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Comparative Assessment of Sodium Hypochlorite, UV Radiation, Aloe Vera and Microwave Irradiation for Disinfection of Impression Materials

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ABSTRACT

Introduction: There is a chance of cross-infection between dental clinics and dental laboratories with contaminated impression materials.

Objective: To evaluate the sodium hypochlorite, UV radiation, aloe vera and microwave irradiation for disinfection of impression materials.

Methods: The present research was done in the department of Prosthodontic. The study consists of 40 alginate impression materials which were disinfected with Sodium hypochlorite, UV radiation, 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 sodium hypochlorite was more effective (359.1 at pre and 24.1 at the post) with lesser microbial count followed by group IV with microwave irradiation (336 at pre and 35.7 at the post), Group-III with UV radiation and least effective (342.4 at pre and 102.6 at the post) with Aloe vera (311.4 at pre and 82.1 at the post). Application of the one-way ANOVA test showed substantial variance ($P < 0.05$) in CFU in all groups.

Conclusion: Authors observed that sodium hypochlorite is the better method of sterilization along with microwave irradiation. Whereas UV radiation and Aloe vera were also effective as a disinfectant.

Key Words: Aloe vera, Disinfection, Impression materials, Sodium hypochlorite, UV radiation, Microwave irradiation

INTRODUCTION

Impression materials are often polluted with oral fluid for example saliva and blood. Person handling with this impression material is susceptible to get infected if not maintained carefully. There are higher chances of cross-infection among dental laboratories and dental clinician. ¹ Earlier kind of research have verified that infected impressions can cross infect gypsum casts while pouring. There have been several methods for disinfection of impression materials. Rinsing with water was the simplest and regularly used method. A 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

Use of Chemical agents, autoclave, radiation, and herbal are various methods of disinfection of impression materials.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. In dental clinics, sterilization is a preferred method of cross-infection control.⁴

Disinfection is considered into three groups such as high-level disinfection, which comprises bacterial spore and other microbial forms inactivity, intermediate level disinfection

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contains, destruction of microorganisms like tubercle bacilli and low-level disinfection possesses narrow antimicrobial activity.⁵ The present research was done to evaluate the Sodium hypochlorite, UV radiation, aloe vera and microwave irradiation for disinfection of impression materials.

MATERIALS AND METHODS

The present research was conducted in the Department of Prosthodontics, after obtaining ethical clearance from the institutional ethics committee. It comprised of 40 alginite impression materials. The study was done by two trained investigators.

Four groups were made. In Group-I: sodium hypochlorite, Group-III: UV radiation, group-II: aloe vera and group-IV: microwave irradiation for disinfection of impression materials.

After disinfection and autoclaving, all the impressions were exposed to 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 incubated at 37°C for 24 h. Later the total number of colony-forming units (CFU's) of the viable micro-organisms were identified using a digital colony counter on the petri dish. The pre disinfectant count was associated with post disinfectant count.⁵

The obtained result was measured using SPSS version 21 (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 indicates the average pre and post disinfection of microbial contamination in various groups. Group 1 with sodium hypochlorite was more effective (359.1 at pre and 24.1 at the post) with lesser microbial count followed by group IV with microwave irradiation (336 at pre and 35.7 at the post), Group-III with UV radiation and least effective (342.4 at pre and 102.6 at the post) with Aloe vera (311.4 at pre and 82.1 at the post). One-way ANOVA test was applied which revealed a significant difference ($P < 0.05$) in CFU in all groups

All the tested group had disinfection capacity but sodium hypochlorite was more effective (Table 2). Application of the one-way ANOVA test showed substantial variance ($P < 0.05$) in CFU in all groups.

DISCUSSION

Cross infection control is the utmost substantial and applicable topic among health care workers. Cross infection is the conversion of an infectious origin from one individual to another in a clinical situation.⁶ From past twenty-two years, novel infectious diseases have been observed at a rate of one disease per year. Infection transmission may be seen in process of carrying impression material. Dental staff including hygienists is at higher risk of getting exposed to infectious agents such as AIDS, hepatitis, herpes simplex and cytomegalovirus etc.⁷

Worldwide it has been deliberated that around 300-400 million people are chronic hepatitis B carriers.⁸ For dental practitioners, the spread of the hepatitis virus is the main occupational hazards. Moreover, HIV can be transmitted employing transfusions, needle stick injury or contact of mucous membrane with the blood or body fluids of a carrier. Dentists are very prone to such injuries due to their nature of work. The present research was done to evaluate the Sodium hypochlorite, UV radiation, aloe vera and microwave irradiation for disinfection of impression materials. We observed that sodium hypochlorite is the better method of sterilization along with microwave irradiation.⁹

Ganavadiya et al. evaluated the effect of various disinfectants such as 2% glutaraldehyde, 6% hydrogen peroxide (H_2O_2), ethyl alcohol, autoclave method and distilled water in reducing viable microbial count. It was found that the autoclave method resulted in the complete elimination of viable microorganisms. In decreasing order H_2O_2 group displayed a higher decrease in microbial count followed by glutaraldehyde, ethyl alcohol and distilled water.¹⁰

Jha et al. in their study assessed the antimicrobial efficiency of organic disinfectant Ecosan® over only rinsing with water for disinfection of alginate impression material. There were significant decreases in bacterial count in the sterilized area with Ecosan® as related to water.¹¹

Ecosan® is developing as a powerful herbal disinfectant which holds characteristic and structure of honey with the primary active ingredient as the natural polymer of glucosamine. The occurrence of the quaternary ammonium compound is used as an emulsifying agent. The natural anthraquinones in 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 assessed the different disinfectants (glutaraldehyde, sodium hypochlorite and ultraviolet chamber on) on impression material (alginate and addition silicone of native origin) and observed better result for dimensional stability and acceptable disinfection using ultraviolet chamber and sodium hypochlorite disinfection method.¹³ Trivedi et al assessed the effectiveness of Aloe Vera

as a Disinfectant on Irreversible Hydrocolloid Impression Material. They 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 Alzin done a systematic review and meta-analysis on microwave irradiation, chemical, steam autoclave, ozone, ultraviolet light radiation, and electrolyzed oxidizing water disinfection on possessions of impression materials. They concluded that some studies stated substantial variations in the properties of the impression materials as a result of using different disinfection methods, however, others conveyed either minor insignificant or no changes. While the conclusions of the studies were controversial.¹⁶

The drawback of the study was the limited sample size using lesser disinfectant types. Further studies are necessary to assess on larger sample size with different disinfecting methods.

CONCLUSION

Sodium hypochlorite was more effective with lesser microbial count followed by microwave irradiation. UV radiation was least effective. Sodium hypochlorite is the better method of sterilization along with microwave irradiation.

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Authors contribution

1. Dr. Baburajan Kandasamy- Manuscript preparation
2. Dr. Preetica Sharma- Statistical analysis
3. Dr. R Naveen Reddy- Manuscript editing
4. Dr. G. Rajkumar *- Investigation
5. Dr. Suma Karthikeyan, -Data collection
6. Dr S.Santhakumari, - Investigation

REFERENCES

1. Maller SV, Karthik KS, Maller US, Abraham MC, Kumar RN, Manikandan R. Drug and dental impression materials. *J Pharm Bioallied Sci* 2012;4(Suppl 2): S316–S318.
2. Demajo JK, Cassar V, Farrugia C, Millan-Sango D, Sammut C, Valdramidis V, et al. Effectiveness of Disinfectants on Antimicrobial and Physical Properties of Dental Impression Materials. *Int J Prosthodont* 2016;29(1):63.
3. Chidambaranathan AS, Balasubramaniam M. Comprehensive Review and Comparison of the Disinfection Techniques Currently Available in the Literature. *J Prosthodont* 2017; 19:1-8.
4. Khinnavar PK, Kumar BH, Nandeeshwar DB. An in vitro study to evaluate the effect on dimensional changes of elastomers during cold sterilization. *J Indian Prosthodont Soc* 2015;15(2):131-137.
5. Nassar U, Chow AK. Surface Detail Reproduction and Effect of Disinfectant and Long-Term Storage on the Dimensional Stability of a Novel Vinyl Polyether Silicone Impression Material. *J Prosthodont* 2015;24(6):494-498.
6. Godbole SR, Dahane TM, Patidar NA, Nimonkar SV. Evaluation of the Effect of Ultraviolet Disinfection on Dimensional Stability of the Polyvinyl Siloxane Impressions. an in-Vitro Study. *J Clin Diagn Res* 2015;8(9):73-76.
7. Badrian H, Davoudi A, Molazem M, Zare MH. The effect of spraying different disinfectants on condensational silicone impressions; an in vitro study. *J Indian Prosthodont Soc* 2015;15(3):263-267.
8. Aeran H, Sharma S, Kumar V, Gupta N. Use of Clinical UV Chamber to Disinfect Dental Impressions: A Comparative Study. *J Clin Diagn Res* 2015;9(8): ZC67-70.
9. Al Mortadi N, Al-Khatib A, Alzoubi KH, Khabour OF. Disinfection of dental impressions: knowledge and practice among dental technicians. *Clin Cosmet Investig Dent* 2019;11:103-108.
10. Ganavadiya R, Chandra Shekar BR, Saxena V, Tomar P, Gupta R, Khandelwal G. Disinfecting efficacy of three chemical disinfectants on contaminated diagnostic instruments: A randomized trial. *J Basic Clin Pharm* 2014;5(4):98-104.
11. Jha P, Shetty AK, Anandakrishna L. Efficiency of an organic disinfectant on alginate impressions-A Pilot Study. *J Den Ora Res* 2019;17(18):19-20.
12. Sahar Elkholy and Walid lofty. Sacred Lotus as an impression disinfectant and its effect on the dimensional stability of elastomeric impression material. *Acta Sci Dent Sci* 2018:39-44.
13. Samra RK, Bhide SV. Comparative evaluation of dimensional stability of impression materials from developing countries and developed countries after disinfection with different immersion disinfectant systems and ultraviolet chamber. *Saudi Dent J* 2018;30(2):125-141.
14. Trivedi R, Sangur R, Bathala LR, Srivastava S1, Madhav S, Chaubey P. Evaluation of the efficacy of Aloe Vera as a Disinfectant by Immersion and Spray methods on Irreversible Hydrocolloid Impression Material and its Effect on the Dimensional Stability of Resultant Gypsum Cast - An in Vitro Study. *J Med Life* 2019;12(4):395-402.
15. Goel K, Gupta R, Solanki J, Nayak M. A Comparative Study Between Microwave Irradiation and Sodium Hypochlorite Chemical Disinfection: A Prosthodontic View. *J Clin Diagn Res* 2014; 8(4):ZC42–ZC46.
16. Alzain S. Effect of chemical, microwave irradiation, steam autoclave, ultraviolet light radiation, ozone and electrolyzed oxidizing water disinfection on properties of impression materials: A systematic review and meta-analysis study. *Saudi Dent J* 2020;32(4):161-170.

Table 1: Microbial contamination during pre disinfection

Groups	Mean (10 ⁶ CFU/ml)	P value
Pre-disinfection		
Group I	359.1	0.081
Group II	311.4	
Group III	342.4	
Group IV	336.1	
Post-disinfection		
Group I	24.1	0.001
Group II	82.1	
Group III	102.6	
Group IV	35.7	

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: sodium hypochlorite	359.1	24.1	11.21	2	0.013
Group II: Aloe vera	311.4	82.1	10.23	2	0.054
Group III: UV radiation	342.4	102.6	9.82	2	0.022
Group IV: microwave irradiation	336.1	35.7	12.11	2	0.001

One-way ANOVA, p< 0.05, significant