Transverse Strength of Heat Cured Acrylic Resin After Immersed in 0, 2% Chlorhexidine Gluconate Mouthwash (In Vitro)

Annisa Mayang Rusdi1*, Lasminda Syafiar2, Astrid Yudhit2

1. Undergraduate student, Faculty of Dentistry, Universitas Sumatera Utara
2. Department of Material and Technology, Faculty of dentistry, Universitas Sumatera Utara Jl. Alumni No. 2 Padang Bulan, Medan, 20155, Indonesia

*E-mail: mayangrusdi@gmail.com

Abstract

Objective: The purpose of this study was to evaluate transverse strength of heat cured acrylic resin after immersed in 0.2% chlorhexidine gluconate mouthwash for 15, 30, 45, and 60 minutes.

Methods: This was an experimental laboratory study with posttest only group design. The samples were heat cured acrylic resin plate with size 65mm x 10mm x 2.5mm. Polymerization of the heat cured acrylic was done by water bath (74 °C for 2hrs followed by 100 °C for 1hr). Totally 30 samples were prepared and divided into 5 groups (n=6) which are group I as control, and others were immersed in 0, 2% chlorhexidine gluconate, group II (15 minutes), group III (30 minutes), group IV (45 minutes) and group V (60 minutes) respectively. The transverse strength was test using Torsee’s Universal Testing machine, Japan with crosshead 1/10 mm/seconds. The data was statistically analyzed using one way ANOVA (p≤0.005).

Results: Means and Standard deviation of Transverse strength were 92.382±11.786 N/mm2, 92.186±13.349 N/mm2,92.578±12.492 N/mm2, 92.382±13.939 N/mm2, and 91.989±12.285 N/mm2 for group I, II, III, IV, and V respectively. Statistic analyzed showed no significant difference among groups with p value= 1,000 (p < 0.05).

Conclusion: The immersion in 0, 2% chlorhexidine gluconate mouthwash at different period does not changed transverse strength of heat cured acrylic resin.

Keywords: 0,2% chlorhexidine gluconate mouthwash, heat cured acrylic resin, transverse strength

Introduction

Heat cured acrylic resins is a common material used as a denture base.1 allows the formation of biofilm accumulation, and can cause various infections in oral mucosa.2 There was reliable evidence showing that unclean dentures and insufficient hygiene care are significant predisposing factors for oral mucosal diseases.3 Candida associated denture stomatitis is a common infection observed in denture patients. The presence of continuously biofilm formation on the surface of the denture base was a major etiological factor of denture stomatitis.2, 4 Prevention can be done with a routine cleaning of denture by mechanical and/or chemical denture cleanser.3 Chemical cleaning by immersed the denture in denture cleaner’s solution was suggested as the first choice for plaque control in elderly patients.5, 3

Chlorhexidine gluconate is an antiseptic and disinfectant agent that active against various types of bacteria, virus, bacterial spores, and fungi and can be used as denture cleansers.2,3,4 It was reported that 0.2% Chlorhexidine gluconate can affect the colonization of Candida albicans bacterial on denture base’s surface and palatal mucosa. Lamfon et al. reported that chlorhexidine gluconate solution effective as a biofilm-removal. Pavarina et al., also reported the effectiveness of chlorhexidine gluconate as a cleanser and disinfectant can reduce the growth of microorganisms on dentures.2

Soaking heat cured acrylic resin denture base in cleansers or disinfectants such as chlorine, sodium hypochlorite, chlorhexidine gluconate and other chemical solutions may affect its mechanical properties, such as transverse strength.6,7 The purpose of this study was to evaluate transverse strength of heat cured acrylic resin after immersed in 0, 2% chlorhexidine gluconate mouthwash for 15, 30, 45, and 60 minutes.
Methods

This was an experimental laboratory study with posttest only group design. The samples were heat cured acrylic resin plate with size 65mm x 10mm x 2.5mm in length, width, and depth respectively according to ADA specification. Polymerization of the heat cured acrylic resin were done by water bath processed by heating at 74°C for 2 hours and then the temperature was increased to the boiling point or 100 °C for 1hr. 9 Totally 30 samples were prepared and divided into 5 groups (n=6) which are group I as control, and others were immersed in 0, 2% chlorhexidine gluconate, group II (immersed for 15 minutes), group III (immersed for 30 minutes), group IV (immersed for 45 minutes) and group V (immersed for 60 minutes) respectively. Material used in this study can be showed in table 1.

Table 1. Material used in this study

<table>
<thead>
<tr>
<th>Materials</th>
<th>Brand</th>
<th>Composition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heat cured acrylic resin</td>
<td>ADM</td>
<td>Powder 450 g</td>
</tr>
<tr>
<td></td>
<td>(Acrylic)</td>
<td>Liquid 250 ml</td>
</tr>
<tr>
<td></td>
<td>Denture Materials, England</td>
<td>Could Mould Seal 110ml</td>
</tr>
<tr>
<td></td>
<td>(approx.)</td>
<td>Separating Sheets 100</td>
</tr>
<tr>
<td>Chlorhexidine gluconate</td>
<td>Minosep, Indonesia</td>
<td>0.2 % chlorhexidine gluconate solution 150 ml</td>
</tr>
</tbody>
</table>

The transverse strength was test using Torrée’s Universal Testing machine, Japan with crosshead 1/10mm/seconds. Transverse strength was determined using equation 1,5,6,7 S= 3π/2bd² (S= transverse strength (N/mm²); b = width of the specimen (mm); d = thickness of the specimen (mm)). Then the data was statistically analyzed using one way ANOVA (p≤0,005).

Results and Discussion

Means and Standard deviation of Transverse strength were 92.382±11.786 N/mm², 92.186±13.349 N/mm², 92.578±12.492 N/mm², 92.382±13.939 N/mm², and 91.989±12.285 N/mm² for group I, II, III, IV, and V respectively. Statistic analyzed showed no significant difference among groups with p value= 1,000 (p < 0, 05). The mean and standard deviation of all measurements of the control and experimental groups used in the present study showed in table 2.

Table 2. Transverse strength value, standard deviation (sd), and significance (p) of heat cured acrylic resin after immersed in 0.2% chlorhexidine gluconate solution.

<table>
<thead>
<tr>
<th>Group</th>
<th>Transverse Strength Mean ± SD (N/mm²)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>I (Control)</td>
<td>92.382 ±11.786</td>
<td></td>
</tr>
<tr>
<td>II (15 min)</td>
<td>92.186 ±13.349</td>
<td></td>
</tr>
<tr>
<td>III (30 min)</td>
<td>92.578 ±12.492</td>
<td>1.000</td>
</tr>
<tr>
<td>IV (45 min)</td>
<td>92.382 ±13.939</td>
<td></td>
</tr>
<tr>
<td>V (60 min)</td>
<td>91.989 ±12.285</td>
<td></td>
</tr>
</tbody>
</table>

Transverse strength of acrylic resin can be influenced by several factors such as molecular weight, polymer particle size, residual monomers, plasticizer composition, porosity, thickness of the denture base, and the amount of crosslinking in molecule chain. 10,11 Polymethyl methacrylate absorbs small amounts of water when placed in an aqueous environment. This water exerts significant effects on the mechanical and dimensional properties of the processed polymer. Water molecules can also interfere with entanglement of polymer chains. 9, 0.2% chlorhexidine gluconate in w/v defined as 2 grams’ chlorhexidine gluconate in 100 ml water (H₂O).

Ganesh al reported there was no significant difference of transverse strength heat cured acrylic resin after immersion in 4% chlorhexidine gluconate for 8 and 16 minutes. 12 Chau et al. reported that immersion of denture base in 4% chlorhexidine gluconate for 10 minutes was not made any significant different of transverse strength values. 7 Neerja, in his study also reported that denture immersion in denture cleanser solution with short time period have no effect on its properties compared to long time period. 6 Shen et al reported that immersion time until 12 hours are not affected the transverse strength of acrylic resin. 13 Polyzois et al also concluded that the transverse strength was not affected by periods of immersion in the chemical solutions. 13

Conclusions

The immersion in 0.2% chlorhexidine gluconate mouthwash at different period does not affect transverse strength of heat cured acrylic resin.

References