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Original article

ANTERIOR CROSSBITE AS A RISK FACTOR FOR THE DEVELOPMENT OF GINGIVAL RECESSION

Stilyana Krasteva[1]. Vladimir Petrunov[2], Silviya Krasteva[3]
1) Department of Periodontics, Faculty of Dental Medicine, Medical University - Plovdiv, Bulgaria
2) Department of Orthodontics, Faculty of Dental Medicine, Medical University - Sofia, Bulgaria
3) Department of Orthodontics, Faculty of Dental Medicine, Medical University - Plovdiv, Bulgaria.

ABSTRACT:

Introduction: A number of studies have indicated that only certain types of malocclusions, such as proclined teeth, deep bite and anterior crossbite, can be considered risk factors for gingival recession.

Aim: The aim of our study was to examine the association between anterior crossbite and gingival recession.

Materials and methods: We monitored 80 patients aged 18 - 52 with anterior crossbite in one or more teeth. 960 teeth were examined, of which 501 exhibited gingival recession. To determine the site of the crossbite intraoral examination was utilized. We visually ascertained the presence of gingival recession and measured it with a periodontal probe CP15(UNC15). Odds ratio and chi-square test were used to examine the association between anterior crossbite and gingival recession. Results were considered statistically significant at *alpha* ≤0.05.

Results: Our results show no statistically significant relationship between the presence of gingival recession and anterior crossbite in the upper jaw (p>0.05), and a statistically significant association in the lower jaw (p< 0.05). The Odd Ratio (OR) values in all lower frontal teeth were higher than 1 and statistically significant (p< 0.05).

Conclusion: The risk of gingival recession development is higher in teeth with anterior crossbite in the lower jaw. In the maxilla, there is no statistically significant relationship between crossbite and gingival recession occurrence.

Keywords: gingival recession, anterior crossbite, malocclusions

INTRODUCTION:

Gingival recession in teeth in anterior crossbite is the focus of our investigation. Gingival recession etiology is multifactorial and can be associated with the combined effect of more than one factor [1, 2, 3, 4], including inflammation, traumatic, iatrogenic, chemical and morphologic factors [5, 6, 7]. A lot of studies show that certain types of malocclusions can be considered risk factors for gingival recession.These include tooth crowding, protrusion, deep bite, open bite, and anterior cross bite in the frontal area [5, 8, 9, 10, 11, 12]. However, to the best of our knowledge, there are no studies about the development of gingival recession in patients with anterior crossbite. What we know about this issue is extrapolated from the findings of related studies about epidemiological and etiological factors involved in gingival recession.

Based on the findings of a number of studies, it can be concluded that the association between gingival recession and crossbite is stronger in the lower jaw. For instance, it has been found that the lower incisors and canines are the areas where there is an association between the crossbite (CB) and gingival recession (GR)[13]. In a large epidemiological study with individuals aged 15-60, Mytri S, Arunkumar M. et al. (2015) observed a higher percentage (43%) of GR in the lower frontal teeth [14]. Other studies also report that the most frequent localization of the GR is in the lower incisors and canines [6, 15]. Han JY and Jung G.U. (2011) conclude that the vestibular bone is the thinnest in the apical part of the alveolar ridge, in the area of the lower incisors [7, 16]. ack of space, one type of crossbite, can also lead to more buccally positioned central incisors, located outside the dental arch.Stauffer K. et Landmeser H. (2004) found a correlation between crowding and gingival recession, especially in the frontal area of the lower jaw [17]. The upper frontal teeth in crossbite cause buccal movement of the lower incisors in the thin, compact bone of the lower jaw [18].

AIM:

In this study, we set up to explore the association between anterior crossbite and gingival recession. We intend our findings to cast further light on this scantily studied relationship.

MATERIALS AND METHODS:

The study involved 80 patients with anterior crossbite (AC) at single or multiple teeth, who were received for consultation and treatment in the Department of Periodontology and Oral Medicine and the Department of Orthodontics, at the Faculty of Dental Medicine, Medical University Plovdiv, Bulgaria. Patients' age ranged between 18 and 52, with a mean age of 25.66 (±1,18). Among them,

there were 36 women of mean age 24.50 (±9.39) and 44 men of mean age 27.09 (±11.73). There was no significant difference between the two genders in mean age, p = .277.Selection of patients was made on the basis of the following inclusion criteria: 1) All teeth in crossbite to be without prosthetic crowns and cervical lesions; 2) Patients to have satisfactory oral hygiene according to Green-Vermillion index. Patients with Debris index 2 and 3 were excluded from the study.

The place of the crossbite was established through an intraoral examination. We visually ascertained the presence of gingival recession and measured it with a periodontal probe CP15(UNC15). The site of the recession was determined and recorded according to the position of the respective tooth in the upper and lower jaw, buccally or lingually and in relation to the respective tooth.

The presence of gingival recession constituted the main unit of study. A total of 960 teeth were examined, and gingival recession was established in 501 of them.

Statistical Analysis:

The data was analyzed through the Statistical Package for the Social Sciences (SPSS), Version 24 (2016) [19]. The analysis was performed separately for the upper and lower jaw. The presence of gingival recession was recorded through frequency statistics and percentages. Odds ratios (OR) and corresponding 95% confidence intervals (CIs), 2 x 2 cross-tabulation tables, and chi-square tests were used to examine the association between anterior crossbite and gingival recession. The odds ratio is used to determine the association between a risk factor, which in this study is identified as crossbite, and a particular outcome (gingival recession). The values were interpreted as follows: *OR*=1 There is no association between crossbite and GR presence; *OR*>1 Crossbite is associated with higher odds of GR; *OR*<1 Crossbite is associated with lower odds of GR. OR values were considered statistically significant at *alpha* ≤0.05.

RESULTS:

As mentioned earlier, the data analysis was conducted separately for the front upper and lower jaw. The presentation of the results is organized accordingly. The frequency statistics, odds ratios, 95% CIs for the odds ratios, and the level of significance (p) for the upper jaw are given in Table 1. The value of *OR* is higher than 1 for three teeth in the front upper jaw, including: the right central incisor (#11) with *OR* = 2.28 (p = 0.08); the right lateral incisor (#12) with *OR* = 2.11 (p = 0.14); and the left lateral incisor (#22) with *OR* = 1.69 (p = 0.29). This suggests that for these upper jaw teeth, the odds of developing GR is higher when they are in crossbite. However, it should be noted that in all three cases, the *OR* values are not statistically significant ($p > 0.05$). In other words, the association is feeble and cannot be attributed with certainty to crossbite.

For the other three teeth the *OR* values are smaller than 1 as follows: the right canine (#13*), OR* = 0.831 (p = 0.69); the left central incisor (#21); *OR* = 0.904, (p = 0.82); and the left canine (#23), *OR* = 0.917 (p = 0.84). These results indicate that crossbite in these teeth is associated with lower odds of having GR.

Table 1. Association between crossbite and gingival recession in the upper jaw

Teeth Numbers			**Gingival Recession**		**Odds Ratio** 95% Confidence Interval			p
			Yes N (%)	No N (%)	OR	Lower Bound	Upper Bound	
11	**Crossbite**	Yes	**17** (60.7)	**11**(39.3)	2.28	.892	5.84	.08
		No	**21** (40.4)	**31**(59.6)				
12	**Crossbite**	Yes	**12** (36.4)	**21** (63.6)	2.11	.781	5.72	.14
		No	**10** (21.3)	**37** (78.7)				
13	**Crossbite**	Yes	**11** (40.7)	**16** (59.3)	.831	.324	2.12	.69
		No	**24** (45.3)	**29** (54.7)				
21	**Crossbite**	Yes	**18** (48.6)	**19**(51.4)	.904	.375	2.17	.82
		No	**22** (51.2)	**21** (48.8)				
22	**Crossbite**	Yes	**21** (40.4)	**31** (59.6)	1.69	.630	4.55	.29
		No	**8** (28.6)	**20** (71.4)				
23	**Crossbite**	Yes	**19** (45.2)	**23** (54.8)	.917	. 308	2.21	.84
		No	**18**(47.4)	**20** (52.6)				

OR = Odds Ratio; *Statistically significant result at *alpha* = 0.05

Likewise, the results of the data analysis for the front lower jaw are presented in Table 2. The values of *OR* for all six teeth in the lower jaw are higher than 1 and statistically significant. For the left central incisor (#31) the value of *OR* = 3.27 and is statistically significant, $p = 0.02$. The odds of developing GR in this tooth are 3.27 times higher when it is in crossbite. For the left lateral incisor (#32) *OR* = 2.56 and is also statistically significant ($p = 0.04$), showing 2.56 times higher odds of GR in the presence of crossbite. Regarding the left canine (#33) *OR* = 3.29 is statistically significant ($p = 0.02$), indicating 3.29 times higher probability of GR occurrence when it is in crossbite.

For the right central incisor (#41) *OR* = 2.79 and is statistically significant ($p = 0.04$). The odds of GR occurrence are 2.79 higher in the presence of crossbite. The odds ratio for the right lateral incisor (#42) is also statistically significant, *OR* = 2.67 ($p = 0.034$) and indicates 2.67 times higher probability of GR development in crossbite. The right canine (#43) shows 3 times higher odds of GR in the presence of crossbite, *OR* = 3.00 ($p = 0.033$).

Table 2. Association between crossbite and gingival recession in the lower jaw

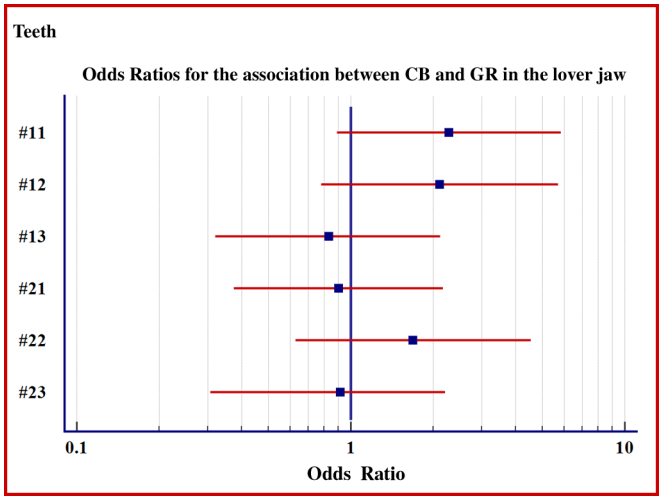
Teeth Numbers			**Gingival Recession**		**Odds Ratio** 95% Confidence Interval			p
			Yes N (%)	No N (%)	OR	Lower Bound	Upper Bound	
31	**Crossbite**	Yes	**26** (78.8)	**7**(21.2)	3.27	1.19	8.99	.02*
		No	**25** (53.2)	**22**(46.8)				
32	**Crossbite**	Yes	**25** (65.8)	**13** (34.2)	2.56	1.04	6.35	.04*
		No	**18**(42.9)	**24** (57.1)				
33	**Crossbite**	Yes	**42** (82.4)	**9** (17.6)	3.29	1.17	9.24	.02*
		No	**17** (58.6)	**12** (54.7)				
41	**Crossbite**	Yes	**23** (76.7)	**7**(23.3)	2.79	1.02	7.70	.04*
		No	**27** (54	**23** (46)				
42	**Crossbite**	Yes	**21** (65.6)	**11** (34.4)	2.67	1.06	6.76	.034*
		No	**20** (41.7)	**28** (58.3)				
43	**Crossbite**	Yes	**26** (78.8)	**7** (21.2)	3.00	1.08	8.26	.033*
		No	**26** (55.3)	**21**(44.7)				

OR = Odds Ratio; *Statistically significant result at *alpha* = 0.05

DISCUSSION:

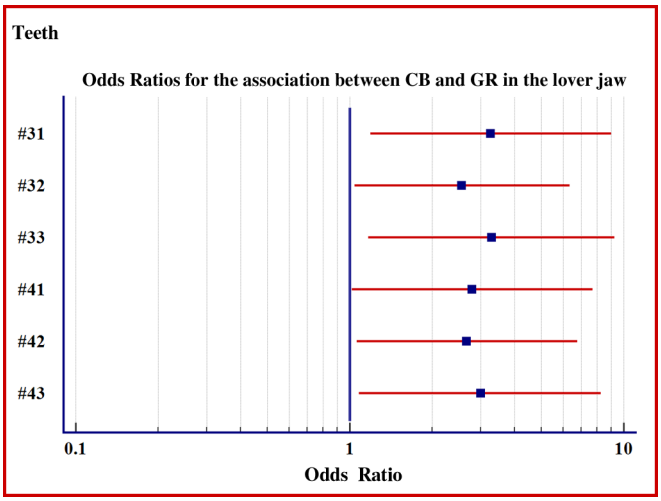
Our results indicate different trends for the upper and lower jaw. Figure 1 illustrates the trend for the upper jaw, where we found a feeble, but no significant association between crossbite and the presence of gingival recession in the right central incisor (#11), the right lateral incisor (#12) and the left lateral incisor (#22). The odds ratio for these teeth was higher than 1 as shown by the corresponding points on Figure 1. For the other three teeth in the front upper jaw, including the right canine (#13), the left central incisor (#21), and the left canine the association between crossbite and GR was close to 1 and not significant. From these results, we can extrapolate that the association between CB and GR in the upper jaw is weak and does not provide solid evidence that will allow us to conclude that crossbite as a risk factor for GR in the upper jaw.

Fig. 1. Odds ratio plot showing the association between CB and GR in the upper jaw



In the lower jaw, we established a significant association between crossbite and gingival recession. The plot of the odds ratios on Figure 2 shows values higher than 1 for all six teeth, including the left central incisor (#31), the left lateral incisor (#32), the left canine (#33), the right central incisor (#41), the right lateral incisor (#42) and the right canine (#43). All six points marking the values of OR are located in the right half of the plot and do not cross the vertical line corresponding to 1. These findings lead us to conclude that crossbite is a risk factor for GR in the lower jaw.

Fig. 2. Odds ratio plot showing the association between CB and GR in the lower jaw



Our results corroborate the findings reported in previous research about significant correlations between crossbite and gingival recession in the lower jaw [7,13, 14, 15, 16, 17, 18]. However, as mentioned in the introduction, the findings of these previous studies do not come from specific examinations of the relationship between crossbite and gingival recession but are extrapolated from broader research agendas that focused on epidemiological and etiological factors involved in gingival recession. For this reason, previous reports about this issue only partially correspond to our results. The results of Pugaca J. , et al. (2007) in part support ours. These authors have observed that the lower incisors and canines are the areas where there is an association between CB and GR [13]. Our findings are also partially supported by previous findings which report that the most frequent localization of the GR is in the lower incisors and canyons [6, 15].

We also find some relation between our conclusions and these of Stauffer K, et al. (2004) who report a correlation between crowding in the lower jaw and gingival recession [17]. Crowding may account for the higher percentage of gingival recession in teeth with crossbite in the lower jaw compared to the upper one. In crossbite, the direction of occlusal force is changed, creating a horizontal component of these forces in the bite function. Thus, the upper frontal teeth in the crossbite cause buccal movement of the lower incisors in the compact bone of the lower jaw [18]. We can also link our results to the ones reported in Mytri S, Arunkumar M, et al. (2015) in so far as these authors observed a higher percentage of gingival recession in the lower frontal teeth [14], but their study did not explore the relationship between crossbite and gingival recession.

CONCLUSION:

Our results shed new light on the association between anterior crossbite and gingival recession. They show that the association is different in the upper and lower jaw. Extrapolating from our findings, we conclude that the risk of gingival recession is higher in teeth with anterior crossbite in the lower jaw. In the maxilla, the risk is feeble in teeth 11, 12 and 22, and does not exist for teeth 13, 21, and 23. We would also like to note here that these findings relate to individual teeth and not patients. The relationship between the number of teeth in anterior crossbite and the frequency of gingival recession in the upper and lower jaw is the object of another research that we plan to undertake.

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Address for correspondence:
Prof. Stilyana Krasteva, DMD
Department of Periodontics,Faculty of Dental Medicine, Medical University - Plovdiv,
3, Hristo Botev Str., 4000 Plovdiv, Bulgaria.
E-mail: dr.krusteva@abv.bg