Antibacterial Effect of Sanosil 2% and 6% and Sodium Hypochlorite 0.5% on Impressions of Irreversible Hydrocolloid (Alginate) and Condensational Silicone (Speedex)

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1. Background

Dentistry profession can play an important role in cross-contamination. Pathogens like tuberculosis, herpes, and different hepatitits viruses can easily enter the impression materials from patients’ blood and saliva and are finally crossed to cast and technician leading to infection especially in case of host weak immune system (1). Study of Powell and coworkers showed that 67 percent of impressions sent to dental laboratories were contaminated with bacteria such as Enterobacter cloacae, Escherichia Coli and Klebsiella oxytoca (2). Rice and coworkers detected microorganisms such as gram-negative cocci and gram-negative bacilli in 25 percent of studied Alginate specimens (3). Another study of this researcher showed bacterial contamination of different Alginate commercial brands containing antibacterial agents (4). Study of Sofou and coworkers showed that 12 percent of impressions obtained from patients infected with tuberculosis carry Mycobacterium tuberculosis. In the same way it was observed that 77 of 107 Alginate impressions send to laboratory in plastic bag showed positive findings in bacterial culture (5). Infected impressions transferred microorganisms to the casts. By cast and die trimming microbes disseminate in laboratory environment (6). Therefore, impressions, casts, wax rims, inter occlusal records and the equipment with direct or indirect contact with the patient’s mouth and its secretions should be disinfected before sending to laboratory (7). Cleaning dental impressions is performed by using different materials including compounds containing hypochlorite, glutaraldehyde and chlorhexidine. Effects of different concentrations of sodium hypochlorite on impression materials were examined in different studies (1, 8). The Center of Disease Control and the American Council of Dentistry stated that all dental
Impressions should be disinfected before pouring cast and sending them to laboratory by immersing them in 5 percent hypochlorite solution for 10 minutes.

American Dental Association (ADA) recommends the use of sodium hypochlorite for disinfection of dental impressions, but it has some problems; for instance, it is volatile and its effectiveness decreases by 30 percent monthly. Moreover, sodium hypochlorite is a poisonous material and has destructive effects over living things (6). Recently, the SanoSIL Company has introduced and supplied a non-poisonous material under the name of SanoSIL, which has a wide range of antibacterial effects. It is a combination of H₂O₂ and Ag ions with a wide range of effect on different microorganisms. There are few studies about its antiseptic effects especially on dental impressions. In addition, the information is very limited due to its particular concentrations in dentistry. If SanoSIL antibacterial effect is confirmed, its usage is recommended in dentists’ office and dental laboratories for a proper technique of disinfection.

2. Objectives

The present study was performed to investigate the antibacterial effect of 6% and 2% concentrations of SanoSIL and 0.5% hypochlorite on condensational Silicone (Speedex) and Alginate impressions.

3. Materials and Methods

In this experimental study, some staff of Hamadan Dentistry College were chosen and details of the investigation were declared to them. After obtaining their agreement, nine staff entered the study. Impressions were made of mandible between 10 AM and 12 PM. Volunteers should have had their breakfast but not lunch. They were instructed not to have any nonvegetarian food or anything sweet in their diet two days prior to making impressions. Four impressions were taken from each participant by using Alginate and four impressions with condensation Silicone. In each turn, impression was made by a separated sterile tray.

Four Alginate impressions were separately placed for ten minutes in following solutions:
1) Sterile distilled water (control)
2) 0.5% sodium hypochlorite
3) 2% SanoSIL
4) 6% SanoSIL

In the same way, four condensational Silicone impressions were taken from each person and put in the same solutions for ten minutes. Then the impressions were taken out of the solutions and separately sent inside sterile containers to microbiology laboratory of Department of Microbiology, School of Medicine of Hamadan University of Medical Sciences. Impressions were washed under laboratory ventilation system with distilled water for 15 seconds and put in sterile containers, and then sterile TSB medium was added to the impressions. Containers containing impression and medium were kept in incubator at 35°C for 24 hours. Then, 0.01 milliliter of each specimen was removed from the medium and incubated on blood agar; the obtained media were put in incubator for 24 hours (9). Then microbial growth was evaluated from colony characteristics in blood agar plates (BAP) and confirmed by biochemical tests, also specific tests were performed for isolated microorganisms. Colony forming units (CFU) were counted and the results documented. BAP contains mammalian blood (usually sheep or horse), typically at a concentration of 5-10%. BAP is enriched to differentiate fastidious organisms and detect hemolytic activity. Colonies on each plate were counted after 24 hours of incubation at 35°C.

4. Results

Table 1 presented some information about bacteria grown in each of the alginate impressions and silicone after immersion in water and disinfectant solutions. The highest inhibition rate of bacterial growth was observed for sodium hypochlorite 0.5% (88.9%). Inhibition rates of bacterial growth ranked in a decreasing order as SanoSIL 6% (83.3%), SanoSIL 2% (61.1%) and distilled water (zero percent). Chi-square test showed significant differences between the groups (P = 0.001). Inhibition rates of bacterial growth in the alginate and silicone impressions after disinfection were 75% and 41.7%, respectively. There was a significant difference between the two groups by using Chi-square test (P = 0.004).

Bacterial contamination after immersing in solutions was presented in Table 2. Alginate impressions of all specimens were kept in distilled water and evaluated for bacterial development. In none of the impressions disinfected with 0.5% sodium hypochlorite, 2% SanoSIL or 6% SanoSIL bacterial growth was observed. Bacterial growth was observed in all samples of Silicone impressions were stored in distilled water. In two of nine samples disinfected with sodium hypochlorite 0.5%, bacterial growth was observed (22.2%). In seven of nine samples disinfected with SanoSIL 2%, bacterial growth was observed (77.8%). In three cases of nine samples disinfected with SanoSIL 6%, bacterial growth was observed (33.3%).

4.1. Different Isolated Microorganisms

Diphtheroids formed small white colonies and sometimes β type of hemolysis. Gram staining showed Gram-positive bacilli arranged at angles. Alpha hemolytic Streptococcus species cause iron oxidation in hemoglobin molecules within red blood cells, giving it a greenish color or on blood agar. Streptococcus pneumonia bacteria were seen as pinpoint with α hemolysis pattern and gram-positive flame shaped cocci in pair or in short chains. Lactobacillus is a genus of Gram-positive facultative anaerobic or microaerophilic rod-shaped bacterium. Staphylococcus epidermidis is Gram-positive and circular and forms pinhead colonies, which are convex with entire margins. The data was analyzed using SPSS 15 for Windows (SPSS Inc., Chicago, Illinois) and Fisher exact test.
In the present study, impressions and impression equipment is necessary to prevent pathogen transmission (11). In the present study, obtained results from 0.5% sodium hypochlorite and polyether impressions even after long-term bacterial contamination. Therefore, prevailing hygienic methods are usually normal flora of the mouth and non-pathogenic in individuals without any immune system disorder in this study. This approves the results of Sofou et al. study, which showed that transferability of infection is so little in dental staff by Alginate, polyvinyl siloxane and polyether impressions even after long-term bacterial contamination. Therefore, prevailing hygienic methods instead of using disincentive materials is recommended (11). In the present study, obtained results from 0.5% sodium hypochlorite solution were very desirable, in such a way that bacterial growth was not observed in none of the Alginate specimens. Although, it is recommended to immerse Alginate impressions in 0.1-1 sodium hypochlorite solution for 15 to 20 minutes (11). However, according to the instructions given by the manufacturer, 20 to 40 minutes is recommended for Sanoil 6%. The probable reason is that in some of the silicone impressions, bacterial development was observed in a shorter time as observed in this study. Grown bacteria in culture time as observed in this study. Grown bacteria in culture is so little in dental staff by Alginate, polyvinyl siloxane and polyether impressions even after long-term bacterial contamination. Therefore, prevailing hygienic methods instead of using disincentive materials is recommended (11). In the present study, obtained results from 0.5% sodium hypochlorite solution were very desirable, in such a way that bacterial growth was not observed in any of the Alginate specimens. According to Samaranayake and Jennings report, disinfection of irreversible hydrocolloid impressions is so little in dental staff by Alginate, polyvinyl siloxane and polyether impressions even after long-term bacterial contamination. Therefore, prevailing hygienic methods instead of using disincentive materials is recommended (11). In the present study, obtained results from 0.5% sodium hypochlorite solution were very desirable, in such a way that bacterial growth was not observed in any of the Alginate specimens. According to Samaranayake and Jennings report, disinfection of irreversible hydrocolloid impressions by sodium Hypochlorite decreased pseudomonas aeruginosa and Candida albicans colonies and total removal of streptococcus sobrinus (12). Besides, Memarian

### Table 2. The Frequency Distribution of Three Bacterial Contaminations After Disinfection in Alginate and Silicone Impressions

<table>
<thead>
<tr>
<th>Disinfection Solution</th>
<th>Bacterial Contamination, No. (%) (n = 9)</th>
<th>P value a</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Alginate</strong></td>
<td></td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Distilled water</td>
<td>0 (0)</td>
<td></td>
</tr>
<tr>
<td>0.5% Sodium hypochlorite</td>
<td>9 (100)</td>
<td></td>
</tr>
<tr>
<td>2% Sanoil</td>
<td>9 (100)</td>
<td></td>
</tr>
<tr>
<td>6% Sanoil</td>
<td>9 (100)</td>
<td></td>
</tr>
<tr>
<td><strong>Silicone</strong></td>
<td></td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Distilled water</td>
<td>0 (0)</td>
<td></td>
</tr>
<tr>
<td>0.5% Sodium hypochlorite</td>
<td>7 (77.8)</td>
<td></td>
</tr>
<tr>
<td>2% Sanoil</td>
<td>2 (22.2)</td>
<td></td>
</tr>
<tr>
<td>6% Sanoil</td>
<td>6 (66.7)</td>
<td></td>
</tr>
</tbody>
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a Fisher Exact Test
and coworkers found that antibacterial effect of sodium hypochlorite on irreversible hydrocolloid impression materials was desirable and in accordance with the ADA recommendations (1).

We found that total effectiveness of 0.5% sodium hypochlorite was higher than Sanosil 6% and 2%. This is similar to the results of Ghahramanloo, which showed a superior antibacterial effect of 0.525% sodium hypochlorite spray over Sanosil solution (13). According to one report, Sanosil was more effective to disinfect environment surface including dental seat and office cabinets (14). Effectiveness of this material in removal of water contamination in dental units is also shown (15). Sanosil has been reported to be effective on Alginate materials (13). In the present study, Sanosil in Alginate impressions led to completed infection. Nevertheless, bacterial disinfection was not complete in case of condensation silicone impressions. In the present study, similar solutions and immersion duration for two kinds of impressions were used for disinfection, but microbial removal for Alginate impression was more desirable than condensation silicone impressions. These results can be due to antibacterial compounds present in each of them. Alginate contains fluoride, which is an antimicrobial factor (16). Fluoride prevents transformation of glucose inside bacteria and has destructive effects on energy production mechanisms, glucose synthesis and metalloenzymes (17). Alginates also contain magnesium oxide, which has disincentive properties (18). Study of Koper and coworkers showed that magnesium oxide could kill 90% of Bacillus globigii, Bacillus cereus and Escherichia in a few minutes (19). In addition, antifungal and anticyeast effects of magnesium oxide over Saccharomyces, Candida albicans, Rhizopusstolonifer and Aspergillus is reported (20).

Controlling infection in offices and dental laboratories is necessary. Most effective disinfecting agents ranked in a decreasing order as 0.5% sodium hypochlorite, Sanosil 6%and 2%. Sodium hypochlorite 5%, Sanosil 2% and 6% were more effective on Alginate impression and similar to each other. In such a way that bacterial growth was not observed on Alginate impressions in none of the three groups. On condensational Silicone impressions, none of the solutions under examination showed complete effectiveness. Despite the fact, the most effective solution was sodium hypochlorite 0.5% and then Sanosil 6% and 2%.

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References
