The Effect of Different Times of Impression Preparing on Dimensional Changes of 2 Silicone Impression Materials

Amirian Kamran¹, Khalilpour Mohammad², Javadi Khatereh³

¹,²Assistant Professor, Department of prosthodontic, College of dentistry, Babol University of medical Science, Babol, Iran
³Dental student, college of dentistry, Babol University of medical Science, Babol, Iran.

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ABSTRACT

Statement of Problem: Making an impression represent an important step in processing and fitting dental prosthesis. Therefore, Detail reproduction and linear dimensional change of the impression material is decisive for dental restoration.

Purpose of study: To evaluate the effect of different times of cast preparing on dimensional changes of 2 silicone impression materials for fixed prosthesis.

Method & materials: In this experimental study, perforated metal stock tray was used with 2 types of impression materials (addition polymerizing silicone and condensation silicone). To make impressions of a modified dent form model containing molar crown preparation, 40 impressions for each material were made, totally we prepared 80 impressions. Then by helping dial indicator instrument with accuracy 0/001mm, we measured dimensional changes of all impressions in occluso gingival and mesio-distal dimension in 0/5, 6, 12, 24 hours.

Result: shows significant difference between the dimensional stability of 2 materials at different intervals with p-value<0/05. comparatively Panasil material showed less distortion with good dimensional stability compared to Speedex at 0/5, 6, 12, 24 in mesio-distal and occluso gingival dimensions.

Conclusion The dimensional stability decrease with increase in time and is influenced by both material factor and time factor. To prepare a good fix prosthesis, the impression material should have high accuracy and dimensional stability. So, the selection of impression material has great importance and must be due to good dimensional stability and detail reproduction.

KEYWORDS: dimensional stability, time, silicone.

INTRODUCTION

Make an impression represent an important step in processing and fitting dental prosthesis. So, detail reproduction and linear dimensional change of the impression material is decisive for dental restoration. Using individual tray to get impression and use new impression material (additional silicon) can increase accuracy of impression.

An ideal impression material has these properties:
A) Biocompatible
B) Homogenous compound with different color
C) Good consistency
D) Mixing time not more than 60 seconds
E) Compatible with gypsum
F) Good setting time
G) Detail record

Several factors need to be taken into account in order to minimize deformation of the impressions, including among other:
1) Polymerization shrinkage
2) Release of byproduct
3) Incomplete recovery of deformation due to the viscoelastic behavior of this material
4) Use of the custom tray made of acrylic resin that has not completed its polymerization and therefore still undergoes polymerization shrinkage
5) Lack of adhesion of the material to the tray
6) Lack of mechanical retention of material for which the adhesive in ineffective
7) Excess material
8) Tray movement during polymerization
9) Early tray removal

The literature describes 2 different ways of evaluating the dimensional stability of the impression materials:
1) By studying the impression material itself
2) By measuring the casts prepared from an impression.

Most of the published papers in prosthodontic journal, do not evaluate the properties of the impression materials themselves, but rather, their effects on impression techniques, decontamination of the impressions, use of different adhesive, among other properties.

*Corresponding Author: Amirian Kamran, Assistant Professor, Department of prosthodontic, College of dentistry, Babol university of medical Science, Babol, Iran.
In this study we didn't standardize the storage condition, in the contrast of many other recent studies which standardized the forms of storage (3, 5, 8), because we wanted to replicate the conditions that material are exposed to in their everyday usage.

The aim of the study was to evaluate the effect of different times of cast preparing on dimensional changes of 2 silicone impression materials for fixed prosthesis.

Material & Methods

The present experimental study, we conducted in the Department of Prosthodontics, Dental College of Babol University, with the objective to evaluate the changed dimension of elastomeric silicon (Speedex and Panasil) in 0/5, 6, 12, 24 hours after impression taking.

Material and Trade:
- Speedex(putty/wash) -Colten,Swiss
- Panasil(putty(soft) /wash(x-light) -
- Kettenbach ,Germany.

Figure 1: Materials used in the study.

Impression was made from a modified dent form model containing molar crown preparation (figure 2).

Figure 2

Perforated metal stock tray was used. In order to standardize insertion path for all impressions, we gave special model to the edge of tray and used self cure acryl around dental model and they pressed to each other to get one unique form. (figure3)

Figure 3
40 impressions were made from Speedex and 40 impressions from Panasil. Then, by help of dial indicator instrument (figure 4), with the accuracy of 0.001 mm, we measured dimensional changes of 2 impression silicon at 0.5, 6, 12, 24 hours after impression taking in mesio-distal and occluso gingival dimensions.

RESULTS

Table 1 and figure 5 show (the comparison of dimensional stability of 2 impression materials at different hours using ANOVA) the mean and SD for the measurement at different time. There were also statistically significant differences for time-material interaction (Table 2).

Table 1: Mean and Standard deviations obtained for each material at each evaluation time:

<table>
<thead>
<tr>
<th>Type of silicone</th>
<th>dimension</th>
<th>30min (SD)</th>
<th>6hs (SD)</th>
<th>12hs (SD)</th>
<th>24hs (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Additional silicone</td>
<td>Occluso gingival</td>
<td>-2.50 (0.8885)</td>
<td>-2.35 (1.089)</td>
<td>-2.55 (1.395)</td>
<td>-2.90 (0.852)</td>
</tr>
<tr>
<td>Panasil</td>
<td>Meso-distal</td>
<td>-1.70 (0.733)</td>
<td>-2.20 (1.005)</td>
<td>-2.40 (0.940)</td>
<td>-3.30 (1.129)</td>
</tr>
<tr>
<td>Condensation silicone</td>
<td>Occluso gingival</td>
<td>-7.45 (11.2084)</td>
<td>-3.70 (0.657)</td>
<td>-4.38 (1.137)</td>
<td>-4.45 (2.946)</td>
</tr>
<tr>
<td>Speedex</td>
<td>Meso-distal</td>
<td>-8.45 (2.114)</td>
<td>-4.45 (0.826)</td>
<td>-5.30 (1.525)</td>
<td>-6.60 (1.353)</td>
</tr>
</tbody>
</table>

Table 2: Statistical evaluation for the time variable.

<table>
<thead>
<tr>
<th>Effect</th>
<th>Value</th>
<th>F</th>
<th>Hypothesis df</th>
<th>Error df</th>
<th>Sig</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time</td>
<td>.235</td>
<td>3.691</td>
<td>3.000</td>
<td>36.000</td>
<td>.020</td>
</tr>
<tr>
<td>Wilks' Lambda</td>
<td>.765</td>
<td>3.691</td>
<td>3.000</td>
<td>36.000</td>
<td>.020</td>
</tr>
<tr>
<td>Hotelling's Trace</td>
<td>.308</td>
<td>3.691</td>
<td>3.000</td>
<td>36.000</td>
<td>.020</td>
</tr>
<tr>
<td>Roy's Largest Root</td>
<td>.308</td>
<td>3.691</td>
<td>3.000</td>
<td>36.000</td>
<td>.020</td>
</tr>
<tr>
<td>Time * material</td>
<td>.133</td>
<td>1.837</td>
<td>3.000</td>
<td>36.000</td>
<td>.158</td>
</tr>
<tr>
<td>Wilks' Lambda</td>
<td>.867</td>
<td>1.837</td>
<td>3.000</td>
<td>36.000</td>
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<tr>
<td>Hotelling's Trace</td>
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<td>Roy's Largest Root</td>
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</table>
DISCUSSION

Dimensional stability of the impression materials used in prosthetics, presents an important factor for the accuracy of the dental devices. Dental impression is the first phase of the complicated sequel of dental device manufacture. Each phase contributes to the overall error of the future work and can lead to poor quality and dimensioned accuracy.

Elastomeric impression material may show dimension instability due to polymerization shrinkage, release of byproducts because of chemical reaction, incomplete elastic recovery or thermal changes over time (12).

Polyvinyl siloxane materials have gained wide popularity because of their excellent physical properties including dimensional accuracy & stability and elastic recovery, ease of handling, ability to pour multiple casts from a single impression and good surface reproduction, has also contributed to their wide acceptance (13, 14, 15).

Most of the published papers in Prosthodontic Journal, shows that they do not evaluate the properties of the impression material themselves.

The dimensional stability of impression silicones evaluated in this study, was measured directly on the impression materials at different time intervals, in order to avoid the variables that may effect of results.

Clancy (2) analyzed the dimensional stability of 3 materials (a polyvinylsiloxane, polydimethylsiloxane and a polyether) at 8 time intervals up to 4 weeks after the impression was taken, and concluded that the impressions of all materials that are immediately emptied have greater dimensional accuracy, and that after 4 weeks, addition silicone maintained the best surface detail and had very small dimensional changes. Polydimethylsiloxane lost detail within 24 hours, and may have clinically significant distortion at 4 hours after the impression is taken. Our study reached similar conclusion.

Valderhaug (3) evaluated a condensation silicone and a polyether, but standardized storage temperature at 21ºC, and considered short storage time intervals, not greater than 24 hours, finding no statistically significant difference between the two groups of materials, we also studied dimensional changes in 24 hours at room temperature.

Corso (16) also studied the effect of Temperature changes on the dimensional stability of polyvinyl siloxane and polyether impression materials.

He measured these changes directly on impression materials, as same as our study.

In general, the measurement can be made by contact or contactless, automatically or manually.

In the case of contact measurement, as it was with the presented study, the contact with the object of measurement is achieved by spherical probe which touches the measured object, and the changes had been shown on the indictor.

The factor that effected the result of our study, was the instrument of the measurement.

Just Stauffer (17) used dial guage, others like Wallace (18) used electronic microscope, Johnson, Craig (19), Langen walter (20), Habib (21) measured with travelling microscope.

Conclusion

The dimensional stability decrease with increase in time and is influenced by both material factor and time factor. To prepare a good fix restoration, the impression material should have high accuracy and dimensional stability. So, the selection of the impression material has great importance and must be due to good dimensional stability and detail reproduction (22), we concluded that the dimensional stability of addition silicon, did not significantly change, not even after 24 hours since the impression was made, these result agree with the previous studies of other researchers (22, 21, 23).

By contrast, condensation silicon was less stable in mesio distal and occluso gingival dimension.

Surprisingly, although dimensional stability decrease over a period of time, but both impression materials after 24 hours were still acceptably accurate.

However, by the result of this study, we can understand that precise working cast can be obtained with condensation silicon if it be poured immediately or 0/5 hours after impression taking and for Panasil, it keeps dimensional stability during 24 hours and can be poured in 24hours.

REFERENCES

1. International Organization For Standardization. Dental material Elastomeric Impression ISO 4823.1984(E)


