

Dimensional Stability of Polyether, Alginate, and Silicone Impression Materials After Disinfection With 2% Sanosil Through the Immersion Technique

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Received: May 24, 2013; Revised: June 28, 2013; Accepted: July 2, 2013

Background: To prevent diseases transmission, infection control in dental offices without reducing the accuracy and dimensional stability of impression materials is very important.

Objectives: The aim of this study was to evaluate the effects of Sanosil disinfectants on the dimensional stability of some usual impression materials.

Materials and Methods: Three types of impression material, namely, alginate, condensational silicone, and polyether, were used in this study. Impressions were obtained from the master steel model. Fifteen impressions of each material (control group) were immersed in water for ten minutes and impressions of study groups were disinfected by immersion in 2% Sanosil for ten minutes. Then impressions were poured by type III gypsum according to the manufacturer's instruction. Dimensions of casts in the two anterior dimensions, i.e. interval between the anterior abutments and interval between anterior-posterior abutments, were recorded by a digital caliper with the accuracy of 0.01 mm. Data were analyzed with SPSS through two-way ANOVA test.

Results: The results showed that there was no significant difference in the mean dimension of casts prepared by different impression materials in anterior and anterior-posterior dimensions in comparison to the original model after disinfection with Sanosil.

Conclusions: The study revealed that disinfection with 2% Sanosil has no significant effect on casts dimensions of alginate, silicone, and polyether impression and dimensional stability is maintained.

Keywords: Disinfection; Dental Impression Materials; Sanosil; Dimensional Stability

1. Background

Dimensional accuracy during making impressions is crucial to the quality of fixed prosthodontic treatment and impression technique is a critical factor affecting this accuracy (1). An accurate impression has a significant role in the success of treatment. Impression and preparing models to achieve maximum adaptation are among the main factors that affect the outcome (2). If the final cast does not reconstruct the patient's mouth, it leads to inappropriate prosthetic adaptation and mandates repeated impressions (2); hence, the number of visits and costs of treatment increase (3). The Sanosil Company (Zurich, Switzerland) has released the Sanosil disinfectant, an antiseptic agent composed of H₂O₂ and silver; the manufacturer claims that the substance is nontoxic and its efficiency decreases by only 1% after one year (4). A study on the effect of this substance concluded that when used as a spray, this material has no corrosive effect and has no remnant on instruments or devices (4).

2. Objectives

Since a few researches exist on this new material, this study was performed to evaluate the effect of Sanosil on the dimensional stability of alginate, silicone, and polyether impression materials.

3. Materials and Methods

In this experimental in vitro study, a master model was designed to contain a metal plate (5) in the form of dental arch consisting of our abutment and two slot guides with 4-mm length and 1-mm depth (Figure 1).

A metal punched stainless steel tray with two prominences was made according to the size of the slot of metal plate. The prominences were placed in slot guide of the plate. Similar to other impression trays, this tray had handles that were removed out of the mouth with a specific method. The intervals of the abutments are shown in the (Figure 1). A small contraction with 6° taper and a total of 22° to the vertical axis and the crossover grooves

were made on the occlusal surface of the abutment. This junction was prepared as a reference point to measure the abutments interval. On the middle part of each abutment, a circular groove with 0.5-mm depth was prepared to measure the diameter of abutments. Thirty impressions were made for each group (a total of 90) and each group was divided into two groups of 15 impressions according to the type of disinfection techniques, i.e. control and immersion groups (Figure 2).

Alginate impressions were prepared by chromatic alginate (Zhermack, Badia Polesine, Italy) according to the manufacturer's instruction. Mixing, working, and setting lasted approximately 45 seconds, 1.35, and 2.35 minutes at room temperature (23°C). The ratio of powder to water was 18 g (2 scoops) to 36 mL for preparing medium-size impressions. Silicone impressions were prepared with condensation silicone (Speedex, Coltene, Switzerland) according to the manufacturer's instructions for mixing putty and activator as monophasic and washing impression techniques. Polyether impressions were prepared using Impergum (3M ESPE, Seefeld/Oberbay, Germany), with the medium-bodied texture and were mixed at base to catalyst ratio of 5:1. Manufacturer's instruction for mixing time was as follows: processing time from start of mixing, 02:45; setting time from start of mixing, 06:00; and residence time from start of mixing, 03:15.

The original model was modified in order to increase the accuracy of polyether impression. Initially, a 2-mm wax was placed between the abutments and then the coping with 2-mm thickness was used on the abutments. Moreover, a spacer (vaseline) was used on the external surface of the coping for easy separation of coping from the acrylic resin.

Some changes in the special tray were made to provide maximum space of 2 mm and to increase the accuracy of polyether impression material. The holes in tray were sealed with wax and acrylic resin that were prepared and placed into the tray. Impression of master model was done by the same acrylic resin during the dough stage and before completing its setting. These led to filling additional spaces of special tray by acrylic resin; the remained space was at the size of coping and wax of abutment floor (about 2 mm) for the polyether impression. Since the suggested time is based on the oral cavity temperature and polymerization time in vitro is longer than mouth, it is recommended to double the setting time in the laboratory research, i.e. in vitro. Hence, the setting time was doubled in our study.

Then disinfection process was performed for all groups except the control group and impressions were immersed in 2% Sanosil solution for ten minutes and after washing the disinfectant, impressions were left to dry at room temperature. The impressions were purred using type III gypsum as instructed by the manufacturer (Elite Rock, Zermack, Italy); at first, pre-weighed gypsum powder was added to water and mixed (The ratio was 5 table

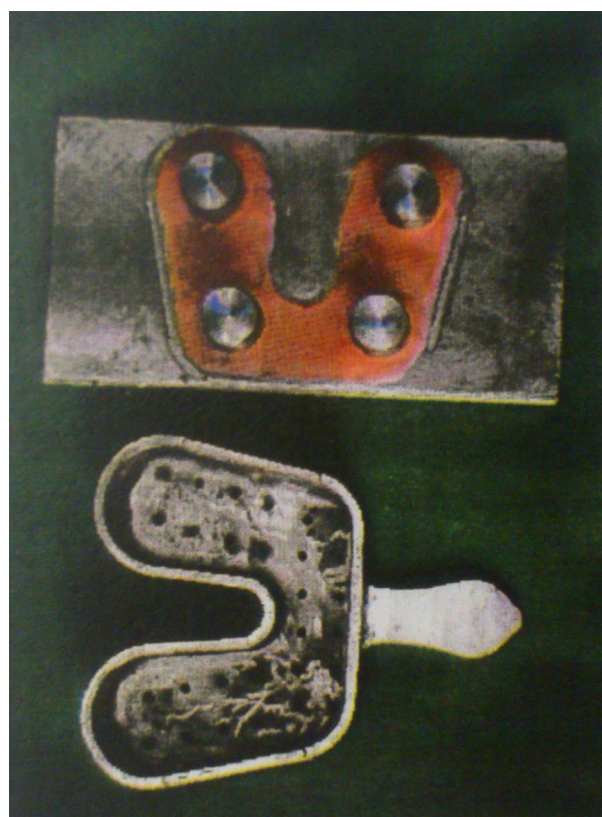


Figure 1. Master Model

spoons (20 g) of powder to 15 mL of water). After placing on vibrator, gypsum was poured into the impression and was removed after an hour and coded. After 24 hours, the dimension of each sample (without reform) was measured by the researcher with a digital caliper with an accuracy of 0.01 mm. The interval of anterior abutments and anterior-posterior abutments were measured (Figure 3). For accuracy of measurement, the laboratory models and gypsum samples were measured three times and mean value was considered as the final result. After measuring the interval between abutments, data were compared with the master model (interval between anterior abutments, 32 mm; and interval between anterior-posterior abutments, 28 mm) (Figure 4).

4. Results

The data were analyzed by two-way ANOVA and showed that in comparison to the original model, there was no significant difference in the mean dimension of casts prepared by different impression materials in anterior ($P = 0.716$) and anterior-posterior ($P = 0.652$) dimensions after disinfection with Sanosil. The mean interval between the anterior abutments in each group is shown in the Table 1. The mean measured interval between the anterior-posterior abutments of different groups is shown in Table 2, .

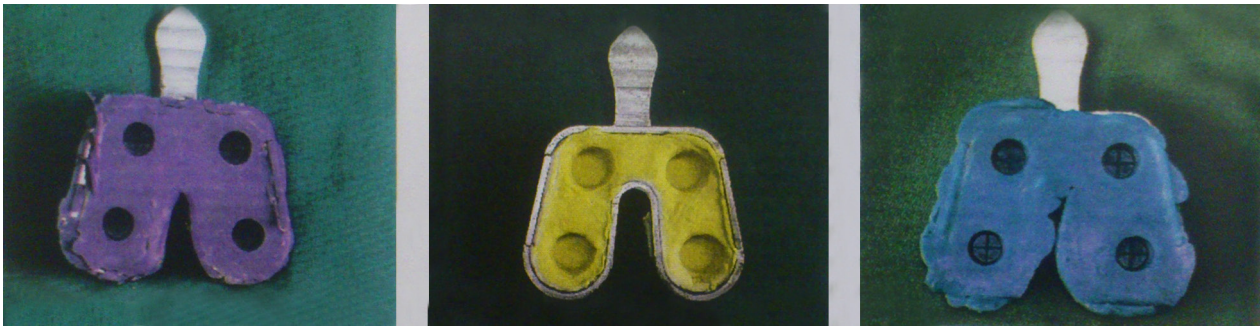


Figure 2. Polyether, Alginate, and Silicon Impressions

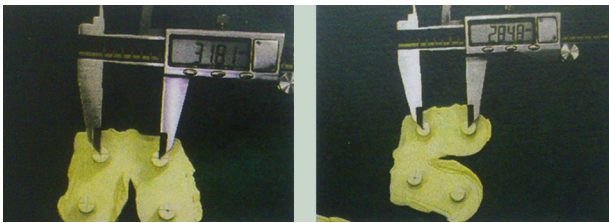


Figure 3. Measuring the Distance Between Abutments

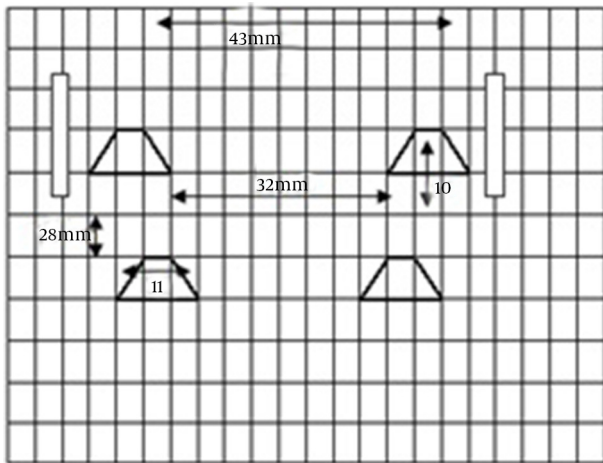


Figure 4. Distance Between Anterior Abutments

Table 1. A Comparison Between the Anterior Abutments on Central Criteria of Cast ^a

Comparison Group	Mean ± SD, mm
Alginate Control Group	31.978 ± 0.153
Alginate Disinfected Group	32.022 ± 0.114
Silicone Control Group	31.967 ± 0.292
Silicone Disinfected Group	31.920 ± 0.236
Polyether Control Group	31.900 ± 0.340
Polyether Disinfected Group	31.928 ± 0.128
Standard Model	31.958 ± 0.005

^a P Value = 0.716; and F = 0.580.

Table 2. A Comparison Between the Anterior-Posterior Abutments on Central Criteria of Cast ^a

Comparison Group	Mean ± SD, mm
Alginate Control Group	28.473 ± 0.208
Alginate Disinfected Group	28.408 ± 0.191
Silicone Control Group	28.390±0.150
Silicone Disinfected Group	28.432±0.182
Polyether Control Group	28.406±0.166
Polyether Disinfected Group	28.362±0.172
Standard Model	28.397±0.001

^a F = 0.664, P = 0.652.

5. Discussion

In this study, the immersion method was used for the disinfection of impressions. Although Sanosil might have negative effect on the dimensional stability of impressions, spray method is preferred to this method; however, more researches are needed to determine the effect of Sanosil with spray methods. The results showed that there was no significant change in anterior and anterior-posterior dimensions in the immersion of alginate, silicone, and polyether impression in 2% Sanosil for ten minutes. The Sanosil manufacturer recommended immersion time of 20 to 30 minutes; thus, lack of dimensional changes during immersion is probably due to low immersion time (6). There are very limited researches that have investigated the effect of Sanosil on the dimensional stability of impression. Lavaf et al. evaluated the effect of 2% deconex and 10.2% Microon the dimensional stability of alginate impression in immersion method and found significant changes in comparison to the master model (P < 0.05) (7). According to the result of a study by Craig and Wataha, immersion in 0.1% sodium hypochlorite and 2% glutaraldehyde caused significant dimensional changes and distortion in alginate impression (8).

By comparing present study with these two studies, it seems that Sanosil is more effective in dimensional stability of impressions than other disinfectants; however it is better to evaluate other Sanosil concentrations in that

regard. The present study examined only Sanosil with 2% concentration. The findings of this study were consistent with the study of Bergman et al. (9), Rueggeberg et al. (10), and Dandakery et al. (11); however, all of them had used spray method and therefore, there are differences between the present study and theirs.

According to the findings of this study, disinfecting with 2% Sanosil by immersion time of ten minutes has no significant effect on the dimensional stability of dental impressions in anterior and anterior-posterior dimension of impression.

Acknowledgements

We would like to thank the Vice-chancellor of Research and Technology, Hamadan University of Medical Sciences, who approved this study.

Funding/Support

This study was funded by Hamadan University of Medical Sciences.

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