

Effect of Different Dental Impression Disinfectants on the Mandibular Teeth and Dental Arch Measurements

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Abstract

Background: This study aimed to test the effect of various dental impression disinfectants on the teeth and dental arch measurements.

Materials and methods: Forty impressions for the mandibular arch were taken with alginate impression material from ten dental students each for four times. The first ten impressions (control) were washed with distilled water and poured with type IV dental stone. The other thirty impressions were immersed in Clorox (sodium hypochlorite), Biosanitizer M and Zeta plus 7 (ten for each agents) for ten minutes before pouring. The mesio-distal dimension of six teeth and dental arch widths were compared between each group with the control using paired samples t-test.

Results and Conclusion: The results revealed non-significant difference between the control group and other groups, so any type of disinfectant can be used without effect on the teeth and dental arch measurements.

Keywords: Dental impression, disinfection, teeth and dental arch measurements.

I. Introduction

In orthodontics, cross infection of the study models through contaminated alginate impressions is a frequent event, so disinfection of the dental impression is essential for the orthodontists, assistants and laboratory technicians.

Dental impressions can be disinfected by four methods: immersion in or spraying with a disinfectant, incorporating chemicals into powder at the time of mixing⁽¹⁻²⁵⁾ or using self-disinfected alginate.

One of the main requirements of the disinfectant solution is the effectiveness against wide range of microorganisms including bacteria, viruses and fungi at the same time it should not affect the physical and mechanical properties of the impression material and should be non-toxic to human tissues also easy to use with reasonable price⁽²⁶⁾.

The literature is rich with the disinfectant materials used to disinfect the dental impressions like aldehydes, chlorine compound, chlorhexidine, iodine compound and sodium fluoride. The effects of these materials on the physical and mechanical properties of alginate in addition to testing their microbial activity have been evaluated in pervious researches⁽²⁻²⁵⁾.

In orthodontics, Jones *et al.*^(27,28) were the first who study the dimensional stability of disinfected alginate impression concentrating on dental arch width and length. The present study aimed to evaluate the effect of various dental impressions disinfectants on the mesio-distal teeth measurements and dental arch widths from orthodontic point of view.

II. Materials And Methods

Sample

Ten students (five males and five females) from the College of Dentistry, University of Baghdad participated in this study. All have class I occlusion with well-aligned or with mild spacing or crowding.

Impression for the mandibular arch was taken with alginate impression material (Kromopan, Lascod Company, Italy) for each student four times successively according to the manufacturer's instructions. The impressions were then washed with distilled water and divided according to the disinfectant used. Each ten impressions were immersed in the specific disinfectant for ten minutes before pouring.

Disinfectant solutions

1. Clorox: it is manufactured by National Cleaning Products Company, KSA. It composed of 5.25% sodium hypochlorite.

2. Biosanitizer M: it is manufactured by SaniSwiss Company, Switzerland. It is supplied as a powder to be mixed with water. It composed of powder-based on monopersulfate compounds, surfactants, chelating and acidifying agents. Active oxygen released after dilution of powder in H₂O.
3. Zeta 7 solution: it is manufactured by Zhermack Company, Italy. It composed of ethanolamine, acetic acid, N, N-didecyl-N, N-dimethylammonium chloride, butane-1, 4-diol.

Methods

Preparation of the disinfectants, disinfection of the impressions and measurements

Clorox was diluted with distilled water at a ratio of 1 part of bleach to 10 parts of water to make 1:10 ratio. Biosanitizer M was prepared by mixing 60 g of powder with 3 L of water while Zeta 7 was used at 1% after dilution with distilled water.

The impressions were washed and immersed in the specific disinfectant for 10 minutes according to the manufacturers' instructions then washed and poured with type IV dental stone (Elite® stone, Zhermack, Italy). After setting, the casts were obtained and photographed in the same method of Hasan⁽²⁹⁾ and Ahmed⁽³⁰⁾.

Teeth and dental arch measurements

The mesio-distal widths of the right central incisor, canine and 2nd premolar and left lateral incisor, 1st premolar and 1st molar were measured occlusally (incisally) from the contact points⁽³¹⁾. The arch widths at the canine, 1st premolars and 1st molars were measured at the level of cusp tips (buccal cusp tip of 1st premolar and mesio-buccal cusp tips for 1st molar)^(30,32) using AutoCAD program 2015.

Statistical analyses

The collected data were analyzed using SPSS program version 21. The descriptive statistics included the means and standard deviations while the inferential statistics included the paired samples t-test to compare the measurements between the control group and other groups. P-value above 0.05 indicated non-significant difference.

III. Results

Table 1 showed the descriptive statistics of the measured variables in mm. Generally, the mean values of the variables were approximate among the groups. Paired samples t-test revealed non-significant difference when the studied groups compared with the control group separately.

Table 1: Descriptive statistics of the measured variables in each group

Measurement (mm.)	Distilled water		Clorox		Biosanitizer M		Zeta 7	
	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
R1	6.071	0.385	6.030	0.415	6.036	0.477	6.029	0.351
L2	6.668	0.452	6.540	0.399	6.624	0.486	6.624	0.366
R3	7.600	0.454	7.501	0.415	7.488	0.472	7.532	0.375
L4	7.507	0.443	7.463	0.673	7.463	0.527	7.210	1.068
R5	8.031	0.695	7.782	0.788	7.913	0.626	8.038	0.493
L6	11.585	0.660	11.425	0.541	11.642	0.720	11.441	0.372
ICD	30.768	2.129	30.548	2.297	30.475	2.273	30.588	2.035
IPD	40.521	3.837	40.518	3.865	40.254	3.880	40.386	3.749
IMD	51.695	3.500	51.507	4.046	51.435	4.256	51.650	3.208

Table 2: Comparing the measurements between the control group and other groups

Measurement (mm.)	Distilled water vs. Clorox			Distilled water vs. Biosanitizer M			Distilled water vs. Zeta 7		
	Mean difference	t-test	p-value	Mean difference	t-test	p-value	Mean difference	t-test	p-value
R1	0.041	0.623	0.549	0.035	0.360	0.727	0.042	0.974	0.356
L2	0.128	1.861	0.096	0.044	0.766	0.463	0.044	0.518	0.617
R3	0.099	1.246	0.244	0.112	0.991	0.348	0.068	0.693	0.506
L4	0.044	0.327	0.751	0.044	0.393	0.703	0.297	0.801	0.444
R5	0.249	1.634	0.137	0.118	0.871	0.407	-0.007	-0.065	0.950
L6	0.160	1.218	0.254	-0.057	-0.470	0.649	0.144	0.918	0.382
ICD	0.220	0.798	0.446	0.293	1.032	0.329	0.180	1.067	0.314
IPD	0.003	0.011	0.991	0.267	0.525	0.612	0.135	1.174	0.271
IMD	0.188	0.578	0.577	0.260	0.555	0.593	0.045	0.288	0.825

R1= right central incisor, L2= left lateral incisor, R3= right canine, L4= left 1st premolar, R5= right 2nd premolar, L6= left 1st molar, ICD= inter-canine distance, IPD= inter-1st premolar distance, IMD= inter-1st molar distance

IV. Discussion

Infection control in the dental practice is far imperative as the microorganisms can be transmitted easily by saliva and blood to the dental staff.

Dental casts are one of the vital diagnostic aids utilized by the orthodontists to visualize the teeth and occlusion in three dimensions, select orthodontic bands and determine the treatment plan after space analysis⁽³³⁾. Dental impressions that were obtained from the patients harbored many types of microorganisms hosted inside the patient's mouth. Pouring such impression may transfer such microorganisms to the study casts so the orthodontists, assistants and technicians are in danger.

Generally, the specialists in fixed and removable dental prostheses and dental materials studied the microbial activities and the effects of various disinfectants on the properties of the impression materials⁽²⁻²⁵⁾. Orthodontists deal with the dimensional changes that may be associated with disinfected alginate impression as the poured casts will be used in construction of removable orthodontic appliances and space analysis.

In this study, ten students had normal occlusion with well-aligned arches or with mild spacing or crowding were agreed to participate. Four impressions have been taken by one of the authors for the lower arch. The first one just washed with distilled water and poured with type IV stone, while the other three impressions were immersed in three different disinfectants (Clorox, Bio-sanitizer M and Zeta 7) for ten minutes then washed with distilled water and poured as the control group under the manufacturer's instructions. Mesio-distal dimensions of six teeth (three in the right and three in the left side) and dental arch widths at the canine, 1st premolar and molar area were measured.

Sodium hypochlorite was used previously in the researches and had strong anti-microbial effects. In 2008, the CDC has advised that household bleach of 1:10 dilution should be used for disinfection of hydrocolloid impressions⁽³⁴⁾. Correia-Sousa *et al.*⁽³⁵⁾ found that washing alginate impression with tap water reduced the microbial load significantly by 48.5%, while sodium hypochlorite decreased the adherence of microorganisms by 99.99%. Immersion alginate impressions in sodium hypochlorite solution led to absorbing water due to the difference in the osmotic pressure between the disinfection solution and the alginate impression⁽³⁶⁾. The dimensional stability of an alginate impression after immersion in sodium hypochlorite solution varied according to kinds and brands but small dimensional changes of the alginate impression had been reported in sodium hypochlorite solution and this in accordance with the present findings.

Bio-sanitizer M and Zeta 7 were used for the first time up to authors' knowledge. According to the manufacturers, they had wide range anti-microbial activity against many types of bacteria, virus and fungi in addition to their negligible effect of the dimensional changes. The outcome of the present study proved statistically non-significant differences in the measured variables between the control group and the studied groups meaning that any type can be used for disinfection safely; this comes in agreement with Jones *et al.*^(27,28) who found the same findings.

V. Conclusions

Disinfection of the dental impressions is vital compulsory measure to prevent the transmission of microorganisms and diseases. Any of the tested disinfectants can be used safely in impression disinfection prior to pouring with dental stone without compromising the teeth and dental arch measurements.

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