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Addition of mouth washes as a disinfectants of irreversible hydrocolloid impression material

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Abstract

Internal disinfection of irriversible hydrocolloid was the prefered disinfection technique because it allows immediate pouring of the impression after removal of the impression from the patient' s mouth. Addition of disinfection to the impression materials was superior to immersion or spraying techniques. The purpose of this study was to assess the surface antimicrobial efficacy, setting time, viscosity and dimensional stability of irreversible hydrocolloid impression material when mixed with two mouth washes and compared with the spray and immersion techniques. The used mouth washes were Tantum verde and Hexitol for mixing and disinfection of alginate impression material. The results indicated that the addition of mouth washes to be mixed with irreversible hydrocolloid impression material produced larger inhibition zones of growth than immersion and spray techniques. The setting time and viscosity were not adversely affected. The dimensional accuracy of the resulted stone cast was suitable.

Keywords: Alginate impression material, disinfection, dimensional stability.

Introduction

The disinfection of dental impression materials has become a critical topic of universal concern (US Department of Health and Human Services, 1987; Council on Dental Material, 1988) because it may be the first link in microbial contamination during dental care (Council on Dental Therapeutics, 1985). Irreversible hydrocolloid [alginate] is currently the most popular dental material in every day practice (Storer R and McCabe, 1981).

Disinfection of dental impressions has drowned much attention and research interest in recent years. The efficacy of disinfectant depends on sufficient length of treatment time and effective concentration of the disinfectant (Tan et al., 1983)

There are inherent limitations on disinfection of irreversible hydrocolloid impression material. The dimensional instability of the material imposes limitations on the length of treatment time and the choice of disinfectants. The water content of the material could dilute the concentration of the active ingredient of the disinfectant (Merchant and Molinare, 1989). The procedure that is recommended by the American Dental Association [ADA] for disinfecting alginate impressions is to use spray disinfectants and to seal the recommended length of disinfection time.

The minimum disinfection time for most surface disinfectants when applied to a dry smooth surface is 10 minutes. However, data on the efficacy of this recommended protocol are not available. Because of the high water content of alginate impression materials, that dilutes the disinfectant agents and not sufficient time for disinfection (Herrera and Merchant, 1986; Minagi et al., 1986). *In vitro* and *in vivo* studies on antiseptics solutions [mouthwashes] as hexetidine, cholorohexidine, cetylpyridinium and alexidine showed that'll antiseptics were effective at low concentrations against the streptococcus mutans and also inhibit plaque growth (Roberts and Addy, 1981; Asley, 1984; Williams et al., 1984; Bergenholtz and Hantstrom, 1974; Hefti and Huber, 1987).

Several studies reported that, although the efficacy of a disinfection treatment is important, it would not be acceptable if the treatment resulted in compromised quality of the impression. Several studies examined disinfectant rinsing and immersion techniques for irreversible hydrocolloids, still little studies examined disinfectant addition technique for irreversible hydrocolloids (Oehring et al., 1980).

This study assessed the surface antimicrobial efficacy, setting time, viscosity and dimensional stability of irreversible hydrocolloid impression material when mixed with two mouthwashes and compared with spray and immersion techniques.

Materials and methods

Antimicrobial test

Saliva samples were obtained randomly from patients at different ages, from the out Dental clinic, Faculty of Dentistry, Mansoura University. These samples were incubated into blood agar plates and incubated at 37^{o}C for 24 hours. Isolated bacterial colonies were selected separately and identified by using automated system [Sensititer] for bacterial identification. One identified colony of streptococcal sorbines strains was purified by subculture on blood agar.

Tantum Verde mouth wash (E.I.P.I.CO.Egyptian INT.Pharmaceutical Industries CO.A.R.E.) and Hexitol mouthwash (Arab Drug Company [ADCO] Cairo.A.R.E.) were used for disinfection of the irreversible hydrocolloid impression material.

a. **Addition method**

   Five grams of irreversible hydrocolloid impression material was mixed in 8ml of mouthwashes [Tantum and Hexitol] using mixing bowl and spatula according to manufacturer instructions. Four small sized plugs of 1cm in diameter were prepared from irreversible hydrocolloid impression material and applied onto the seeded blood agar plate.

   The streptococcus sorbines strains suspended in broth was standardized using Mc Farland [0.5 Mc Faraland, a colorimeterically determined concentration] representing 10^6 organisms/ml of broth]. Blood agar plate was seeded by standardized isolated. The plate was incubated at 37^{O}C for 24 hours, then examined for the presence of well-defined zones of inhibited growth.

b. **Immersion method**

   Five grams of irreversible hydrocolloid were mixed with 8ml of sterile water using mixing bowl and spatula according to manufacturer instructions. Four small plugs of 1cm of irreversible hydrocolloid were prepared then immersed in solution of mouth-washes [Tantum and Hexitol] for 10 minutes, then applied to blood agar plate for testing the inhibitory zones.

c. **Spray method**
Four small plugs of 1cm of irreversible hydrocolloid were prepared then sprayed for 10 minutes with mouthwashes [Tantum and Hexitol], and placed in blood agar plate for testing the inhibitory zones.

Setting time test

Five grams of irreversible hydrocolloid were mixed with 8ml of sterile water using mixing bowl and spatula according to manufacturer's instructions for the control group. Five grams of irreversible hydrocolloid were mixed with 8ml of mouthwashes [Hexitol and Tantum] using mixing bowl and spatula for testing groups. The material was poured in a cylindrical ring 27mm in diameter, 25mm.in length. With a flat bladed spatula the surface of the material was made smooth.

The setting time of the impression material was recorded by using a cone and plate pentrometer (Combe and Moser, 1978)). The pentrometer (Eijkel Kamp Agri Search Equipment, Netherlands) has a movable metal rod attached to its end a metal conical plunger. The pentrometer permitted the needle holder to move in a guide without appreciable friction and is capable of indicating the depth of penetration in mm. The total moving weight (needle and the needle holder were 78gm). The standard needle was then lowered to the surface of the material sample. The penetration was carried out every minute; each times the needle being cleaned and dried.

After each impact, a fresh surface was obtained by rotating the plate filled with the material. The final setting was taken at the point where the needle penetration remained constant and subsequent readings showed no further significant changes. The shearing stress was constant and the rate of shearing in revolutions per minute produced on the cone was recorded on the indicator scale.

Viscosity test

A parallel plate compression viscometer (Monsanto Mooney Viscometer 2000) with a chart recorder was used to evaluate the changes of viscosity of irreversible impression material mixed with water and others with mouthwashes [Hexitol and Tantum] with sample volume =2.7cm^3

The viscometer had a heated and pressurized die cavity that contained a serrated rotor .The rotor was removed from dies and inserted into the lower sample. The rotor and the lower sample were then inserted into the instrument. The upper sample was then placed on top of rotor. Thus discs of materials were compressed between parallel plates under the action of standard load (60 psi=4.2kg/cm^2). Two viscosities were selected and recorded at 30^{o}C and 37^{o}C for evaluation of each of the irreversible hydrocolloid mixed with Tantum, Hexitol and Water.

Dimensional stability test

An acrylic resin master cast was made to represent one half of dentulous mandibular arch from the central incisor to the second molar. Reference points for cast measurements were provided by embedding four hard, steel pins with cross hairs at selected locations on the cast. The anteroposterior dimensions was measured from the tip of the canine [A] to disto-occlusal surface of second molar [B]. The vertical occluso-gingival dimension was measured from the height of convexity of the lingual surface of first molar [C] to a point directly below in the lingual vestibule [D]. The cast was attached to an acrylic resin base that extended with one quarter of an inch on all four different sides and was indexed on each side (Tullner et al., 1988).

Perforated tray with 6mm relief was used with irreversible hydrocolloid impression material. Five impressions were made of the master cast for each impression material mixed with mouth washes [Tantum and Hexitol] and for the respective control group [mixing with water].The irreversible hydrocolloid was allowed to set for 5 minutes after placement on the master cast. After setting the impression material, the impression sudden removed from the cast and rinsed briefly in tap water, dried with a stream of air, and poured immediately. All casts were made in improved stone (Die Keen,Columbus Dental,St.Louis,Mo.), measured, mixed, and poured according to manufacturer's recommendations. The poured impressions were allowed to set for 60 minutes before separation of the cast from the impressions. Each cast was measured five times for each reference distance (A-B and C-D) with measuring microscope (Stakhouse, 1970).

Results

Inhibition zones for the growth of the tested microorganisms are presented in Tables 1 and 2. Addition of mouthwashes to be mixed with irreversible hydrocolloid showed the larger inhibition zones of growth. When comparing the mean values of the different methods of disinfection with each other for each mouthwash, it was found that, there were significant differences at level of 0.05% Table 3.

The mean values and standard deviations of the setting time of the irreversible hydrocolloid when mixed with mouthwashes [tantum and hexitol] and water are showed in Table 4.When comparing the mean values of different mixing techniques; it was found that, there were significant differences at the level of 0.05%.

Table 5 showing the mean values of the viscosity of irreversible hydrocolloid at different temperatures. At 30c^o, Hexitol mouthwash showed higher viscosity [42.1X10^3] then tantum [40.2X10^3] and water [34.9X10^3]. At 37c^o, Hexitol mouthwash showed higher viscosity [44.1X10^3] then tantum [42.2X10^3] and water [36.7X10^3].

The mean values of each five-cast measurement and the least significant difference for each impression material and disinfectant combination with their respective control group are given in the Tables 6,7 and 8. When comparing the mean values of the antroposterior (A-B) and occlusogingival (C-D) measurments, it was found that, no significant difference from their control group at the level p=. 05% for (A-B) measurements and significant for (C-D) measurements.

Discussion

The microorganism utilized in this study, streptococcus sorbines was selected because it is an oral bacterium with average resistance to disinfectant (Caughman et al., 1989). Tantum and Hexitol mouthwashes were selected in this study, because they are the most available in dental market with good taste, inhibit plaque growth and high water content to facilitate the setting reaction with irreversible hydrocolloid impression material (Poulus and Antonoff, 1997).

This study revealed that the addition technique of mouthwashes as a disinfecting of irreversible hydrocolloid impression material gave a good resistant to microorganism than immersion and spray techniques because in the addition technique the disinfection solution homogenous spread in between the molecules of irreversible hydrocolloid impression material.

Poulus and co-workers concluded that, the internal disinfection replacing water with disinfecting before impression taking] is the method of choice for alginate, since it allows immediate pouring of the impression after removal from the oral cavity.

Because of the impression materials varying in hygroscopic characteristics and stability over time care must be taken in the selection of the method of disinfection. In the present study the setting time and viscosity at different temperature are not affected when irreversible hydrocolloid mixed with mouthwashes [Tantum and Hexitol] instead of water, because of water is the main component in the composition of mouthwashes.

This study revealed that, there was no significant when used mouthwashes

Table 1: Means of inhibition zones [mm] for Hexitol mouthwash.			
F. ratio= 62* P>0.05	Addition	Immersion	Spray
Mean	-30	-23	-19
SD	1.61	1.54	1.47

Table 2: Means of inhibition zones [mm] for Tantum verde mouthwash.			
F.ratio=41* P >0.05	Addition	Immersion	Spray
Mean	--29	-24	-20
SD	1.58	1.53	1.49

Table 3: Means zones [mm] and standard deviations of growth inhibition For Hexitol and Tantum mouth washes			
Hexitol Mouthwash			
	Addition	Immersion	Spray
Mean	-30	-23	-19
SD	1.61	1.54	1.47
F. ratio	= 62*		
P-value	>0.05		
Tantum Mouthwash			
	Addition	Immersion	Spray
Mean	--29	-24	-20
SD	1.58	1.53	1.49
F. ratio	=41*		
P-value	>0.05		

Table 4: Mean setting time [minutes] & standard deviations of irreversible hydrocolloid mixing with Tantum and Hexitol mouth washes.			
F.ratio=13 p>0.05	Water	Tantum	Hexitol
Mean	5.8	5.6	5.5
SD	0.16	0.15	0.16

(Tantum & Hexitol) instead of water to be mixing with irreversible hydrocolloid on the accuracy of resulting stone cast for antroposterior measurements due to the waters is the main component in the composition of the mouthwashes. Johnson and co-workers found that the disinfection of the irreversible hydrocolloid maintained high accuracy in both the antroposterior and cross arch dimensions.

Table 6: Mean distance [cm] and standard deviations of antroposterior [A-B] and their least significant difference.			
F.ratio=. 52 P<0.05	Water	Tantum	Hexito l
Mean	3.541	3.575	3.60
SD	1.22	.014	.158

Table 5: Mean viscosity values of irreversible hydrocolloid impression material mixed with water, tantum and hexitol mouthwashes at 30 c^0 and 37 c^0 in centipoises [values $X10^3$]			
Temperature	Water	Tantum	Hexitol
$30c^o$	34.9	40.2	42.1
$37c^o$	36.4	42.3	44.1

Table 7: Mean distance [cm] and standard deviations of occluso -gingival [C-D] and their least significant difference.			
F.ratio=17.1* P>0.05	Water	Tantum	Hexitol
Mean	.75	.77	.79
SD	.15	.02	.08

Table 8: Mean distance [cm] and standard deviations of antroposterior [A-B], [C-D] and their least significant difference.			
+insignificant	Water	Tantum	Hexitol
Mean[A-B]	3.541	3.575	3.60
SD	1.22	.014	.158
F.ratio	= 0. 52	P-value	$<0.05^+$
Mean[C-D]	0.75	0.77	0.79
SD	0.15	.02	
F.ratio	=17.1*	P-value	>0.05

Conclusion

Disinfection of irreversible hydrocoloid impression material is more appropriate using addition of two mouthwashes [Tantum and Hexitol] to be mixed with the powder instead of water. The addition technique revealed good inhibiting zones than the immersion and spray techniques. The addition of mouthwashes to be mixed with irreversible hydrocolloid instead of water did not affect the setting time, viscosity and the dimensional stability of the resulting stone cast.

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