

Effect of Five Types of Denture Cleansers on Three Types of Denture Base Resins

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Article History

Received: 24 Mar 2016

Revised: 28 Mar 2016

Accepted: 30 Mar 2016

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ABSTRACT

Introduction: The aim of the present study was to evaluate the effect of five different denture cleansers (distilled water, hydrogen peroxide, dettol disinfectant, Fittydent, Lifebuoy hand wash) on weight, surface roughness and surface texture of three types of acrylic resin denture base (Lucitone 199, Travelon HI, Lucitone FRS).

Material and Methods: 150 specimens were fabricated using metal discs of standard dimension of 10mm (diameter) x 2mm (thickness). 50 samples using Lucitone 199 and Travelon HI were made using conventional compression molding technique and 50 samples were fabricated by using Lucitone FRS using injection molding technique. Measurements were taken for weight and roughness using Digital Weighing Machine and Surface Roughness Tester before and after 15 days of immersion in cleansing solutions. Statistical analysis was carried out using Student's Unpaired-T test and ANNOVA Test with p-value <0.05 considered as significant value.

Results: Immersion in Dettol disinfectant caused more alteration in surface properties and weight loss, which is found statistically significant. The least effect was seen in samples immersed in fittydent denture cleanser other than control group, which was statistically significant. All the materials used in this study showed same amount of alternation in surface properties and weight loss, statistically significant differences were not observed when we compared all the three materials.

Conclusion: As the least roughness was seen in samples immersed in fittydent denture cleanser other than control group, which was statistically significant. Therefore, fittydent denture cleanser should be recommended as a routine denture maintenance method for the prevention of the development of microbial biofilm-induced denture stomatitis.

KEYWORDS: Denture cleansers, Fittydent, H₂O₂, Sodium perborate.

INTRODUCTION

Rough and pitted surface seen on the acrylic denture surfaces acts as a nidus for biofilm formation and colonization of microorganisms. Dentures can be cleaned by mechanical methods, chemical methods or a combination of both. Cleansing with a brush and an abrasive is the most popular mechanical method widely used.¹ The literature has shown the correlation between poor hygiene and lesions in the oral mucosa of complete dentures wearers, mainly chronic atrophic candidiasis.

Furthermore, the colonization of the internal surface of dentures can act as reservoir for dissemination of infections, such as gastrointestinal and pleuropulmonary infections.² The aim of the present study was to evaluate the effect of five different denture cleansers (distilled water, hydrogen peroxide, dettol disinfectant, Fittydent, Lifebuoy hand wash) on weight, surface roughness and surface texture of three types of acrylic resin denture base (Lucitone 199, Travelon HI, Lucitone FRS) and to

evaluate the detrimental effects on surface structure of acrylic resin by using digital weight machine and surface profilometer.

MATERIALS AND METHODS

150 specimens were fabricated using metal discs of standard dimension of 10mm (diameter) x 2mm (thickness).

50 samples using Lucitone 199 and Travelon HI were made using conventional compression molding technique and 50 samples were fabricated by using Lucitone FRS using injection molding technique.

Prior to immersion in solutions, all samples were brushed using Colgate tooth powder and a motorized

toothbrush for 5 minutes daily, followed by immersion in correspondent solution for 8 hours in a day at room temperature. After this, the samples were immersed in normal saline at 37°C in an incubator to simulate oral environment for the rest of the day as well as to simulate the conditions of denture wearing. Measurements were taken for weight and roughness using Digital Weighing Machine and Surface Roughness Tester before immersion in cleansing solutions.

After 15 days of immersion again weight and roughness was done to evaluate the changes. Data so obtained was compiled and statistical analysis was carried out using Student’s Unpaired-T test and ANNOVA Test with p-value <0.05 considered as significant value.



Fig 1: Labeled Samples

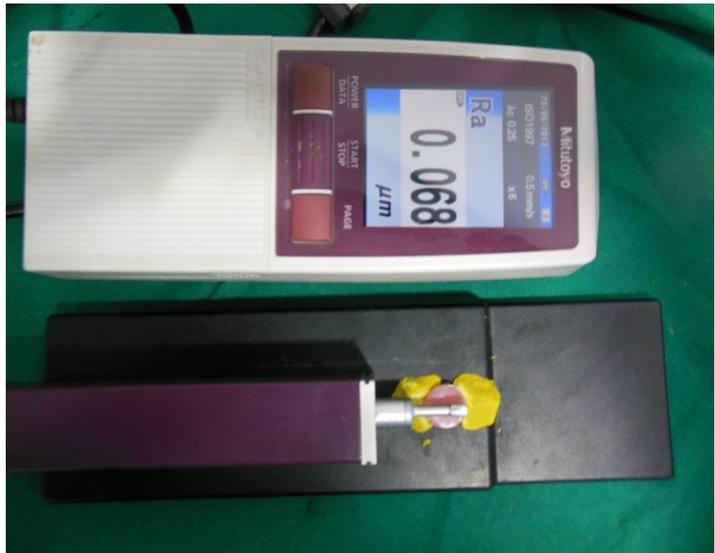


Fig 2: Surface Profilometer

RESULTS

In present study, the results were based on surface roughness and mean weight loss in three acrylic denture base resins by immersion in five types of denture cleansers. 150 samples comprising the 10 Groups were tested. Table 1 is showing different groups, 150 samples are divided into 15 groups according to denture base resin used in fabrication of samples and denture cleansers in which they are immersed. Table 2 is showing mean roughness values and standard deviation before and after immersion in denture cleanser in all samples made of Lucitone 199, Travelon HI and Lucitone FRS. The study found increase in roughness with highly significant p value in all groups. Table 3 is showing mean weight loss values and standard deviation before and after immersion in denture cleanser in all samples made of Lucitone 199, Trevalon HI and Lucitone FRS. Table 4 is showing comparison of mean weight loss and standard deviation between Lucitone 199 and Trevalon HI samples using Student’s Unpaired-T test. The P- values obtained were not significant. (P-Value > 0.001). Table 5 is showing comparison of mean weight loss and standard deviation between Lucitone FRS and Trevalon HI samples using Student’s Unpaired-

T test. The P- values obtained were not significant. (P-Value > 0.001) Table 6 is showing comparison of mean weight loss and standard deviation between Lucitone 199 and Lucitone FRS samples Student’s Unpaired-T test. The P- values obtained were not significant (P-Value>0.001).

Table 7 to 11 shows differences in mean roughness scores among different groups. Non-significant differences were seen among Lucitone, Trevalon and Lucitone FRS. Table 7 is showing comparison between samples of control groups, which were immersed in Distilled water using ANNOVA Test. The differences in mean roughness noted between these groups were not significant with the critical P- value of 0.20.

Table 8 is showing comparison between samples of groups, which were immersed in Hydrogen Peroxide using ANNOVA Test. The differences in mean roughness noted between these groups were not significant with the critical P- value of 0.21. Table 9 is showing comparison between samples of groups, which were immersed in Lifeboy Handwash using ANNOVA Test. The differences in mean roughness noted between these groups were not significant with the critical P- value of 0.99.

Table 1: Showing Different Groups

Samples made of Lucitone 199 immersed in Distilled water	LA
Samples made of Lucitone 199 immersed in Hydrogen peroxide	LB
Samples made of Lucitone 199 immersed in Lifebuy Handwash	LC
Samples made of Lucitone 199 immersed in Dettol Disinfectant liquid	LD
Samples made of Lucitone 199 immersed in Fittydent denture cleanser	LE
Samples made of Trevalon HI immersed in distilled water	TA
Samples made of Trevalon HI immersed in Hydrogen peroxide	TB
Samples made of Trevalon HI immersed in Lifebuy handwash	TC
Samples made of Trevalon HI immersed in Dettol disinfectant liquid	TD
Samples made of Trevalon HI immersed in Fittydent denture cleanser	TE
Samples made of Lucitone FRS immersed in distilled water	FA
Samples made of Lucitone FRS immersed in Hydrogen peroxide	FB
Samples made of Lucitone FRS immersed in Lifebuoy handwash	FC
Samples made of Lucitone FRS immersed in Dettol disinfectant liquid	FD
Samples made of Lucitone FRS immersed in Fittydent denture cleanser	FE

Table 2: Showing the Values of Standered Deciation (SD) and Mean Roughness of All Samples

LUCITONE 199	Roughness Before	Roughness After	P-Value	TRAVEL ON HI	Roughness Before	Roughness After	P-Value	LUCITONE FRS	Roughness Before	Roughness After	P-Value
LA Mean	0.1103	0.3672	0.0015 HS	TA Mean	0.135	0.329	0.0076 HS	FA Mean	0.3123	0.437	0.005 HS
LA SD	0.0352	0.1762		TA SD	0.054	0.151		FA SD	0.11	0.142	
LB Mean	0.24	0.4	0.0032 HS	TB Mean	0.241	0.33	0.0041 HS	FB Mean	0.337	0.509	0.002 HS
LB SD	0.2	0.27		TB SD	0.259	0.264		FB SD	0.235	0.231	
LC Mean	0.1358	0.2426	0.0038 HS	TC Mean	0.206	0.339	0.01 HS	FC Mean	0.451	0.581	0.0008 HS
LC SD	0.109	0.1644		TC SD	0.133	0.165		FC SD	0.167	0.171	
LD Mean	0.1797	0.6105	0.102 HS	TD Mean	0.1992	0.5797	0.001 HS	FD Mean	0.281	0.53	0.0008 HS
LD SD	0.1091	0.7795		TD SD	0.1649	0.289		FD SD	0.146	0.252	
LE Mean	0.3025	0.5791	0.0015 HS	TE Mean	0.116	0.357	0.002 HS	FE Mean	0.216	0.466	0.043 HS
LE SD	0.2444	0.3092		TE SD	0.038	0.175		FE SD	0.124	0.303	

Table 3: Showing the values of standered deciation (SD) and mean weight loss of all samples

LUCITONE 199	Weight Before	Weight After	P-Value	TRAVELON HI	Weight Before	Weight After	P-Value	LUCITONE FRS	Weight Before	Weight After	P-Value
LA Mean	0.55	0.54	0.0009 HS	TA Mean	0.48	0.48	0.0003 HS	FA Mean	0.43	0.43	0.0005 HS
LA SD	0.03	0.03		TA SD	0.02	0.02		FA SD	0.02	0.021	
LB Mean	0.56	0.55	0.0001 HS	TB Mean	0.47	0.46	0.0001 HS	FB Mean	0.44	0.43	0.0001 HS
LB SD	0.03	0.03		TB SD	0.04	0.04		FB SD	0.009	0.008	
LC Mean	0.55	0.49	0.23 HS	TC Mean	0.48	0.47	0.0001 HS	FC Mean	0.42	0.41	0.0001 HS
LC SD	0.02	0.15		TC SD	0.04	0.04		FC SD	0.012	0.011	
LD Mean	0.55	0.54	0.006 HS	TD Mean	0.47	0.46	0.0001 HS	FD Mean	0.51	0.5	0.0001 HS
LD SD	0.03	0.03		TD SD	0.03	0.03		FD SD	0.067	0.068	
LE Mean	0.54	0.54	0.0048 HS	TE Mean	0.480	0.47	0.0005 HS	FE Mean	0.48	0.47	0.0001 HS
LE SD	0.03	0.03		TE SD	0.03	0.03		FE SD	0.067	0.067	

Table 4: Comparison of Weight Loss Between LUCITONE 199 and TREVALON HI

SAMPLE	MEAN WEIGHT LOSS	SD	P-VALUE
LA	0.00909	0.005877	0.09 NS
TA	0.0054	0.002959	
LB	0.00931	0.004002	0.36 NS
TB	0.00774	0.003506	
LC	0.056585	0.150385	0.29 NS
TC	0.00669	0.003234	
LD	0.00666	0.004046	0.29 NS
TD	0.00845	0.003314	
LE	0.00245	0.002081	0.13 NS
TE	0.00405	0.002428	

Table 5: Comparison of Weight Loss Between TREVALON HI and LUCITONE FRS

SAMPLE	MEAN WEIGHT LOSS	SD	P- VALUE
FA	0.00623	0.00376	0.59 NS
TA	0.0054	0.002959	
FB	0.00964	0.004793	0.33 NS
TB	0.00774	0.003506	
FC	0.00866	0.001692	0.1 NS
TC	0.00669	0.003234	
FD	0.00952	0.004681	0.58 NS
TD	0.00845	0.003314	
FE	0.00604	0.002907	0.11 NS
TE	0.00405	0.002428	

Table 6: Comparison of Weight Loss Between LUCITONE 199 and LUCITONE FRS

SAMPLE	MEAN WEIGHT LOSS	SD	P- VALUE
LA	0.00909	0.005877	0.21 NS
FA	0.00623	0.00376	
LB	0.00931	0.004002	0.87 NS
FB	0.00964	0.004793	
LC	0.056585	0.150385	0.33 NS
FC	0.00866	0.001692	
LD	0.00666	0.004046	0.29 NS
FD	0.00952	0.004681	
LE	0.00245	0.002081	0.13 NS
FE	0.00604	0.002907	

Table 7: Comparison between three groups immersed in distilled water

A-Distilled Water	MEAN	SD	P VALUE
LUCITONE	0.2569	0.179939	0.20 NS
TRAVELON	0.1942	0.179388	
LUCITONE-FRS	0.1247	0.107149	

Table 8: Comparison between three groups immersed in hydrogen peroxide

B-Hydrogen Peroxide	MEAN	SD	P VALUE
LUCITONE	0.1639	0.129894	0.21
TRAVELON	0.089	0.073737	
LUCITONE-FRS	0.1715	0.122464	

Table 9: Comparison between three groups immersed in lifebouy hand wash

C-lifebouy hand wash	MEAN	SD	P VALUE
LUCITONE	0.1368	0.111812	0.99 NS
TRAVELON	0.1328	0.130741	
LUCITONE-FRS	0.1301	0.083318	

Table 10: Comparison between three groups immersed in dettol disinfectant liquid

D-DETTOL	MEAN	SD	P VALUE
LUCITONE	0.4308	0.750276	0.67 NS
TRAVELON	0.3805	0.257497	
LUCITONE-FRS	0.2483	0.142817	

Table 11: Comparison between three groups immersed in fittydent denture cleanser

E-FITTIDENT	MEAN	SD	P VALUE
LUCITONE	0.2766	0.193657	0.91 NS
TRAVELON	0.241	0.179049	
LUCITONE-FRS	0.2499	0.208588	

Table 10 is showing comparison between samples of groups, which were immersed in Dettol disinfectant using ANNOVA Test. The differences in mean roughness noted between these groups were not significant with the critical P- value of 0.67. Table 11 is

showing comparison between samples of groups, which were immersed in Fittydent denture cleansers using ANNOVA Test. The differences in mean roughness noted between these groups were not significant with the critical P- value of 0.91.

Immersion in Dettol disinfectant caused more alteration in surface properties and weight loss, which is found statistically significant. The least effect was seen in samples immersed in Fittydent denture cleanser other than control group, which was statistically significant. All the materials used in this study showed same amount of alternation in surface properties and weight loss, statistically significant differences were not observed when we compared all the three materials.

DISCUSSION

Cleanliness of artificial denture is imperative in order to eliminate mouth odors, minimize tissue irritation and maintain good oral tissue tone. Many types of materials are now employed for cleaning dentures.³ Denture cleansers may be divided into two groups, pastes and immersion types. Denture cleaning pastes and toothpastes has very similar constituents. The complex composition of cleaning pastes with their abrasives, humectants, detergents and flavouring provides a variety of potential effects on the denture surface.⁴ The present study found increase in surface roughness after immersion in solutions. Immersion in Dettol disinfectant caused more alteration in surface properties and weight loss, which is found statistically significant. The least effect was seen in samples immersed in Fittydent denture cleanser other than control group, which was statistically significant. Fittydent tablet has sodium perborate as an active gradient. A saturated aqueous solution of sodium perborate gives, in effect, a solution of H₂O₂ buffered to a pH of about 10. The H₂O₂ oxidizes to release oxygen. The evolved O₂, related to the observed effervescing action of the cleanser solutions, is also supposed to exert a mechanical cleansing effect.⁵

The roughness of materials might affect plaque formation or inhibit its removal. It could therefore be assumed that abrasive denture cleansers are creating a suitable surface on the denture resin for plaque to accumulate and rest. Immersion type denture cleaners contain no abrasive particles. The only means of abrading the denture surface would therefore be during the brushing phase before or after soaking.⁴

Renata CM et al⁶ evaluated the effect of denture cleanser (Polydent, tap water) and does not find any significant differences either among the denture cleansers (Bony Plus; Corega Tabs; Efferdent Plus and control) or between the soaking periods throughout the soaking cycles simulating 30 days of use. No color alterations were identified by visual examination. Keng SB et al⁷ determined the distribution of plaque on dentures. The plaque material was disclosed with a dye solution and measured with a modified Quigley-Hein scale. The effectiveness of a perborate soak-type cleanser was also measured by studying the precleaned and postcleaned states of the denture. Denture plaque was more evident on the fitting surfaces of the dentures

than on areas of the flange, teeth, and palate. The use of the soak-type cleanser alone may not be completely effective for the control of heavy plaque. Peracini A et al⁸ to evaluate the effect of denture cleansers (Corega tabs, Bony Plus) on colour change, surface roughness and flexural strength of heat polymerized acrylic resin, simulating a 180 days use. He found that the colour changes were significantly higher for Corega tabs than the control group. Bony Plus had significantly higher surface roughness than the other groups. Corega tabs and bony plus groups presented lower flexural strength than the control group. Jeyapalan K et al¹ evaluated three chemically different denture cleansers (sodium perborate, 1% sodium hypochlorite, 0.2% chlorhexidine gluconate) on two denture base materials (acrylic resin and chrome cobalt alloy) and found that all three denture cleanser solutions showed no statistically significant surface changes on the acrylic resin portions at 56 h, 120 h, and 240 h of immersion. However, on the alloy portion changes were significant at the end of 120 h and 240 h.

Denture plaque can be a significant factor in the production of denture and angular stomatitis, periodontal disease, and caries. It can also pose a threat to the general health of the patient, since an oral candidal infection in a debilitated person may progress to a systemic and possibly fatal spread.⁹ The fitting surface of the denture is the main reservoir for *Candida albicans*. Efficient and regular hygiene are important for long-term upkeep of complete dentures and are indispensable for the general health of edentulous people. Factors such as high temperature of the water used for soaking can cause some degree of whitening. Similarly, chemical products such as hot alkaline peroxide solutions result in elevated water absorption on acrylic surfaces, which causes surface whitening that is not reversible after desiccating. Little information is available in the literature regarding the long-term effect of denture cleansers on acrylic resin subjected to overnight immersion.¹⁰

Particular patient individualization should include type of resin, patient habits, type of cleaning agent, type of brush, and routine maintenance recall. In general, the most abrasive denture cleaning pastes should not be recommended, except in selected situations where all fabrication, resin (most abrasion resistant) selection, and home care is controlled. The routine use of a bath type cleaning agent before the mechanical cleaning of dentures with soap and a dilute water solution of the bath cleaner, with a certain type brush design, will produce the least abrasion of contoured surfaces.¹¹

Since most elderly people do not know how to keep dentures clean, knowledge of the efficacy of different denture maintenance protocols is of importance to improve the quality of life of these dentures wearing patients and also the durability of the denture itself will be prolonged.¹²

CONCLUSION

The dentist must select the type of denture base or veneering resin specifically for the patient, relative to abrasion-resistant properties of the specific resin as related to its use. The patient's habits must be taken into account for the knowledgeable recommendation of a specific cleaning agent or dentifrice and its use with a specified brush type.

Immersion in Dettol disinfectant caused more alteration in surface properties and weight loss, which is found statistically significant. The least effect was seen in samples immersed in fittydent denture cleanser other than control group, which was statistically significant. Therefore, fittydent denture cleanser should be recommended as a routine denture maintenance method for the prevention of the development of microbial biofilm-induced denture stomatitis.

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Source of Support: Nil.

Conflict of Interest: None Declared.

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Cite this article as: Vinay Kumar Gupta, Rahul Kumar Singh, Vishal Singh, Sumit Singh, Vidya Vaidya, Amit Kumar Mishra. Effect of Five Types of Denture Cleansers on Three Types of Denture Base Resins. *Int J Med Res Prof*. 2016, 2(2); 310-15.