INTRODUCTION

Acrylic resins were introduced in 1936 as denture base material. Amongst their characteristics, are good thermal conductivity, low permeability to oral fluids, easy handling and colour stability. One of the major disadvantages of these materials is that they can be deeply colonized by microorganisms. Like *Candida albicans*, *Streptococcus sanguis*, *Streptococcus salivarius*, *Streptococcus mutans*, *Fusobacterium nucleatum* and *Actinomyces viscosus*. These microorganisms transmitted from the contaminated devices between dental personnel and patients. Most common opportunistic infection that is seen in denture wearers is denture-related stomatitis which is caused by the accumulation of denture plaque on prosthesis. In the elderly patients there is a major risk of developing respiratory tract infection because of these microorganisms. To prevent cross infection of microorganisms from contaminated prosthesis to dentists, dental assistant and patients, disinfection of these prosthesis has been recommended as an vital procedure. For denture disinfection many procedures have been suggested. They are immersion in solutions and irradiation. A study established an effective infection control protocol for denture disinfection by immersing the prosthesis in 3.78% solution of sodium perborate after scrubbing with 4% chlorhexidine. In a preliminary study, the researchers immersed the specimens in water and then disinfection was carried out with microwave irradiation of 3 hard reline resins and they found that this regimen was effective against both pathogenic and nonpathogenic microorganisms. Many chemical cleansers that contain...
sodium hypochlorite, acid solutions, enzymes, and alkaline peroxide, are available to remove the residual biofilm attached to denture surfaces\textsuperscript{15,21-23}. Many studies demonstrated that denture cleansing solutions have antimicrobial properties\textsuperscript{22-27}; however, none of these methods seem to effectively prevent recolonization on the denture surface and to remove the biofilm\textsuperscript{21-22}. There is a wide variation in the literature regarding the use of denture cleansers as a study has shown that for reducing microorganisms the most effective denture cleanser is \textit{0.5\% sodium hypochlorite solution}\textsuperscript{28}. On the other hand in another study researchers evaluate the maxillary dentures by using alkaline peroxide tablets that there is significant decrease in \textit{Candida albicans} colony-forming units as well as other\textsuperscript{29} microbial bioburden\textsuperscript{30}. Surface hardness of the denture base polymers can be affected by dentifrice toothbrush/abrasion,\textsuperscript{31} denture cleansers\textsuperscript{32}, polymerization cycles,\textsuperscript{33} different systems used for polymerization of denture base\textsuperscript{34} and thermal cycling\textsuperscript{35}. When acrylic resins were disinfected by chlorhexidine gluconate, sodium hypochlorite or sodium perborate, lower hardness values were observed\textsuperscript{36}. According to Previous studies the hardness of the resins was not affected by immersing the conventional denture base polymer in \textit{1\% sodium hypochlorite, 4\% chlorhexidine solutions} or in \textit{sodium perborate\textsuperscript{14,37}}. On the other hand the hardness can be altered by solutions of \textit{2\% glutaraldehyde, 4\% chlorhexidine or 1\% sodium hypochlorite}\textsuperscript{38}. Therefore the aim of this study is to assess the surface hardness of acrylic resins after immersed in different denture cleansers solution. The hypothesis of this in vitro study was that the surface hardness of denture base resins was decreased after disinfection with denture cleansers.

**METHODOLOGY**

Table I presented the material used in this study. For the fabrication of samples Vertex\textsuperscript{™} Rapid Simplified Holland was used that represent the conventional denture base acrylic resins. Fabrication and testing of specimens was conducted at Dr IshratulEbad Khan institute of Oral Health Sciences (Department of Science of Dental Materials and Department of Prosthodontics). Test specimens were fabricated by the investment of material in stainless steel mold \textit{13 x 4 mm}. The American society for testing and material standard D 256-06a was used for the dimension of specimens. The material was mixed according to the instructions by the manufacturer and after dough stage achieved, material was inserted into the molds. Specimens were inspected visually for any defects or porosities. Only those specimens were included in the study which were free of voids or porosity and having smooth surfaces. Excess material (flash) was removed immediately after polymerization and then polishing was done using progressively finer grades by silicon carbide paper (3M of Brazil; São Paulo, Brazil) for smooth, flat surface. Sample size was estimated by considering; Neppelenbroek KH et al\textsuperscript{17} work. A total of 108 specimens were fabricated. These specimens were divided randomly 06 groups (n=18). These groups were: at baseline (0 day dry specimens), artificial saliva (control) group. The experimental solutions of the study were: fittydent denture cleanser tablets, corega denture cleansers tablets, polident denture cleansers tablets and fixodent Denture Cleanser for 10 minutes according to manufacturer recommendations (Table 2). The samples were distributed through non probability convenience sampling. All specimens were placed in their respective containers and filled with distilled water except the specimens of baseline group. The specimens in the baseline group were measure at 0 day. The distilled water was discarded after 24 hours. The containers were then filled with their respective denture cleansers and artificial saliva. The specimens were washed and stored in distilled water. This disinfection regime was repeated twice a day for total of 60 days.

<table>
<thead>
<tr>
<th>Material</th>
<th>Type</th>
<th>Processing method</th>
<th>Manufacturer</th>
<th>Powder Liquid Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heat cure acrylic resins</td>
<td>PMMA</td>
<td>Heat cure polymerization 100°C for 20 min in the curing tank</td>
<td>Vertex™ Rapid Simplified</td>
<td>1 ml of liquid (monomer) and 2.3 gm of powder (polymer)</td>
</tr>
</tbody>
</table>

**Table 2: Material used in the study**

<table>
<thead>
<tr>
<th>DENTURE CLEANSER</th>
<th>MANUFACTURER</th>
<th>COMPOSITION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corega</td>
<td>GlaxoSmithKline (GSK)</td>
<td>Sodium Hypochlorite</td>
</tr>
<tr>
<td>Fittydent</td>
<td>Fittydent International GmbH (Marketed by Curelink Pharmaceuticals)</td>
<td>Sodium Carbonate Peroxyhydrate, Sodium Perborate monohydrate, Potassium Monopersulphate</td>
</tr>
<tr>
<td>Polident</td>
<td>GlaxoSmithKline</td>
<td>Tetraacetyl Ethylenediamine &amp; Peroxycetic acid.</td>
</tr>
<tr>
<td>Fixodent Denture Cleaner</td>
<td>Procter &amp; Gamble</td>
<td>Sodium Perborate Monohydrate Sodium Carbonate Citric Acid</td>
</tr>
</tbody>
</table>
When no disinfection was carried out during storage specimens were placed in distilled water. The artificial saliva consisted of NaCl (0.40 g), KCl (0.4 g), NaOH (0.05 g), CaCl2·2H2O (0.22 g), NaH2PO4 (0.12 g), urea (1 g) in 1 dm3 of distilled water, adjusted to pH 7. After 60 days, microhardness was evaluated using Vickers microhardness tester (Wolpert W group micro Vickers hardness tester digital auto-turret model number 402 MVD Figure 1, 2 and 3). Data analysis was performed by using Statistical Package for Social Sciences (SPSS) version-16. The data was analyzed by using one way analysis of variance-one way (ANOVA) which was followed by Tuckey’s HSD (Honestly significant difference) was used at 0.05 significance level.

RESULTS

The mean values of the specimens at baseline, artificial saliva (control) and when immersed in experimental solutions were shown in Table 3. The corega denture cleanser tablets showed lowest value of hardness as compared to baseline and artificial saliva (control) specimens. One way ANOVA showed that significant difference was observed among all the groups (p < 0.001). It was further confirmed by post-Hoc Tukey test (Dunnett test) which stated that significant difference was found when baseline and artificial saliva (control) was compared with Fittydent, corega and poildent denture cleanser tablets (p < 0.001).

DISCUSSION

The effect of exposure of disinfection methods on the properties of denture base materials is of prime importance Vickers microhardness of denture base resins after immersed in denture cleansers were evaluated in this study. One sodium hypochlorite based, two sodium perborate based, and one tetraacetylene based denture cleansers in effervescent tablet form which are commonly used on the local market were included in the study. The hypothesis that denture cleansers may decrease
the micro hardness of denture base resins was accepted. The results showed that there was a significant decrease in Vickers micro hardness when specimens were immersed in denture cleansers solution when compared with the specimens who were not immersed in control group.

The denture cleansers are chemical soak-type products. Sodium-perborate decomposed to form nascent oxygen, sodium metaborate and hydrogen peroxide and transforms to an alkaline peroxide solution. This peroxide solution has chemical as well as mechanical cleansing mechanism by releasing oxygen.

The decrease in Vickers hardness observed in this study might because of active oxygen released by hydrogen peroxide and oxygen liberating solution at a certain soaking temperature in the present study in perborate containing denture cleansers tablets that is Fixodent and fittydent denture cleaner tablets. A similar study conducted by Machado et al in which author used sodium perborate as an immersion media and found that hardness of denture base was decreased significantly after seven days of immersion as compared to the control group which was distilled water. In the present study, instead of distilled water, artificial saliva was used and found that hardness was not affected significantly after immersion into artificial saliva.

Other important factor might be due to the plasticizing effect of chemicals. Lowering the hardness of the acrylic resin denture base resins as compared with artificial saliva might be due to the plasticizing effects of chemicals present in denture cleansers. These chemicals ingredients diffused in between the polymer chains causing relaxation of these chains and subsequently affected the hardness of denture base resins. The duration of immersion and the type of denture cleanser play an important role in affecting the properties of denture base. Consistent with previous research, the hardness of heat cure resins decreased after immersion in denture cleansers. When acrylic resins are immersed in cleansers, residual monomers release and water absorption occur simultaneously. These processes are diffusion controlled and time-dependent. It has been demonstrated that both water and residual monomer molecules act as plasticizers, thus affecting the strength of polymerized resins. As stated by Takahashi et al if the constituents that leach out exert a lesser plasticizing effect than ingredients in the denture cleansers, the strength of polymers will decrease.

To evaluate the effect of chemical immersion on denture bases, in vivo studies should be carried out. Evaluation of the efficacy of chemical disinfection through long term clinical trials should be carried out in the future. As the material is subjected to compressive, thermal, tensile and shear stresses unfavorable oral environment should be probed in future studies. One of the most important limitations of the study is due to the availability of limited technical resources available Vickers microhardness was evaluated.

**CONCLUSION**

Within the limitations of this in vitro study, it was concluded that:
- Surface hardness of denture base resins decreased after immersion in denture cleansers.
- The most significant decrease in the surface hardness of heat cure acrylic resins was with Corega denture cleanser tablets when compared to the specimens at baseline (dry) and control group. This was followed by Fixodent denture cleanser tablets.
- The least change in hardness was observed with Fittydent denture cleanser tablets and Poildent denture cleanser tablets respectively after immersing the specimens for 60 days.

**REFERENCES**

29. Uludamar, A., Ozkan, Y. K., Kadir, T. & Ceyhan, I. "In Vivo Efficacy of Alkaline Peroxide Tablets and...