Original Research Paper

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Evaluation of Cymbopogon Citratus as Disinfectant and Its Effect on The Dimensional Stability of the Resultant Gypsum Casts: An in Vitro Study.

Abstract :

Background aand Aim: Proper disinfection of impression is probably the most important procedure for dental lab to render it safe for further handling without affecting the accuracy of fine details. In light of these intermingling facts, author aimed to 1) investigate the antimicrobial effect of Cymbopogon citratus on selected microorganism colony and 2) the effect of the disinfectant solution on the dimensional accuracy of the resultant gypsum casts.

Materials & Method: Initially, tropicalgin Alginate was mixed and total of 20 impressions of the alginate and painted with bacterial colonies. Swabs were further subjected to culture and sensitivity tests for predetermined bacterial strains. Alginate impressions were immersed in glutaraldehyde 2% and Cymbopogon Citratus 30% for 10 minutes (ten each). The swabs were wiped on glass Petri dish and inoculated. The colonial growth was transferred to the glass slide for Gram staining which confirmed presence of Staphylococcus aureus, Streptococcus mutans and Candida albicans in control group. Cross-arch distance between 16 and 26 of the poured samples were compared with the cross arch distance in the typhodont teeth using digimatic vernier caliper.

Result: Statistical analysis was attempted using SPSS version 22.0. The results of dimensional accuracy of 2% Glutaraldehyde (Group A) mean reading was 55.114, Variance =0.00687 and standard deviation were 0.8289 obtained. The results of dimensional accuracy of 30% Cymbopogan Citratus (Group B) mean reading was 55.403, Variance = 0.0268 and standard deviation were 0.16384 obtained.

Conclusion: Within the limitations of the study, authors concluded that anti-microbial efficacy of 2% Glutaraldehyde was less in comparison to 30% Cymbopogon Citratus on resultant selected microorganism in this study and dimensional accuracy was superior in Cymbopogan citratus in comparison to glutaraldehyde.

Keywords: Citratus, Microorganism, Casts, Impression, Candida Albicans, Lemongrass oil

Introduction:

Impression materials are used to make accurate negative replica of form of oral hard and soft tissue. Irreversible hydrocolloid is the most popular impression materials in everyday practice as it fulfills most of the requirement of an ideal impression material. Irreversible hydrocolloids material is partly organic, hydrophilic, irregular & porous in nature and thus support retention and growth of micro-organism.[1] During routine dental treatment pathogenic micro-organism can be transmitted through impression.[2] As we know that infection control has become one of the most explored issues in dentistry these days.[3] Dental people are becoming aware of the risk of transmission of infection by blood & saliva from contaminated impression and research is evolving that relates directly to these previously neglected disciplines.[4,5] Sterilization of dental instruments & disinfection of worktops and equipment have been elaborately described in literature to avoid cross- infection from one patient to another & from operator, chair side assistance or dental technician. Standard procedure of rinsing impression under water immediately after removal from mouth eliminates gross contamination along with most of saliva clinging to the impression. However, all microorganisms are not removed by rinsing alone.[6,7,8] and residual micro-organisms can still be source of infection

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&exist for extended periods outside their human host. Recent information indicates that oral bacteria can remain viable in set gypsum up to7days.9 Disinfection is a lethal process intended to kill disease producing microorganism, but not the bacterial spores. It comprises a wide range of actions that can extend from sterility at to a minimal decrease in bacterial infectivity.10 Infection transmission from impression occur through skin contact; disinfection can easily prevent this transmission from patient to person who handle the impression.11 In view of these points, the sole aim of this study was to investigate the antimicrobial effect of Cymbopogon citratus on selected microorganism colony &the effect of the disinfectant solution on the dimensional accuracy of the resultant gypsum casts.

Materials and Methods:

This study was planned, abstracted and conducted in the department of Prosthodontics at Rama Dental College. Initially, reference holes were made using flat end taper bur on the mesiobuccal cusp of 16 and 26 of the typhodont model (Maxillary GDC-N type). The study was approved by the institutional ethical committee vide letter no 02/IEC/RDCHRC/2020-21/014 Dated 13 January 2021. A total of 20 impressions of the Tropicalgin alginate were made using perforated stock maxillary tray on typhodont model. The alginate impressions were painted with selected bacterial colonies using Camlin hair brush (Figure 1). A sterile cotton swab was wiped on the selected areas of impression (swab was transferred on Petri dish, served as non-disinfected control) and was further subjected to culture and sensitivity tests for predetermined bacterial strains. Alginate impressions were immersed in a sealed plastic bag containing disinfecting solution glutaraldehyde 2 % (CIDEX) and Cymbopogon Citratus 30% for 10 minutes (ten each). Sterile cotton swab was used on the alginate impression to wipe from 20 impressions. The swabs were wiped on glass Petri dish and inoculated at 37°C for 24 hours. The control section (non-disinfected) of the glass Petri dish showed some bacterial colony growth where as other sections (disinfected) didn't show any bacterial growth (Figure-2). The colonial growth was transferred to the glass slide for Gram staining which confirmed presence of Staphylococcus aureus (cocci seen in clusters), Streptococcus mutans (cocci seen in chains) and Candida albicans (budding yeast like cells of oval shape) in control group light microscope at 100X magnification. For detailed analysis of antimicrobial efficacy, 9 samples were grouped under 2 % Glutaraldehyde and other 9 samples under 30% Cymbopogan Citratus. This segregation was based according to strains of microorganism colonies used in the study viz; Staphylococcus aureus, Streptococcus mutans and Candida albicans. For evaluating dimensional accuracy, cross-arch distance between 16 and 26 of the poured samples were compared with the cross arch distance in the typhodont teeth using digimatic vernier caliper (0.01mm). The cross-arch distance in the master model was recorded as 54.38 mm. All 20 casts measurements were recorded by one operator using a digimatic vernier caliper (Figure 3). Impression were poured using die stone and retrieved after 45 minutes and then dimensionally corrected to ideal dimensions. For the ease of study and statistical analysis, all study samples were divided into 2 groups of 10 each. Group A and group B has Casts obtained after disinfecting by immersion in Glutaraldehyde solution and Cymbopogon Citratus respectively.

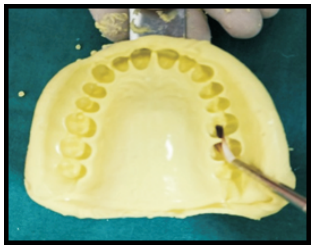


Figure 1: Painting of impression with bacterial colonies

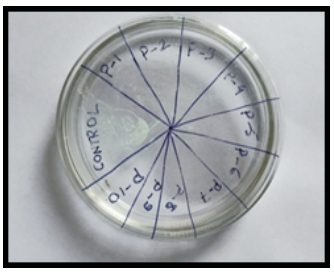


Figure 2: Glass petridish colonial growth (control group only)

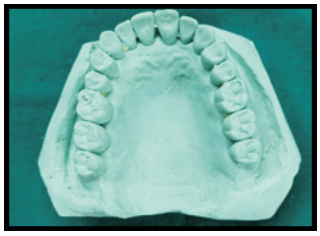


Figure 3: Cast obtained after disinfecting impression by 30% cymbopogon disinfectant

Statistical Analysis and Results:

The mean of three cross- arch measurements taken from the Gypsum stone casts were compared to those recorded from typhodont model. The cross-arch distance between 16 and 26 of the poured samples were compared with the typhodont teeth using digimatic vernier caliper. The cross-arch distance in the master model was recorded as 54.38 mm. The three measurements and the mean distance of their respective casts when impressions immersed in 30% lemongrass and 2% glutaraldehyde were recorded. Table 1 showed the results of dimensional accuracy of 2% Glutaraldehyde (Group A) in which mean reading was 55.114, Variance = 0.00687 and standard deviation were 0.8289 obtained. Table 2 showed the analysis of variance through one way – Anova. Graph 1 depicts mean value of master model was 54.38 mm and result obtained after disinfected cast of 2% Glutaraldehyde was 55.11 mm and 30% Cymbopogan Citratus was 55.4 mm. The antimicrobial efficacy of 2 % Glutaraldehyde on the selected colony of microorganism was estimated. Results obtained in mean value of Staphylococcus aureus (0.622), Streptococcus mutans (0.505) and Candida albicans (0.333). This showed the reduction of microorganism colony in Petri dish other than control group. Similar interpretation of Cymbopogan Citratus showed mean value of Staphylococcus aureus (0.501), Streptococcus mutans (0.488) and Candida albicans (0.233). This showed the reduction of microorganism colony in Petri dish other than control group.

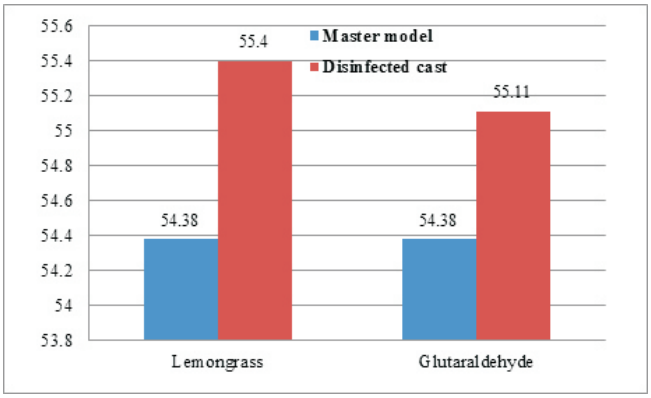
Table 1: This table showed the results of dimensional accuracy of Group A and Group B

VARIABLES	MEAN READING	VARIANCE	STANDARD DEVIATION
GROUP A	55.114 mm	0.006871111	0.82892165
GROUP B	55.403 mm	0.026845556	0.16384614

Table 2: This table showed the analysis of variance through one way – Anova

SOURCE	SUM OF SQUARE	Df	MEAN SQUARE	F-RATIO	P-VALUE	CRITICAL VARIATION
BETWEEN GROUP	0.4176	1	0.4176	24.77143	.000098 (<0.05)	0.211621
WITHIN GROUP	0.3035	18	0.0169			
TOTAL	0.7211	19	The F-ratio value is 24.77143. The p-value is .000098. The result is significant at p < .05.			

Graph 1: Comparison of mean distance between the master model and the different disinfected casts



Discussion:

Infection control has become an important issue for the dental laboratory personnel in recent years. Oral impressions are usually infected with bacteria of patient's saliva and blood which may easily cross contaminate stone casts. Prospective resource of infection transmission to dental and laboratory impressions have been noticed to person, who usually handles them.12,13 The mean percentage deviation of measurements recorded for gypsum casts poured after disinfecting by two different disinfectants produced comparable results. There was statistically significant difference ($p<0.05$) in dimensional accuracy for the control group of the impression materials compared with the materials treated with disinfectant solutions. Silva Cristiane de Bona, reported that the MIC value obtained for citral against C. Albicanswas 0.05% (v/v), and this value was similar to those obtained in studies with lemongrass oil. Nystatin is used as a reference substance, and in comparison with that drug, the samples of the oil and citral showed higher activity.14 However in this study, antimicrobial efficacy of 2% Glutaraldehyde on the selected colony of microorganism showed mean value of Staphylococcus Aureus as 0.622, Streptococcus Mutans as 0.505 and Candida Albicans as 0.333. This showed the reduction of microorganism colony in Petri dish. Khongkhunthian and colleagues found that some bacterial strains could be resistant to both essential oil concentrations (0.44 and 0.22 mg/ml) and to the positive controls.15 Moore-Neibel newly showed that the constituents of lemongrass oil also diminish biofilm configuration, kill preformed biofilms and have numerous attack points on the bacterial cell.16 In

our study, 30% emulsion of Cymbopogon Citratus was used against the selected microorganism colony showed the reduction in bacterial colony in compare to control group. The essential oil of C. Citratus demonstrated bacteriostatic action to all strains of Staphylococcus spp. and S. mutans in the dissimilar concentrations. The minimum inhibitory concentration (MIC) of essential oil of C. citratus was 0.062% up to 70% to strains of C. albicans and 100% to the strains of C. tropicalis.17 Purpose of lemongrass in air packaged rocket salads appeared to have a bactericidal action against enterococci. Certainly, when lemongrass essential oil was applied enterococci, populace were below the enumeration limit. In contrast, they reached a population range of 2–5 log CFU·g- 1 without application of lemongrass essential oil.18 LGO is an effective antimicrobial agent in controlling the infection of turtle-borne pathogenic Gram –ve bacteria with exception of P. aeruginosa.19 The LG extract has effectiveness in inhibiting (MIC) at 25% and killing (MBC) at 50% concentration of Porphyromonas gingivalis ATCC® 33277™ growth.20 We have showed the effectiveness of ethanolic LG as a potent anticancer agent against both p53-positive and p53-negative human colon cancer cells. We observed that LG caused an increase in ROS production and depolarization of MMP in both cancer cell lines. Most important, when administered orally, the extract was able to inhibit the growth of human colon cancer xenografts in mice. LG not only enhanced the efficacy of FOLFOX in inhibiting growth of colon cancer xenografts but also reduced the toxic effects of FOLFOX in mice.21

Conclusion:

All the two studied disinfectants were effective against the selected bacterial species viz. Candida albicans, Streptococcus mutans, Staphylococcus aureus. Partial deterioration of TROPICALGIN alginate was noticed following immersion into 30% Cymbopogon Citratus (leading to poor surface quality of the resultant casts.)Compatibility studies need to be performed in order to have analyzed methodologies for dimensional changes, anti-microbial efficacy and surface quality of the impression material after their disinfection. Antimicrobial efficacy of 2 % Glutaraldehyde is less in comparison to 30 % Cymbopogon Citratus on resultant selected microorganism in this study.

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