

ORIGINAL RESEARCH

Assessment of Efficacy of Two Types of Brushes for Removal of Biofilm from the Complete Denture Surface

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ABSTRACT:

Background: The various methods for the removal of biofilm from denture surface are mechanical (brushing and ultrasonic device) and chemical methods (alkaline peroxide and hypochlorite, acids, enzymes and disinfectants). **Aim of the study:** To assess the efficacy of two types of brushes for removal of biofilm from the complete denture surface. **Materials and method:** The current study was conducted in the Department of Prosthodontics of the dental institution. The selection of 36 healthy edentulous patients wearing maxillary and mandibular complete dentures was done. The patients were grouped randomly into 2 groups, Group 1 in which denture cleansing was done using toothbrush and Group 2 in which denture cleansing was done using Denture brush. Two techniques were used for cleansing. In technique 1, the denture surface was cleaned with brush with neutral soap whereas in technique 2, a specific denture paste was used as an auxiliary brushing agent for cleansing denture. The percentage of biofilm covered area was calculated and analyzed. **Results:** Significant difference in the mean biofilm exposed surface from week 1 to week 6 in both groups was observed. For both the groups, technique 2 was more successful in removal of biofilm as compared to technique 1 because the mean exposed surface of biofilm was significantly reduced in technique 2. On the comparison of group 1 and 2 on the basis of cleaning efficiency of internal denture surface, we observed statistical significant difference. **Conclusion:** Denture brushes are significantly more effective in removal of biofilm from the denture surface. Also, specific paste for denture cleansing increases the efficacy of denture brush.

Key words: Biofilm, Complete denture, denture brush, maxillary.

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INTRODUCTION:

Biofilm accumulation is an important etiologic factor for caries and periodontal disease in teeth that are retainers of overdentures or are adjacent to prosthetic devices.^{1, 2} The defective cleansing of complete dentures has also been a reason of concern. The various methods for the removal of biofilm from denture surface are mechanical (brushing and ultrasonic device) and chemical methods (alkaline peroxide and hypochlorite, acids, enzymes and disinfectants). Among these, brushing with conventional and specific dentifrices is the most common method applied for routine denture biofilm control and has been proven effective.^{3, 4} Soap, as an auxiliary hygiene agent, is an accessible abrasive-free product and has been claimed as effective against anaerobic microorganisms and yeasts and stains. Studies have indicated that the combination of coconut soap with hypochlorite is an effective cleansing method.^{5, 6} However, randomized clinical trials regarding its effectiveness as an isolated cleansing method have not been reported. With respect to natural teeth, efficient hygiene control in complete dentures can be obtained by an orientation program, correct use of materials and methods available for denture cleansing and by utilization of a biofilm disclosing agent, allowing quantification and localization of biofilm on

dentures, which could allow its removal more effectively.⁷ Hence, the present study was planned to assess the efficacy of two types of brushes for removal of biofilm from the complete denture surface.

MATERIALS AND METHOD:

The current study was conducted in the Department of Prosthodontics of the dental institution. The selection of 36 healthy edentulous patients wearing maxillary and mandibular complete dentures was done after approval of study protocol from ethical committee of the institute. Patients with motor deficiency based on the Discipline of Complete Denture of FORP-USP were excluded from the study. The patients were enlightened about the study protocol and an informed written signed consent was obtained.

Heat cured acrylic resin with acrylic teeth were used for construction of maxillary denture and were checked for any damage or repair. The score of biofilm degree of at least 1 for complete denture were selected. The patients were grouped randomly into 2 groups, Group 1 in which denture cleansing was done using toothbrush and Group 2 in which denture cleansing was done using Denture brush. Two techniques were used for cleansing. In technique 1, the denture surface was cleaned with brush with neutral soap

whereas in technique 2, a specific denture paste was used as an auxiliary brushing agent for cleansing denture. The instructions were given to the patients to clean the dentures 3 times a day, to rinse their mouth after brushing and to keep the denture immersed in water for whole night. This technique of cleaning denture was employed for 6 weeks as per the instructions of investigator. The patients were instructed to report to the department weekly for assessment of the biofilm on the denture surface. During the visit, the maxillary denture of the patients was removed, rinsed under running water for 5 seconds and air dried for 10 seconds. Following this, 1% neutral red as disclosing agent was applied on internal surface using a cotton swab. Denture was again rinsed and air dried. Disclosed surfaces of the denture surface were photographed with standardized film-object distance and exposure time. The quantification of biofilm was done by computerized method in which the denture's internal surface and area covered by biofilm were measured using Image Tool software. The percentage of biofilm covered area was calculated and analyzed.

The statistical analysis of the database was done using SPSS program version 20.0 for windows. The significance of the data was analyzed using Student's t-test and Chi square test. The statistical significance was predefined at p-value \leq 0.05.

RESULTS:

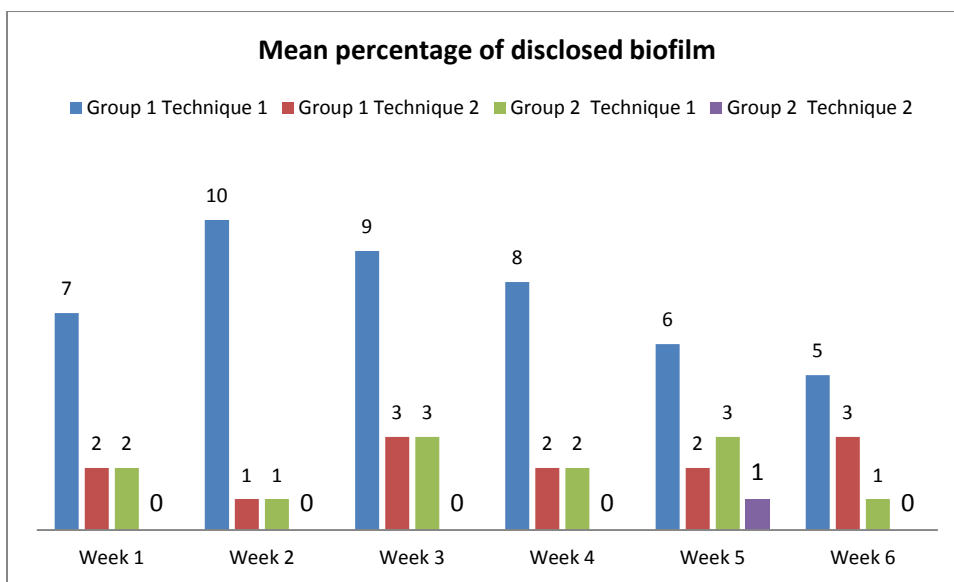
Table 1 shows the mean percentage and sum of means of the disclosed biofilm on the internal surface of the dentures at weekly intervals. We observed significant difference in the mean biofilm exposed surface from week 1 to week 6 in both groups. For both the groups, technique 2 was more successful in removal of biofilm as compared to technique 1 because the mean exposed surface of biofilm was significantly reduced in technique 2. On the comparison of group 1 and 2 on the basis of cleaning efficiency of internal denture surface, we observed statistical significant difference (p value<0.05).

Table 1: Table showing Mean percentage of disclosed biofilm

No. of weeks	Mean percentage of disclosed biofilm				p-value
	Group 1 (using toothbrush)		Group 2 (using denture brush)		
	Technique 1	Technique 2	Technique 1	Technique 2	
Week 1	7	4	5	0	0.032**
Week 2	10	2	4	1	
Week 3	9	3	4	0	
Week 4	8	2	3	1	
Week 5	6	2	3	1	
Week 6	5	1	2	0	
TOTAL	45	14	21	3	

** p value<0.05 –Statistically Significant

Figure 1: Graph showing Mean percentage of disclosed biofilm



DISCUSSION:

Poor denture hygiene is often associated with lack of orientation, characteristics of the prosthesis, reduction of patient's manual dexterity and lack of specific cleansing products on the market. Denture cleansing products are not widely advertised. As denture brushes and dentifrices are not common in India, it is frequent the use of products originally designed for natural teeth. In addition, these products are not regularly available for purchasing and, when they are, this occurs for short periods of time. In the present study, we compared the efficacy of two types of brushes for the biofilm removal from denture surface. We observed that denture brushes along with specific auxiliary paste were more efficient in biofilm removal as compared to conventional tooth brush. The difference on comparison was also found to be statistically significant. Similar studies were conducted by other authors reported similar results. Paranhos Hde F et al compared the levels of biofilm in maxillary and mandibular complete dentures and evaluated the number of colony-forming units (cfu) of yeasts, after using auxiliary brushing agents and artificial saliva. Twenty-three denture wearers with hyposalivation and xerostomia were instructed to brush the dentures 3 times a day during 3 weeks with the following products: Corega Brite denture dentifrice, neutral liquid soap, Corega Brite combined with Oral Balance (artificial saliva) or tap water. For biofilm quantification, the internal surfaces of the dentures were disclosed, photographed and measured using software. For microbiological analysis, the biofilm was scrapped off, and the harvested material was diluted, sown in CHROMagar™ Candida and incubated at 37°C for 48 h. Data were analyzed statistically by two-way ANOVA and Tukey's test. Mandibular dentures presented a mean biofilm percentage significantly greater than the maxillary ones. Brushing using Corega Brite combined with Oral Balance was more effective than using the denture dentifrice, neutral soap or tap water. For the microbiological analysis, the chi-square test did not indicate significant difference between the hygiene products for either type of denture. The more frequently isolated species of yeasts were *C. albicans*, *C. tropicalis* and *C. glabrata*. In conclusion, mandibular dentures had more biofilm formation than maxillary ones. Denture brushing with Corega Brite dentifrice combined with the use of Oral Balance was the most effective method for reduction of biofilm levels, but the use of products did not show difference in yeast cfu counts. Salles AE et al compared and correlated biofilm levels in complete upper and lower prosthesis after brushing, associated with specific paste and soap, by means of computerised methodology. Forty-five complete denture wearers were selected and instructed to brush their prostheses (Soft Oral B 40) three times a day for 3 weeks with water (Control), specific paste for complete dentures (Corega Brite) (Experiment 1) and neutral soap (Experiment 2). The study was based on a cross-over model and a wash-out period was not included. For biofilm quantification, the internal surfaces were dyed

(neutral red 1%), photographed (Canon EOS Digital) and the disclosed biofilm was measured with the Image Tool 2.0 software. The variance analysis indicated that the lower prostheses exhibited a mean biofilm percentage, significantly higher than the upper prostheses and that brushing with paste (Experiment 1) was more effective than soap (Experiment 2) and, in turn, this was more effective than water (Control). There was a high biofilm correlation between both prostheses. Both products were well accepted by the patients, but the most favoured one was the paste. The authors concluded that this method was effective in controlling the biofilm and can be used preventatively in the maintenance of oral health by wearers of complete dentures.^{8,9}

Cruz PC et al evaluated the efficacy of complete denture biofilm removal using chemical (alkaline peroxide-effervescent tablets), mechanical (ultrasonic) and combined (association of the effervescent and ultrasonic) methods. Eighty complete denture wearers participated in the experiment for 21 days. They were distributed into 4 groups: (1) Brushing with water (Control); (2) Effervescent tablets (Corega Tabs); (3) Ultrasonic device; (4) Association of effervescent tablets and ultrasonic device. All groups brushed their dentures with a specific brush and water, 3 times a day, before applying their treatments. Denture biofilm was collected at baseline and after 21 days. To quantify the biofilm, the internal surfaces of the maxillary complete dentures were stained and photographed at 45°. The photographs were processed and the areas quantified. The percentage of the biofilm was calculated by the ratio between the biofilm area multiplied by 100 and the total area of the internal surface of the maxillary complete denture. Significant difference was found among the treatments. It was concluded by authors that experimental methods are equally effective regarding the ability to remove biofilm and are superior to the control method. Immersion in alkaline peroxide and ultrasonic vibration can be used as auxiliary agents for cleaning complete dentures. de Andrade IM et al evaluated the antimicrobial action of effervescent tablets and ultrasound on *Candida* spp. and mutans streptococci from denture biofilm. Seventy-seven complete denture wearers were randomly assigned into four groups: (A) Brushing with water; (B) Effervescent tablets; (C) Ultrasonic device (D) Effervescent tablets and ultrasonic device. All groups brushed their dentures with a specific brush and water, three times a day, before applying their treatments. Denture biofilm was collected at baseline and after 21 days. The samples were collected by brushing the dentures with saline and the detached microbial cells were quantified by plating. No significant difference was found among the methods from *C. albicans*, *C. tropicalis* and *C. glabrata*. Lower counts were found for methods B and D when compared with the other methods against mutans streptococci. Method B showed lower total aerobic counts than A, whereas C and D showed intermediate results. The authors concluded that effervescent tablets

significantly reduced mutans streptococci and total aerobes from denture biofilm. However, they were not as effective against *C. albicans*. Ultrasonic cleansing presented a discrete antimicrobial effect and was less effective than the tablets for complete denture disinfection.^{10,11}

CONCLUSION:

From the results, we conclude that denture brushes are significantly more effective in removal of biofilm from the denture surface. Also, specific paste for denture cleansing increases the efficacy of denture brush.

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