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Effect of the Different Disinfectants on the Microbial Contamination of Alginate Impression Materials

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Abstract

Objectives: This study aimed to evaluate the efficacy of different solutions used to disinfect Alginate impression material.

Materials and Method: Twenty Alginate impressions for the maxillary arch of five patients recently completed their treatment (four impressions for each patients) were taken swabbed before and after disinfecting them with Chlorhexidine, Desident CaviCide and Alcohol and one just washed with tap water as a control. Swabs were cultured to detect bacteria and fungi and count them.

Results: Only Streptococcus bacteria were detected with no fungal contamination. Tap water reduced the bacterial count while other disinfectants killed the bacteria completely.

Conclusions: Chlorhexidine, Desident CaviCide and Alcohol can be used to disinfect the dental impression effectively.

Key words: *Disinfection, infection control, dental impression.*

Introduction

There is a great danger nowadays about transferring of infectious organisms to the workers in dental field's treatment as orthodontists, prosthodontists, oral surgeons and their assistants whom dealing with dental impression for patients required prosthesis [1, 2].

Disinfection can be defined as the procedure that kills vegetative organisms, in the same context; sterilization is the procedure of terminating spores too[3].

There are many researches that study the effect of different disinfectant on irreversible hydrocolloid dental impressions and they monitor that effect on the measurements of the dental cast produced from a disinfected impression [4,5].

Alcohol is not highly recommended for sterilization since it lacks the sporicidal activity while it works well in the category of antimicrobial activity against bacteria, fungi and viruses (cell lysis and proteins denaturation) in the range of 60-90% but it demonstrates low activity below 50% [6].

Chlorhexidine had a wide range anti-microbial activity against many micro-organisms. Jani et al. [7] in 2010 used chlorhexidine from different manufacturers to disinfect alginate dental impressions and found that Corsodyl was the most potent one in killing Streptococcus Mutans and Lactobacilli.

Desident CaviCide is a disinfected solution with broad anti-microbial activity used in recent Iraqi study to disinfect the contaminated clamping tweezers. It showed potent antibacterial activity but poor antifungal effect [8].

This study aimed to test the effect of different solutions in disinfecting irreversible hydrocolloid alginate dental impressions.

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Materials and Method

Sample

Five orthodontic patients (3 males and 2 females), whose had just finished their orthodontic treatment that lasting more than 12months, will be carefully selected with fair oral hygiene and full complement permanent teeth.

Method

The patients or patients' parents were asked for permission to participate in this research and a written consent form was signed by the patient or the parent. A total of 20 alginate impressions were taken (four maxillary dental impressions taken successively for each patient) using Hydrogum soft mint scent alginate, Zhermack, Germany). Alginate was mixed according to manufacturer instructions (2 spoons 18 gm mixed with 2 levels 36 ml of water loaded into a disposable dental tray and left to set for two and half minutes). The impressions were grouped according to the disinfectant used as followed:

Group A: represented the first impression that will be taken, swabbed (A1) then washed with running tap water and swabbed again (A2).

Group B: represents the second impression that will be taken, swabbed (B1) then washed and immersed in Desident CaviCide (Spofa Dental Co., Czech Republic) for five minutes and swabbed again (B2).

Group C: represents the third impression that will be taken, swabbed (C1) then washed and immersed in Alcohol 96% (Teeba Co., Iraq) for five minutes and swabbed again (C2).

Group D: represents the fourth impression that will be taken, swabbed (D1) then washed and immersed ten minutes in Corsodyl (Chlorhexidine 0.2%, Omega Pharma Manufacturing GmbH & Co. KG, Germany) mouth wash and swabbed again (D2).

The surface of each impression was swabbed with sterile cotton swab and dipped in normal saline then sent to the laboratory for incubation and culturing on three agar media Blood agar, McConkey agar, and Sabouraud dextrose agar (Hi-Media Co., India) to detect the aerobic and facultative anaerobic bacteria of both types Gram positive and negative, in addition to candida species before and after disinfections using manual colony forming counting.

Statistical Analyses

Data were managed statistically using SPSS version 25 software. Means, standard deviations were obtained for each disinfection solutions in addition to the tap water.

Findings

Table 1 showed the means and standard deviations of the colony forming units of Streptococcus bacteria isolated from five successive dental impressions of the five patients.

Generally, the highest CFU was decreased after washing in tap water but still there is growth in contrary to other disinfectants that kill all bacteria. No fungal contamination was detected.

Table 1: Descriptive statistics of colony forming units (CFU) before and after disinfection with different disinfectants

	Tap water		**Desident CaviCide**		**Alcohol 96%**		**Corsodyl**	
	A1	A2	B1	B2	C1	C2	D1	D2
	1140	950	1000	0	900	0	900	0
	1150	900	900	0	850	0	850	0
	1200	850	950	0	950	0	900	0
	1000	950	900	0	850	0	850	0
	1100	1000	850	0	850	0	850	0
Mean	**1118**	**930**	**920**	**0**	**880**	**0**	**870**	**0**
S.D.	**74.967**	**57.009**	**57.009**	**0**	**44.721**	**0**	**27.386**	**0**

Discussion

One of the major infection control procedure in the dental practice is disinfecting the dental impressions as the microorganisms can be transmitted effortlessly by saliva and blood to the dental staff and technicians, so a high standard of hygiene and disinfection of dental equipment, including dental impressions is recommended.

Generally, chemicals are broadly used in dental practice because of their easy application although their actions is influenced by many factors like the numbers and types of the organisms, disinfectant concentration, presence of blood and mucus which act as a insulating layer preventing the disinfection from contact with surface, time of contact with the disinfectant and the nature of the surface weather it is porous or not [9].

In this study swabs from Alginate dental impression materials were obtained from five successive impressions for five patients completed their fixed orthodontic therapy that lasts more than one year. The main aim of this study was to evaluate the efficacy of different agents in disinfecting the dental impressions. Tap water was used as a negative control and had been tested previously in two studies [7,11], while Desident CaviCide is tested for the first time in this study. It possessed wide range anti-microbial activity in short period of exposure reaching to 30 seconds.

Immersion not spraying technique of disinfection is used to ensure uniform contact between the disinfectant and dental impression. Disinfection with spraying method decreases the possibility of distortion, particularly in hydrocolloids impression materials, but will not reach the areas of undercuts and may releases air that leads to occupational exposure [10].

Correia-Sousa et al.[12] found a 48.5% reduction in the microbial load after washing alginate impression with tap water. The present study reported lesser percentage of reduction (Table 1). Jani et al. [7] reported that tap water fail to kill the Streptococcus Mutans and Lactobacilli while Chlorhexidine kill Streptococcus Mutans completely. Chlorhexidine is a positively charged molecule that binds with the negatively charged sites of the bacterial cell wall so interferes with the osmosis. Moreover, it assaults the cytoplasmic membrane and leaks the components that lead to cell death. It has been shown that Chlorhexidine at high concentration of 2% demonstrated antimicrobial activity against *S. aureus, E. coli,* and *B. subtilis,* but not *C. albicans* [13].

Desident CaviCide contains low concentration of Alcohol and enable to inactivate the bacterial growth in the impression by alkylating the amino and sulf hydral groups of bacterial proteins, the present findings come in agreement with that of other studies [8,14,15].

Isopropyl alcohol has high bactericidal activity in concentration as high as 99% but is relatively inefficient in the presence of blood and saliva. It lacks sporicidal activity and also causes corrosion of metals. Ethyl alcohol has more bactericidal than bacteriostatic activity in addition to tuberculocidal, fungicidal, and virucidal activity against enveloped viruses but has no effect against bacterial spores and non-enveloped viruses. They work by denaturation the bacterial proteins and lipids and leads to cell membrane disintegration so, inactivating the microorganisms. The optimum bactericidal concentration in water is 60% to 90%, and the lethal activity falls when diluted below 50% concentration. Ethanol has shown clear bacterial growth inhibition, especially when used in high concentrations against *S. mutans* and *S. aureus* [16,17]. In this study, Alcohol was used in a concentration of 96% and it as able to kill all detected bacteria (Table 1).

In a previous study, Mohammed et al. [11] tested the effect of sodium hypochlorite, Biosanitizer M and Zeta plus 7, used as disinfectant for Alginate impression materials, on the teeth and dental arch measurements and the results proved non-significant effect. Further studies are needed to check the efficacy of the tested disinfectants in this study on the viral and fungal contaminations and their effect on the dimensional stability of the resultant model.

Conclusions

Disinfecting dental impressions is far important procedure to control the transmission of microorganisms among the dental staff. Tap water was able to reduce the microorganism while Desident CaviCide, Alcohol and Chlorhexidine eradicated the bacteria completely.

Ethical Clearance

The Research Ethical Committee at scientific research by ethical approval of both environmental and health and higher education and scientific research ministries in Iraq

Conflict of Interest: The authors declare that they

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