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EVALUATION OF SURFACE ACCURACY AND DIMENSIONAL STABILITY OF TWO SILICONE BASED IMPRESSION MATERIALS SUBJECTED TO CHEMICAL DISINFECTION BY THREE DIFFERENT IMMERSION DISINFECTANTS: AN IN VITRO STUDY

Mushtaq Mohammad Bhat*[1], Anum Maqbool[2], Malik Sartaj[3], Waseem ul Ayoub[4]

[1]Post Graduate scholar, Department of Conservative Dentistry and Endodontics.

[2]Post Graduate scholar, Department of Conservative Dentistry and Endodontics.

[3]Senior Resident, Department of Conservative Dentistry and Endodontics.

[4]Senior Resident, Department of Prosthodontics and Crown and Bridge.

ABSTRACT

Aim:The aim of present was to study the surface changes and dimensional stability of two silicone based impression materials viz; addition silicone and polyether impression materials subjected to chemical disinfection by three different immersion disinfectants viz; 0.525% sodium hypochlorite, 0.3% benzalkonium chloride and 2% Glutaraldehyde at different time intervals.

Materials and methodology: 40 samples of 2x2cm were prepared from Aquasil Ultra (Group 1) and Impregum Garant (Group 2) impression materials by placing it between two microscopic slides to an even surface. Ten samples of each group were subjected to disinfection by 0.525% sodium hypochlorite immersion disinfection (Group 1A and 2A) 0.3% benzalkonium chloride immersion disinfection (Group 1B and 2B) and 2% Glutaraldehyde(Group 1C and 2C). Ten samples from each impression material served as controls (Group 1D and 2D) in which samples were rinsed under tap water for 10 seconds. The surface texture was measured by surface profilometer and dimensional accuracy by digital vernier calliper.

Results: Statistical analysis of computed data was carried by ANOVA and Chi square test. Results of the present study indicate that siloxane impression materials were quite smooth and dimensionally accurate than the polyether impression materials. All the disfectants tested lead to change in surface topography and dimensional changes in both impression materials but the changes are statistically insignificant.

Conclusion: The results demonstrated that the addition silicone and polyether impressions could be disinfected by immersion disinfectants without change in their surface topography and dimensional accuracy.

Keywords: benzalkonium chloride, Glutaraldehyde

Introduction:

Impression materials that are currently popular include hydrocolloids, silicones, polyethers, and polysulfides. These impression materials may be contaminated with blood or saliva from patient's mouth and may act as a potential source for cross contamination between different health care delivery personals. Simply rinsing the impressions under running water does not clear them of micro-organisms.[1,2] With elastomeric impression materials such as polyvinyl siloxane, polyether, and polysulfide, the dimensional accuracy is usually time dependent, with greater dimensional accuracy occurring immediately after polymerization is complete but declining as the impression is stored for extended periods of time. So the handling and disinfection time becomes critical for the dimensional stability of these

*Corresponding author: Mushtaq Mohammad Bhat |

materials.[3,4] Manufacturers usually do not recommend any certain disinfectant or disinfection protocol for impressions in order to control cross-contamination. This has led to many studies investigating different types of disinfectants and application methods on impression materials. Practitioners should take this into consideration when selecting impression materials given the time available to the practitioner to pour casts during office hours. Since conventional sterilization methods, such as dry heat sterilization, cannot be used for eliminating potential pathogen microorganisms that are present on the dental impression surface, many immersion disinfection solutions contain sodium hypochlorite (0.525%), quaternary ammonium compounds, glutaraldehyde, phenols and iodophors, ultraviolet rays, ozone and microwave in various concentrations and immersion times have been recommended.[5-8]A recommended protocol for handling of impression is to place in glutaraldehyde for 1 hour, rinse in sterile water, and soaks in a fresh solution of glutaraldehyde for at least 10 hours, which is too long for the dimensional stability of impressions.[9]Little information could be traced considering the stability of hydrophilic silicones upon prolonged immersion disinfection.[10]The aim of present was to study the surface changes and dimensional stability of silicone based impression materials subjected to chemical disinfection by three different immersion disinfection methods.

Materials and methodology

Two impression materials vinyl polysiloxane i.e. (Aquasil Ultra) and polyether i.e. Impregum Garant were used in the study. Impression materials were dispensed and mixed according to manufacturer recommendations. After manipulation 40 samples were prepared from Aquasil Ultra material by placing it between two microscopic slides to an even surface and were marked as Group 1.Similarly after manipulation another 40 samples were prepared from Impregum Garant by placing it between two microscopic slides to an even surface and were marked as Group 2. After setting samples were cut into uniform dimensions of 2x2 cm which were measured by digital vernier calliper. Ten samples from each Group 1 and Group 2 were subjected to disinfection by 0.525% sodium hypochlorite immersion disinfection (Group 1A and 2A) ,0.3% benzalkonium chloride immersion disinfection (Group 1B and 2B) and 2% Glutaraldehyde (Group 1C and 2C). Ten samples from each impression material served as controls (Group 1D and 2D) in which samples were rinsed under tap water for 10 seconds. Immersion time for each disinfectant was standardised to 2min with complete immersion of each sample. Following disinfection, the impressions were rinsed with deionized water and air dried. The surface texture was measured by surface profilometer and categorized as (1) smooth (2) mottled, or (3) matte/sticky. Dimensional stability (accuracy over time) was evaluated by measuring impression dimensional accuracy after 4 hr,24-hr, 3 days and 1-week period. Digital vernier calliper was used to calculate the percentage dimensional changes in impression samples after disinfection. Statistical analysis of computed data was carried by ANOVA and Chi square test.

Results

Mean Surface roughness of each group was calculated after different Time intervals of 4hr, 24hr, 3days and 1 week and results were tabulated in able 1.Comparison between different groups show that Group 1 show smooth surfaces in each disinfectant group compares to Group 2.Intra group comparison between different disinfectant groups does not show any statistically significant difference in surface roughness. Mean of the Vernier calliper measurements for each group was calculated as shown in table 2. All impression contracted in size compared to the initial measurements of samples. Dimensional changes were statistically significant between siloxane i.e. Group 1 and polyether i.e. Group 2.Intragroup comparison of linear measurements for both groups doesn't show any statistically significant difference.

Table1: Showing Mean Surface roughness after different Time intervals

Groups	Mean Surface roughness after different Time intervals			
	4 hr	24 hr	3 days	1 week
Group 1A	2.134	3.123	3.142	4.132
Group 2A	4.117	4.134	4.353	4.132
Group 1B	1.127	1.230	1.323	1.101
Group 2B	5.321	6.234	6.342	6.143
Group 1C	0.132	1.231	1.321	0.132
Group 2C	6.143	6.143	7.123	7.326
Group 1D	0.231	1.332	1.224	1.954
Group 2D	3.231	5.123	6.232	6.254

Table 2: Showing Mean Dimensional change after different Time intervals

Groups	Mean Dimensional change at different Time intervals			
	4 hr	24 hr	3 days	1 week
Group 1A	2.0x1.90	2.0x1.90	2.0x1.90	1.90x1.90
Group 2A	1.60x1.70	1.50x1.60	1.50x1.60	1.40x1.40
Group 1B	2.0x2.0	2.0x2.0	1.90x2.0	1.90x2.0
Group 2B	1.40x1.90	1.30x1.70	1.30x1.60	1.20x1.60
Group 1C	1.90x1.90	1.90x1.90	1.90x1.80	1.90x1.80
Group 2C	1.20x1.30	1.10x1.20	1.10x1.20	1.10x1.20
Group 1D	1.80x2.0	1.80x1.90	1.80x1.90	1.70x1.90
Group 2D	1.40x1.60	1.30x1.60	1.40x1.50	1.40x1.60

Discussion

Elastomeric impression materials undergo contraction upon polymerization. Compared to other impression materials, addition silicone and polyether impression materials undergo small dimensional changes of -0.15% and -0.20%, respectively, with half of the 24 hour contraction occurring within the first hour after setting.[11]During handling and pouring impressions can act as a potential source of cross contamination and thus need to be disinfected. The effect of disinfectant agents on the dimensional stability of an impression is a critical factor. Thus it becomes important to check the effectiveness of the disinfectant used against the possible negative side effects on these impression materials. In the current investigation, we evaluated and compared the surface roughness and dimensional stability of these two commonly used impression materials after disinfection by three commonly used disinfectant solutions in dental practice. For comparative purposes smoothness and dimensional changes were also assessed when the impressions did not undergo any disinfection (control samples).Results of the present study indicate that siloxane impression materials were quite smooth and dimensionally accurate than the polyether impression materials. All the disfectants tested lead to change in surface topography and dimensional changes in both impression materials but the changes are statistically insignificant. The results demonstrated that the addition silicone and polyether impressions could be disinfected by immersion with any of these three disinfectants viz; 0.525% sodium hypochlorite, 0.3% benzalkonium chloride and 2% Glutaraldehyde without a loss of accuracy or surface detail. These results are in concordance with the results of study by Langenwalter et al and Tullner et al who has not observed any negative effect after immersing different

impression materials in iodophor, 0.525% sodium hypochlorite and neutral 2% glutaraldehyde.[12,13] But results of a study by Lepe and Johnson show that overnight disinfection of the polyether or the addition silicone impression materials for 18 hours in a full strength 2% acid glutaraldehyde solution have adverse effect on their dimensional stability, which is opposite to the results of our study.[14]

Conclusion

Among the siloxane and polyether materials, siloxane exhibits better surface and dimensional stability. These impression materials can be safely immersed in commonly used disinfectants and left for longer periods without change in their surface topography and dimensional accuracy.

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