COMPARATIVE EVALUATION OF COMpressive RESISTANCE OF AN ELASTOMERIC INTEROCCLUSAL RECORD MATERIAL AFTER IMMERSION IN A DISINFECTANT SOLUTION AT DIFFERENT TIME INTERVALS- AN INVITRO STUDY

Dental Science

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Abstract

The aim of this study was to compare the compressive resistance of PVS interocclusal record material after disinfection at different time intervals.

MATERIAL & METHOD:
24 specimens of the VPS interocclusal recording material (Imprint Bite) were prepared using a cylindrical stainless steel mould according to ADA no.19. The manipulation of VPS was done by an auto-mixing gun, which was injected into the mould. Then specimens were divided into 4 groups according to disinfection time: Group A-control (no immersion) (n=6), Group B-immersion for 10 min (n=6), Group C-immersion for 30 min (n=6), Group D-immersion for 60 min (n=6). The disinfectant used was 2% Glutaraldehyde. Then the specimens were stored in tightly sealed containers and kept for 24 hours. Compression resistance of the specimens were determined using a Universal Testing Machine with a compressive force of 25N for 1 min. The specimens were loaded to breakage or failure and value was expressed in Megapascals.

RESULT:
Statistical analysis was done using chi square and anova test. The mean compressive resistance of Group A is found to be 9.47±0.64, Group B 10.25±0.95, Group C 10.47±0.58, Group D 11.04±0.68 and was found to be statistically significant (0.017).

CONCLUSION:
The compressive resistance of VPS (Imprint Bite) interocclusal record material Imprint Bite increases with increase in disinfection time.

Key Words
Imprint Bite, Compressive Resistance, Glutaraldehyde

INTRODUCTION
Interocclusal bite registration, on the whole is an essential record used to transfer interarch relationships from the mouth to an articulator. Interocclusal recording materials are fairly responsible for the accuracy and occlusal quality of final prosthetic restorations since it is used for mounting cast on an articulator. An accurate interocclusal record will minimal occlusal modifications intraorally and thereby reduces the chair side time. The selection of interocclusal registration material plays a critical role for precise reproduction of details apart from the operators clinical ability and the technique.

Polyvinyl siloxane material and polyether material is widely used nowadays due to its excellent dimensional stability, superior recovery and precise detail reproduction. Polyvinyl siloxane material have also shown to have better resistance to compression. One of the most desirable characteristics of the interocclusal registration material is, it should be rigid enough to withstand the weight from cast, components of articulator or other means that is used to stabilize the cast during mounting.

Interocclusal materials are one of the common source for cross contamination. So disinfection of these bite records is inevitable. The agent that are used to disinfect should not change the property of the interocclusal record material. American dental association in 1996 and council on dental materials and equipment in 1988 issued guideline on disinfecting impression by immersion technique. So, this study was done to analyse the compressive resistance of vinyl polysiloxane interocclusal record materials after disinfection at varying time interval.

MATERIAL AND METHOD
A total of 24 specimens of the vinyl polysiloxane interocclusal recording material (Imprint Bite) were prepared using a cylindrical stainless steel mould of appropriate dimension (20mm height and 20mm diameter) (fig.1) according to American Dental Association no. 19. The manipulation of VPS were done by attaching a mixing tip to the cartridge with an auto-mixing gun(fig.2) The material was injected into the cylindrical mould which was resting on a glass plate. A second glass plate was placed on top of it, and hand pressure was applied for 5 seconds to initially express material followed by application of a 0.5 kg weight to further eliminate excess material. The specimens were divided into 4 groups according to disinfection time: Group A-control (no immersion) (n=6), Group B-immersion for 10 min (n=6), Group C-immersion for 30 min (n=6), Group D-immersion for 60 min (n=6). The disinfectant used was 2% Glutaraldehyde. Then the specimens were stored in tightly sealed containers and kept for 24 hours. Compression resistance of the specimens were determined using a Universal Testing Machine and subjected to a constant compressive force of 25N until breakage or failure. The compression resistance was calculated as follows:

Compressive resistance = compressive load (Newton) / cross-sectional area of the specimen (in mm²)

After disinfection the specimens were stored in tightly sealed containers and kept for 24 hours before testing for standardization to simulate the time between clinical and laboratory phases. Compression resistance of the specimens were determined using a Universal Testing Machine. Each of test specimens were loaded on a Universal Testing Machine and subjected to a constant compressive force of 25N for a duration of 1 min (fig.5). The specimens were loaded until breakage or failure. The compression resistance was calculated as follows:

Compression resistance = compressive load (Newton) / cross-sectional area of the specimen (in mm²)

Compression resistance were expressed in Megapascals.

Statistical Analysis:
For analyzing the data, statistical test used was chi square test and anova followed by tukey post hoc test

Table 1: Comparison Of Compressive Resistance Of Vps Interocclusal Record Material After Disinfection At Different Time Intervals Using Chi Square Test

<table>
<thead>
<tr>
<th>GROUP</th>
<th>Mean</th>
<th>Standard deviation</th>
<th>Median</th>
<th>Mean rank</th>
<th>Chi square value</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>9.4733</td>
<td>0.64782</td>
<td>9.6400</td>
<td>5.58</td>
<td>10.182</td>
<td>0.017</td>
</tr>
</tbody>
</table>
Table 1 and Graph 1 shows the mean compressive resistance of VPS interocclusal record material after disinfection at different time intervals. The mean compressive resistance of Group A is found to be 9.47±0.64, Group B is 10.25±0.95; Group C is 10.47±0.58; Group D is found to be 11.04±0.68 and It was found to be statistically significant (0.017).

Table 2: Inter Group Comparison Of Compressive Resistance Of Vps Interocclusal Record Material After Disinfection At Different Time Intervals Using Anova And Tukey Post Hoc Test

<table>
<thead>
<tr>
<th>Group</th>
<th>Mean compression resistance</th>
<th>Standard deviation</th>
<th>Median</th>
<th>Mean rank</th>
<th>Z</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>GROUP A</td>
<td>9.4733</td>
<td>0.64782</td>
<td>9.6400</td>
<td>4.83</td>
<td>-1.604</td>
<td>0.019 (NS)</td>
</tr>
<tr>
<td>GROUP B</td>
<td>10.2500</td>
<td>0.95083</td>
<td>10.1850</td>
<td>8.17</td>
<td>0.020</td>
<td>0.002 (S)</td>
</tr>
<tr>
<td>GROUP C</td>
<td>9.4733</td>
<td>0.64782</td>
<td>9.6400</td>
<td>4.83</td>
<td>0.020</td>
<td>0.002 (S)</td>
</tr>
<tr>
<td>GROUP D</td>
<td>10.2500</td>
<td>0.95083</td>
<td>10.1850</td>
<td>8.17</td>
<td>0.020</td>
<td>0.002 (S)</td>
</tr>
</tbody>
</table>

Graph 1: Depicts The Mean Compressive Resistance Of Vps Interocclusal Record Material After Disinfection At Different Time Intervals

(Groups A-control, Group B-10 min, Group C-30 min, Group D-60 min)

Graph shows increased compressive resistance in group D when compared to other groups.

DISCUSSION

An interocclusal record is an essential factor that helps in transferring the intraoral records to an extraoral device. An accurate interocclusal record will ease the fabrication of prostheses with minimal distortion and saves clinicians chair time. Various materials are available in the market now a days for recording the interocclusal relationship, which include waxes, addition silicone, condensation silicone and poly ether. The clinicians chair side time will ease the fabrication of prosthesis with minimum distortion and saves steps in the fabrication procedure. Study done by Dua MP et al states that polysiloxane bite registration material was more accurate and dimensionally stable than Polyether Bite Registration Material.

A Study done by Breeding et al states that polyvinylsiloxane bite registration material was more accurate and dimensionally stable than material with good physical and mechanical properties. The choosen material should be rigid enough to resist the distortion that might cause from the weight of the dental casts, the components of the articulator, or other means used to stabilize the casts during the mounting procedure. Study done by Breeding et al states that pvs material have better compressive resistance than other elastomeric record material. The resistance to compressive forces is very important because restorative errors occurs due to the discrepancy between the intra-oral relationships of the teeth and the position of the teeth on the mounted working cast. The specimens in this study were fabricated with a thickness of 20mm height and 20 mm width according to ADA specification no. 19. The specimens were the disinfected in 2% Glutaraldehyde.

The American Dental Association in 1996 and Council on Dental Materials, Instruments and Equipment in 1988 issued guidelines on disinfecting impressions both by immersion and spray atomization techniques. Guidelines suggested that addition silicone impression can be disinfected by immersion without affecting accuracy and detail reproduction. Time for disinfection vary according to manufacturer, so information supplied with the disinfectant should be consulted to determine the proper time. Current ADA guidelines state that the impression should be removed to remove saliva, blood, and debris, followed by immersion in a disinfecting product, such as hypochlorite, iodophor, glutaraldehyde, or phenol. According to the Organization for Safety and Asepsis Procedures, the recommended exposure time for most surface disinfectants is 10–15 minutes. The use of disinfectants requiring time of not more than 30 minutes for disinfection is recommended according to ADA.

Glutaraldehyde / Cidex ( 2% alkaline NaHCO3 ) is a high level disinfectant. Especially active against tubercle bacilli, fungi and viruses. Less toxic than formaldehyde. The ideal disinfection time for Glutaraldehyde as per manufactures instruction is 20 min. But to follow disinfection time as per guidelines is very difficult due to hectic schedule.

So this study was done to analyse the effect of different disinfection time on compressive resistance of VPS bite registration material. After disinfection, the specimens were stored at room temperature for 24hrs to simulate the time between clinical and laboratory phases. Then the specimens were loaded onto universal testing machine for checking the compression resistance. Rubber bands are commonly used to sustain the contact of opposing casts during mounting procedures. The maximal force exerted by use of one standard rubber band (No.19) to position a maxillary cast to a mandibular cast mounted on an articulator was approximately 25 N, because of which the same value was selected to do compressive resistance on a universal testing machine.

The result shows significant difference among various group. The compressive resistance increases from Group B to Group C and from Group C to Group D when comparing with the control group ie Group A. The optimal dimensional stability of these materials is due to its polymerization reaction by addition. In this reaction there are no by-products, provided that the correct proportions are maintained. A study conducted by Carvalhal et al states that after 60 minutes the pvs material showed contraction which was due to approximation of the monomer and the polymer chains occurs during polymerization. Due to this there is a reduction of space between molecules, leading to contraction of the material. This polymerization shrinkage also depends on the amount of filler particles added to the material. PVS is hydrophobic in nature, so surfactants have added to improve the wettability of the material, but this can also increase the sorption of water when the impressions are immersed for long periods (60 minutes) in disinfectant solutions. Carvalhal et al states that the sorption of water compensated for the contraction of the material occurred during the polymerization reaction. So we can assume that, all these factors are responsible for the increased compression resistance of samples that have undergone disinfection and disinfectant by itself does not have any influence on compressive resistance of the material.

Few limitations observed in this study are:

- the thickness of the sample was 20 mm based on ADA specification, which will not be seen in clinical situation
- incorporation of air bubble during specimen fabrication

CONCLUSION

Within the limitations of this study, certain conclusions have been made.

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CONCLUSION

Within the limitations of this study, certain conclusions have been made.
• Compressive resistance of PVS interocclusal record material imprint bite is higher after disinfection in gluteraldehyde.
• The compressive resistance of PVS interocclusal record material imprint bite increases with increase in disinfection time.

LIST OF FIGURES

Figure 1: Stainless steel mould

Figure 2: Imprint Bite interocclusal record material

Figure 3: Glutaraldehyde Solution

Figure 4: Specimens in disinfectant solution

Figure 5: Testing compressive resistance in universal testing machine

REFERENCES