overjet degree increased in the non-orthodontic group. This decrease was statistically significant at a level of 5% (P=0.02, Table 2). In the orthodontic group, the patients whose overjet was more than 7 mm had the highest GE mean (0.79±0.55). However, the differences between the overjet degree and GE scores were not statistically significant (P=0.20, Table 2).

Overjet degree	Orthodontic Group		Non-Orthodontic Group	
	Mean ± SD	P value	Mean ± SD	P value
0–3 mm	0.68±0.36	0.20	0.45±0.30	0.02*
3.1–5 mm	0.59±0.41		0.38±0.20	
5.1–7 mm	0.52±0.39		0.35±0.29	
> 7 mm	0.79±0.55		0.26±0.27	
* Significant at P≤0.05.				

Table 2: *Mean and standard deviation (SD) of gingival enlargement score in different overjet degree among orthodontic and non-orthodontic groups*

The Kruskal–Wallis test showed no significant differences between the overbite degree and GE scores in orthodontic or non-orthodontic patients (P=0.36 and P=0.91, respectively; Table 3). The differences between the mean GE scores and malocclusion classification were not statistically significant in the orthodontic and non-orthodontic groups (P=0.80 and P=0.69, respectively; Table 3). The lack of correlation between the GE index and malocclusion indicated that the malocclusion class was not related to GE occurrence.

Variables	Variable Degree	Orthodontic Group		Non-Orthodontic Group	
		Mean ± SD	P value	Mean ± SD	P value
Overbite	Less than 1/3 coverage	0.65±0.42	0.36	0.38±0.24	0.91
	1/3–2/3 coverage	0.67±0.36		0.38±0.30	
	More than 2/3 coverage	0.58±0.52		0.41±0.32	

Angle's Malocclusion	Class I	0.61±0.40	0.80	0.39±0.28	0.69
	Class II	0.68±0.50		0.36±0.27	
	Class III	0.66±0.38		0.42±0.24	

Table 3: *Mean and standard deviation (SD) of gingival enlargement score among orthodontic and non-orthodontic groups*

Discussion

Malocclusion leads to poor periodontal health (19). Although orthodontic treatment is the preferred and most commonly used to treat malocclusion (12), this method can cause side effects such as chronic infection, inflammatory hyperplasia, gingival recession, attachment loss and GE (5, 6). This study assessed the effect of malocclusion on the occurrence of GE. In non-orthodontic patients, overjet severity was associated with significantly decreased occurrence of GE. This phenomenon occurred because most of the patients in the non-orthodontic group were recruited from the Department of Restoration and did not have crowded anterior teeth, which could cause plaque accumulation and calculus formation and lead to gingivitis and problems in maintaining oral hygiene (20). This finding disagreed with a previous study, which reported that anterior overjet is not related to periodontal destruction (14). The difference may be attributed to the dissimilarity in the study population, age and statistical analyses. In the orthodontic group, the highest mean GE scores were found for patients with overjet of more than 7 mm because they were treated with extraction. Much force was applied on all their teeth to correct the high degree of protrusion.

Studies on the relationship of various malocclusion features with periodontal disease and gingival inflammation showed that overbite, overjet and cuspal interdigitation are not related to periodontal destruction or gingival inflammation (14, 16, 21). In the present work, no statistically significant association was found between overbite severity and GE occurrence in both groups. This result indicated that overbite severity has no effect on the occurrences of GE among orthodontics and non-orthodontic patients. This finding was in conflict with a previous study, which showed that the overlapping of incisor teeth is directly related to gingivitis (22). The present study indicated no differences in GE incidence within different classes of occlusion. This finding may be due to the difference in the sample size within varying classes of malocclusion or the relation of Angle's classification of occlusion was based upon the molar region, although GE often occurs in the incisor region (23). These results were similar to previous studies (24-26) reporting no statistically significant relationships between periodontal destruction and occlusion class.

Conclusion

Malocclusion classes and overbite severity do not affect the incidence of GE among orthodontic and non-orthodontic patients. Overjet severity influences the occurrences of GE only in non-orthodontic patients. Further longitudinal study with a large sample size is required to validate these findings.

Conflict of Interest

The authors confirm that this article content has no conflict of interest.

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