INTERNATIONAL JOURNAL OF CURRENT RESEARCH IN CHEMISTRY AND PHARMACEUTICAL SCIENCES

(p-ISSN: 2348-5213: e-ISSN: 2348-5221)
www.ijcrcps.com

Research Article

THE EFFECT OF ORTHO-KIN MOUTHWASH ON DENTAL PLAQUE AROUND DIFFERENT ELASTOMERIC LIGATURES, AN IN VIVO STUDY

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Abstract

Introduction: Maintaining an acceptable level of oral hygiene during orthodontic treatment is critical. Elastomeric ligatures facilitate plaque accumulation around orthodontic brackets. Dental plaque may cause enamel demineralization and periodontal diseases. To prevent these complications, mouthwash consumption is recommended to the patients. The aim of this clinical study was to assess the effect of Ortho-kin mouthwash on the dental plaque around four different trademarks of elastomeric ligatures. **Methods:** seventeen patients were randomly selected. The design of the investigation was split mouth study. After bonding the brackets, four different brands of elastomeric ligatures (Falkon, ODP, Ortho-technology, and Astar) were randomly tied on the premolar teeth. After 21 days the ligatures were removed and bacterial analysis was performed. Afterward, the same ligatures were used for ligation of the same teeth and the patients were asked to use Ortho-kin mouthwash for 21 days. After this period, elastomeric rings were removed and bacterial plaque around these auxiliaries was assessed. Generalized estimating equation test was used to compare the plaque before after mouthwash use within the groups. Pairwise comparison test was used to compare the groups. **Result:** Mouthwash consumption reduced bacterial plaque around elastomeric ligatures (all $p < 0.05$). No significant difference in colony count was detected between the groups (all $p > 0.05$). In viridans streptococci count, there was significant difference between Ortho-technology and other types of elastomeric rings (all $p < 0.05$), whereas any significant difference wasn't detected among the other groups ($p > 0.05$). **Conclusion:** Ortho-kin mouthwash can efficiently reduce plaque accumulation around elastomeric ligatures.

Keywords: dental plaque, periodontal disease, mouthwash, viridans streptococci.

Introduction

Maintaining an acceptable level of oral hygiene during orthodontic treatment has always been a challenging issue (Baygin O et al., 2013). Fixed orthodontic appliances create retentive areas which are suitable for bacterial plaque deposition (Alves de Souza R et al., 2008; Condò R et al., 2012; Derks A et al., 2008).

Elastomeric ligatures are auxiliary components connect the arch wires and brackets (Condò R et al., 2012; Brêtas SM et al., 2005; Pithon MM et al., 2013). Previous investigations (Brêtas SM et al., 2005; Garcez AS et al., 2011)showed that this method of ligation is associated with increased caries risk and plaque

accumulation. Because these complications may have adverse effects on the treatment result, providing a comprehensive oral hygiene program for each patient seems to be essential (Pithon MM et al., 2013). Usually toothbrush and dental floss cannot sufficiently clean the tooth surfaces adjacent to orthodontic appliances (Akgun OM et al., 2014; Fard BK et al., 2011). As a result, consumption of the antimicrobial products such as mouthwashes is recommended by the orthodontists (Pithon M et al., 2013).

Chlorhexidine (CHX) and zinc salts are cationic agents which adhere to negatively charged oral surfaces. In the presence of these substrates, microorganisms cannot obtain their nutritional needs (Burguera-Pascu M et al., 2007). It has been found that 0.2% concentration of chlorhexidine can reduce streptococcus mutans level in oral flora (Baygin O et al., 2013). Sodium fluoride shows antimicrobial activity through impeding the enzyme activity and formation of cell components of the microorganisms (Kumar R et al., 2006). Orthodontic patients are recommended to use sodium fluoride mouthwash (0.05%) daily (Derks A et al., 2008). It is reported that CHX and sodium fluoride have synergistic effect (Twetman S et al., 1995).

Ortho-kin is a commercial mouthwash which contains cholorhexidinedegluconate 0.06%, sodium fluoride 0.05% and zinc acetate 0.345% (Toledano M et al., 2006). It has been suggested that this product can efficiently reduce enamel demineralization and plaque accumulation (Fard BK et al., 2011).

There are some studies which examined the effect of chlorhexidine mouthwash and varnish on the oral microbial flora (Kumar R et al., 2006; Anderson GB et al., 1997). Furthermore, limited investigations have worked on the association between ligation technique and microbial colonization (Alves de Souza R et al., 2008; Garcez AS et al., 2011; Türkkahraman H et al., 2005; Pan YC et al., 2007). Yet, there is no study which examines the effect of Ortho-kin mouthwash on the microbial plaque around elastomeric ligatures. So the aim of this in vivo study was to assess the effect of Ortho-kin mouthwash on the microbial plaque colonization around four different brands of elastomeric ligatures.

Materials and Methods

In this clinical study 17 patients (9 females and 8 men, age 18±3 years) scheduled for fixed orthodontic treatment at the Ahvaz dental school were randomly selected. The subjects provided informed consent. All patients were in good oral hygiene status, and had neither caries nor restorations on the premolar teeth. The excluded subjects were those who had any systemic disease that influence periodontal condition, history of antibiotics medication in recent 3 months, and history of application any type of mouth rinse in 1 month before outset of the investigation. The selected group received professional guidance on oral hygiene (Bass technique) and were given standard toothpaste and asked to not to consume any other oral hygiene products.

The patients received fixed orthodontic appliance from first molar to contralateral first molar. For bonding procedure the teeth were pumiced to remove any debris. Then the tooth surfaces were etched with 37% phosphoric acid for 30 seconds, then rinsed with slurry water for 20 seconds and dried with compressed air for 20 seconds. Afterward, Transbond XT Primer (3M Unitek) was applied on the surface, and finally the metal standard edgewise orthodontic brackets (Victory Series, 3M Unitek, Monrovia, Calif) with 0.022 inch slot were bonded with the light-cured composite resin (Transbond XT; 3M Unitek). The Ortholux XT Visible light-curing unit (3M Unitek) was used for 20 seconds (5 seconds on each side) to cure the adhesive paste. The 0.014 inch nitinolarchwire was used for initial alignment.

The split-mouth study was considered as a design of the investigation. Four trademarks of elastomeric rings including Ortho-technology (Ortho-technology, Florida, USA), ODP (orthodontic design and production, California, USA), Astar (Astar orthodontics, Shanghai, China), and Falkon (Hangzhou Yamei Dental Medical Equipment, Hangzhou, China) were used for ligation. In all patients each brand of the elastomeric module was randomly used for ligation of a first premolar tooth in each quadrant.

The patients were asked to brush their teeth two times a day with the instructed technique. After 21 days the elastomeric rings were carefully removed and placed in 5 ml normal saline and stored at $4^{\circ c}$ until plated. The inoculated bottles were transplanted immediately to department of microbiology for culture. The samples were vortexed to uniformity mix. Using 10 µl of every sample was streaked on Blood agar and Mitissalivarius agar. The plates were incubated in aerobic conditions with 5% CO2 for 48 hours at $37^{\circ c}$. The colonies in Blood agar were counted as total microbial count (figure 1). The colonies on Mitissalivarius agar were enumerated as *S.viridance* adapted to biochemical tests (figure 2). Each colony suspected to be *S.viridance* was checked by Gram stain, catalase test, hemolysis, resistant to optochine, bile esculine hydrolysis, arginine dihydrolysis, carbohydrate tests (mannitol, sorbitol, inuline) and urease (Patil S et al., 2010).

In second stage of the experiment the elastomeric rings were ligated on the same tooth as the previous stage

and the patients were asked to use Ortho-kin mouth rinse (Ortho-kin, Kin, Spain) twice a day for two minutes after tooth brushing based on the manufacturer's instruction. After 21 days the elastomeric rings were carefully removed and microbial records were obtained in the same manner as described before.

Descriptive statistics included the mean and standard deviation was calculated for all the groups. Generalized estimating equation (GEE) test was used to compare the colony count for each elastomeric ring before and after mouth wash application. Pairwise comparison test was used to compare the colony count between the groups. To analyze the data SPSS software (version 17.0, SPSS Inc; Chicago, Illinois, USA) was applied. Significance level was considered as a P-value ≤ 0.05.

Figure I. Bacterial colonies on blood agar culture media

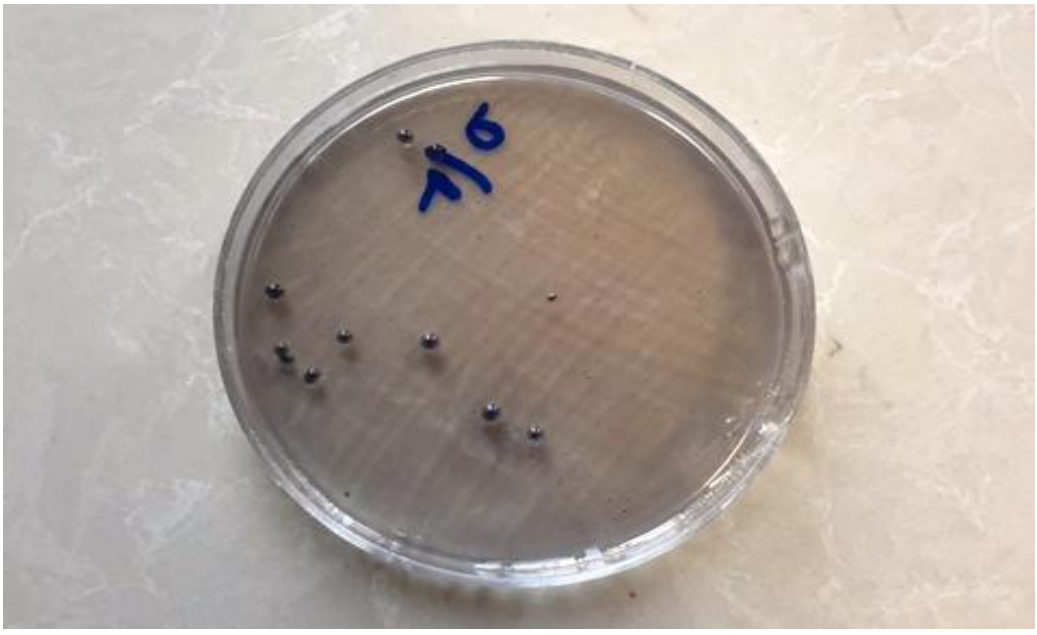

Figure II. Bacterial colonies on mitissalivarius culture media.

Results

The outcome of colony count for all elastomeric rings is presented in table 1. GEE test showed that in all groups, colony counts significantly decreased after mouthwash application (all $p < 0.001$). Figure 3 demonstrate the colony count before and after mouthwash use.There was no interaction between the elastomeric ring brand and mouthwash application ($p = 0.73$). Pairwise comparison test showed that there was no significant difference in the colony count between the elastomeric rings (all $P > 0.05$). The result of pairwise comparison test is demonstrated in table 2.

Analysis of the viridans streptococci count is summarized in table 3. GEE test showed that in all groups, viridans streptococci significantly decreased after mouthwash application (all $p < 0.001$). The viridans streptococci count before and after mouthwash use is presented in Figure 4.There was no interaction between the elastomeric ring brand and mouthwash application ($p = 0.27$). The number of viridans streptococci around Ortho-technology ligatures was higher than the other groups. Pairwise comparison test showed that Ortho-technology had significant difference with Falkon ($p = 0.03$), ODP ($p = 0.02$), and Astar ($p = 0.03$). While, there wasn't any significant difference between the other groups (table 4)

Table I. Summary of colony count and statistical analysis before and after mouthwash use

		Elastomeric ring			
		Colony count (mean ± SD)			
		Falkon	ODP	Ortho Technology	Astar
Mouthwash	Before	3.87 ± 2.96	3.89 ± 3.12	5.43 ± 3.22	4.57 ± 2.99
	After	2.03 ± 2.37	2.18 ± 1.61	3.11 ± 2.39	2.81 ± 2.63
	P-value*	<0.001	<0.001	<0.001	<0.001

*: Using GEE test

Table II. Summary of Pairwise comparison analysis of colony count

Elastomeric ring		P-value*
Falkon	ODP	0.94
	Ortho Technology	0.82
	Astar	0.96
ODP	Ortho Technology	0.42
	Astar	0.93
Ortho technology	Astar	0.79

*: Using pairwise comparison test

Table III. Summary of viridans streptococci count and statistical analysis before and after mouthwash use

		Elastomeric ring			
		Viridans streptococci count (mean ± SD)			
		Falkon	ODP	Ortho Technology	Astar
Mouthwash	Before	7.58 ± 1.37	8.05 ± 9.88	21.23 ± 3.13	11.58 ± 2.00
	After	1.29 ± 2.05	2.52 ± 4.63	7.88 ± 1.93	3.70 ± 7.10
	P-value*	<0.001	<0.001	<0.001	<0.001

*: Using GEE test

Table IV. Summary of Pairwise comparison analysis of viridans streptococci count before and after mouthwash use

Elastomeric ring		P-value*
Falkon	ODP	0.71
	Ortho Technology	0.03
	Astar	0.63
ODP	Ortho Technology	0.02
	Astar	0.71
Ortho technology	Astar	0.03

*: Using pairwise comparison test

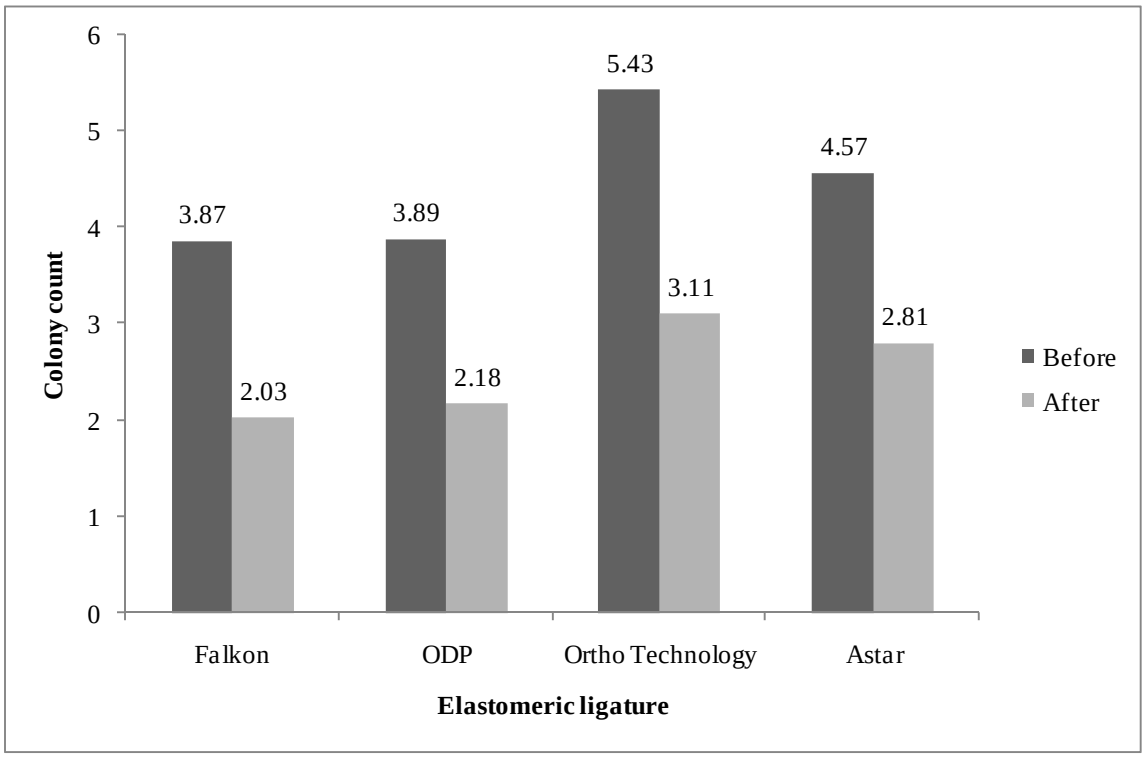

Figure III. Colony count before and after mouthwash use

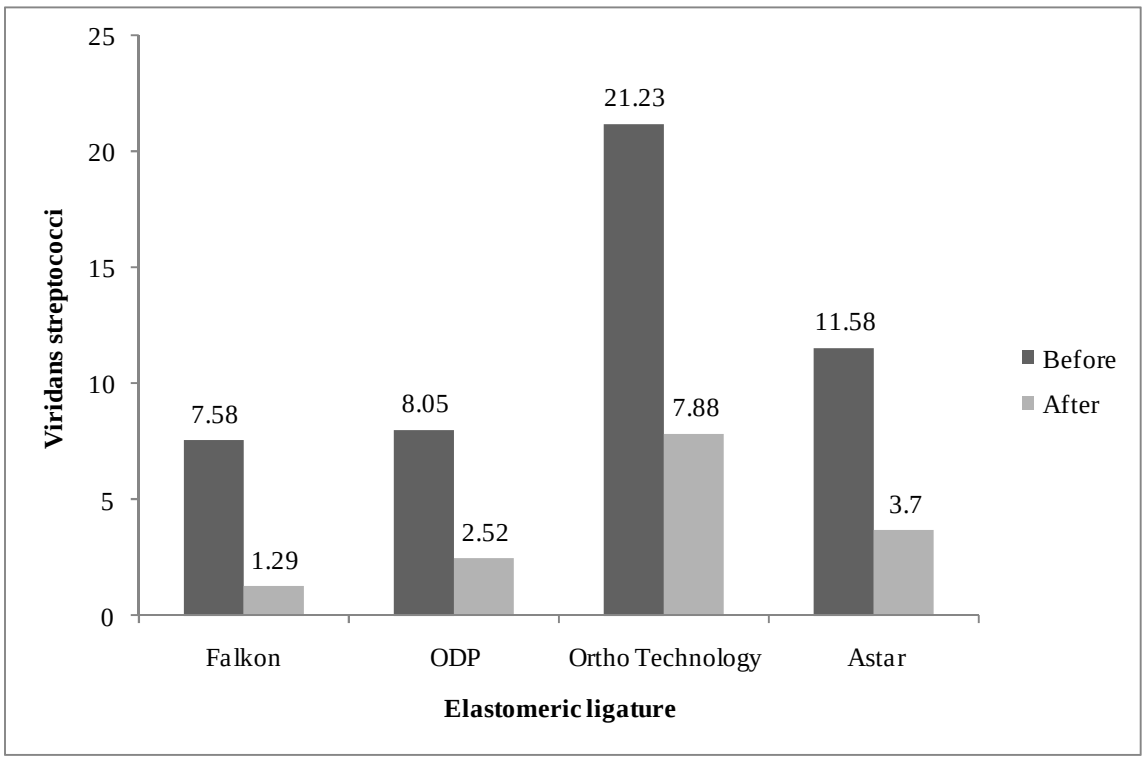

Figure IV. Viridans streptococci count before and after mouthwash use

Discussion

One of the most important issues during orthodontic treatment is maintaining an optimum level of oral hygiene (Baygin O et al., 2013). Orthodontic auxiliaries such as elastomeric ligatures facilitate bacterial plaque deposition (Brêtas SM et al., 2005;Garcez AS et al., 2011). It is not uncommon to see white spot lesions and periodontal problems during or after orthodontic treatment (Alves de Souza R et al., 2008; Condò R et al., 2012; Fard BK et al., 2011). Consequently, it seems necessary to conduct a comprehensive oral hygiene program for high risk patients (Baygin O et al., 2013). One of the effective methods to prevent these complications is accompanying antimicrobial mouth rinses with oral hygiene habits (Pithon MM et al., 2013). In this context, the aim of this in vivo study was to evaluate the effect of Ortho-kin mouthwash on the bacterial plaque around four trademarks of elastomeric ligatures.

Our findings indicated that after 21 days consumption of the mouthwash, bacterial plaque around elastomeric ligatures decreased significantly (all $p < 0.05$). In comparison the groups there wasn't any significant difference in colony count (all $p > 0.05$).

In the investigation performed by Kumar et al. they compared the microbicidal effect of CHX 0.2%, sodium fluoride 0.2% and essential oil mouth rinses. They measured colony forming unit, plaque index and gingival index at the outset and after 21 days of the study. The results showed that although all the mouthwashes were effective in reducing plaque accumulation, CHX 0.2% was the most effective. The mean reduction of plaque index was 33.3% (Kumar R et al.,2006).

Khosravani Fard et al. evaluated the effect of Ortho-kin, Listerine and Oral B mouthwash on the Mutans Streptococcus (MS) and plaque index in orthodontic patients. These factors were measured before and after 21 days of mouthwash use. They concluded that Ortho-kin was more effective than the other mouthwash in reducing MS and plaque index around the orthodontic brackets (Fard BK et al., 2011).

In another study, Anderson et al. compared the effect of CHX 0.12% and placebo mouth rinse on the plaque, retention and gingival indices of adolescent patients. They evaluated the patients 1, 2 and 3 months after using the mouthwash. In 1 and 2 months evaluation, no significant difference was detected in the indices between the control and experimental group. However, after 3 months, all the indices were significantly lower in the CHX group. The findings in above investigations agree with our study. The antimicrobial effect of Ortho-kin may be primarily due to CHX component (Anderson GB et al., 1997).

We assessed the bacterial genus of viridians streptococci separately because this species is the most frequent in the oral cavity. This group of bacteria is so important because of their pathogenic potential (Whiley RA et al., 1998). Our findings showed that after mouthwash use there was significant reduction of this group of bacteria (all $p < 0.001$). There was higher number of bacteria around Ortho-technology ligatures and the difference was significant ($p < 0.05$). However, any significant difference wasn't detected among the other groups ($p > 0.05$).

The results of the present study indicated that patients can benefit from Ortho-kin mouthwash during the orthodontic treatment. The trademark of the elastomeric ligature doesn't have a significant role on the bacterial plaque. However, interfering factors such as motivation, and oral hygiene habits may have an influence on the results. Therefore, more investigations are needed to clarify the effect of Ortho-kin mouthwash on the bacterial plaque around orthodontic appliances.

Conclusion

Ortho-kin mouthwash efficiently reduces dental plaque around orthodontic appliances. In orthodontic patients, this antimicrobial agent would a suitable recommendation.

Acknowledgments

This paper is issued from thesis of (SururSamie). This work was financially supported by grant: (93055) from Vice- Chancellor for Research Affairs of Ahvaz Jundishapur University of Medical Sciences.

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