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RESEARCH ARTICLE

Evaluating the Efficacy of Bio-Sanitizer S1 in Disinfecting Contaminated Elastomeric Chains

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Abstract

Background: Special consideration for the elastomeric chains must be paid in order to prevent their contamination. The purpose of this study was to test the efficacy of Bio-sanitizer S1 in disinfection the contaminated elastomeric chains. Materials and methods: Three types of elastomeric chains of short types from three companies were utilized in this study. The as-received elastomeric chains were checked for bacterial and fungal growth using Blood, MacConkey and Sabouraud dextrose agars. Elastomeric chains contaminated by saliva of orthodontic patients were checked for bacterial and fungal growth using the same media. After disinfecting the contaminated elastomeric chains, they were cultured again in the same agars to test the efficacy of Bio-sanitizer S1 as compared to chlorhexidine 0.2%. One-way ANOVA test was used for comparison. Results: As-received elastomeric chains from all companies were free from bacterial and fungal contaminations. The contaminated chains had no growth at all after disinfection with Bio-sanitizer S1 and chlorhexidine. Conclusions: Bio-sanitizer S1 acts as efficacious as chlorhexidine in disinfecting the contaminated elastomeric chains with the disadvantages of longer immersion time associated with the latter.

Keywords: *Elastomeric chain, disinfection, colony forming units.*

Introduction

The use of polyurethane elastomeric material in the form of ligatures and chains is very popular in orthodontic practice, as they are easy to apply, cost effective, and they generate the force needed for tooth movement [1]. The elastomeric chains are the most commonly force system to accomplish orthodontic correction of spacing, canine retraction, and derotation [2].

Cross-infection in an orthodontic office can be prevented by following proper infection control procedures and it is the responsibility of the orthodontist to make sure that the practice is complying with these procedures [3]. Although it was found that new elastic modules showed no evidence of biological contamination because of their manufacturing process, care must be exercised to avoid their contamination [2].

Different methods have been used to ensure sterilization/disinfection of elastomeric chain e.g. wiping with 70% alcohol, autoclave, glutaraldehyde, chlorhexidine, peracetic acid,

microwave, ultraviolet, ethylene oxide and gamma rays [4, 5]. Biosanitizer S1 is an eco-friendly surface cleaner sanitizer. It had special formulation free from aldehyde, alcohol and phenols. It shows less evaporation during wiping, saving cost and ensuring a compliant sanitizing of surfaces. Biosanitizer S1 includes < 2% boosted Hydrogen Peroxide, the solution presents a true eco-friendly substitute to classical-chemical sanitizers.

After use, the active component reverts back into water and oxygen leaving virtually no residue on surfaces or in the air. It possessed no harmful side-effects, no toxicity, and no disposal precautions in addition to its simplicity of handling making it a truly efficient product for daily use [6]. To the best of authors' knowledge, there is no study that

examined the efficacy of Bio-sanitizer S1 solution in disinfecting contaminated elastomeric chains, so this study was conducted.

Materials and Methods

The sample of this study consisted of short type clear elastomeric chain from three manufacturers namely; Orthotechnology Co. (Florida, USA), Fairfield Orthodontics Co. (Fairfield, USA) and Dentaurum Co. (Ispringen, Germany). The total sample contained 57 pieces of 10 cm elastomeric chains (See Fig.1) Unstimulated saliva was collected from six patients- who signed a consent form for participation-wearing stainless steel fixed orthodontic appliance for a period of no less than three months. Three agar media namely: Blood agar, McConkey agar, and Sabouraud dextrose agar (Hi-Media Co., India) were used to detect the aerobic and facultative anaerobic bacteria of both types Gram positive and negative, in addition to Candida species.

The main grouping was done according to the manufacturer, while subgrouping was done as follows:

G1: As-received elastomeric chain. Swabbing was performed to inoculate the three different media of agar.

G2: Contaminated with saliva: this group served as a negative control. A piece of 10 cm length of elastomeric chain was immersed in each patient's saliva for three minutes, then in normal saline to take a swab.

G3: Contaminated with saliva and disinfected with Biosanitizer S1. Following immersion in saliva for three minutes, it was disinfected by immersion in Biosanitizer S1 for five minutes, and then immersed in normal saline to take a swab.

G4: Contaminated with saliva and disinfected with chlorhexidine 0.2% (Corsodyl, Omega Pharma Manufacturing GmbH & Co. KG, Germany). Following immersion in saliva for three minutes, it was disinfected in chlorhexidine for 10 minutes, then in normal saline to take a swab.

Swabbing was performed with a sterile cotton swab that was dipped in the normal saline and sent to the laboratory for culturing and identification. After incubation, the microorganisms were counted directly on the plate as mean number of colony forming unit (CFU).

Statistical Analyses

Data were managed statistically using SPSS version 24 software. The following types of statistics were used:

- Descriptive statistics: including means, standard deviations, standard errors, minimum and maximum values.
- Inferential statistics: including Shapiro-Wilk test for testing the normality of distribution of collected data and One-way ANOVA test to compare the colony forming units among different manufacturers.

Results

The data for each group were tested for the normality of distribution and the results indicated a non-significant difference meaning that the data were normally distributed; hence parametric tests should be used. The results showed that Group 1 (G1) revealed no growth at all, while for G2 there was an obvious growth of Gram positive Streptococci bacteria with no other growth whether bacterial or fungal.

There was no statistically significant difference in the CFU among different groups i.e. between different manufacturers. Group 3 and 4 on the other hand, showed no growth at all indicating that both types of disinfectants worked efficaciously (Table 1).

Table 1: Descriptive statistics of the colony forming unit and groups' difference after contamination with patients' saliva

Groups	Descriptive statistics						Comparison	
	N	Mean	S.D.	S.E.	Min.	Max.	F-test	p-value
Orthotechnology	6	1148.167	40.740	16.632	1112	1210	0.018	0.983
Fairfield	6	1161.667	264.845	108.122	912	1601		
Dentaurum	6	1144.333	114.544	46.762	1012	1310		

p>0.05

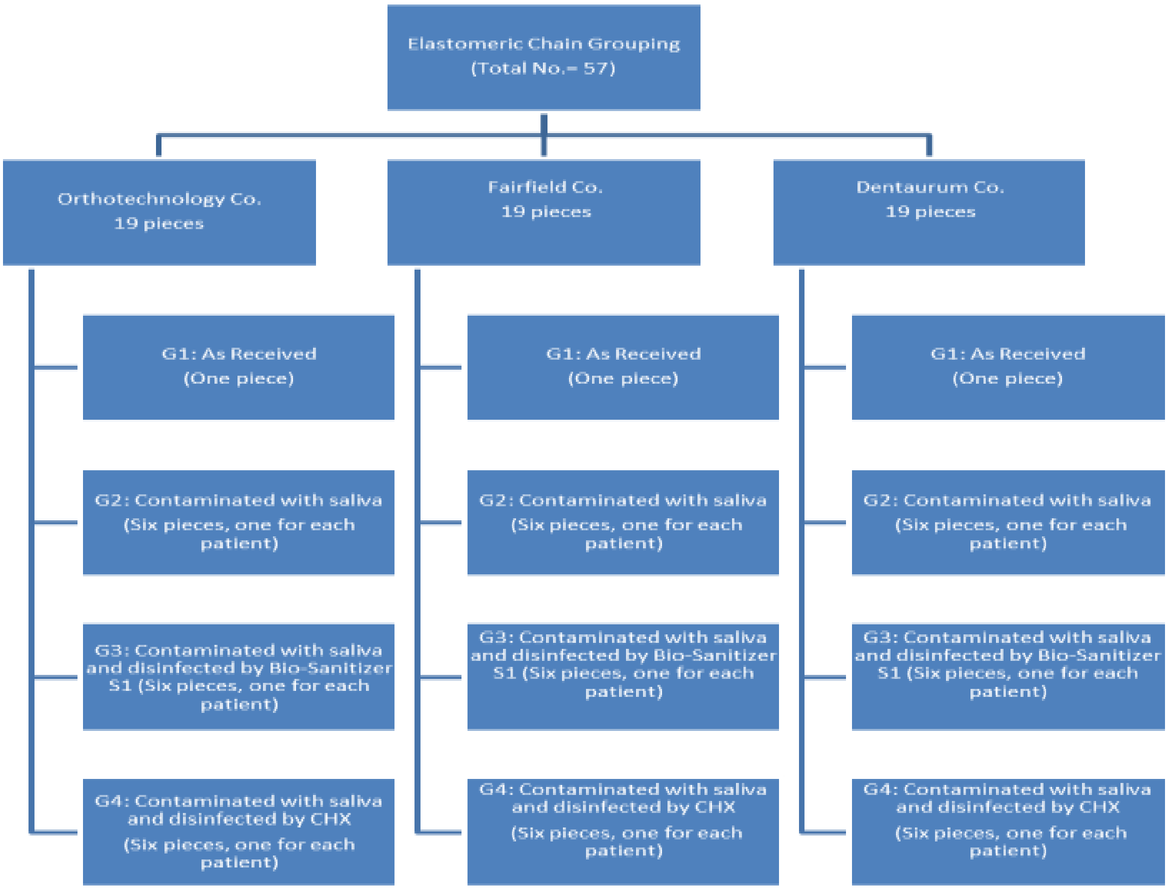

Figure 1: Sample distribution

Discussion

One of the orthodontic materials used in daily practice is the elastomeric chains. These are sold in about four meters spools and are normally cut off with scissors and introduced into the mouth without any disinfection or sterilization. With the introduction of harder biohazard measures, this demeanor had been issued. The material of elastomeric chain could be contaminated throughout processing, packaging, and manipulation by either the dental assistant or orthodontist before its use in the oral cavity [2, 4].

The findings of the current study come in coincidence with that of Casaccia et al [2]. Who found that packed elastomeric chains are free of contamination. This is considered as a positive point as reports verified that sterilizing or disinfecting elastomeric chains prior to their use is not necessary. The lack of growth in the as-received elastomeric chains may be interrelated to the manufacturing processes. Ammonia is customarily added to avert the rise in alkalinity and impede the microbial growth. Moreover, it has the ability to elevate the stability of rubber particles through assimilation of negative ions on its surface [7]. However, Casaccia et al [2].Found no bacterial inhibition zone around the elastomeric chain confirming that they did not contain any antimicrobial agents in their composition. Studies proved that the levels of S. mutans and Lactobacilli increased significantly and reaching the peak after three months of fixed appliance wearing [8], so the patients selected in this study were at least wearing the appliance three months ago. In this study, only one species of bacteria was detected which is Gram positive Streptococci after 3 minutes of immersion in patients' saliva. No fungal or other bacterial growths occur.

Regardless the type of tooth surface, Fejerskov and Nyvad [9] stated that streptococci bacteria especially S. sanguinis, S. oralis and S. mitis biovar 1 considered as initial colonizers and the latter three species account for 95% of the streptococci and 56% of the total initial microflora. The colony forming unit was not significantly different among tested groups (Table 1). Reviewing the literatures regarding the use of Biosanitizer in dentistry indicated the presence of two studies. One investigated the effect of Biosanitizer M, used for dental impression disinfection, on the teeth and dental arches

dimensions [10] and the other study tested the efficacy of Biosanitizer S1 in disinfection the contaminated clamping tweezers [11]. Biosanitizer S1 is used for the first time to examine its effect in disinfecting the contaminated elastomeric chains. Chlorhexidine 0.2% is used here as positive control. Aghili et al [12].Proved that chlorhexidine eliminated completely all microorganisms attached to the elastomeric rings. Chlorhexidine has a wide range anti-microbial activity against many micro-organisms.

Pithon et al. and Mirhashemi et al [4, 13].Found non-significant increase in the force decay of elastomeric chains treated with Chlorhexidine. Omidkhoda et al [14]. Thermo cycled the power chain and treated them with Chlorhexidine contained 65.13% ethanol, found that the sum of force decay differed significantly over time. The findings of the current study proved the powerful efficacy of Biosanitizer S1 and Chlorhexidine in elimination of bacterial contamination from patients' saliva when the CFU was dropped to zero in all types of elastomeric chains. Further studies are needed to examine the efficacy of Biosanitizer S1 on contaminated power chains with other types of microorganisms.

Conclusions

Within the limitations of the present study, Bio-sanitizer S1 acts as efficacious as chlorhexidine in disinfecting the contaminated elastomeric chains with the disadvantages of long time of immersion related to chlorhexidine.

References

1. Evangelista MB, Berzins DW, Monaghan P (2007) Effect of disinfecting solutions on the mechanical properties of orthodontic elastomeric ligatures. Angle Orthod., 77(4): 681-7.
2. Casaccia GR, Gomes JC, Alviano DS, Ruellas ACdO, Anna EFS (2007) Microbiological evaluation of elastomeric chains. Angle Orthod., 77(5): 890-3.
3. Starnbach H, Biddle P (1980) A pragmatic approach to asepsis in the orthodontic office. Angle Orthod., 50(1): 63-6.
4. Pithon MM, dos Santos RL, Martins FO, Romanos MTV, Araújo MT (2010) Cytotoxicity of orthodontic elastic chain bands after sterilization by different methods. Orthod Waves, 69(4):151-5.
5. Pithon MM, dos Santos RL, Judice RL, de Assuncao PS, Restle L (2013) Evaluation of the cytotoxicity of elastomeric ligatures after sterilization with 0.25% peracetic acid. Aust. Orthod. J., 29(2): 139-44.
6. Saniswiss (2018) Biosanitizor S1: Saniswiss; (2018-11-07). Available from: https://www.saniswiss.com/en/products/sanitizers/biosanitizer-s1/.
7. Perrella FW, Gaspari AA (2002) Natural rubber latex protein reduction with an emphasis on enzyme treatment. Methods, 27(1): 77-86.
8. Kishnan V, Davidovitch Z (2015) Biological mechanisms of tooth movement. 2nd ed. Oxford: Wiley Blackwell.
9. Fejerskov O, Nyvad B (2015) Dental caries: The disease and its clinical management. 4th ed. Oxford: Wiley Blackwell.
10. Mohammed SA, Ahmed HMA, Nahidh M (2016) Effect of different dental impression disinfectants on the mandibular teeth and dental arch measurements. IOSR J. Dent. Med. Sci., 15(7): 60-63.
11. Hamzah RAM, Saloom HF (2018) Efficacy of various disinfectants on bacterial and fungal contamination of clamping tweezers. Inter J. Med. Res Health Sci., 7(12): 41-45.
12. Aghili H, Abbas Nadoushan AA, Herandi V (2015) Antimicrobial effect of Zataria Multiflora extract in comparison with Chlorhexidine mouthwash on experimentally contaminated orthodontic elastomeric ligatures. J Dentistry, Tehran University Med. Sci., Tehran, Iran, 12(1): 1-10.
13. Mirhashemi AH, Farahmand N, Shahroudi AS, Akhoundi MSA (2017) Effect of four different mouthwashes on force-degradation pattern of orthodontic elastomeric chains. Orthod. Waves, 76(2): 67-72.
14. Omidkhoda M, Rashed R, Khodarahmi N (2015) Evaluation of the effects of three different mouthwashes on the force decay of orthodontic chains. Dent Res J., (Isfahan) 12(4): 348-52.

