

Antimicrobial Efficacy of Immersion 0.5% Sodium Hypochlorite And 2% Glutaraldehyde Disinfectants on Alginate Impressions

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Abstract: *Dental impressions often carry microorganisms that may cause cross infection from patients to dental staff. The control of cross infection is an imperative issue when dealing with dental impression materials in Dentistry and the lack of procedures for its control is currently a real problem. The aim of this study was to evaluate the antimicrobial effectiveness of 0.5% sodium hypochlorite and 2% glutaraldehyde immersion of alginate. Thirty edentulous patients were selected for the present study. Maxillary ridge impressions were taken out in 30 patients with alginate and was randomly divided into two groups containing 15 impressions each group, each impression was swabbed and incubated on nutrient agar culture media. This constituted the control group. Group A impressions were immersed in 0.5% sodium hypochlorite and group B impressions were immersed in 2% glutaraldehyde. All impressions received the similar disinfectant treatment. After 10 minutes the impressions were reswabbed and incubated for 24 hours and microbial colony count was carried out. It was observed that 2% glutaraldehyde is more efficient in reducing the number of bacterial colony count compared to 0.5% sodium hypochlorite. 2% glutaraldehyde eliminated 46.74% of bacteria colony count while 0.5% sodium hypochlorite eliminated 43.33% of bacteria colony count. Dental impression materials can act as vectors transmitting a significant amount of microorganisms. It was concluded that 0.5% sodium hypochlorite and 2% glutaraldehyde was statistically equally effective in reducing the number of bacterial colony count. 2% glutaraldehyde was found to be marginally more effective than 0.5% sodium hypochlorite on alginate impressions.*

Keywords: *Alginate impression, Disinfection, Sodium hypochlorite, Glutaraldehyde*

I. Introduction

There are many types of microorganisms in the human oral cavity, such as bacteria, viruses, fungi and others. In the field of dentistry, it is very prone to cause cross contamination infections. Therefore dental care providers as well as dental assistants, staff and laboratory technicians are possible targets of contamination. Many infectious disease can be transmitted during dental treatment, including tuberculosis, syphilis, hepatitis A, B, C and acquired immunodeficiency syndrome (AIDS). According to various studies, dental impressions are one of the main source of cross infection between dentists, nurses, patients and laboratory personnel. Dental impressions consist of taking into the mouth and is able to register the anatomical relief of the area desired that is dimensionally stable. The impression then displays the anatomy of the impressed area. During this procedure, the material has contact with saliva and blood, which are sources of contamination, and carries a great number of microorganisms of the flora upon removal from the mouth.

New researches have shown that 64% of materials sent to dental laboratories are infected by various types of harmful microorganisms on them. In dentistry there are several types of impression materials that have as main features such as accuracy, elastic recovery, dimensional stability, flow, flexibility, workability, hydrophilicity, a long shelf-life, patient comfort and economics. Of all materials used for impressions, hydrocolloids and elastomers are the most important in this field. The hydrocolloids are subdivided into reversible and irreversible. Alginate is an example of irreversible hydrocolloid and is the most commonly used material in dentistry since it is easy to manipulate, does not imply specialized equipment and is low-priced. As irreversible hydrocolloids are composed of 80% water they are subject to the phenomena of imbibition (absorption of water) and syneresis (evaporation of water).

The International Dental Federation (IDF) insists on disinfecting all impressions taken from patients before sending them to laboratories. Also the American Dental Association (ADA) has advised all dental stuffs to disinfect patient's impression trays. The most common chemical disinfectants which are used by dentist, are hypochlorites, biguanides, aldehydes, alcohols, phenols and chlorhexidine. Among these 0.5% sodium hypochlorite and 2% glutaraldehyde have been considered effective, a good surface disinfectant, non-irritating and efficient against wide-spectrum microorganisms. Both sodium hypochlorite and glutaraldehyde act in the

fixation of the cell membrane, blocking the release of cellular components and consequently killing the microorganisms.

There are two disinfectant techniques for impression material, immersion and spraying. Disinfection by immersion allows the solution to contact with all surfaces of the impression. Spraying has a lower probability of distortion than the other technique but it may not reach all surfaces. Yet, the antimicrobial activity of both techniques is considered similar. The objective of this study was to evaluate the antimicrobial efficacy of 0.5% sodium hypochlorite and 2% glutaraldehyde disinfecting solutions in removing microorganisms from the surface of alginate impression material.

II. Methods

Each of the patient was evaluated by a medical and dental history. Treatment plan and study procedure were explained to the patient. After confirmation of their full cooperation, 30 subjects of them were finally selected. Study procedure consisted of prosthodontic laboratory procedure and microbiological laboratory procedure. The impressions were made with alginate (Aroma Line Plus Normal Set, Tokyo-Japan) which was manipulated according to the manufacturer's instructions. The disinfectants used in this study were 0.5% sodium hypochlorite and 2% glutaraldehyde. Suitable impression trays were used for the impression, total of 30 impressions of maxillary ridges were taken out in 30 patients which were randomly divided into two groups of each containing 15 impressions.

After removal from the mouth the impression was washed with running tap water for 15 seconds to remove excess saliva. Prior to disinfectant, the impression that was used for the study constituted the control group and the same was used as test group after disinfection. For this purpose, each of the impressions was numbered on the back of it.

Pre disinfectant microbial colony count.

For this purpose the surface of each of the impression was swabbed with sterile needle wire and was applied into nutrient broths. Nutrient broths were vortexed for 30 seconds and then 10 µl from each suspension was inoculated onto nutrient agar media using a micropipette and incubated for 24 hours at 37°C. After 24 hours, the microbial colony count was then carried out using a colony counter.

Disinfectant procedure.

Group A and Group B impressions were reused in disinfection procedures. Group A included 15 impressions immersed in a beaker containing 0.5% sodium hypochlorite disinfectant for 10 minutes. Group B included 15 impressions immersed in a beaker containing 2% glutaraldehyde disinfectant for 10 minutes.

Post disinfectant microbial colony count.

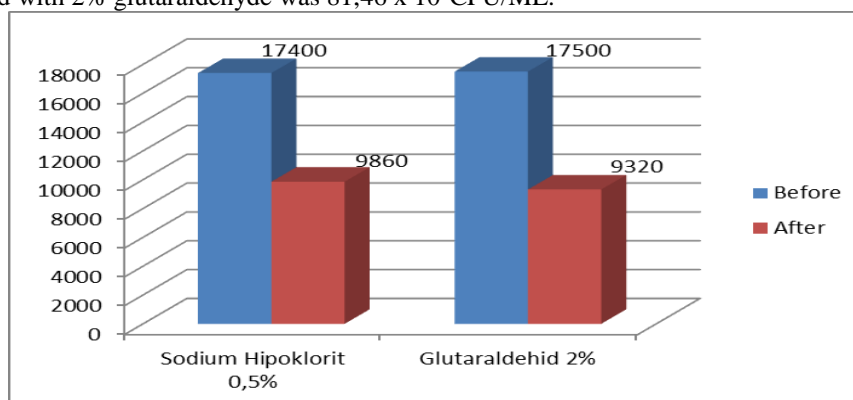
After a period of 10 minutes, each of the impressions was removed from the beaker and again swabbed with sterile needle wire and was applied onto nutrient broths. Nutrient broths were vortexed for 30 seconds and then 10 µl from each suspensions was inoculated onto nutrient agar media using a micropipette and incubated for 24 hours at 37°C. After 24 hours, the microbial colony count was then carried out using a colony counter. All 30 impressions were treated in similar manner. The results were recorded, analyzed and compared with the control and were subjected to statistical analysis.

Groups	n	Difference in total bacteria count (CFU/ml)	p
		$\bar{x} \pm SD$	
0,5% Sodium Hypochlorite	15	$75,46 \times 10^2 \pm 1,50 \times 10^2$	0,342
2% Glutaraldehyde	15	$81,46 \times 10^2 \pm 23,99 \times 10^2$	

III. Results

According to table above, the disinfection action of the two mentioned disinfectants showed no significant difference between groups after 10 minutes immersion (P value >0.05) but it was proven that 2% glutaraldehyde is more effective is reducing the number of total bacteria count CFU/ML. The difference in

reduction of total bacteria count CFU/ML (Colony Forming Unit) with 0.5 % sodium hypochlorite was 75,46 x 10²CFU/ML and with 2% glutaraldehyde was 81,46 x 10²CFU/ML.



It was also proven graphically that 2% glutaraldehyde is more efficient in reducing the number of bacterial colony count compared to 0.5% sodium hypochlorite. From the graph above, it was observed that 2% glutaraldehyde eliminated 46.74% of bacteria colony count while 0.5% sodium hypochlorite only eliminated 43.33% of bacteria colony count.

IV. Discussion

Minimizing the risk of disease transmission in the dental workplace has today become a high priority for the dental profession. Dentist are responsible for prevention of cross infection in dental clinic, including proper impression disinfection before sending to dental laboratory. Studies have documented the presence of bacteria on the impression and dental prosthesis sent to laboratory. Hence, dental impressions should always be disinfected to prevent infection. These disinfectants can be used either in the form of immersion or as spray disinfectant. Spray disinfectant though effective, they are not as satisfactory as immersion, considering their adverse effect where it is not capable of disinfecting all surfaces effectively and also cannot cover all undercuts. Considering this, immersion disinfectants were selected to study their antimicrobial effect. Among the two impression materials used for edentulous impression it has been reported that alginate impression material has an intrinsic retentive potential for microbes and is therefore potentially more difficult to disinfect. It has been reported by Samaranayake et al that alginate impression carry three to four times more organisms than impression compound. This is yet another reason for including alginate impression in this study.

The data collected was based on the colony forming units in the culture media. They were counted with colony counter and the counts were expressed under the standard method of recording microbial colony count (CFU count). This study was designed to evaluate the antimicrobial efficacy of 0.5% sodium hypochlorite and 2% glutaraldehyde disinfecting solution in removing microorganisms from the surface of alginate impression material. Immersion disinfection of impressions were performed with a 10 minutes application time. Total of 30 impressions were collected (01 from each subject). Impressions were divided into two groups, each consisted of 15 impressions. The mean bacterial colony count for group A was $75.46 \times 10^2 \pm 1.50 \times 10^2$ CFU/ML and for group B was $81.46 \times 10^2 \pm 23.99 \times 10^2$ CFU/ML. The mean bacterial count difference between groups was statistically not significant ($p > 0,05$).

In westerholm study, it was showed that sodium hypochlorite can absolutely 99.99% prevent the growth of staphylococcus aureus. In another study by Ghahramanloo and colleagues (2009), spraying 0.525% sodium hypochlorite could desinfect samples effectively (96.6%) in 10 minutes. Bustos et al (2010) used 2% glutaraldehyde solution with 5 minutes application time to disinfect alginate impression which reduced microbial count to mean cfu = $0.02 \times 10^3 \pm 0.04 \times 10^3$ from the untreated control groups count mean cfu = $0.71 \times 10^3 \pm 1.05 \times 10^3$. Egusa et al (2008) described a 42.8% reduction of microbial colony count on alginate impressions surface when they were treated with 2% glutaraldehyde solution for 10 minutes where as only 15.8% colony count reduction achieved when rinsed with tap water. The antimicrobial efficiency of 2% glutaraldehyde solution is also supported by this present study. Himanshu Aeran et al (2010) concluded that the antimicrobial activity of spray disinfectant with 2% glutaraldehyde and 0.5% sodium hypochlorite was statistically to be equally effective both against gram positive and gram negative organisms. Look et al (1990) concluded that sodium hypochlorite and glutaraldehyde were better than iodophors. Efficacy of sodium hypochlorite was almost similar to glutaraldehyde. The results are similar to a study conducted by Jennings et al (1991) concluded that glutaraldehyde and sodium hypochlorite exhibited comparable microbiocidal activity.

The data of this study showed that 0.5% sodium hypochlorite eliminated 43.33% of bacteria on alginate impression and 2% glutaraldehyde eliminated 46.74% of bacteria on alginate impression. Since so many dentist

are concerned about viruses such as HIV and HBV, further studies should be conducted to find an effective method to eradicate these kinds of pathogens.

V. Conclusion

According to the results of the present study, it can be concluded that both disinfectant agents effectively disinfected alginate impressions. The antimicrobial activity of immersed disinfectants of 0.5% sodium hypochlorite and 2% glutaraldehyde was found to be equally effective. 2% glutaraldehyde was marginally more effective than 0.5% sodium hypochlorite on alginate impression. Hence, routine disinfection of impressions using either one of the disinfectants is preferred to prevent cross infection in dental practice.

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