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Comparative assessment of chlorhexidine, autoclave, aleo vera and microwave irradiation for disinfection of impression materials

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Abstract---Objectives: The present research was done to assess the disinfection of impression materials with chlorhexidine, autoclave, aleo vera and microwave irradiation. Materials & Methods: The present research was done in the department of Prosthodontic. The

study consists of 48 alginate impression materials which were disinfected with chlorhexidine, autoclave, aloe vera and microwave irradiation for disinfection of impression materials. The pre and post bacterial count was evaluated. Results: The average post disinfection of microbial contamination showed that; Group 1 with chlorhexidine was more effective (434.1 at pre and 21.5 at post) with lesser microbial count followed by group III with autoclave (411.1 at pre and 27.4 at post), Group-II with microwave irradiation (321.4 at pre and 13.3 at post) and least effective with group IV: Aloe vera (278.6 at pre and 11.1 at post). One-way ANOVA test was applied which revealed significant difference ($P < 0.05$) in colony forming unit (CFU) in all groups. Conclusion: Authors found that chlorhexidine, is the better method of sterilization along with autoclave, whereas microwave irradiation and Aloe vera were also effective as disinfectant.

Keywords---aloe vera, autoclave, disinfection, chlorhexidine, impression materials, microwave irradiation.

Introduction

Dental impression materials are often contaminated with oral saliva and blood. Hence dentist and laboratory person handling impression materials are always susceptible to get infected.¹ Proposal by Guidelines for infection control in dental health care comprise that disinfection, cleaning, disinfection, and rinsing of all dental prostheses and prosthodontic items should be finished before they are handling in the laboratory using an active hospital disinfectant.²

There are several disinfection methods such as soaking in chemical disinfectant, autoclave, radiation, herbal etc.³ The disinfectant solution should show greater efficacy in the reduction of pathogenic microorganisms without interfering with the dimensional stability or ability to replicate particulars of the material. Sterilization is a method that removes all microorganisms unlike disinfection.⁴

Disinfection is considered into three groups such as high level disinfection, which consists of bacterial spore and other microbial forms inactivity, intermediate level disinfection contains, destruction of microorganisms like tubercle bacilli and low level disinfection possesses narrow antimicrobial activity.⁵ The present study was done to assess the chlorhexidine, autoclave, aloe vera and microwave irradiation for disinfection of impression materials.

Materials & Methods

The current study was done in the Department of Prosthodontics, after attaining ethical clearance from institutional ethics committee. It comprised of 48 alginate impression materials, divided equally into 4 groups. The study was done by two trained investigators. Four groups were made. In Group-1: chlorhexidine, Group-II: microwave irradiation, group-III: Autoclave, and group IV: aloe vera for disinfection of impression materials. Subsequent to disinfection and autoclaving, all the impressions were exposed for microbial valuation. To find the growth of

micro-organisms, nutrient agar was included as a media. On the Petri plates containing the nutrient agar, poured plate technique was used to equally distribute the diluted samples. These Petri plates were then inoculated and incubated at 37°C for 24 h. Total number of colony forming units (CFU's) of the viable micro-organisms subsequent to incubation were inspected and noted using a digital colony counter on petri dish. The pre disinfectant count was associated with post disinfectant count. The obtained data statistically evaluated with SPSS version 20 (IBM, Chicago, USA). The total viable count was expressed as mean and standard deviation (SD) using One-way ANOVA and t test to associate pre and post disinfectant CFU in all groups with p significance at 0.05.

Results

Table 1 and 2 indicates average pre and post disinfection of microbial contamination in various groups. The average post disinfection of microbial contamination showed that; Group 1 with chlorhexidine was more effective (434.1 at pre and 21.5 at post) with lesser microbial count followed by group III with autoclave (411.1 at pre and 27.4 at post), Group-II with microwave irradiation (321.4 at pre and 13.3 at post) and least effective with group IV: Aloe vera (278.6 at pre and 11.1 at post). One-way ANOVA test was applied which revealed significant difference ($P < 0.05$) in CFU in all groups. All the tested group had disinfection capacity but chlorhexidine was more effective (Table-2). One-way ANOVA test was applied which revealed significant difference ($P < 0.05$) in CFU in all groups.

Discussion

Cross infection is the conversion of an infectious origin from one individual to another in a clinical situation. ⁶ Infection transmission may be seen in process of carrying impression material. Dental staff including hygienists is at higher risk to getting exposed to infectious agents such as AIDS, hepatitis, herpes simplex and cytomegalovirus etc. ⁷ Worldwide it has been observed that around 300-400 million people are chronic hepatitis B carriers. ⁸ For dental practitioners, spread of hepatitis virus is the main occupational hazards. Moreover, HIV can be transmitted by transfusions, needle stick injury or contact of mucous membrane with the blood or body fluids of a carrier. Dentists are very prone to such detriments due to their scenery of work. The current study was done to assess the chlorhexidine, autoclave, aloe vera and microwave irradiation for disinfection of impression materials.

Ganavadiya et al found that autoclaved instruments resulted in complete elimination of viable micro-organisms. In decreasing order H₂O₂ group displayed higher decrease in microbial count followed by glutaraldehyde, ethyl alcohol and distilled water. ¹⁰ Jha et al stated that, significant decreases in bacterial count in sterilized area with Ecosan® as related to water. ¹¹ Ecosan® is developing as a powerful herbal disinfectant which hold characteristic and structure of honey with primary active ingredient as natural polymer of glucosamine. The occurrence of quaternary ammonium compound is used as an emulsifying agent. The natural anthraquinones in the form of aloin from Aloe Vera also boosts its antimicrobial property. This natural polymer of glucosamine in mixture with Aloe Vera has bioactive properties, wound healing, haemostatic, and tissue regeneration. ¹²

Samra and Bhide observed better result for dimensional stability and acceptable disinfection using ultra violet chamber and sodium hypochlorite disinfection method.¹³ Trivedi et al concluded that Spraying with aloe vera for 7 minutes was proved to be the most effective disinfection procedure without altering dimensional stability.¹⁴ In contrast to our findings Goel et al evaluated Sodium Hypochlorite and Microwave Irradiation as a disinfectant and found that microwave irradiated Kala stone casts showed an improved disinfection system linked with 0.07% sodium hypochlorite.¹⁵ The drawback of the study was limited sample size using lesser disinfectant types. Further studies are necessary to assess on larger sample size with different disinfecting methods.

Conclusion

Authors found that chlorhexidine, is the better method of sterilization along with autoclave. Whereas microwave irradiation and Aloe vera were also effective as disinfectant.

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Legends for illustrations

Tables

Table 1: Microbial contamination during pre disinfection

Groups	Mean (10 ⁶ CFU/ml)	P value
Pre-disinfection		
Group I Chlorhexidine	434.1	0.081
Group II microwave	321.4	
Group III Autoclave	411.1	
Group IV aloe vera	278.6	
Post-disinfection		
Group I Chlorhexidine	21.5	0.001
Group II microwave	13.3	
Group III Autoclave	27.4	
Group IV aloe vera	11.1	

One-way ANOVA, $p < 0.05$, significant

Table 2: Assessment of the pre- and post-disinfection microbial contamination in various groups

Groups	Pre	Post	t	df	P
Group I Chlorhexidine	434.1	21.5	12.13	2	0.012
Group II microwave	321.4	13.3	9.23	2	0.042

Group III Autoclave	411.1	27.4	8.71	2	0.025
Group IV aleo vera	278.6	11.1	11.03	2	0.001

One-way ANOVA, $p < 0.05$, significant