

Original Article

Assessment of impact of denture cleansers on surface roughness of heat cure acrylic dentures

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ABSTRACT:

Objectives: The purpose of this investigation was to evaluate the effect of different denture cleansers on surface roughness of heat cure acrylic dentures. **Materials and Method:** Denture base resin material heat cure resin was immersed for 120 days in commercially available two denture cleansers (Group 1-sodium perborate, Group 2-sodium hypochlorite and Group 3-control). Surface roughness and hardness were measured for each sample before and after immersion procedure. **Results:** Heat cure resin immersed in sodium hypochlorite and sodium perborate showed a change in surface roughness of (0.29 μ m) and (0.16) respectively. Heat cure resin immersed in sodium hypochlorite and sodium perborate showed change in surface hardness of (0.10 and 0.24) respectively. It was found heat cure resin immersed in sodium hypochlorite showed maximum change in surface roughness and heat cure immersed in sodium perborate showed a maximum change in hardness. The surface roughness and hardness of heat cure acrylic dentures was increased significantly by chemical solutions of denture cleansers. **Conclusion:** Surface roughness change of heat cure resin was not within the clinically accepted range of surface roughness. Denture cleansers can considerably alter the surface roughness and hardness of denture base resins and should be used carefully depending on the material.

Keywords: Denture cleansers, Surface roughness, Denture bases, Acrylic resin

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INTRODUCTION

Over the years, a variety of materials has been used for the fabrication of the denture bases. Polymethyl methacrylate (PMMA) is the most commonly used denture base resin as they have less cost, easy manipulation, easy construction method, and easiness of repair as compared to other materials available for fabrication of denture [1]. The curing process of PMMA is a reaction which requires an activator such as heat or light. So, the conversion of the methyl methacrylate (MMA) monomer to the PMMA polymer is accomplished (2,3). A polymerisation reaction with heat is a prominent method which can be carried out easily (4) Acrylic resin (PMMA - Polymethylmethacrylate) is extensively used material in different branches of dentistry.[5.6]. In spite of its advantages, acrylic resin is not an ideal material, with surface roughness and discoloration being two disadvantages.[7,8] Appropriate cleaning of dentures

is crucial for keeping a healthy mucosa of the oral cavity.[9]

Maintaining hygiene of acrylic dentures is a primary issue to prevent oral and general health of individuals. (12).Cleaning of dentures is important for maintaining oral mucosal health and the longevity of partial removable dentures. Bacterial and fungal colonization on dentures can cause denture stomatitis, angular cheilitis, and poor oral health[10,11]Processed biofilm on dentures has been related to halitosis, denture stomatitis and even general systemic diseases such as aspiration pneumonia, infectious endocarditis, gastrointestinal infection and chronic obstructive pulmonary diseases .[12]

Chemical cleansers such as sodium hypochlorite solutions, denture cleansing tablets (sodium perborate) or mouthwashes like chlorhexidine gluconate are introduced to enhance hygiene of dentures (13). Chlorhexidine gluconate can inhibit candida yeasts on

oral soft tissues and also the surface of dentures (15). Sodium perborate and chlorhexidine gluconate can be added to a denture hygiene routine. Ideally, these cleaning agents should not change the mechanical properties of denture base (14). But significant changes have been reported after immersion in cleansers.

METHOD AND MATERIAL

The conventional heat cure resin (Trevalon, Dentsply India Pvt. Ltd.) and two commercially available denture cleansers such as sodium hypochlorite (Vishal Dentocare Pvt. Ltd.) and sodium perborate (Vovantis Laboratories Pvt. Ltd.) were used in this study. Metal discs of dimension 3 mm thickness and 20 mm diameter were invested in dental flasks using dental stone. The mold space was obtained and separating medium was applied on the dental stone mold. The conventional heat cure resin was used in the powder-liquid form. When the mix reached the dough stage, it was kneaded and packed into the mold space, and final closure was done under bench press. The flasks were allowed to undergo short-time polymerization in a water bath at 72°C for 1.5 h, followed by 30 min boiling in 100°C water in a dental acrylizer. After completion of the curing cycle, the flasks were bench cooled till they reached room temperature and dentures were recovered. Following polymerization, the dentures were finished with silicone carbide grinding papers and polished with abrasive waterproof paper, rinsed with tap water, and air dried. Dentures was polished using a slurry of water and pumice with brush wheel followed by a slurry of tin oxide with a cloth wheel. Twenty six samples were fabricated of conventional heat cure denture base material. It was immersed in sodium hypochlorite and

sodium perborate denture cleanser.

Initial measurements for surface roughness, and hardness were performed. The surface roughness was analyzed with a profilometer and microhardness measurements were obtained with a Vickers hardness tester.

Denture cleanser solutions used were 0.5% sodium hypochlorite and 3.8% sodium perborate. The specimens were stored in distilled water for 24 h and were immersed in sodium hypochlorite denture cleanser for 10 min daily at room temperature. After 10 min, specimens were thoroughly washed and stored in distilled water at room temperature. This procedure was repeated daily for 120 days.[16],[17],[18]

RESULT

Heat cure resin immersed in sodium hypochlorite and sodium perborate showed a change in surface roughness of (0.29 μ m) and (0.16) respectively. Heat cure resin immersed in sodium hypochlorite and sodium perborate showed change in surface hardness of (0.10) and (0.24) respectively. It was found heat cure resin immersed in sodium hypochlorite showed maximum change in surface roughness and heat cure resin immersed in sodium perborate showed a maximum change in hardness.

The surface roughness and hardness of heat cure acrylic dentures was increased significantly by chemical solutions of denture cleansers. The results of the study are summarized in Table1, Table2

Conventional heat cure resin exhibited an increase in the surface roughness above a threshold value of clinically acceptable limit with both the denture cleansers. Change in hardness of heat cure resin was significant greater.

Table 1: Shows change in surface roughness of heat cure denture base resins immersed in sodium hypochlorite and sodium perborate denture cleansers

Denture cleansers	Surface roughness	P Value
Sodium hypochlorite	0.29	0.01 (Significant)
Sodium perborate	0.16	
Control	0.01	

Table 2: Shows change in surface hardness of denture base resins immersed in sodium hypochlorite and sodium perborate denture cleansers

Denture cleansers	Surface hardness	P Value
Sodium hypochlorite	0.10	0.001 (Significant)
Sodium perborate	0.24	
Control	0.02	

DISCUSSION

The surface of the acrylic base denture can influence the oral health profile of denture wearers. The acrylic base is in direct contact with oral tissues and the improper surface texture of the base facilitates the cumulation of microorganisms. The surface texture of acrylic dentures depends on many factors, such as residual methyl methacrylate monomer, polymerisation methods, polymerisation cycle, storage time in water and denture cleaning protocol [13,19]

The increase in the surface roughness after treatment with denture cleansers in the present study can be attributed to the active oxygen released by the solution containing hydrogen peroxide at a certain temperature[20].Moreover, Davi et al. reported that treatment with alkaline chemical solutions altered the surface morphology of polymeric denture base resins by inducing the release of plasticizers[21].Machado et al. observed a significant increase in the surface roughness of denture base resins after repeated

disinfection by immersion in a chemical solution containing sodium perborate added via effervescent tablets

In the present study, immersion of heat cure acrylic resins in Sodium perborate showed a significant increase in surface roughness compared to distilled water. This could be explained by the mechanism of action of sodium perborate which turns into an alkaline peroxide solution by decomposing into sodium metaborate, hydrogen peroxide, and nascent oxygen when it comes in contact with water [22] This peroxide solution combines alkaline detergents (which reduce surface tension) and agents such as sodium perborate or percarbonate (which release oxygen from the solution). Both mechanical and chemical cleaning are effected through oxygen bubbles.[23]

Conventional heat cure shows a change in surface roughness because of less crosslinking of structure. In a Peracini et al. also reported that, compared with distilled water, chemical solutions prepared from two different sodium perborate-based effervescent tablets significantly increased the surface roughness of heat-polymerized acrylic resin.[24]

Decrease in hardness of conventional heat cure acrylic resin specimens can be attributed to the continuous polymerization reaction, monomer release, and the combination of monomers with free active radicals by bonding with liberated oxygen. High impact resin has less residual monomer and no residual monomer in polyamide resin, so less decrease in hardness of these materials

An increase in surface roughness above this threshold roughness, however, resulted in a simultaneous increase in plaque accumulation. In the present study, surface roughness change of conventional heat cure resin was not within the clinically accepted range of surface roughness. The influence of abutment surface roughness on plaque accumulation and peri-implant mucositis[25,26].

CONCLUSION

Within the limitations of the study, it can be concluded that the usage of denture cleansers(sodium hypochlorite and sodium perborate) for few months conventional heat cure resin exhibited an increase in the surface roughness above a threshold value of clinically acceptable limit with both the denture cleansers. Change in hardness of conventional in heat cure resin was significant greater.

Chemical structure, immersion time, temperature of solution, and mechanism of action of a denture cleanser are the factors which affect the surface roughness, and hardness of denture base resins immersed in them. Denture cleansers can considerably alter the surface roughness and hardness of denture base resins and should be used carefully depending on the material.

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