

Study on dental crowding and gingival inflammation correlation in a group of youths

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Summary

It is known that dental crowding is one of the favorising factors for the onset and evolution of gingival inflammation as crowding areas are retentive of bacterial plaque, making access of cleaning methods difficult.

The *object* of this paper is to assess if there are correlations between the severity of dental crowding and the severity of gingival inflammation in a study group of young adults, without systemic involvement, all evidencing various degrees of dental crowding.

Method. Dental crowding severity was evaluated using TSALD value (Tooth Size-Arch Length Discrepancy) and the severity of inflammation was assessed by Papilla Bleeding Index. For the statistical evaluation MedCalc program was used.

The *results* show that clinical signs of gingival inflammation are present in almost all investigated patients. Despite this clinical finding, a positive statistical correlation between the severity of dental crowding and the severity of gingival inflammation has not been identified. But the treatment of tooth alignment is consequential on the decrease of clinical inflammatory signs.

The *conclusion* of the study is that dental crowding contributes to the onset of gingival inflammation only when the patient does not observe proper oral hygiene. Orthodontic alignment contributes to the reduction of inflammatory signs.

Keywords: gingivitis, papilla bleeding index, dental crowding.

Introduction

There are contradictory opinions in literature concerning the correlation between dental crowding and periodontal disease.

Dental crowding is a frequently seen malocclusion among the population, with a various etiology and many negative consequences at dentomaxillary system structures [1]. Dental crowding is also known in the literature as “dentomaxillary disharmony”

(Cauhepe), “class I malocclusion” (Angle), “large teeth on small jaws” (Korhaus), or “dento-alveolar incongruence with crowding” (Firu). [2]

The present work is motivated by the following observations:

1. Besides the esthetic problem, which is the main factor motivating the patient to ask dental treatment, there are other functional consequences of dental crowding, which can be favoring factors for the onset

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and evolution of periodontal disease [3]. According to Proffit (1993) 10% of the orthodontically treated patients are motivated by periodontal problems [4]. Therefore, patients with periodontal involvement and dental crowding should receive orthodontic alignment, also considering the high prevalence of periodontal disease in the adult population [5]

2. The effects of anterior or posterior dental crowding on the marginal periodontium include [6]:

- Plaque retention and the difficulty in maintaining good oral hygiene
- Pathologic changes in gingival contour, interdental bone and facial-lingual alveolar margin
- Periodontal therapy (scaling, root planning, regenerative surgery) is more difficult to be performed in areas of crowding.

3. Orthodontic adjustment of crowding has a good deal of esthetic, functional benefits and will also facilitate the maintenance of good oral hygiene, which is the key point to prevention and successful treatment of periodontal disease. [7,8]

The *purpose* of the work is to display the consequences of dental crowding on periodontal health. The examination of periodontal status of patients with crowding included a group of patients who reported to Constanta and Bucharest Periodontology Clinics, complaining about gingival bleeding.

Based on clinical examinations and recorded data, we intend to make in future an epidemiological study of the prevalence of gingival inflammation in patients suffering from dento-alveolar incongruence with crowding. We have chosen for this presentation, of the cases examined, an adolescent, female, with no systemic involvement, showing good education concerning the individual methods of plaque removal and good life conditions (in order to eliminate as much as possible from the favoring factors

of periodontal disease). In the clinical examination it was shown that there is a difference regarding the degree of gingival inflammation and periodontal destruction between the crowded and non-crowded areas. More heightened gingival inflammation and periodontal destruction was associated with crowded areas.

Method

Patients were examined according to the periodontal chart devised by Prof. Dr. H.T. Dumitriu, with some additional records concerning malocclusion. In all cases we have insisted on the periodontal examination and the correlation between malocclusion and periodontal destruction.

The examination of the superficial periodontium includes:

-Examination of the interdental papilla, free gingiva and attached gingival. The level of epithelial attachment is also assessed. Palpation is done with the periodontal probe.

-Assessment of the degree of gingival inflammation using Papilla Bleeding Index of Muhlemann. The reason of choosing this index is that in case of patients with crowding the interdentally papilla located in areas of incongruence is the most suffering, therefore the degree of papillary inflammation in these areas will reveal the health status at this level more accurately.

A TOPAS biochemical test was used to examine the severity of gingival inflammation.

The principle of TOPAS test is the detection of the presence of actively growing and dividing anaerobic pathogens resulting in increased levels of their toxic metabolites in the crevicular fluid. The periodontal pathogen bacteria are producing toxic metabolites [9] to be found in the crevicular fluid. Bacteria are also releasing specific proteins and endotoxins which can also be found in crevicular fluid [10]. The organism

submitted to bacterial aggression releases certain factors of the immune response (antibodies, cytokines), which are responsible of inducing an inflammatory response in the periodontal structures [11].

The greater the degree of the metabolic activity, the higher the concentrations of these toxins shown by the color intensity scale of the TOPAS test. This test includes two reagents, one for measuring the concentration of bacterial toxins and the second for measuring the level of total proteins in crevicular fluid. The concentration of bacterial toxins is evaluated by the yellow color intensity obtained in the vial of the test. The concentration of total proteins (including antibodies, human serum albumin, aspartate aminotransferase, beta glucuronidase and bacterial proteins) is assessed by the blue color intensity given by the reaction with the second specific reagent.

The reason of using this test is to evaluate the severity of gingival inflammation and the evolution of the severity of inflammation after orthodontic alignment treatment.

The study

The study is done on a test group including a number of 46 patients, adolescents and

young adults, with ages between 15 and 40 years, all with a certain degree of dental crowding and gingival inflammation.

The severity of dental crowding is evaluated according to the TSALD value [3] - Tooth Size Arch Length Discrepancy. The severity of gingival inflammation was recorded clinically by Papilla Bleeding Index (PBI) and paraclinically by TOPAS test.

MedCalc®, version 7.3.0.1. was used for the statistical analysis.

The correlation between the severity of dental crowding and clinical and paraclinical parameters of gingival inflammation were analyzed within the test group using Spearman rank correlation coefficient (*Table 1*).

Of the investigated patients, a number of 30 followed orthodontic alignment treatment. The same variables (PBI and TOPAS values) were measured at the end of treatment in treatment group, when dental crowding was no longer present.

The changes in PBI, BT and TP between baseline and end of tooth alignment treatment were analyzed within the treatment groups using the Wilcoxon test (*Table 2*). The level of significance was set at 5% [12].

Table 1. Correlation between severity of dental crowding and parameters of gingival inflammation (Spearman rank correlation coefficient)

Severity of crowding	PBI		TOPAS BT		TOPAS TP	
	rho	P	rho	P	rho	P
	-0.264	0.0768	-0.279	0.0610	0.011	0.9412

Rho = correlation coefficient
P = probability

Table 2. The changes in parameters after tooth alignment treatment

	Before Treatment	After treatment
PBI	1.8333 (0.46)	1.2300 (0.45)*
TOPAS TB	2.8333 (0.83)	1.3333 (0.66)*
TOPAS PT	2.9000 (0.40)	2.1333 (0.73)*

Wilcoxon test: p<0.001
* standard deviation

It is presented below as example one of the cases included in this study, a 16-year-old young girl with moderate bimaxilar frontal crowding.

Reason of presentation: gingival bleeding produced especially by the daily dental brushing.

The patient is not satisfied with her physiognomic aspect and she agrees to the treatment.

Intraoral examination reveals the presence of all teeth on the arch (*Figure 1*). The dental crowding affects both arches. The lower jaw is trapezoidal and the upper Ω-like.

Examination of oral hygiene status shows the presence of plaque and calculus deposits, affecting the lower teeth more, recording a plaque index (PI) of 1.3 and a calculus index (CI) of 0.3, with a 1.6 score for the oral hygiene.

Figure 1. Initial clinical aspect (after extraction of first premolars)



Periodontal examination displays the existence of generalized gingival inflammation involving both interdental papillae and free gingiva. The color of the gingiva is red, smooth and shiny, with disappearance of orange peel aspect. Because of the severe crowding, the frontal interdental papillae are thin and reduced in height (*Figure 1*). Bleeding on probing is present in all areas, but more severe in frontal region, with a PBI 1.3 in the maxilla and 1.6 in the mandible.

The Radiologic examination unveils the thin aspect of frontal interdental alveolar septa due to the dental crowding (*Figure 2*).

Figure 2. The initial radiographic aspect



The Paraclinical examination includes the use of two tests, the biochemical TOPAS test and the microbial-enzymatic BANA test.

TOPAS test records medium levels for both bacterial toxins and total proteins (*Figure 3 and 4*), which confirm the existence of a developing gingival inflammation.

Figure 3. Medium level of bacterial toxins

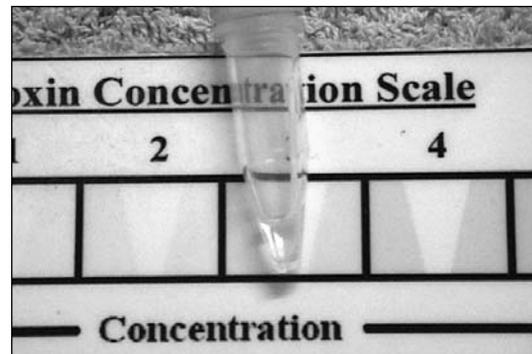
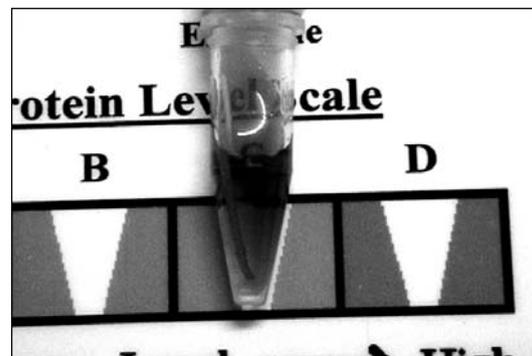


Figure 4. Total protein concentration is intermediate



BANA test is negative (*Figure 5*), which means that the three pathogen anaerob species BANA sensitive (*Treponema denticola*, *Porphyromonas gingivalis* and *Bacteriodes forsythus*) are not detectable in the subgingival bacterial samples.

Figure 5. The BANA test result is negative



Diagnosis

The patient has plaque-induced chronic gingivitis associated with class I Angle malocclusion with severe bimaxilar dental crowding.

The treatment included the following objectives:

1. Instruction of the patient to improve oral hygiene measures
2. Removal of local etiologic factors
3. Dental alignment with physiologic occlusal contacts and a good physiognomic aspect
4. Maintenance of good orodental hygiene during orthodontic treatment

Figure 6. Preliminary result at one year and ten months from onset of treatment



A preliminary dento-periodontal evaluation at one year and ten months interval after beginning of orthodontic treatment (*Figure 6*) evinces good evolution, the disappearance of dental crowding with good occlusal contacts.

The periodontal status shows an improvement of the severity of gingival inflammation, the patient reporting that the gingival bleeding occurs now only occasionally when caused by brushing. Re-formation of the physiologic relief of the interdental papilla, previously affected by the dental crowding is remarkable. The reduction of the severity of bleeding on probing is also a positive aspect, now recording a 0.6 score for the maxilla and 0.8 score for the mandible.

Bacterial plaque deposits are present especially on the facial surfaces, with a PI score 0.3.

Figure 7. Clinical aspect two years from onset of treatment



Another evaluation done two years from onset of treatment evidences the same positive evolution (*Figure 7*).

At the end of orthodontic treatment the objective examination shows good periodontal status (*Figure 8*), with absence of objective gingival inflammation signs and a PBI score 0.5. The interdental papillae are now well contoured and the free gingiva is firm. Oral hygiene is good, with a PI score 0.3.

Figure 8. Clinical aspect at the end of orthodontic treatment



TOPAS test performed at this moment and compared with the initial values shows a decrease of the concentration of bacterial toxins from score 3 to score 1 and of total protein concentration from level C to level A (Figures 9 and 10).

Figure 9. Very low bacterial toxins level

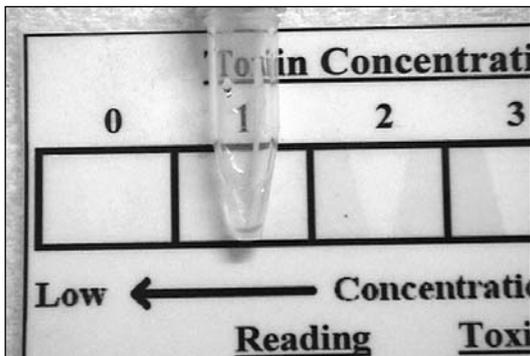


Figure 10. Only traces of total proteins are present



Results

Statistical analysis evidences that there is no relevant correlation between the severity of dental crowding and the clinical and paraclinical assessed parameters of gingival inflammation. This can be attributed to the existence of a multitude of etiologic factors which can be involved in the onset and evolution of gingival inflammation. The same absence of correlation between the previously evaluated variables was observed in another study on a larger group of patients [13], although the clinical and paraclinical compared parameters (PBI and TOPAS values) are well correlated and reflect the same clinical condition. This means that in case of patients examined, the severity of dental crowding does not influence directly the severity of gingival inflammation.

Comparing the results listed in *Table 2* we can observe that there is a consistent and uniform variation in decreasing the clinical and paraclinical parameters of gingival inflammation after tooth alignment treatment. These results suggest that orthodontic tooth alignment had beneficial effects on the periodontium, leading to a decrease of the severity of gingival inflammation, evaluated clinically by PBI index and paraclinically within biochemical TOPAS test.

It is important to remark that orthodontic treatment in the study group had as consequence a comparable decrease of the degree of gingival inflammation. This can be explained as after tooth alignment the retentive areas are no longer present, the periodontal structures are gaining their physiologic form and thickness and are less subjected to microbial aggression.

A positive statistical reduction in degree of gingival inflammation was also observed in a control group of 29 patients with dental crowding, who did follow only anti-microbial and anti-inflammatory periodontal treatment [13].

Another study [14] showed that ortho-

dontic alignment treatment induces a decrease in the level of periodontal inflammation, comparable as clinical parameters (degree of gingival bleeding and level of inflammatory products present in the crevicular fluid) with the results obtained in the same category of patients with dental crowding who only follow periodontal antimicrobial and anti-inflammatory therapy.

Conclusion

The severity of dental crowding does not influence directly the severity of gingival inflammation assessed clinically by papilla bleeding index and paraclinically by TOPAS test.

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