

## ORIGINAL RESEARCH

# Antimicrobial Efficacy of Different Disinfectant Materials on Alginate Impression - A Comparative Study

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## ABSTRACT

**Background:** Impressions constitute one of the main factors in the chain of infection. Dental impressions are one such kind in which the sterilization is not possible and can hence act as a means of transmitting infectious agents from patients to those who handle them subsequently. Hence, the present study was aimed to evaluate the effectiveness of spray disinfectants against oral microorganisms on the irreversible hydrocolloid impression material that is alginate.

**Material and Methods:** In this study, alginate impressions of 30 patients were taken. 10 patients were randomly divided into three groups each. Different groups of the study are Group A - 0.5% sodium hypochlorite, Group B - 2% glutaraldehyde, and Group C - distilled water. The total bacterial count was taken for each impression before and after disinfection to compare the effectiveness against oral microorganisms.

**Results:** 2%, glutaraldehyde i.e., Group B was the most effective among all the groups which resulted in 99.3% reduction in the total bacterial count. 0.5% sodium hypochlorite, i.e., Group A caused 98.4%, and distilled water, i.e., Group C caused 36% reduction in bacterial count. On statistical analysis, there was a significant difference in post-disinfection total bacterial count among three groups.

**Conclusion:** 2% glutaraldehyde and 0.5% sodium hypochlorite spray disinfectants can be effectively used for the disinfection of alginate impressions.

**Keywords:** Alginate, Glutaraldehyde, Irreversible hydrocolloid, Sodium hypochlor.

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## INTRODUCTION

Nowadays, in dentistry, there is growing concern toward the transmission of pathogenic agents to professionals involved in the manufacturing of prostheses, orthodontic devices, and other appliances used in rehabilitation treatments. Impressions constitute one of the main factors in the chain of infection.<sup>[1,2]</sup> Dental impressions are one such kind in which the sterilization is not possible and can hence act as a means of transmitting infectious agents from patients to those who handle them subsequently. For prevention of this transmission, effective infection control procedures should be exercised by all dental health-care personnel.<sup>[3]</sup>

Multiple studies have been done with the purpose of establishing protocols for disinfection to decrease the contamination of impressions before making gypsum casts. The impression material properties should be preserved, irrespective of the disinfection method used.<sup>[4]</sup> Among the impression materials, irreversible hydrocolloid, i.e., alginate is the most commonly used and also one of the most criticized one in terms of its disinfection process. It even has certain limitations, such as the material's dimensional instability and set boundaries to the treatment, and as a result of its hydrophilic nature, it has the highest retention of bacteria.<sup>[5,6]</sup>

Disinfection of impression is done mainly by two methods: (1) Immersion and (2) sprays. Spray method does not completely expose the contaminated surface and undercuts to the antimicrobial agent, whereas immersion method covers all the surfaces but not considered ideal, as some impression materials, such as alginate, absorb water, and distort, when they are immersed in disinfectant materials due to their hydrophilic properties. Hence, spray method can be used for disinfection, as in contrast to immersion, it limits the amount of distortion. Disinfectant should be such that it will take the least amount of time for the disinfection.<sup>[6,7]</sup>

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Several new products are being continuously developed. Literature mention of many disinfectant materials used to disinfect the dental impressions such as aldehydes, chlorine compound, chlorhexidine, iodine compound, and sodium fluoride. Among these, 0.5% sodium hypochlorite and 2% glutaraldehyde have been considered effective.<sup>[8,9]</sup>

Keeping this background in mind, this study was conducted to find the effectiveness of spray disinfectants against oral microorganisms on the irreversible hydrocolloid impressions material that is alginate.

## MATERIALS AND METHODS

### Sample

For the present study, 30 patients with Class I malocclusion and 2–3 missing teeth were randomly included in the study. Each of the patients was evaluated for medical and dental history. Treatment plan and study procedure were explained to the patient. After their consent, they were included.

### Making of Impression

The impressions were made with alginate (Alginate-Zelgan 2002, Dentsply India Pvt. Ltd., Gurgaon) which was manipulated according to the manufacturer's instructions.

The disinfectants used in this study were 0.5% sodium hypochlorite and 2% glutaraldehyde. Appropriate impression trays were used for the impression, and a total of 30 impressions of maxillary arch were taken out in 30 patients who were randomly divided into three groups of each containing 10 patients.

Group A - 0.5% sodium hypochlorite

Group B - 2% glutaraldehyde

Group C - Distilled water.

After removal from the mouth, the impression was washed with running tap water for 15 s to remove excess saliva. Each of the impressions was numbered on the back of it.

### Pre-disinfectant Microbial Colony Count

For this purpose, the surface of each of the impression was swabbed with sterile needle wire and was applied into nutrient broths. For 30 s, nutrient broths were vortexed and then 10 µl from each suspension was inoculated onto nutrient agar media using a micropipette and incubated for 24 h at 37°C. After 24 h, the microbial colony count was then carried out using a colony counter.

### Disinfectant Procedure

Impressions of Group A, Group B, and Group C impressions were disinfected.

Group A - Impressions sprayed with 0.5% sodium hypochlorite disinfectant

Group B - Impressions sprayed with 2% glutaraldehyde disinfectant

Group C - Impressions sprayed with distilled water.

Care was taken to evenly distribute disinfectant across the impression, and no area was left uncovered. After disinfection, each of the impression was kept in airtight polythene bag for 10 min.

### Post-disinfectant Microbial Colony Count

After 10 min, each of the impressions was removed from the plastic bag and again swabbed with sterile needle wire and was applied onto nutrient broths. For 30 s, nutrient broths were vortexed, and then 10 µl from each suspension was inoculated onto nutrient agar media using a micropipette and incubated for 24 h at 37°C. After 24 h, the microbial colony count was then carried out using a colony counter. All 30 impressions were treated in similar manner.

### Statistical Analysis

The data were recorded, analyzed, and compared using *t*-test and ANOVA in SPSS 16.

## RESULT

The present study was conducted to find the effectiveness of spray disinfectants against oral microorganisms on alginate. There was no significant difference between the three groups in background variables, i.e., gender and age [Tables 1 and 2, Graph 1].

As seen in Table 3 pre-disinfection, there was no significant statistical difference in total bacterial count between study groups. Post-disinfection Group A, i.e., 0.5% sodium hypochlorite group showed 98.4% reduction in total bacterial count, Group B, i.e., 2% glutaraldehyde group showed 99.3% reduction, and Group C, i.e.,

**Table 1:** Gender distribution in different study groups

Groups	Gender		Total
	Male	Female	
Group A	5	5	10
Group B	6	4	10
Group C	5	5	10
Total	16	14	30

**Table 2:** Age distribution in different study groups

Groups	<i>n</i>	Mean±SD
Group A	10	36.20±6.925
Group B	10	37.10±7.651
Group C	10	37.20±8.702
Total	30	36.83±7.534

SD: Standard deviation

distilled water group showed 36% reduction. Difference in post-disinfection bacterial count was statistically significant [Table 4]. However, when Group A compared with Group B, there was no statistically significant difference [Table 5].

## DISCUSSION

Prosthetic patients constitute a high-risk group compared to their potential to transmit infectious diseases as well as acquire them. Recently, there has been increased awareness of the need for cross-infection control measures to protect against possible routes of transmission frequently overlooked in the past. Dental practitioners, patients, and laboratory personnel are subjected to notable risks with respect to infectious diseases, which can be spread by saliva or blood from contaminated

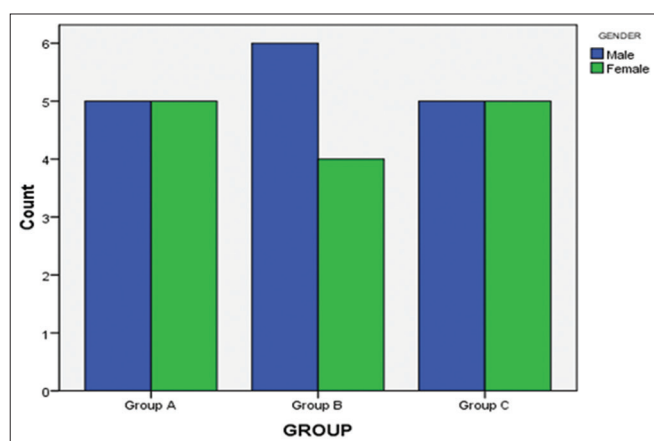
impression material, particularly irreversible hydrocolloid impression material like alginates.<sup>[10]</sup>

Oral floras have ecologically diverse population groups and contain at least 350 cultivable species.<sup>[11]</sup> There are numerous types of microorganisms present in the human oral cavity, such as bacteria, viruses, fungi, and others. As discussed before in dentistry, cross-contaminated infections are very common. Therefore, dentists as well as dental auxiliaries are possible targets of contamination. Multiple infectious diseases can be transmitted during dental treatment, including tuberculosis, hepatitis A, B, and C, syphilis, and acquired immunodeficiency syndrome. According to different studies, dental impressions are one of the main sources of cross-contamination between dentists, patients, and dental auxiliaries.

Dental impressions consist of taking impression material into the mouth and are able to register the anatomical relief of the desired area that is dimensionally stable. And it replicates the anatomy of the impressed area when poured with gypsum product. During this procedure, the material has contact with patient's teeth, dental plaque, saliva, and blood, which are sources of contamination containing a great number of microorganisms of the flora upon removal from the mouth.<sup>[12]</sup>

Cross-contamination control procedures are considered within several categories such as patient evaluation, personal protection, clinical practice, equipment contamination, impression handling, and laboratory asepsis.<sup>[13]</sup> The 1980's was a start of new era in the field of dentistry, where cross-infection control, communications, infectious waste management, and chemical hazards were highlighted to denote a great change in clinical practice.<sup>[14]</sup> In dentistry, majority of the clinical treatments are undertaken in an environment in which there are saliva and blood contaminated with microorganisms. The standard procedure of washing impressions under running water instantly after removal from the mouth prevents only a gross removal of contamination with saliva and blood but fails to completely eliminate all microorganisms. Surface disinfection to inactivate infectious agents is highly recommended to reduce the potential transmission of disease to dental personnel from contaminated impressions.<sup>[15]</sup>

The American Dental Association (ADA, 1985) and many other professional organizations proposed guidelines to limit cross-contamination during dental clinical procedures such as impression disinfection. However, unfortunately, adequate data regarding infection control and sterility of impression materials received by the dentist from the manufacturer are not readily available. Further study in this area is warranted because of the increasing number of subjects



Graph 1: Gender distribution in different study groups

Table 3: Pre-disinfection total bacterial count (CFU/ml) in different study groups

Groups	n	Mean	SD	F	Significance
Group A	10	$8.94 \times 10^5$	75453.621	0.232	0.795
Group B	10	$8.91 \times 10^5$	31259.800		
Group C	10	$9.08 \times 10^5$	67941.506		

SD: Standard deviation

Table 4: Post-disinfection total bacterial count (CFU/ml) in different study groups

Groups	n	Mean	SD	F	Significance
Group A	10	$1.42 \times 10^4$	5014.766	198.042	0.0001
Group B	10	6675.40	2025.767		
Group C	10	$5.81 \times 10^5$	128009.394		

SD: Standard deviation

Table 5: Comparison between post-disinfection total bacterial count between Group A and Group B

Groups	n	Mean	SD	t	Significance
Group A	10	$1.42 \times 10^4$	5014.766	4.37	0.036
Group B	10	6675.40	2025.767		

SD: Standard deviation

who were immunocompromised due to disease process, elderly individuals, and patients on chemotherapy who are very prone to normal or opportunistic infections.<sup>[16]</sup>

The growing importance of infection control has created interest in the possible hazard of the clinical use of commercial available irreversible hydrocolloid impressions material, i.e., alginate impression material. Previous studies have demonstrated microbial contamination in commercially available alginate impression material.<sup>[17]</sup>

Several methods of disinfection for alginate impression materials were proposed. Spray and immersion methods are the two most widely used techniques in clinical practice. Each method has its advantages and disadvantages. The present study was conducted to know the effectiveness of spray disinfectants, i.e., 0.5% sodium hypochlorite, 2% glutaraldehyde, and distilled water against oral microorganisms on alginate impression material.

Results of this study showed that 2% glutaraldehyde was the most effective among all the groups which resulted in 99.3% reduction in total bacterial count. 0.5% sodium hypochlorite caused 98.4% and distilled water 36% reduction in bacterial count. On statistical analysis, there was a significant difference in post-disinfection total bacterial count among three groups; however, comparison of Group A (0.5% Sodium hypochlorite) and Group B (2% Glutaraldehyde) showed no significant statistical difference.

In this study, Group C (distilled water) showed 36% reduction in microbial count which was in accordance with the study by Al-Jabrah *et al.* which reported 40% reduction.<sup>[18]</sup>

Aeran *et al.* also found that disinfectant was highly effective eliminating about 90–100% bacterial load.<sup>[19]</sup> Furthermore, results of a study conducted by Doddamani *et al.* were in accordance with the results of the present study and also it was found that sodium hypochlorite works better in higher concentration, i.e., 5.25% with lesser contact time.<sup>[20]</sup>

In contrast to the present study, 2% glutaraldehyde eliminated 46.74% of bacteria colony count, while 0.5% sodium hypochlorite eliminated 43.33% of bacteria colony count.<sup>[21]</sup>

The outcome of the present study showed that 0.5% sodium hypochlorite and 2% glutaraldehyde are effective disinfectants resulting in a reduction in total bacterial count; however, it did not evaluate in detail about effectiveness against different types of bacteria and viruses. Hence, further studies should be planned with this concern.

## CONCLUSION

Disinfection of the dental impressions should be the fundamental step to prevent the transmission of microorganisms and diseases, i.e., cross contamination. As found in the present study, spray disinfectants 0.5% sodium hypochlorite and 2% Glutaraldehyde can be used safely in impression disinfection before pouring with gypsum material. 2% glutaraldehyde was marginally better than 0.5% sodium hypochlorite.

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