

Periodontal evaluation of different toothbrushing techniques in patients with fixed orthodontic appliances

Patricia Oehlmeyer Nassar¹, Carolina Grando Bombardelli², Carolina Schmitt Walker³, Karyne Vargas Neves³, Karine Tonet³, Rodolfo Nishimoto Nishi⁴, Roberto Bombonatti⁵, Carlos Augusto Nassar⁶

Introduction: Plaque control is the major consensus during orthodontic treatment to prevent the occurrence of cavities and periodontal inflammation. The mechanic resource of greater effectiveness and frequent use in this control is the oral hygiene. The tooth brushing techniques most used in orthodontic patients are: Ramfjord's method, Modified Stillman technique and Bass method. **Objective:** Since control studies evaluating the effectiveness of usual tooth brushing techniques do not show clear advantage, the objective of this study was to evaluate the effectiveness of three brushing methods, through periodontal clinical parameters of patients with fixed orthodontic appliances. **Methods:** Thirty patients were selected, with ages between 14 and 22 years old, with fixed orthodontic appliances. After basic periodontal treatment the following factors were evaluated: 1–Plaque index and 2–Gingival index and each patient was randomly included in one of the three selected groups according to the brushing technique: Group 1–Scrubbing technique; Group 2–Modified Stillman technique and Group 3–Bass technique. Patients were evaluated for 9 months. **Results:** The results showed a significant reduction of clinical parameters by the end of this period, however there was a very significant reduction of Gingival index on group 3 (13.6%) when compared to the other groups. **Conclusion:** Thus, it can be suggested that the Bass technique can be effective on the reduction of periodontal clinical parameters of Plaque index and Gingival index in patients with fixed orthodontic appliances.

Keywords: Dental plaque. Tooth brushing. Orthodontic appliances.

Introdução: o controle de placa bacteriana é o maior consenso durante o tratamento ortodôntico para prevenir a ocorrência de cáries e inflamação periodontal. O recurso mecânico de maior efetividade e uso frequente nesse controle é a higienização bucal. As técnicas de escovação dentária mais usadas por pacientes ortodônticos são: a friccional giratória de Ramfjord, a Stillman modificada e a sulcular de Bass. **Objetivo:** tendo em vista que estudos de controle avaliando a efetividade das técnicas de escovação mais comuns não demonstraram nenhuma superioridade clara, o objetivo desse estudo foi avaliar a efetividade de três técnicas de escovação, através dos parâmetros clínicos periodontais de pacientes portadores de aparelhos ortodônticos fixos. **Métodos:** foram selecionados 30 pacientes, com idades entre 14 e 22 anos, portadores de aparelhos ortodônticos fixos. Após o final do tratamento periodontal básico, determinou-se o (1) Índice de Placa e o (2) Índice Gengival, e cada paciente foi incluído, aleatoriamente, em um dos três grupos, selecionados de acordo com a técnica de escovação (Grupo 1 = Técnica de esfregaço; Grupo 2 = Técnica de Stillman Modificada e Grupo 3 = Técnica de Bass). Os pacientes foram avaliados por um período total de 9 meses. **Resultados:** os resultados mostraram uma diminuição significativa dos parâmetros clínicos ao final desse período, porém houve uma redução muito significativa do Índice Gengival no grupo 3 (13,6%), em comparação aos demais grupos. **Conclusão:** pode-se sugerir que a Técnica de Bass pode ser efetiva na redução dos parâmetros clínicos periodontais de Índice de Placa e Índice Gengival em pacientes portadores de aparelhos ortodônticos fixos.

Palavras-chave: Placa dentária. Escovação dentária. Aparelhos ortodônticos.

¹ Adjunct Professor of Periodontology, State University of Western Paraná (UNIOESTE).

² Student of the Dentistry Specialization Program, UNIOESTE.

³ Graduated in Dentistry, UNIOESTE.

⁴ Student of the Dentistry Specialization Program, UNIOESTE.

⁵ Assistant Professor of Orthodontics, UNIOESTE.

⁶ Adjunct Professor of Periodontology, UNIOESTE.

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Contact address: Patricia Oehlmeyer Nassar
Rua Pernambuco, 593 apto 504, Centro – CEP: 85.810-020 – Cascavel / PR
E-mail: ponassar@yahoo.com

INTRODUCTION

Plaque control is the major consensus during orthodontic treatment to prevent the occurrence of cavities and periodontal inflammation. Patients with orthodontic bands and brackets may show greater accumulation of dental plaque, requiring enhanced programs of personal oral hygiene and regular professional prophylaxis.¹¹ The mechanic resource of greater effectiveness and frequent use on plaque control is the oral hygiene, consisting of tooth brushing complemented with the use of dental floss and other supporting means. In orthodontic patients, generally this procedure becomes more complex for the difficulty provided by the appliances. For this reason it demands greater attention from the professional to modify the conventional techniques seeking the best method for the patient.⁵

The tooth brushing techniques most used in orthodontic patients are: Ramfjord's method, modified Stillman and Bass method.⁵ Control studies evaluating the effectiveness of usual brushing techniques do not show clear advantage for any of the methods. It is probable that the scrubbing technique is the most simple and common brushing method. For patients with periodontal disease, the instruction of a sulcular brushing, using vibrating movements to increase the access to gingival areas is common. The most recommended method is the Bass technique for it emphasizes the sulcular placement of the bristles.¹⁰

The most important factor for patients to develop a good tooth brushing is not only the technique itself, but the way it is oriented and executed. Through a thorough clinical exam, followed by application of plaque index and gingival index, the professional must implement the motivation program, being performed in several sessions and repeatedly.⁵ Thus, the dentist is responsible for providing information about the periodontal disease and its effects, and the patient is responsible for acquiring and maintaining habits of oral hygiene. Manual dexterity must be developed and used to establish an effective regime of plaque control. Besides, the patient must understand his role in the treatment and maintenance of the periodontal health. Otherwise, the long term success of the treatment is much less probable.¹⁰

The process of changing habits starts educating the patient about periodontal health and disease, developing an acceptable strategy of plaque control, and emphasizing the positive changes on the behavior.¹⁰

Studies have proved that in all situations in which the plaque control was supervised and reinforced with long term programs of intensive instructions, there was a reduction on the plaque and gingival indexes and reversal of the pathology; while when elaborated in short term or in a single instruction session, the results were not favorable. It is important to emphasize that patients who uses orthodontic appliances, when well-motivated and oriented, keeps their oral and periodontal health state stable.^{2,3,9}

Therefore, as long as patients obtain an effective motivational program and a long term periodic and supervised mechanic control, admittedly, the orthodontic appliances alone, when well installed, prizing the teeth anatomy and keeping distance from the free gingival margin, does not compromise the anatomic and physiologic integrity of the periodontium.⁵

OBJECTIVES

The objective of this study was to evaluate the effectiveness of three tooth brushing techniques (Scrubbing technique, modified Stillman and Bass method) through periodontal clinical parameters of Plaque and Gingival Indexes on periodontal tissues of patients with fixed orthodontic appliances.

MATERIAL AND METHODS

Thirty patients were selected, with ages between 14 and 22 years old, using fixed orthodontic appliances. The evaluations were performed in patients that were not subjected to basic periodontal treatment and to no maintenance clinical procedure previous to the this study.

After performing basic periodontal treatment it was performed the clinical exam on the buccal, lingual/palatal, mesial and distal surfaces and each patient was included in one of the three selected groups according to the brushing technique:

- » Scrubbing technique: Placement of toothbrush in a 90° angle in relation to the dental surface and then a horizontal movement is applied.
- » Modified Stillman: The brush head is positioned in an oblique direction pointing to the root apex, with the bristles partially located on the gingiva and on the dental surface and after applying a slight vibrating movement, the brush head turns progressively on the occlusal or incisal direction.

» Bass method: The brush head is positioned in an oblique direction turned to the root apex aiming to introduce the bristles on the gingival sulcus. The brush is then shifted on an anteroposterior direction, using short rhythmic movements.⁴

Clinical assessment

The initial clinical exam was performed by a single examiner previously trained, using a Williams #23 periodontal probe, who determined:

- 1) Silness and Løe¹² Plaque Index.
- 2) Løe and Silness⁷ Gingival Index.

After the initial clinical exam, patients were randomly divided in three groups with 10 patients each according to Table 1.

Patients were evaluated for a total of 9 months and the clinical exams were performed on 0, 3, 6 and 9 months periods and in all periods, patients were again instructed and received maintenance therapy. The brushes used in the mechanic procedure were standardized, through characteristics such as soft and horizontal bristles of same size and small brush head, independently of brands, as well as the tooth pastes could not present any component that could affect the plaque accumulation, besides their basic components.

Statistical analysis

The obtained data were analyzed and evaluated through ANOVA and Tukey tests.

RESULTS

Table 2 shows the mean percentages of Plaque Index for the four exams performed (0, 3, 6 and 9 months) in all groups according to Table 1.

In group 1 there was a progressive and significant ($p < 0.01$) reduction of the Plaque index from the first

exam (70.6 ± 16.0) to the second exam (42.6 ± 16.3), from the second to the third exam (38.9 ± 17.9) and from the third to the fourth exam (24.5 ± 11.3).

In group 2 there was a statistically significant difference ($p < 0.01$) from the first exam (68.6 ± 19.6) to the second exam (33.8 ± 17.8). However, from the second to the third exam (40.9 ± 27.3), there was a significant increase ($p < 0.01$) on the Plaque Index and from the third to the fourth exam occurs again a statistically significant reduction ($p < 0.01$) (26.9 ± 16.0).

In group 3 there was also a progressive and significant ($p < 0.01$) reduction on the Plaque Index from the first exam (57.3 ± 21.4) to the second exam (44.6 ± 20.6), and from the second to the third exam (32.2 ± 20.9) and from the third to the fourth exam (24.8 ± 6.9).

Table 3 shows the percentages of reduction from the first exam (0) to the fourth exam (9 months) on the Plaque index, in all groups according to Table 1.

There was a reduction of 46.1% on group 1, 41.7% on group 2 and 32.5% on group 3. All these values were significantly different from one another ($p < 0.01$).

Table 4 shows the Gingival Index percentages means for the 4 performed exams (0, 3, 6 and 9 months) in all groups according to Table 1.

Interestingly, in all treated groups, a significant reduction ($p < 0.01$) on the Gingival Index occurred from the first to the second exam, followed by a small but significant increase ($p < 0.01$) from the second to the third exam and finally, again a significant reduction ($p < 0.01$) from the third to the fourth exam.

Table 5 shows the reduction percentages from the first exam (0) to the fourth exam (9 months) for the Gingival Index, in all groups according to Table 1.

There was a reduction of 6.1% on group 1, 3.2% on group 2 and 13.6% on group 3. All these values were significantly different from one another ($p < 0.01$).

Table 1 - Distribution of the 30 patients according to the proposed treatments.

Group 1 (n = 10)	Group 2 (n = 10)	Group 3 (n = 10)
Mechanic control (Scrubbing technique +dental floss with floss threaders)	Mechanic control (Modified Stillman + dental floss with floss threaders)	Mechanic control (Bass method + Dental floss with floss threaders)

Table 2 - Plaque Index values for all groups in the periods of 0, 3, 6 and 9 months (mean \pm S.D.). Results are expressed in percentages means.

	Group 1	Group 2	Group 3
First exam (0)	70.6 \pm 16.0	68.6 \pm 19.6	57.3 \pm 21.4
Second exam (3 months)	42.6 \pm 16.3 *	33.8 \pm 17.8 *	44.6 \pm 20.6 *
Third exam (6 months)	38.9 \pm 17.9 #	40.9 \pm 27.3 #	32.2 \pm 20.9 #
Fourth exam (9 months)	24.5 \pm 11.3 €	26.9 \pm 16.0 €	24.8 \pm 6.9 €

*, #, € (p < 0.01) statistically different data in the same group.

Table 3 - Plaque Index reduction percentage from the first (0) to the fourth exam (9 months).

	Group 1	Group 2	Group 3
First exam (0) to fourth exam (9 months)	46.1	41.7 *	32.5 #

*, # (p < 0.01) statistically different data in the same group.

Table 4 - Gingival index values for all groups in the periods of 0, 3, 6 and 9 months (mean \pm S.D.). Results are expressed in percentages means.

	Group 1	Group 2	Group 3
First exam (0)	9.8 + 5.3	10.1 + 8.6	18.2 + 7.7
Second exam (3 months)	6.5 + 4.7 *	5.5 + 4.5 *	6.8 + 4.5 *
Third exam (6 months)	7.6 + 6.7 #	8.6 + 8.3 #	7.9 + 7.0 #
Fourth exam (9 months)	3.7 + 2.4 €	6.9 + 3.9 €	4.6 + 2.3 €

*, #, € (p < 0.01) statistically different data in the same group.

Table 5 - Gingival Index reduction percentage from first (0) to the fourth exam (9 months).

	Group 1	Group 2	Group 3
First exam (0) to the fourth exam (9 months)	6.1	3.2 *	13.6 #

*, # (p < 0.01) statistically different data in the same group.

DISCUSSION

The aim of this study was to evaluate the effectiveness of three different brushing techniques in patients with fixed orthodontic appliances, where, according to the presented results, an improvement in all periodontal clinical parameters can be observed, in all techniques, by the end of the evaluation period, when compared to initial exams. Once the effective oral hygiene is especially important for those undergoing orthodontic therapy, since fixed orthodontic appliances may complicate an efficient brushing and a mechanical cleaning action, leading to a subsequent plaque buildup. Thus, it is considered that for long treatment periods, a routine of oral hygiene must be emphasized to these patients with fixed orthodontic appliances, including professional cleaning and instructions for home care.¹ The literature has not yet identified a plaque infection level that is compatible to periodontal health maintenance. However, in a clinical standard,

a plaque control record of 20–40% can be tolerated by most patients. It is important to comprehend that the amount of plaque in the oral cavity is related to the host response, i.e., to the inflammatory parameters.⁶

The study proved the initial expectations about improvement of periodontal clinical parameters, since in all groups there was a significant reduction both on Plaque and Gingival Indexes, and in all groups occurred a reduction in this standard on Plaque Index where it was observed that by the end of the experimental period the patients that performed Scrubbing technique presented 24.5% of plaque, those that performed Modified Stillman presented 26.9% of plaque and those that performed Bass method presented 24.8% of plaque.

However, the reduction of Plaque Index may not have been greater due the age group of selected patients and for the low quality of brushing technique that they presented previously.¹

The plaque indexes are useful indicators of patient cooperation and successful daily plaque control procedures. Although, the plaque levels itself do not necessarily reflect gingival health or risk of disease progression, even though plaque is highly correlated to the presence of gingivitis.⁸ In terms of predicting success controlling the inflammation and reducing the chance of disease progression, bleeding is by far the best indicator.¹⁰ Considering the Gingival index performed in this study, a very significant reduction percentage was observed of this index in the group that performed the Bass method (13.6%). This can be explained by the fact that this technique emphasizes the sulcular placement of the bristles, removing the plaque not only from the gingival margin but also subgingivally. Through literature review it can be proved and shown that using this brushing technique the cleaning efficiency can reach a depth of 0.5 mm subgingivally.⁴ The Bass method requires patience and positioning the toothbrush in many different positions to cover the entire dentition. Patients must be instructed to brush in a systematic and controlled sequence. Other brushing techniques, as Modified Stillman and Charters are variation of the Bass method also designated to obtain the complete removal of plaque from gingival

margins. They emphasize the stimulation of gingival circulation, which has not been proven to reach better repairers results than the ones obtained through an adequate plaque removal. The Bass method principles has two advantages in relation to other more complex techniques: The short back and forth movement is easy to control because it is a simple familiar movement for most patients that use the scrubbing technique. It concentrates the cleaning action on the cervical and interproximal part of the tooth, where the plaque is mostly accumulated,¹⁰ proving the ease and efficiency of the technique.

CONCLUSION

Within the limits of this study and based on clinical significance of the obtained results, it can be concluded that all analyzed techniques show effectiveness on the plaque control in patients with fixed orthodontic appliances. However, it can be suggested that the Bass method was more effective on the maintenance of periodontal health in these patients for a period of 9 months. Further studies may be important to confirm these findings and show the effectiveness of this method on the periodontal tissues health in patients with fixed orthodontic appliances.

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