Multiparametric analysis of the results of dental crowding treatment on the periodontal status

Cristina Puşcaşu[1], Anca Dumitriu[2], Dragoş Totolici[1],
Horia Traian Dumitriu[2]

[1] Constanța, [2] Bucharest, Romania

Summary

One justification of orthodontic treatment is that crowded teeth are more retentive and more difficult to be cleaned, favoring dental plaque accumulation. The aim of this study is to evaluate the changes of some parameters as plaque index, bleeding index, results of paraclinical tests (aimed to check the degree of gingival inflammation), on a group of young adult patients with dental crowding, which underwent orthodontic treatment. The changes in clinical and paraclinical parameters after orthodontic treatment are compared with the control group of patients, all with dental crowding, who followed only the local antimicrobial and anti-inflammatory treatment. The conclusion of this study is that orthodontic alignment of irregular teeth has as consequence the reduction of gingival inflammation clinical parameters, comparable with the local antimicrobial and anti-inflammatory treatment alone; therefore we indicate it for prevention as well as part of the complex treatment of the periodontal disease.

Keywords: dental crowding, orthodontic alignment, gingival inflammation.

Introduction

Dental abnormalities, especially ones associated with tooth irregularity can be favoring factors for the onset and evolution of periodontal disease [1,2,3]. A number of studies showed a correlation between dental crowding and periodontal disease. Ashley and co. (1998) [4] in a study on a group of schoolchildren found a correlation between the gingival inflammation and dental crowding affecting the frontal area. Buckley (1981) [5] concluded that individual tooth irregularity is correlated with plaque and gingival inflammation in a group of teenagers. Dental crowding influences the periodontal status in negative manner because the papillae from the affected areas are short, thin, with a weak blood circulation, subjected to inflammation, and the interdental alveolar septa are thinner, easily affected by the demineralization process [6]. The areas of severe crowding are more retentive for bacterial plaque, being more subjected to gingival inflammation [7,8]. The labial movement of lower crowded incisor does not lead to gingival recession, if the orthodontic movements are well controlled [9].

It is important to know that the existence of a previous periodontal disease in a patient with dental crowding does not exclude the orthodontic treatment [10,11]. On the contrary, after resolution of the inflammatory factor, orthodontic alignment eliminates retentive areas, which should lead to an improvement in the periodontal status [12,13,14].

Based on such observations, the **aim** of this study is to evaluate the effect of orthodontic alignment of crowded teed on the periodontal condition.

Material and method

The patients included in this study are teenagers and young adults aging between 15 and 46 years old, all suffering of periodontal disease and a certain clinical form of dental crowding. The study lasted from 2003 until 2005. From the patients examined in this interval in the Periodontology Department in collaboration with the Orthodontics Department we included in the study a number of 61 patients, who fulfilled the protocol of the study.

All patients were subjected to a complete periodontal examination, results being recorded in individual periodontal charts.

For a better evaluation of the treatment results we compared the periodontal status of the *study group*, consisting of 32 patients with periodontal disease and dental crowding, who underwent orthodontic alignment and the *control group*, consisting of 29 patients also suffering from periodontal disease and tooth irregularity who did follow only periodontal treatment, which included antimicrobial and anti-inflammatory therapy.

The protocol of the study

All patients included in the study did not report the existence of any systemic disease that could affect the periodontal and dental health. All patients are aware of individual methods of dental hygiene and had proved a good collaboration during observing interval. The deviation from protocol includes those patients, who did not finish the treatment at the moment of ending of the study, or the ones who abandoned the treatment.

This is a case-control study [15] comparing the control group of patients with dental crowding and periodontal involvement with the study group of patients also exhibiting dental crowding and periodontal disease, who followed orthodontic treatment.

The purpose: to investigate the existence and evolution of the periodontal inflammatory phenomena in both groups of patients.

Most of the data used in the study are qualitative:

- nominal data as: clinical form of periodontal disease, type of dento-alveolar abnormality;
- ordinal data: the values of plaque index (PI), the values of the papilla bleeding index (PBI), the results of paraclinical tests used (TOPAS).

Results

The variables used for the statistical study are: The Plaque Index (PI), The Papilla Bleeding Index (PBI), level of bacterial toxins (BT) measured with TOPAS test, level of total proteins (TP) measured also with TOPAS.

For the statistic comparison of the effects of teeth alignment treatment versus periodontal antimicrobial and anti-inflammatory treatment we calculated separately the average of variables assessed for both groups. The values are presented in *Tables 1* and *2*.

In order to assess the existence of a correlation between the same parameters in control and study groups before and after treatment, Spearman rank correlation coefficient was utilized.

The values obtained are presented in the *Tables 3,4,5,6*.

A good statistic correlation exists between the degree of gingival inflammation assessed by Papilla Bleeding Index (PBI) and the concentration of bacterial toxins in the gingival crevicular fluid (*Table 3*).

After orthodontic treatment in the study group, a positive statistic correlation was found between the degree of gingival inflammation and the concentration of total proteins in the gingival crevicular fluid, assessed with TOPAS test (*Table 4*).

Table 1. The average of certain parameters evaluated before and after therapy in the study group

		Average	Standard Deviation
PBI	Initial	1.8906	0.2538
	Final	1.2625	0.4591
	Variation	0.6281	0.3448
TOPAS TP	Initial	2.9687	0.4741
	Final	2.1875	0.7378
	Variation	0.7812	0.7064
TOPAS BT	Initial	2.8750	0.8328
	Final	1.4063	0.7121
	Variation	1.4688	0.6713
PI	Initial	1.4625	0.4353
	Final	0.8813	0.4254
	Variation	0.5813	0.3402

Table 2. The average of certain parameters evaluated before and after therapy in the control group

		Average	Standard Deviation
PBI	Initial	2.0069	0.6425
	Final	1.2414	0.5925
	Variation	0.7655	0.6537
TOPAS TP	Initial	2.7586	0.6895
	Final	2.4483	0.6317
	Variation	0.3103	0.6603
TOPAS BT	Initial	2.3103	0.9675
	Final	1.6897	0.6603
	Variation	0.6207	0.9416
PI	Initial	1.5069	0.4358
	Final	0.7103	0.3658
	Variation	0.7966	0.4066

Table 3. Correlations in study group before treatment (Spearman rank correlation coefficient)

		Initial TOPAS	
		TP	**BT**
PI Initial	rho	0.367	0.447
	P	0.0409	0.0128
PBI Initial	rho	0.279	0.808
	P	0.1205	<0.0001

Table 4. Correlations in study group after treatment (Spearman rank correlation coefficient)

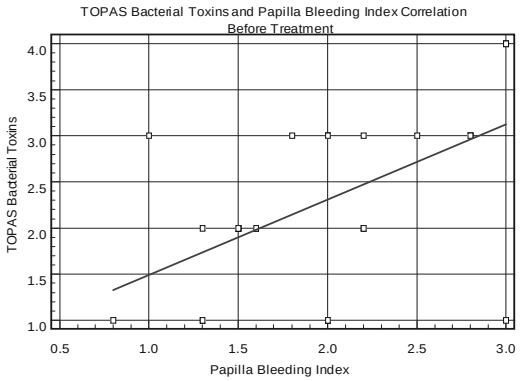
		Final TOPAS B	
		TP	**BT**
PI Final	rho	0.572	0.377
	P	0.0014	0.0356
PBI Final	rho	0.752	0.526
	P	<0.0001	0.0034

Table 5. Correlations in control group before treatment (Spearman rank correlation coefficient)

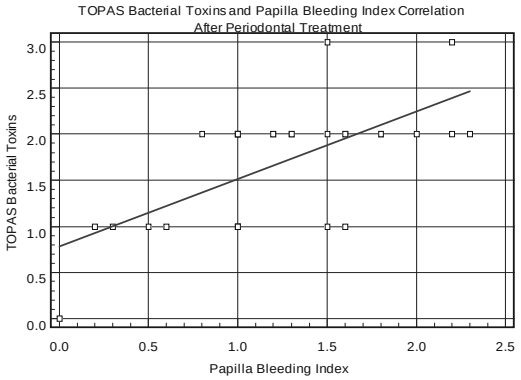
		Initial TOPAS	
		TP	**BT**
PI Initial	rho	0.354	0.461
	P	0.0607	0.0147
PBI Initial	rho	0.405	0.524
	P	0.0322	0.0056

In control group the same statistic correlation exists between the degree of gingival inflammation assessed by Papilla Bleeding Index and the concentration of bacterial toxins in gingival crevicular fluid as in case of study group, but less important as value (*Table 5*).

Chart 1. The graphic representation of correlation between papilla bleeding index and level of bacterial toxins before and after therapy



Before



After

After periodontal treatment (*Table 6*) the best statistic correlation between the degree of gingival inflammation (assessed by Papilla Bleeding Index) and the concentration of bacterial toxins in gingival crevicular fluid (assessed by TOPAS test) remains the same as before treatment (*Chart 1*).

Table 6. Correlations in control group after treatment (Spearman rank correlation coefficient)

		Initial TOPAS	
		TP	**BT**
PI Initial	rho	0.455	0.539
	P	0.016	0.0044
PBI Initial	rho	0.242	0.600
	P	0.2002	0.0015

Discussion

Comparing the average of PBI in both groups before and after treatment (*Tables 1* and *2*) we can observe that the decreasing intensity of bleeding, as average, is comparable in both groups, a slightly reduction of the degree of gingival inflammation being recorded in the control group, secondary to periodontal treatment. It is important to remark that orthodontic treatment in the study group had as consequence a comparable reduction of the degree of gingival inflammation as against the control group. This can be explained because after teeth alignment the retentive areas are no longer present. The same aspect can be observed comparing the values of plaque index (PI) average, which follows a comparable decrease in both groups, but more obvious in periodontally treated group of patients (the variation is greater than in the study group). On the other hand, a greater decrease of the average of bacterial toxins concentration (BT) is observed in the study group, aspect which corresponds with the previous idea that by teeth alignment treatment the retentive areas are removed, decreasing the bacterial plaque accumulation and consequently the concentration of the bacterial toxins in the gingival crevicular fluid, assessed with TOPAS test.

Because the total protein concentration assessed also by TOPAS test includes the concentration of bacterial proteins as well as human proteins (host proteins, antibodies present in the gingival crevicular fluid) the decrease of its average is less remarkable.

The best statistical correlation in both groups of patients before treatment (*Table 3* and *Table 5*) exists between the degrees of gingival inflammation evaluated by PBI

index and the concentration of bacterial toxins evaluated by TOPAS test. We obtained a rho (Spearman correlation coefficient) value of 0.808 (P<0.0001) for the study group and rho value 0.524 (P=0.056) for the control group. Similar positive correlations are found between the same variables also after treatment in both groups. This suggests that the evaluation of bacterial toxins with TOPAS test is well correlated showing the actual degree of gingival inflammation in both situations, before and after treatment, the bacterial plaque removal as well as the tooth alignment having as consequence the reduction of gingival inflammation (decrease of the degree of bleeding and the concentration of bacterial toxins in the crevicular fluid).

Another positive statistical correlation was found between the severity of gingival bleeding and the level of total proteins in the crevicular fluid (*Table 4* and *Table 6*), more important in case of study group after orthodontic treatment (rho value 0.752, P<0.0001). This finding suggests that orthodontic alignment of crowded teeth has positive effects on the degree of periodontal inflammation, having as consequence its reduction, proved by the paraclinic TOPAS evaluation.

We could not prove the existence of a direct statistic correlation between the level of bacterial plaque (PI) and the degree of gingival inflammation evaluated by TOPAS test.

Conclusion

The results of this study show that the orthodontic alignment treatment produces a decrease of the degree of periodontal inflammation, comparable in its clinical parameters (the degree of gingival bleeding and the level of inflammatory products present in the crevicular fluid) with the results obtained in the same category of patients with dental crowding, who follow only periodontal antimicrobial and anti-inflammatory therapy.

These observations need to be extended on a larger group of patients and it should be interesting to search if there are particular mechanisms involved in the improvement of periodontal status after orthodontic alignment of crowded teeth. Further research is needed in this respect.

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Correspondence to: Dr. Puşcaşu Cristina, Assist. Prof., Discipline of Periodontology, Faculty of Dental Medicine and Pharmacy, Constanța. Siretului str., no. 54, 900675, Constanța, Romania. E-mail: cristinap@gmb.ro