International Journal of Research in Health and Allied Sciences
Journal home page: www.ijrhas.com
Official Publication of "Society for Scientific Research and Studies" [Regd.]
ISSN: 2455-7803

ORIGINAL RESEARCH

Evaluate effects of denture cleansers on surface roughness of heat cure acrylic dentures

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ABSTRACT:
Background: Denture hygiene is of utmost importance because dentures are used by the patients throughout the day and are in constant touch with oral environment including various microorganisms. Chemical cleansers are alternatives to mechanical cleaning. For cleaning, dentures should be immersed in the chemical solutions for a certain period of time. These solutions may include one or a combination of various active agents, such as sodium hypochlorite (NaOCl), chlorhexidine, alkaline peroxides, enzymes, and diluted acids. **Aim of the study:** To evaluate effects of denture cleansers on surface roughness of heat cure acrylic dentures. **Materials and methods:** The present study was conducted in the Department of Prosthodontics of the dental institutions. Total of 20 specimens of heat cure denture base resin were fabricated for evaluation of effect of various denture cleaners on surface roughness. Disc shaped wax patterns (10 mm in diameter and 2 mm thick) for surface roughness testing were fabricated using stainless steel mould of desired dimension and were invested in Type III gypsum product in a metallic flask. **Results:** We observed that difference in surface roughness was 0.22 µm with NaOCl, 0.09 µm with vinegar and 0.01 µm with control solution. Highest mean difference in surface roughness was seen with NaOCl and minimum with control solution. **Conclusion**: Within the limitations of the present study, it can be concluded that sodium hypochlorite resulted in increase in surface roughness as compared to Vinegar. Thus, NaOCl can be detrimental to prosthesis when used for longer duration.
Keywords: Denture, Denture cleaners, Surface roughness

Received: 8 December, 2019 Revised: 19 December, 2019 Accepted: 26 December, 2019

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This article may be cited as: Gupta S, Sharma A, Jain P, Sain P, Tikkiwal S, Bansal R. Evaluate effects of denture cleansers on surface roughness of heat cure acrylic dentures. Int J Res Health Allied Sci 2020; 6(1):16-18.

INTRODUCTION

Denture hygiene is of utmost importance because dentures are used by the patients throughout the day and are in constant touch with oral environment including various microorganisms. [1] The microbial load of the prosthesis is responsible for increased incidence of oral problems such as denture stomatitis, inflammatory papillary hyperplasia etc. [2] The most commonly used method for cleaning denture is mechanical cleaning using detergent, soap, or toothpaste. Older patients often face a difficulty in mechanical removal of plaque because of reduced manual dexterity or impaired vision or physical limitations.[3]

Chemical cleansers are alternatives to mechanical cleaning. For cleaning, dentures should be immersed in the chemical solutions for a certain period of time. These solutions may include one or a combination of various active agents, such as sodium hypochlorite (NaOCl), chlorhexidine, alkaline peroxides, enzymes, and diluted acids.[4]

An ideal denture cleanser should reduce biofilm accumulation and be antibacterial, antifungal, non-toxic, short-acting, easy to use, and cost-effective. Also, an ideal denture cleanser should not have any detrimental effect on the denture materials. However, long-term immersion or incorrect use of chemical denture cleansers may adversely alter the physical and mechanical properties of the artificial denture teeth and base materials.[5,6]

Hence, the present study was conducted to study etching patterns of sodium hypochlorite pretreated hypocalcified amelogenesis imperfecta primary molars

MATERIALS AND METHODS

The present study was conducted in the Department of Prosthodontics of the dental institutions. The ethical clearance for the study was approved from the ethical committee of the hospital. Total of 20 specimens of heat cure denture base resin were fabricated for evaluation of effect of various denture cleaners on surface roughness.

Disc shaped wax patterns (10 mm in diameter and 2 mm thick) for surface roughness testing were fabricated using stainless steel mould of desired dimension and were invested in Type III gypsum product in a metallic flask. After setting of the stone, dewaxing was performed followed by application of separating media. Molds were packed with heat polymerized acrylic resin and were processed according to manufacturer's instructions. Dimensions of all specimens were checked with digital Vernier caliper and those not accurate were replaced with new specimens. All specimens thus obtained were immersed in distilled water at 37±1°C for 24 hours for residual monomer elimination. Surface analyser was used to measure the surface roughness of each disc shaped specimens before and after immersion procedures. The statistical analysis of the data was done using SPSS version 11.0 for windows. Chi-square and Student's t-test were used for checking the significance of the data. A p-value of 0.05 and lesser was defined to be statistical significant.

RESULTS

Table 1 shows mean difference in surface roughness (µm). We observed that difference in surface roughness was 0.22 µm with NaOCl, 0.09 µm with vinegar and 0.01 µm with control solution. Highest mean difference in surface roughness was seen with NaOCl and minimum with control solution. On comparing, the results were found to be statistically significant. (Fig 1)

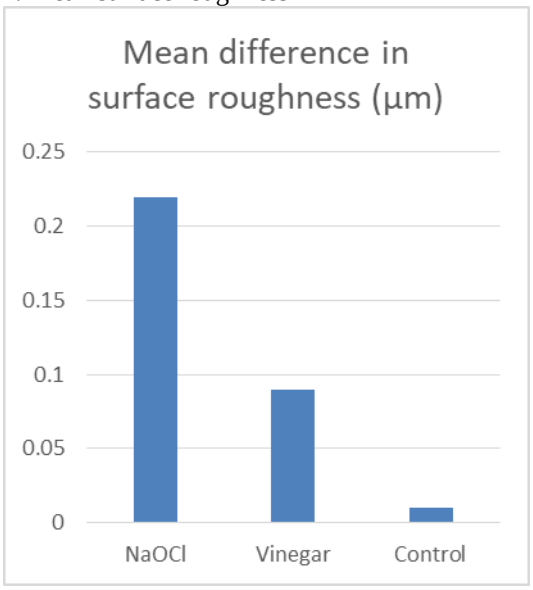
Table 1: Mean difference in surface roughness (µm)

Denture cleansers	Mean difference in surface roughness (µm)	p-value
NaOCl	0.22	0.05
Vinegar	0.09	
Control	0.01	

DISCUSSION

In the present study, we observed that difference in surface roughness was 0.22 µm with NaOCl, 0.09 µm with vinegar and 0.01 µm with control solution. Highest mean difference in surface roughness was seen with NaOCl and minimum with control solution. Yuzugullu B et al compared the effects of different denture cleansers on the surface roughness and microhardness of various types of posterior denture teeth. 168 artificial tooth specimens were divided into the following four subgroups (n=42): SR Orthotyp PE (polymethylmethacrylate); SR Orthosit PE (Isosit); SR Postaris DCL (double cross-linked); and SR Phonares II (nanohybrid composite). The specimens were further divided according to the type of the denture cleanser (Corega Tabs (sodium perborate), sodium hypochlorite (NaOCl), and distilled water (control) (n=14)) and immersed in the cleanser to simulate a 180-day immersion period, after which the surface roughness and microhardness were tested.

Fig 1: Mean surface roughness



The data were analyzed using the Kruskal–Wallis test, Conover's nonparametric multiple comparison test, and Spearman's rank correlation analysis. A comparison among the denture cleanser groups showed that NaOCl caused significantly higher roughness values on SR Orthotyp PE specimens when compared with the other artificial teeth. Furthermore, Corega Tabs resulted in higher microhardness values in SR Orthotyp PE specimens than distilled water and NaOCl. The microhardness values decreased significantly from distilled water, NaOCl, to Corega Tabs for SR Orthosit PE specimens. SR Postaris DLC specimens showed increased microhardness when immersed in distilled water or NaOCl when compared with immersion in Corega Tabs. No correlation was found between surface roughness and microhardness. They concluded that NaOCl and Corega Tabs affected the surface roughness and microhardness of all artificial denture teeth except for the new generation nanohybrid composite teeth. Porwal A et al evaluated the effect of different denture cleansers on the color stability, surface hardness, and roughness of different denture base resins. Three denture base resin materials (conventional heat cure resin, high impact resin, and polyamide denture base resin) were immersed for 180 days in commercially available two denture cleansers (sodium perborate and sodium hypochlorite). Color, surface roughness, and hardness were measured for each sample before and after immersion procedure. All denture base resins tested exhibited a change in color, surface roughness, and hardness to some degree in both denture cleansers. Polyamides resin immersed in sodium perborate showed a maximum change in color after immersion for 180 days. Conventional heat cure resin immersed in sodium hypochlorite showed a maximum change in surface roughness and conventional heat cure immersed in sodium perborate showed a maximum change in hardness. They concluded that color changes of all denture base resins were within the clinically accepted range for color difference. Surface roughness change of

conventional heat cure resin was not within the clinically accepted range of surface roughness. The choice of denture cleanser for different denture base resins should be based on the chemistry of resin and cleanser, denture cleanser concentration, and duration of immersion. [7, 8]

Pahuja RK et al determined the effect of two chemically distinct denture cleansers and water on the surface hardness of acrylic and silicone based soft denture liners at various time intervals. Two commonly used commercial resilient liner material were selected based on their chemical composition (silicone- and acrylic-based soft liners) for this investigation. 120 cylindrical specimens were made of 15 mm × 10 mm dimensions (according to ASTM: D-2240-64T) in a custom made metal mold. All specimens were stored in artificial saliva throughout the study. Forty specimens were cleansed daily in 0.5% sodium hypochlorite solution; forty were cleansed in sodium perborate and remaining forty specimens were daily rinsed in water. Testing was done at 1 week, 1 month, 3 months and 6 months for surface hardness using a Shore A Durometer. A mean of 3 reading for each sample was subjected to one-way ANOVA, Post Hoc test and pair-t test for statistical analysis. P values of less than 0.05 were taken as statistically significant. Surface hardness of all the samples was significantly higher after a period of 6 months irrespective of the cleansing treatment. Minor changes were observed between control, sodium hypochlorite and sodium perborate groups with time. Greater change was observed in surface hardness of acrylic-based soft denture liners as compared to silicone-based soft liners for all groups, as time progressed. They concluded that silicone-based soft denture liners performed significantly better in all cleansing treatments than acrylic-based soft denture liners. Mohammed HS et al evaluated the effect of commercially available denture cleansers on surface hardness and roughness of acrylic and silicon based denture liners at various time interval. Two autopolymerising denture liners Kooliner (acrylic) and GC reline soft (silicon) were tested with two commercially available denture cleansers, polident and efferdent plus. Total of 120 specimens were prepared and all the specimens were divided into six groups based on the relining materials and denture cleansers used. Surface hardness and surface roughness was tested using Shore A durometer and profilometer respectively at the end of day 1, day 7, day 30 and day 90. All the specimens were stored in artificial saliva throughout the study. Cleanser solution was prepared daily by adding Polident and Efferdent plus denture cleanser tablet into 250ml of enough very warm (not hot) water. Acrylic and silicon liner groups were cleansed in a solution of denture cleanser and water for 15 minutes daily, rinsed with water and stored in artificial saliva at room temperature. The data was analyzed with one way ANOVA and independent t-test. The acrylic soft lining showed gradual hardening and increase in surface roughness after immersion in denture cleanser and also with time. Acrylic liner material showed maximum hardness and roughness with Polident followed by Efferdent plus and water (control group). Silicone lining material showed a slight difference in hardness and roughness between the test group and control group. There was a slight increase in hardness in all the groups with time. Very slight increase in mean surface roughness of all the silicon liner groups from day 1 to day 90 was observed. A statistically significant change was noted between and within the all silicon liner groups on day 7, day 30 and day 90. It was concluded that the average surface hardness and surface roughness were lower in silicon liner material than acrylic liner material. Maximum surface roughness was noted by Polident followed by Efferdent Plus and Water for both acrylic liner group and silicon liner group. [9, 10]

CONCLUSION

Within the limitations of the present study, it can be concluded that sodium hypochlorite resulted in increase in surface roughness as compared to Vinegar. Thus, NaOCl can be detrimental to prosthesis when used for longer duration.

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