

# Dimensional changes of self-cure acrylic when subjected to alcohol, listerine, and chlorhexidine

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## ABSTRACT

**Aim:** The aim of the study is to observe the dimensional changes of self-cure acrylic when subjected to alcohol, Listerine, and chlorhexidine. **Objective:** The objective of the research is to know the changes that can occur in denture given to patients who use the above-mentioned solutions regularly. **Background:** The resin does not require an external agent for polymerization, and hence it is known as a self-cure. The basis of self-cure is that it is strong and durable. It is one of the most commonly used materials in prosthodontics. **Materials and Methods:** A total of 15 cubes of acrylic processed with self-cure are immersed in alcohol, Listerine, and chlorhexidine and left for 12 h. Dimensions of the cube ps are measured before and after immersing in the solutions. **Reason:** This research is done for better success rates and patient acceptability for prosthodontics treatments. **Conclusion:** The study shows that there are changes in the blocks when subjected to these liquids.

**KEY WORDS:** Dimensional stability, Physical structure, Self-cure resin

## INTRODUCTION

Acrylic resins are one of the most frequently used materials in dental practice. They are used for repairs, relines, orthodontic appliances, and maxillofacial prosthesis in addition to its use in crown and bridge work as a temporary coverage of prepared tooth and a denture base material, as they are able to provide necessary characteristics such as sufficient strength to withstand mastication forces, maintain dimensional stability, and mainly biocompatibility.<sup>[1]</sup> Based on their polymerization reaction, acrylic resins can be made available in different forms which are heat polymerizable acrylic resin, auto polymerizable acrylic resin, light-activated resin, and microwave cured resins. These resins commonly consist of methacrylates, especially polymethyl methacrylate, poly ethyl methacrylate, and additional copolymers. The resins are made available in powder and liquid form. The common usage of auto polymerizable

acrylic resin in prosthetic work is mainly related to its simple production technique at room temperature, less time consuming for processing, do not show crazing as observed in resins urged in high temperatures and they do not require elaborate heating equipment.<sup>[2]</sup> They may also be referred as cold curing, self-curing or chemically activated resins. The ingredients of auto polymerized resin is given in Table 1.<sup>[3]</sup>

However, the properties of resins are not ideal in all aspects as these acrylic resin dentures are present in an atmosphere having variations in oral temperature, pH of saliva and their constituents, they might undergo changes in its physical structure and appearance. Relatively poor mechanical properties and a high level of residual monomer is the disadvantage of self-cure resin overheat cure.<sup>[4]</sup> In self-cure resin, surface characteristics such as roughness, surface energy, and porosity are high, whereas the degree of polymerization and color stability are low.<sup>[5]</sup> The dimensional changes that occur in self-cure acrylic are shrinkage and expansion.

Regular usage of the dentures in the mouth can eventually cause colonization of microorganisms

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**Table 1: Auto polymerised resin ( adapted from Latief A., 2012)**

Powder System	Liquid System
Poly (methyl methacrylate)	Methyl methacrylate
Benzoyl Peroxide	Dibutyl phthalate
Mercuric Sulphide,	Glycol dimethacrylate
Cadmium Sulphide	(-2%)
Zinc Oxide, Titanium Oxide	Hydroquinone (0.006%)
Dibutyl phthalate	Dimethyl-p-toluidine
Dyed particles-glasses, beads	

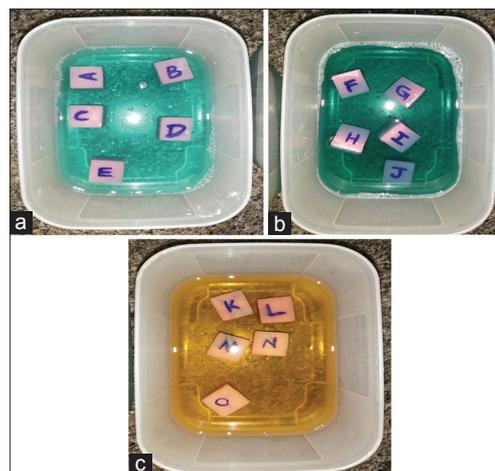
to the surface of denture bases. Maintenance of oral hygiene for denture wearers is an important aspect and can be done mechanically or chemically, as deficient denture hygiene can lead to an increase in a number of microorganisms and acts as a source of infection. The mechanical procedure for removal of biofilm from the surfaces is by brushing the denture with soap or dentifrice. This may be ineffective in elderly patients with poor manual dexterity or patients with impaired motor coordination. Hence, chemical cleaning should also be incorporated. Chemical cleaning requires the immersion of the denture in disinfectant solutions. The agents commonly used in disinfectant solutions may include alcohol and chlorhexidine digluconate. The role of chlorhexidine as a chemical agent includes, inactivation of biofilm and adhesion capacity of microorganism said are reduced.<sup>[6-8]</sup>

Considering the importance of dimensional changes occurring during denture usage by patients, the present study was undertaken to determine dimensional changes of self-cure acrylic subjected to common liquids exposed to dentures, alcohol, Listerine, and chlorhexidine.

## MATERIALS AND METHODS

The first step of the procedure is to make a dental plaster master cube of size 2 cm, length, and breadth. An impression of the cube is taken after preparing it using putty material. After the impression is ready, self-cure monomer and polymer are mixed in a porcelain jar to a liquid consistency and poured into the impression. A few minutes later, say approximately 15 min the set block can be removed from the impression. This procedure is repeated 14 other times, and we get 15 blocks ready for the next step of the process.

These blocks were named from A to O. The blocks A, B, C, D, and E were immersed in 250 ml of Listerine liquid [Figure 1a]. Blocks F, G, H, I, and J were immersed in 250 ml of chlorhexidine liquid [Figure 1b] and blocks K, L, M, N, and O were immersed in 250 ml of alcohol liquid. The blocks remain immersed for 12 h undisturbed [Figure 1c]. Before and after the immersion of the self-cure acrylic blocks, they are measured using a digital Vernier caliper [Figure 2]. The measurements are then tabulated and compared.



**Figure 1:** Cubes immersed in (a) listerine, (b) chlorhexidine and (c) alcohol



**Figure 2:** Measurement using digital vernier caliper

## RESULTS

The Table 2 was formulated based on the values obtained before and after immersion of the cubes, of average size 20mm, in liquids listerine, chlorhexidine and alcohol for 12 hours. The blocks A, B, C, D and

**Table 2: Dimension of the cubes before and after immersion in specified liquids**

Name of the cube	Before immersion (in mm)	After immersion (in mm)
A	20.78	19.95
B	20.58	20.12
C	20.34	20.15
D	20.02	19.86
E	20.76	20.45
F	20.01	19.62
G	20.00	19.86
H	20.05	19.97
I	20.10	20.02
J	20.11	19.85
K	20.07	19.99
L	20.12	19.88
M	20.01	19.70
N	20.02	19.86
O	19.96	19.74

E which were immersed in listerine liquid showed a minimum shrinkage in the cubes after 12 hours of immersion. The average shrinkage being 0.39%.

The blocks F, G, H, I and J which were immersed in chlorhexidine liquid showed a minimum shrinkage in the cubes after 12 hours of immersion. The average shrinkage being 0.95%.

## DISCUSSION

Prolonged wear of dentures by patients may lead to adhesion of microorganism such as viruses, bacteria, and fungi which may be a part of normal oral microbial flora or from the food and liquid items consumed. Hence, increasing the need for disinfection of the dentures to prevent cross-contamination between the patient and dental member and vice versa or even between one patient to another through contaminated surfaces which may lead to spread of diseases if any, to treat denture stomatitis, bad odor and also to remove stains on the denture. They can be cleaned daily by brushing and also by soaking in disinfectant solutions such as sodium hypochlorite, antibacterial mouthwashes, or alkaline solutions.<sup>[9,10]</sup>

In the present study, the changes observed when acrylic cubes were subjected to alcohol, chlorhexidine, and Listerine, agents which are commonly used in disinfectants, were noted and studied. Few other studies also revealed changes in acrylic resin when subjected to common liquids.

According to Basavarajappa *et al.* his study of ethanol treatment on heat polymerized denture base polymers suggested that the heat polymerized denture base polymers are prone to changes by ethanol which alters its mechanical properties.<sup>[11]</sup>

Feitosa *et al.* immersed acrylic resin in coffee, lemon juice, chlorhexidine gluconate, red wine, cola-based soft drink, vinegar or antiseptic with and without alcohol for 10 min and then stored in artificial saliva for 23 h 50 min, and for 14 days. It was observed from the results that 0.12% chlorhexidine gluconate and mint flavored oral antiseptic without alcohol showed a great difference between initial microhardness and after solution submersion, this may lead to a structural change of the polymer. Similar changes were observed for roughness.<sup>[12]</sup>

The advantages of the self-cure resin from which dentures can be made are plenty, such as excellent esthetic values, adequate strength, low cost, less time consuming, and less equipment consumption, but the dimensional changes that may occur when these resins are subjected to certain liquids are considered a major disadvantage.<sup>[13]</sup> The monomers used in dental resin materials have the ability to absorb water

and chemicals and also release components into the environment which would lead to certain changes in the processes that may result in deleterious effects on the structure of dental polymers.<sup>[14,15]</sup> Prolonged action of water sorption may lead to a long-term plasticizing effect on the resin material. The solutions we have taken for conducting the test also contain a good amount of water.<sup>[3]</sup>

A study conducted by Gupta and Kamra, in heat cure acrylic resin denture bases by immersing them in water for 28 days to find out the effect of water sorption on the dimensional stability of the acrylic resin denture bases revealed that there were significant dimensional changes.<sup>[15]</sup>

Many researches are done to improve the mechanical strength and durability of self-cure resins.

## CONCLUSION

Within the limitations of the study (small sample size and shorter duration of time), the above results show that there are dimensional changes in the self-cure blocks when immersed in Listerine, chlorhexidine, and alcohol and the change are mostly shrinkages of the self-cure blocks. Hence, patient consuming these type of liquids in regular frequencies should be made aware of the dimensional changes that may occur to their prosthesis.

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