



Dental Bacterial Plaque Control in Pediatric Patients during Orthodontic Treatment with Chlorhexidine vs. Sodium Fluoride

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Abstract

Introduction: Dental bacterial plaque control is fundamental in order to prevent dental caries as well as to prevent periodontal disease through an orthodontic treatment.

Objective: To compare the efficacy of two rinses regarding dental bacterial plaque control during the orthodontic treatment in pediatric patients, applying Chlorhexidine Gluconate (0.12%) vs. Sodium Fluoride (0.5%).

Materials and methods: We designed a clinical experimental study, which included 42 patients from six to eleven years old with their first four permanent molars erupted, dividing them in two experimental groups and one control. We measured the initial OHI-S, 1, 3 and 6 months after the application of the rinses. We used the t-Tests to compare the average intra-groups and an ANOVA test for comparisons.

Results: Both experimental groups were effective in decrease the OHI-S values. Conclusions: Chlorhexidine Gluconate was more effective for dental bacterial plaque control with a significant difference of $p \leq 0.05$.

Keywords: Antiseptics; Odontology Dental bacterial plaque; Chlorhexidine gluconate; Sodium fluoride

Introduction

Dental Plaque (DP) is a heterogenic accumulation which sticks to the teeth surface, or it locates in the gingival sulcus, composed by a microbial community enriched with aerobic and anaerobic bacteria surrounded by an intercellular matrix of polymer of microbial and salivary origin.

The presence of PD in enamel clinically perceptible, conducts regularly to decalcification, this has been accepted as one of the risks during orthodontic treatment, especially in patients with a poor oral hygiene, the clinical evidence has proven the existing relation between the use of orthodontic tools and a highly accumulation and retention of DP, situations which leads to gingivitis. Its formation can be prevented with specific actions and procedures which include an adequate mechanical removal of plaque. It is important to consider that through an orthodontic treatment the accumulation of DP importantly depends in the patients and their active cooperation to maintain an adequate hygiene, the use of chemical agents as Chlorhexidine and/or fluoride might help the patient with the control of its formation [1].

Chlorhexidine is nowadays one of the main antiseptics of general use in odontology. Chlorhexidine digluconate mouth rinses are commercialized at 0.2 and 0.12% in aqueous solution. The lowest concentration seems enough to obtain satisfactory clinical results without apparent side effects [2]. Chlorhexidine attaches to epithelial cells from oral mucosa, to dental enamel hydroxyapatite and to salivary proteins, from where it slowly releases in an active way. In this way it keeps bacteriostatic levels in saliva from 8 to 13 hours. It possesses a fungicide and bactericide action against Gram positive organisms as well as Gram negative helping to inhibit DP formation [3].

The use of fluoride rinses after teeth brush is a practice every time more extended and of proven anti-caries proven effects [4,5]. Fluoride mixes at 0.20% are used for weekly use and of 0.05% per daily use. Fluor favors the remineralization of demineralized zones by attaching to the crystals forming fluoroapatite increasing their resistance to demineralization [6,7] when the metabolic bacterial activity over carbohydrates generates acids. The presence of fluorides favors the

inhibition of bacterial activity by blocking the mean of transportation in a membrane level, affecting in this way DP growth.

Materials and Methods

We designed a clinical experimental study, where we compared the efficacy of two preventive agents regarding dental bacterial plaque decrease with the application of Chlorhexidine Gluconate at 0.12% and Sodium Fluoride at 0.5%. Within a population sample of 36 healthy patients from 6 to 11 years old in both genres with an active orthodontic treatment, free of caries, randomly assigned into 3 groups of 12 patients, a control group, and two experimental groups (GA and GB). The study consisted of 3 phases:

Before the beginning of the study we obtained the signature of the informed consent from parents and/or legal tutors of the patients [8]. Once they were included in the study, we randomly assigned them to a group following the order in which they were selected and we adequately taught each participant about brushing technique [9].

We treated group A with the Chlorhexidine Gluconate application at 0.12%, the group B with the application of Sodium Fluoride at 0.5% and we applied group C a placebo. We practice prophylaxis and tooth polishing to the surfaces with pumice stone and a mounted brush in a hand piece with counter-angle to all of the participants, after that, we made 3 applications with the study agent in the first permanent molars waiting 30 seconds among each application previous to the colocation and cementation of a fixed or mobile orthodontic appliance [10,11].

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We registered the OHI-S at the beginning, at 1, 3 and 6 months, after the application of the agent following the WHO criteria. We added the obtained values and divided them among the total number of examined teeth to obtain an OHI-S average, taking into consideration the plaque index scale of values of the WHO is the following: Excellent 0, Good oral hygiene from 0.1 to 1.2, Regular oral hygiene from 1.3 to 3.0, Bad oral hygiene from 3.1 to 6.0.

Results

The initial samples were of 42 patients, each group formed by 14 patients. We eliminated 6 patient, 4 for abandoning the study and 2 for treatment abandoning; 2 patients belonged to group A Chlorhexidine Gluconate at 0.12%, 2 to group B Sodium Fluoride and 2 to group C placebo. Keeping a sample of 36 patients being 12 patients per group [12].

The distribution by the fixed or removable type of orthodontic appliances for the Chlorhexidine Gluconate group was of 8 fixed and 4 removable, for the Sodium Fluoride group was of 7 fixed appliances and 5 removable devices and for the Prophylaxis group was of 7 fixed and 5 removable.

For the average difference within each group we applied ad T-test:

Chlorhexidine	Statistic							P value
	Average	Confidence interval for the average at 95%		Average	Std. Dev.	Minimum	Maximum	
		Limit inferior	Limit superior					
Initial OHI-S	2.08	1.71	2.44	2.05	0.57	1.2	2.8	0.047
OHI-S 1 month	1.45	1.14	1.76	1.5	0.48	0.6	2.3	
OHI-S 3 months	1.53	1.27	1.8	1.5	0.42	0.8	2.3	
OHI-S 6 months	1.53	1.33	1.72	1.5	0.31	1.1	2	

Table 1: OHI-S values in patients treated with Chlorhexidine Gluconate at 0.12% (n=12).

Sodium Fluoride	Statistic							P. Value
	Average	Average Confidence interval for the average at 95%		Average	Std. Dev.	Minimum	Maximum	
		Limit inferior	Limit superior					
Initial OHI-S	2.08	1.81	2.34	2.15	0.42	1.30	2.60	0.232
OHI-S 1 month	1.91	1.60	2.21	2.05	0.48	0.60	2.50	
OHI-S 3 months	2.12	1.91	2.32	2.05	0.32	1.60	2.60	
OHI-S 6 months	1.99	1.83	2.15	1.90	0.25	1.80	2.60	

Table 2: OHI-S values in patients treated with Sodium Fluoride at 0.5% 8n=12).

Prophylaxis	Statistic							P. Value
	Average	Confidence interval for the average at 95%		Average	Std. Dev.	Minimum	Maximum	
		Limit inferior	Limit superior					
Initial OHI-S	1.93	1.63	2.24	2.00	0.48	1.10	2.60	0.001
OHI-S 1 month	3.61	-0.08	7.30	1.85	5.81	1.30	22.00	
OHI-S 3 months	2.49	1.98	3.00	2.75	0.80	0.00	2.90	
OHI-S 6 months	3.14	2.99	3.29	3.10	0.23	2.70	3.60	

Table 3: OHI-S values in patients treated with Prophylaxis. (n=12).

Multiple Comparison			Averages Differences	P Value
OHI-S 3 months	Chlorhexidine	Sodium Fluoride	-0.58333*	0.048
		Placebo	-0.95833*	0.001
	Sodium Fluoride	Placebo	-0.37500	0.266
IHOS 6Mes	Chlorhexidine	Sodium Fluoride	-0.46667*	0.001
		Placebo	-1.61667*	0.000
	Sodium Fluoride	Placebo	-1.15000*	0.000

*The averages difference is significant at level 0.05.

Table 4: Comparison of the average at 3, 6 months of Chlorhexidine Gluconate group with the ones of Sodium Fluoride and Placebo.

- The initial OHI-S for the patients treated with Chlorhexidine Gluconate at 0.12% was of 2.08 and by 6 month there was a decrease of 26.5% maintaining the value in 1.53 with a statistically significant difference ($p < 0.005$) (Table 1).
- The initial OHI-S for patients treated with Sodium Fluoride at 0.5% was of 2.08 and by 6 months there was a decrease of 4.4 maintaining it in 1.99, without showing a statistically significant difference ($p > 0.005$) (Table 2).
- Patients treated with Placebo showed an initial OHI-S of 1.93, and by 6 months they showed an increase of 62.6% maintaining it in 3.14, finding a statistically significant difference ($p < 0.05$) (Table 3).
- To confirm the difference among groups we practice an ANOVA test where we found a statistically significant difference in favor of the Chlorhexidine Gluconate at 3 months of its application regarding the Sodium Fluoride and Placebo groups, with the same results at 6 months of the study (Table 4).

Discussion

The correct oral hygiene is a difficult task within patients under

fixed appliances treatment, because it favors the fast accumulation of dental bacterial plaque, from the very first moments of the appliances' cementation. The areas where food is held back and the accumulation of plaque increase considerably the risk factors, if not removed in the proper way, they will become a substrate that will cause quantitative changes into microbial flora.

Marin and Brito et al. [13,14] proved the relation between the use of orthodontic devices and the accumulation and retention of dental bacterial plaque, situation which might derive in gingivitis. We agreed with their study due to the fact that we found a relation between the accumulation and retention of dental bacterial plaque and the presence of gingivitis in 6 patients under the use of fixed devices within the control group.

Khalaf [15] observed that in order to avoid the accumulation of bacterial plaque and gingival hypertrophy among patients using cemented bands, it is recommended to practice an adequate control and mechanical removal of plaque, as well as the use of chemically active agents, as Chlorhexidine in the form of oral rinses or the application of fluoride. We observed that when applying Sodium Fluoride at 0.5% and Chlorhexidine Gluconate at 0.12% the OHI-S values were lower than at the beginning from 2.08 to 1.99, at six months and from 2.08 to 1.53 at six months, respectively.

Lopatiene et al. and Jurišić et al. [16,17] observed that orthodontic devices tend to hold back food residues helping the formation of DP due to the lack of cooperation of the patients regarding their hygiene, being this an important factor to begin a gingivitis; in other words, more than the orthodontic devices, the cause of this accumulation of dental bacterial plaque is the lack of hygiene by the patient. In our study we were able to observe that orthodontic devices favor the accumulation of food leftovers and the formation of DP worsen by the lack of oral hygiene of the patient causing gingivitis within the control group where a placebo agent was used.

Pacho [18] refers that in the control of supra-gingival bacterial plaque; Chlorhexidine Gluconate has proven to be the most effective and the safest. Observation which we agree due to the results of our study within the Chlorhexidine Gluconate group which showed a higher decrease with a 26.5% in OHI-S values.

Mutia [19] mentions that the presence of Sodium Fluoride at 0.20% for weekly use during the use of fixed appliances favors the remineralization by incorporating to the new fluoroapatite crystals and resulting in a surface which resists more to the acids' action and by inhibiting the bacterial activity [20]. Our results confirmed that this agent requires of a constant presence in the mouth in order to reach the mentioned effects due to the fact that with only one application the effects are very limited, the reached values showed a decrease of the OHI-S of only 4.4%.

Conclusion

At 6 months of observation both experimental groups (Chlorhexidine Gluconate and Sodium Fluoride) showed efficacy in dental bacterial control by keeping a low OHI-S.

The Chlorhexidine Gluconate showed a better efficacy than the Sodium Fluoride with a statistically significant difference $p \leq 0.05$, despite both showed a low OHI-S index.

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