Differential Clinical Effects of Chlorhexidine Gels on Patients Undergoing Orthodontic Treatment

ROXANA BUZATU[1], ANDREEA A. POGAN[2]*, DAN ONISEI[2], ANCA S. VALCEANU[1], IOANA IONITA[2], DOINA ONISEI[3]

[1] University of Medicine and Pharmacy Victor Babes Timisoara, Faculty of Dental Medicine, Dental Aesthetics, 2 E. Murgu Sq., 300041, Timisoara, Romania

[2] University of Medicine and Pharmacy Vicotor Babes, Internal Medicine, 2 Eftimie Murgu Sq., 300041, Timisoara, Romania

[3] University of Medicine and Pharmacy Victor Babes Timisoara, Faculty of Dental Medicine, Periodontology, 2 E. Murgu Sq., 300041, Timisoara, Romania

Gingivitis is the most common type of periodontal disease, established by local factors such as biofilm, majorly increased by orthodontic treatment. It is reversed by thorough mechanical and chemical plaque control. One of the chemical agents used to control plaque formation is chlorhexidine. The purpose of this study is to compare the clinical benefits of the adjunctive use of two chlorhexidine gels of different concentrations upon inflammation caused by fixed orthodontic appliances. Results show that efficacy of different concentrations of chlorhexidine are still under debate, depending more on the patient's compliance upon plaque control.

Keywords: chlorhexidine, plaque control, orthodontic treatment, gingival inflammation

Gingivitis is a reversible inflammatory condition of the gingival tissue. The presence of plaque is a key factor in the development of periodontal inflammation. [1]. Orthodontic appliances prevent the removal of plaque by brushing, salivary flow or mastication. Nevertheless, it is more difficult to control a gingival inflammation when orthodontic bands, wires and ligatures are placed. Several studies have reported the development of gingivitis within 1-2 months after the placement of fixed orthodontic appliances. [2]. Some authors have even reported slight attachment loss 2 years after removal of fixed orthodontic appliances when patients have not been motivated regarding oral hygiene habits and plaque control. [3,4] The inflammation of the gingival tissue can be reversed and kept under control by thorough mechanical and chemical plaque control, followed by home care. Antiseptics are highly recommended as an adjunct to mechanical plaque control in periodontal disease [5,6]. Chlorhexidine is considered one of the most effective antibacterial agents. It has been shown to have an immediate bactericidal action and a prolonged bacteriostatic action due to adsorption onto the pellicle-coated enamel surface [7]. The bactericidal effect is a result of the binding of this cationic molecule to negatively charged bacterial cell walls. At low concentrations of chlorhexidine, this results in a bacteriostatic effect; at high concentrations, membrane disruption results in cell death.[8]

This study aims to evaluate and compare the clinical effects on gingival inflammation and plaque control in patients undergoing orthodontic treatment, of a 0.2% chlorhexidine gluconate gel with a 0.1% chlorhexidine digluconate gel, applied immediately after scaling, and then twice daily, by each patient for 2 weeks.

Experimental part

This study was conceived as a prospective clinical trial. Twenty six patients aged between 20 and 30 years receiving fixed appliance orthodontic treatment in a private practice, were selected to take part in this study. The nature of this trial was undoubtedly explained and understood by each patient before signing a written consent. The approval of the Ethics Committee was obtained.

Only clinical healthy patients were included. Subjects with medication or previous periodontal treatment were excluded, as well as smokers. The patients were undergoing either upper or both upper and lower fixed appliance with a 018 standard edgewise system with brackets. They were undergoing treatment for at least 6 months. One of the mandatory conditions for the subjects to take part in this study was to have at least one site with signs of active gingival inflammation on the basis of the following criteria: bleeding on probing (BOP) at least 30% and a gingival index GI (LBe and Silness) greater than 0.5.

The patients were split in two groups. Each subject was clinically examined and plaque index (PI), simplified oral hygiene index (OHI-S), bleeding on probing (BOP), gingival index (GI) and probing depth (PD) were assesed.

The first group (3 males and 10 females) received after scaling, a subgingival application of 10 mL 0.2% chlorhexidine gluconate gel (Glucosite, Cerkamed). Subjects in the second group (4 males and 9 females) received after scaling, a subgingival application of 10 mL 0.1% chlorhexidine digluconate gel (RxPerioflush, Dental Life Sciences). Patients in both groups were then instructed for correct oral hygiene, and further applications of the chlorhexidine gels for the next 2 weeks. The gels were applied twice daily, after tooth brushing and mouthwash, 10 mL each time for 1 min. Instructions regarding oral hygiene and how to use the study products were explained by an individual who wasn't involved in the examination procedure. On day 14, subjects were clinically examined again and PI, OHI-S, BOP, GI and PD were assessed by the same periodontist.

T-test and Mann-Whitney U test for 2 samples were used to compare differences between the two groups and sessions. A $p<0.001$ was considered as statistically

* *email: pogan_andreea@yahoo.com*

	Parameters	Baseline	4 weeks
Gel 0.2% chlorhexidine	PI (%)±SD	36.53±15.34	21.61±9.18
	OHI-S	1.93±0.63	1.03±0.43*
	BOP (%)±SD	41.15±13.98	19.46±6.14*
	GI (mean±SD)	0.97±0.38	0.39±0.21*†
	PD(mm, mean±SD)	3.10±0.34	2.67±0.16*
Gel 0.1% chlorhexidine	PI (%)±SD	42.69±15.62	17.00±4.86*
	OHI-S	2.08± 0.62	0.89±0.40*
	BOP (%)±SD	40.00±17.50	22.46±6.42*
	GI (mean±SD)	0.93±0.28	0.75±0.20*
	PD(mm, mean±SD)	3.06±0.48	2.91±0.40*

Table 1
THE STUDY GROUPS AND CLINICAL PARAMETERS WITH STATISTICAL SIGNIFICANCE

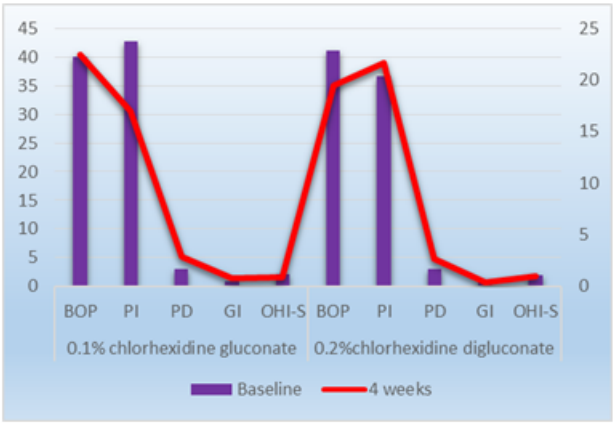

Fig. 1. Clinical parameters variance within and between study groups

significant. The software program used for statistical analysis was SPSS version 2.0.

Results and discussions

Table 1.shows the means of PI, OHI-S, BOP, GI and PD for the two chlorhexidine gels at baseline and 4 weeks. T-test was used to compare differences in assessed values within group and Mann-Whitney U test for 2 samples for the comparison between groups. No statistically significant differences were found for baseline parameters between groups. At the 4 weeks examination, there was a significant decrease in BOP, GI and PD in both groups, compared to baseline ($p<0.001$). However, there was only a slight decrease, not statistically significant, for PI and OHI-S in the experimental group where the 0.2% chlorhexidine gel was applied, in comparison to the group using the 0.1% chlorhexidine gel, which showed significant decreases ($p=0.000$). A notable statistically significant difference ($p=0.000$) was found for GI, between groups, after 4 weeks. Subjects that used the 0.2% chlorhexidine gluconate gel had a major decrease in GI values. Even though, BOP might not have had such a spectacular evolution, a decrease in GI values might mean that a higher concentration of chlorhexidine has a stronger effect on gingival inflammation. The evolution of clinical parameters is represented in figure 1.

In the management of periodontal disease, a core element of therapy is effective tooth brushing. In some circumstances, however, chlorhexidine may be used as an adjunctive treatment. A possibility for those orthodontic patients who are undergoing a long orthodontic treatment is the local application of chlorhexidine gels.

The results of the present study seem to agree with the findings of previous studies where chlorhexidine gluconate was used in a similar population [9,10,11].In a study performed by Pannuti , he showed that 0.5% chlorhexidine gel has prominent impact on decreasing gingival bleeding [12]. Segreto et al. [13] found an average of 28% less gingival occurrence in a 3 months study. Grossman et al. [14] found that the decrease in gingival occurrence averaged 29% after 3 months and 37% after 6 months. Similar findings were reported by Fine et al. [15] regarding subgingival irrigation of chlorhexidine. Lorenz et al. [16] found that the new chlorhexidine mouthrinses were able to inhibit plaque re-growth and gingivitis.

In a longitudinal clinical study on the gingival condition of young patients (aged 11–13 years) treated with fixed orthodontic appliances, it was determined that despite repeated motivation in tooth brushing technique and sodium fluoride rinses twice weekly, most of the children developed generalized gingivitis within 1–2 months after the placement of appliances [3]. The concept of a chemical agent to enhance oral health has long been considered and the importance of such an agent is even greater in orthodontic patients with established gingivitis. Chlorhexidine is an important therapeutic agent in controlling gingival inflammation due to its antimicrobial activity [17-19].

Conclusions

Within the limits of this study, we showed that usage of chlorhexidine gels in patients undergoing orthodontic treatment reduce PI, GI and BOP and PD, but no significant difference exists, except for the initial phase of the inflammatory process of the gingival tissue. Thus, this study showed that additional chlorhexidine usage can reduce gingival inflammation and dental plaque, but this effect is slightly depended upon the concentration used.

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