Evaluation of dimensional changes in denture base resins in different storage medium

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ABSTRACT

Aim: The aim of the study is to evaluate the dimensional changes in denture base resins in different storage medium.

Materials and Methods: The denture bases that were fabricated were stored into the storage environments which follow: Water, saline, artificial saliva, and vinegar for 2 weeks. Based on the number of mediums, each medium was allotted 5 dentures which was 20 dentures in total (n = 20). The dimensional changes of the dentures were recorded every 2 days for 2 weeks. Results: At the end of 2 weeks, the dentures stored in vinegar and saline contracted 0.052 mm and 0.040 mm, respectively, and the dentures which were stored in water and artificial saliva contracted 0.031 mm, 0.015 mm respectively. Conclusion: Within the limitations of this study, water and artificial saliva were the best mediums to be used.

KEY WORDS: Artificial saliva, Denture bases, Dimensional changes, Storage medium, Vernier caliper

INTRODUCTION

Dental prosthesis was done as early in 700 BC. They were made of ivory and bone. Later, many materials were tried for the fabrication of dental prosthesis. Due to major disadvantages, their usage in the dental field was diminished. Resins were introduced to dentistry by Dr. Walter Wright in 1937. Since then, resins are the most widely used material for the fabrication of dentures. Resins used for the fabrication of dentures are available in pre-polymerized polymethyl methacrylate (PMMA) as powder form and methyl methacrylate as monomer form. Polymerization takes place when the polymer powder mixed with monomer with proportion in the presence of initiator benzoyl peroxide, cross-linking agent, and the activator. The polymerized denture base resins are PMMA.\(^{1,2}\)

Denture base resins have adequate physical features, with reduced toxic quality, high mechanical strength, good esthetics, easy to repair, and can be cured by simple procedures when compared to other denture base materials. However, the properties will not be the same in all conditions. During processing, alteration in heat may impair the properties of the denture base resin, resulting shrinkage or warpage.\(^{3-9,10}\) Modifications in denture base resins also modify the property.\(^{11}\)

It is well known that denture should be stored in the water storage medium to minimize distortion and shrinkage when they are once removed from the mouth.\(^{7,12-16}\) It is uncertain to find which portion of the denture begins with distortion or warpage when it was kept in dry place. Consequently, a satisfactory medium ought to be chosen for storage of denture with a specific end goal to limit the distortion for dependable utilization. Hence, it is vital to find what sort of storage medium can be prescribed keeping in mind the end goal to avert dimensional changes of the denture.\(^{17,18}\) Considering the importance of dimensional changes occurring during storage, the present study was undertaken to determine linear dimensional changes of commercially available heat-cured acrylic resins in four different liquid mediums.

MATERIALS AND METHODS

This in vitro experimental study was conducted on four types of liquid medium (water, saline, artificial saliva,
and vinegar) with heat-cured acrylic resins. Based on the number of mediums, five denture bases were determined for each group (n = 20). Hence, each medium was allotted 5 denture bases which was 20 dentures in total [Figure 1].

The fabricated denture bases were stored into following storage environments: Water, saline, artificial saliva, and vinegar. Fusayama Meyer artificial saliva was used for this study. It was prepared in the Biochemistry Department, Saveetha Dental College. Saline and water mediums were kept at room temperature, whereas artificial saliva and vinegar mediums were stored at refrigerator temperature. The dentures were allowed to be stored in the mediums for 4 weeks where every 2 days, the dentures were placed in the cast and were measured using digital vernier caliper to check for any distortion. The denture bases were measured in the posterior-palatal region, the interface between the cast and the denture [Figure 2]. After 4 weeks, all the measurements that were taken were compared with the base measurements and analyzed by paired t-test using SPSS software version 20 at statistically significant P = 0.05.

RESULTS

Table 1 represents the dimensional changes of measured dentures in four different storage mediums after every 2 days for 4 weeks.

<table>
<thead>
<tr>
<th>Days</th>
<th>Water</th>
<th>Artificial saliva</th>
<th>Saline</th>
<th>Vinegar</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Dimensional change measured at posterior palatal region</td>
<td>Mean standard deviation</td>
<td>P-value</td>
<td>Mean standard deviation</td>
</tr>
<tr>
<td>2nd day</td>
<td>0.000 mm</td>
<td>0.209</td>
<td>0.000 mm</td>
<td>0.274</td>
</tr>
<tr>
<td>4th day</td>
<td>0.002 mm</td>
<td>0.145</td>
<td>0.000 mm</td>
<td>0.155</td>
</tr>
<tr>
<td>8th day</td>
<td>0.009 mm</td>
<td>0.349</td>
<td>0.002 mm</td>
<td>0.593</td>
</tr>
<tr>
<td>16th day</td>
<td>0.019 mm</td>
<td>1.013</td>
<td>0.010 mm</td>
<td>0.379</td>
</tr>
<tr>
<td>20th day</td>
<td>0.022 mm</td>
<td>0.149</td>
<td>0.012 mm</td>
<td>0.416</td>
</tr>
<tr>
<td>25th day</td>
<td>0.028 mm</td>
<td>0.637</td>
<td>0.013 mm</td>
<td>0.511</td>
</tr>
<tr>
<td>30th day</td>
<td>0.031 mm</td>
<td>1.000</td>
<td>0.015 mm</td>
<td>0.721</td>
</tr>
</tbody>
</table>

To determine the difference in each sample before and after storage in the liquid mediums, paired t-test was used which is shown in Table 1. The data showed the dentures stored in vinegar and saline contracted 0.052 mm and 0.040 mm, respectively, and the dentures which were stored in water and artificial saliva contracted 0.031 mm, 0.015 mm, respectively.

DISCUSSION

The acrylic pitch has been extremely fruitful as a denture base, as it has amazing esthetic quality, shading soundness, and can be utilized with a straightforward strategy for the development of dentures. Regardless of having every one of these favorable circumstances, the absence of dimensional soundness is broadly acknowledged as one of the burdens of acrylic resin dentures.

The studies done in the past years indicate that the acrylic denture base resins tend to absorb water; in this manner, expansion can make up when minimal polymerization shrinkage takes place. This can clarify the minimal measure of dimensional changes seen in acrylic heat-cured denture resins which were put in water which is as per the findings of this study.[19-21]

Wong et al.[19] revealed that the tendency to retain water in acrylic resins shows shrinkage amid setting. Expansion that follows absorption of water can make up for a part or the majority of the polymerization shrinkage or even expansion can happen.

Goodkind and Schulte[22] conducted a study which indicated that water immersion had no critical impact on denture base measurements.

Consani et al.[23] reported that 90 days of storage of denture bases in water did not result in significant changes in distances between the teeth in comparison to deflasking period.

Miessi et al.[24] studied that 180 days of storage in water caused major dimensional changes and
adjustment issues in denture bases. A few researches have suggested that water immersion of acrylic denture bases brings about extension because of water absorption. Water absorption powers the macromolecules separated and brings about acrylic extension.\textsuperscript{[23]} The polymerization shrinkage of acrylic resin is repaid by this extension which in turn leads to adjustment of denture bases with soft tissues and mucosa.\textsuperscript{[24]} The present examination additionally affirmed this finding and demonstrated that in both trial groups, 30 days of capacity in water brought about a noteworthy diminishing in dimensional changes and repaid the polymerization shrinkage.

**CONCLUSION**

Within the limitations of this study, water and artificial saliva were the best mediums to be used as a storage medium.

**REFERENCES**


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