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"Effectiveness of Surface Treatment with spray disinfectants on Impression Materials"

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Abstract
Purpose: *To evaluate the efficacy of 0.5 % Sodium hypochlorite and 2% Glutaraldehyde spray disinfectants on impression compound and irreversible hydrocolloid impressions.*
Material and Methods: *Twenty edentulous patients (age group of 45-65 years) were randomly selected for the present study. Maxillary and mandibular impressions of 10 patients were made in compound and remaining 10 patients in alginate. All 40 impressions were swabbed and incubated on nutrient agar culture media. Both alginate and compound impressions were divided into two groups of 10 each . 50% of total impressions of alginate and compound were disinfected with 0.5% NaOCl and were designated as group –I and remaining 50% impressions of both were disinfected with 2% Glutaraldehyde and were designated as group –II respectively.*
Post 10 minutes, the impressions were reswabbed and incubated on nutrient agar culture media for 24-48 hours and microbial colony count was carried out.
Results: *Numerous gram positive and gram negative bacteria , were found to be present on compound and irreversible hydrocolloid impressions obtained from edentulous patients. Both the disinfectants, 0.5 % Sodium hypochlorite and 2% glutaraldehyde were statistically equally effective against gram positive and gram negative organisms. However, sodium hypochlorite 0.5% is marginally more effective than 2% glutaraldehyde on irreversible hydrocolloid.*
Conclusions: *Within the limitations of this study, it can be concluded that 2% Glutaraldehyde and 0.5% Sodium hypochlorite are highly effective against gram positive and gram negative organisms and eliminate around 90-100% bacteria. So, oral impressions can be satisfactorily disinfected using either 0.5 % Sodium hypochlorite or 2% Glutaraldehyde. It is recommended that disinfection of impressions should be practiced regularly to prevent cross infection.*
Keywords: *Disinfectants, impressions, infection.*

I. Introduction

The human mouth is usually the first to be exposed to microorganisms at birth during passage through the birth canal. Most of the microorganisms are transient and do not establish as regular inhabitants of the oral cavity. However, with passage of time, the child is exposed to numerous other environmental microorganisms. Eruption of primary teeth results in a major change in this environment, providing tooth surfaces and gingival crevices, which make further opportunities for infection in the mouth. Further, new bacterial strains also appear that can survive only on teeth making the oral flora the most concentrated microbial population of the body.

In1980s, a new era began in the field of dentistry where the issues of cross infection control, chemical hazards, communications and infectious waste management were paid heed, which brought a great change in clinical practice[1]. In dentistry all the clinical procedures are undertaken in an environment in which there is saliva and blood contaminated with micro-organisms. The last decade has seen many changes in the clinical practice of general dentistry directed to effectively implement infection control which has also been a prime concern in Prosthodontic practice.

Prosthodontic patients are generally a high risk group relative to their potential to transmit infectious diseases as well as acquire them. There has been a recent increased awareness regarding the need for cross

infection control measures to protect against possible routes of transmission of potential pathogens. Cross contamination control measures are considered within the following categories[2] :

- Patient evaluation
- Personal protection
- Instrument and equipment contamination
- Clinical technique
- Impression handling
- Laboratory asepsis

The standard procedure of rinsing impressions under running tap water, immediately post removal from the mouth provides only a gross removal of contamination with saliva and blood and does not completely eliminate all microorganisms. Surface disinfection to inactivate infectious agents is highly desirable to reduce the potential transmission of disease to dental personnel from contaminated impressions[3].

A number of professional organizations have issued recommendations for cross infection control, but there is an inadequate implementation regarding the ease with which the oral micro-organisms can be removed by disinfectants from impression material and cast [4,5]. Therefore it is the responsibility of dental practitioners to comply with the infection control measures and establish a set of practical procedures that are simple, safe, scientific, legal, cost effective and quick.

To prevent cross contamination during clinical and laboratory procedures among patients, operators and technicians, several new products are being continuously developed. Of these, 0.5% Sodium hypochlorite and 2% Glutaraldehyde have been considered effective. Spray disinfectants are usually preferred over immersion disinfectants as negligible dimensional changes are seen in the impressions when former is used.[6.]

Numerous studies have demonstrated the antimicrobial properties of 0.5% sodium hypochlorite on irreversible hydrocolloid impression material [3,7,8,9,10]. Relatively fewer studies have been done to assess the antimicrobial properties of 0.5% sodium hypochlorite and 2% glutaraldehyde on irreversible hydrocolloid impression material[12]. However, comparative studies evaluating the antimicrobial effectiveness of 0.5% sodium hypochlorite and 2% glutaraldehyde on irreversible hydrocolloid are rare.

Hence this *in vivo* study was conducted in the Department of Prosthodontics, in collaboration with Department of Microbiology to evaluate the efficacy of two spray disinfectants, that are 0.5% Sodium hypochlorite & 2% Glutaraldehyde on compound & irreversible hydrocolloid impressions

II. Materials And Methods

Twenty edentulous patients in age group of 45-65 years were enrolled in the study. Ethical approval was obtained from the institution. Prior to the participation in the study, a written consent was obtained from all the patients. Apparently healthy patients showing no evidence of any local or systemic disease were selected. Standard techniques were used for making the impressions by the same prosthodontist

All the patients were asked to rinse once with water prior to impression making. Maxillary and mandibular impressions of 10 patients were made in compound and remaining 10 patients in alginate using suitable metal stock trays. All 40 impressions were swabbed and incubated on nutrient agar culture media **(Fig.1).** Both alginate and compound impressions were divided into two groups of 10 each. 50% of total impressions of alginate and compound were disinfected with 0.5% NaOCl and were designated as group –I **(Fig.2)** and remaining 50% impressions of both were disinfected with 2% Glutaraldehyde and were designated as group –II respectively.

Post 10 minutes, the impressions were reswabbed and incubated aerobically at 37°C on nutrient agar culture media for 24-48 hours and also incubated under micro-aerophyllic conditions by providing 5-10% CO_2. Then the microbial colony count was carried out**(Fig.3)** and were viewed microscopically **(Fig.4).** The cases where no bacterial growth could be obtained post incubation , were excluded from the study. The findings were recorded.

Comparisons between groups were made by using Mann-Whitney U test while assessment of change within groups from pre-treatment to post-treatment were done using Wilcoxon signed rank test. The confidence level was 95% and a "p" value less than 0.05 indicated statistically significant difference.

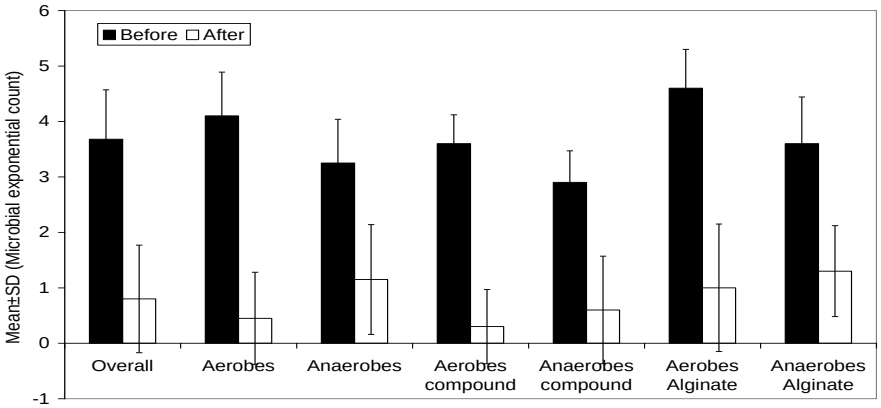
III. Results

Numerous gram positive and gram negative bacteria , were found to be present on compound and irreversible hydrocolloid impressions obtained from edentulous patients. Both the disinfectants, 0.5 % Sodium hypochlorite and 2% glutaraldehyde were statistically equally effective against gram positive and gram negative organisms. However, sodium hypochlorite 0.5% is marginally more effective than 2% glutaraldehyde on irreversible hydrocolloid as shown in Table 1 and Table 2.

Table 1: Comparison of Post treatment Change in Microbial count in Group I

Values in exponential terms (10^n)

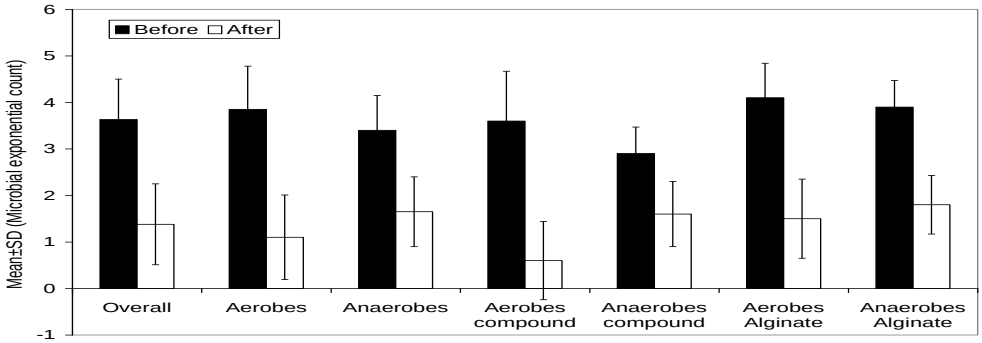
Time interval	Before treatment						After treatment						Significance of difference (Wilcoxon signed rank test)	
	n	Mean	SD	P_{50}	Range		n	Mean	SD	P_{50}	Range		z	p
					min	max					min	max		
Overall	40	3.68	0.89	4	2	5	40	0.80	0.97	0	0	3	5.555	<0.001
Aerobes	20	4.10	0.79	4	3	5	20	0.45	0.83	0	0	2	3.963	<0.001
Anaerobes	20	3.25	0.79	3	2	5	20	1.15	0.99	1	0	3	3.976	<0.001
Aerobes compound	10	3.60	0.52	4	3	4	10	0.30	0.67	0	0	2	2.850	0.004
Anaerobes compound	10	2.90	0.57	3	2	4	10	0.60	0.97	0	0	2	2.836	0.004
Aerobes Alginate	10	4.60	0.70	5	3	5	10	1.00	1.15	1	0	3	2.842	0.004
Anaerobes Alginate	10	3.60	0.84	4	2	5	10	1.30	0.82	2	0	2	2.859	0.004



For all the conditions, after treatment levels were significantly lower as compared to before treatment ($p<0.05$).

Table 2: Comparison of Post treatment Change in Microbial count in Group II
Values in exponential terms (10^n)

Time interval	Before treatment						After treatment						Significance of difference (Wilcoxon signed rank test)	
	n	Mean	SD	P_{50}	Range		n	Mean	SD	P_{50}	Range		z	p
					min	max					min	max		
Overall	40	3.63	0.87	4	2	5	40	1.38	0.87	2	0	3	5.563	<0.001
Aerobes	20	3.85	0.93	4	2	5	20	1.10	0.91	1	0	2	3.967	<0.001
Anaerobes	20	3.40	0.75	3	2	5	20	1.65	0.75	2	0	3	4.005	<0.001
Aerobes compound	10	3.60	1.07	3	2	5	10	0.60	0.84	0	0	2	2.820	0.005
Anaerobes compound	10	2.90	0.57	3	2	4	10	1.60	0.70	2	0	2	2.970	0.003
Aerobes Alginate	10	4.10	0.74	4	3	5	10	1.50	0.85	2	0	2	2.877	0.004
Anaerobes Alginate	10	3.90	0.57	4	3	5	10	1.80	0.63	2	1	3	2.836	0.005



For all the conditions, after treatment levels were significantly lower as compared to before treatment ($p<0.05$).

IV. Discussion

Minimizing the risk of disease transmission in the dental workplace has become a high priority for the dental profession today. Contaminated materials are routinely sent to dental laboratories thus creating an occupational hazard. Microbial contamination of dental materials and prosthesis has been documented by **Wakefeld et al**[11]. Such pathogenic contaminants include bacteria such as E.coli, staphylococcus aureus , streptococcus mutans, yeast and Candida albicans. **Samaranayake et al** [12] found the coliforms organism E.coli and fungus C.albicans to be more persistent on impression materials than staphylococcus aureus or streptococcus mutans.

A routine procedure of disinfection should be done on primary and secondary impressions to reduce the risk of contamination of the casts. Casts which are not disinfected carry the virus, micro-organisms from the oral cavity and some of them survive for longer periods. The dentists, their assistants, and technicians face the hazard of getting infected from some of the pathogenic organisms contained on the cast. Therefore, there is a need to effectively disinfect these impressions.[13]

In the present study, 0.5% Sodium hypochlorite and 2% Glutaraldehyde were used to spray the impression in a even manner to coat its surface. These disinfectants were particularly selected as they have been shown to be the most effective disinfectants [14]**.** Swabs for culture taken pre and post the disinfection were inoculated on culture media nutrient agar to see the growth of gram positive and gram negative organism. This bacteriological investigation was done to assess the growth of bacterial colonies and their species. These disinfectants can be used either in form of immersion or as spray disinfectant. Immersion disinfectant though effective are not as satisfactory as spray, considering their adverse effect on the dimensional stability. Spray disinfectants are therefore superior and produce good disinfection. Considering this, spray disinfection method was employed in the present study.

Among the two impression materials used for edentulous impression it has been reported that irreversible hydrocolloid material has an intrinsic retentive potential for microbes as compared to impression compound materials and is therefore potentially more difficult to disinfect. It has been reported by **Samaraayanke et al**[12] that irreversible hydrocolloid impression carry three to four times more organisms than impression compound,so irreversible hydrocolloid impression were included in this study.

A few of the earlier investigators have studied the disinfection of irreversible hydrocolloid impression by an indirect method of taking hydrocolloid impression in a typodont and later exposing the impression to an artificial saliva broth containing selected groups of bacteria after rinsing the impression in running water.[13]Swabs were then made and inoculated in culture media. It is felt that a direct study involving the micro-organisms carried on the impressions from the oral cavity will be more accurate to assess the efficacy of disinfectants. Therefore in the present study a direct method was preferred.

The results of the present study clearly indicate that both the disinfectants, 0.5 % Sodium hypochlorite and 2% glutaraldehyde revealed a statistically significant difference as compared to controls, both in case of compound impressions as well as alginate impressions. This is based on the fact that the disinfection efficacy ranged between 92% - 99.97% considering all the situations.

The data collected was based on the colony forming units in the culture media .These were counted with colony counter and the counts were expressed under the standard method of recording microbial colony count ***(****Cfu Count****)*** .The bacteriological investigation clearly demonstrated that the colony forming units recovered pre disinfection were much greater than post disinfection. It was also seen that both 0.5% Sodium hypochlorite and 2% Glutaraldehyde solution were more effective on gram positive organisms such as streptococcus mutans, viridians, peptostreptococcus than gram negative organisma such as Prevotella, Pseudomonas, Klebsiella. Sodium hypochlorite 0.5% was marginally more effective than 2% Glutaraldehyde on gram positive as well as gram negative organisms.

Though most of the organisms cultured were commensals and grouped as non- pathogenic, they might be able to cause cross infection if their virulence & no. is high or the resistance of host is compromised.

This study has been carried out on edentulous patients it is presumed that dentulous patients and those having any oro- dental pathology have the potential to transmit the infection to dental personnel.

This study shows the importance of disinfecting the impressions as a precautionary measure in order to prevent cross infection in the dental clinic and the dental laboratory.

V. Conclusions

From the results of the foregoing microbiological study the following conclusions were drawn.

1. The Antimicrobial activity of spray disinfectants - 2% Glutaraldehyde and 0.5% Sodium hypochlorite was found statistically to be equally effective both against gram positive and gram negative organisms.

2. Sodium hypochlorite 0.5% was found to be marginally more effective than 2% Glutaraldehyde on Irreversible hydrocolloid.

3. Routine disinfection of impressions using either of the disinfectant is recommended to be followed to prevent cross infection in dental practice.

Bibliography

[1]. Runnells R.R, Powell G. Lynn : Managing infection control, Hazards communications, and infection waste disposal. DCNA. April 1991;35:299- 308.
[2]. Connor Clare: Cross contamination control in prosthodontic practice. Int. J. of Prosthodontics.1991 ; 4 : 337-344.
[3]. McNeill MR, Coulter WA: Disinfection of irreversible hydrocolloid impressions- A comparative study. Int. J. Prosthodontics.1992; 5(6): 563-567
[4]. ADA council on dental therapeutics and council on prosthetic services and dental laboratory relations: guidelines for infection control in dental office and commercial dental laboratory. J. Am. Dent Assoc.1985; 100 : 969 - 972.
[5]. British Dental Association Guide to blood borne viruses and the control of cross infection in dentistry. London, 1987.
[6]. Bergman Bo: Disinfection of Prosthodontic impression materials: A literature review. Int. J. Prosthodontics.1989; 2: 537-542.
[7]. Rueggeberg Frederick A. et al: Sodium hypochlorite disinfection of irreversible hydrocolloid impression material. Journal of Prosthetic dentistry. 1992; 67: 628- 631.
[8]. Durr, D.P. and Novak, E.V.: Dimensional stability of alginate impressions immersed in disinfecting solutions. Journal of Dentistry for Children. 1987; 54: 45-48.
[9]. Gerhardt Donald E. & Williams Henry N.: Factors affecting the stability of Sodium hypochlorite solutions used to disinfect dental impressions. Quintessence International. 1991; 22:587-591.
[10]. Beyerle MP, Hensley DM : "Immersion disinfection of irreversible hydrocolloid impressions with Sodium hypochlorite. Int.J. Prosthodontics. 1994; 7(3): 234-238.
[11]. Wakefield C W: Laboratory contamination of dental prostheses. J. Prosthet. Dent. 1980; 65: 143-146.
[12]. Lakshman P. Samaranayake: Carriage of oral flora on irreversible hydrocolloid and elastomeric impression materials. J. Prosthet Dent. 1991; 65: 244-249.
[13]. Leung R.L & Schonfeld S.C.: Gypsum casts as a potential source of microbial cross contamination. Journal of Prosthetic dentistry.1983; 49: 210 -211.
[14]. Storer, R. and Mc Cabe : An investigation of methods available for sterilizing impressions. British Dental Journal. 1981; 151: 217-219

Figure Legends

Fig.1 Collecting Swab From Impression.
Fig.2 Spraying Disinfectant On The Impression
Fig. 3 Colony Forming Units As Seen Through Colony Counter
Fig. 4 Gram + Ve & Gram –Ve Bacteria: Microscopic Views

FIGURES

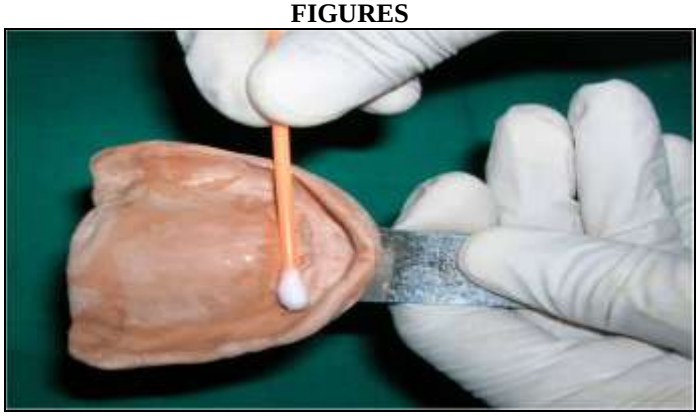


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Fig.2 Spraying Disinfectant On The Impression

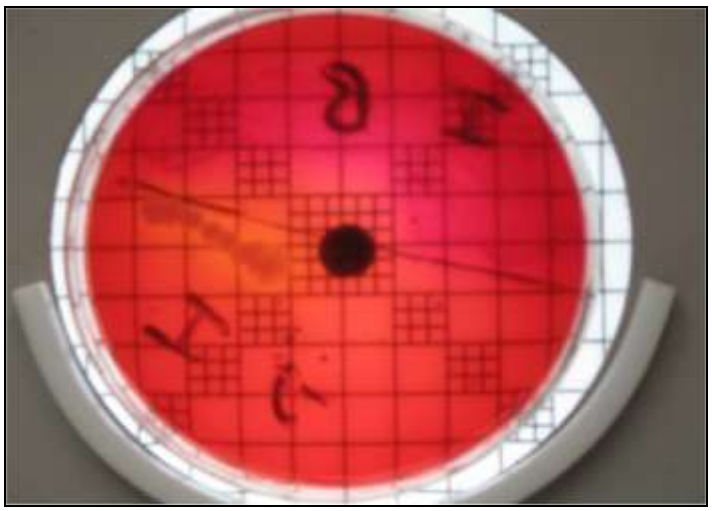

Fig. 3 Colony Forming Units As Seen Through Colony Counter

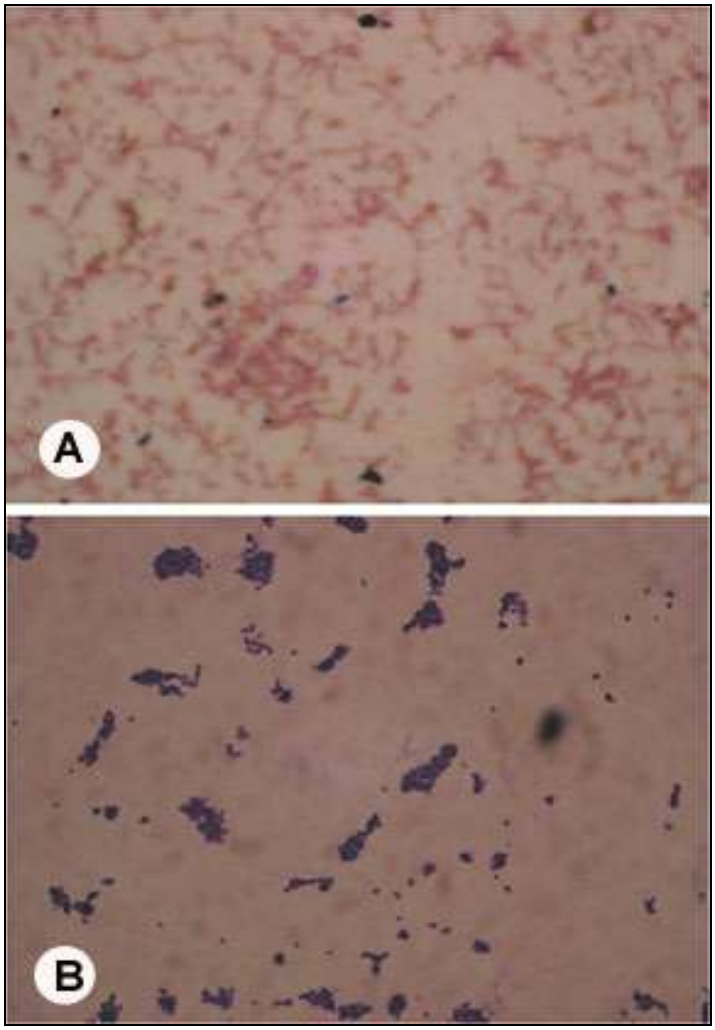

Fig. 4 (a) Gram + Ve & (b)Gram –Ve Bacteria: Microscopic Views