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# An In Vitro Study To Compare The Effectiveness Of Decontamination Methods Used For Dental Bur

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***Abstract: In daily practice, we use same instruments on many patients. Before use, all instruments should be cleaned, disinfected, and sterilized to prevent any contamination. Pre-cleaning and sterilization of some devices can be difficult because of their small size and complex architecture.***

***Dental burs come in a variety of shapes and sizes, all with highly complex and detailed surface features. Dental burs can be a potent vehicle for cross infection. Currently numerous articles address the transmission of blood and tissue borne pathogens from one patient to another via contaminated devices. Within general dental practice the level of risk of cross-infection associated with poor instrument decontamination is unclear. While most of the dental instruments are effectively cleansed after use, the diamond burs are often neglected and only brushed or immersed in mild disinfectant after prior to reuse. Dental burs are identified as potent vehicle for cross infection due to their contact with saliva, blood, and tooth structure etc. Evidence suggests transmission of viruses such as hepatitis B and bacteria such as Staphylococcus aureus can occur in dental practice.***

***Effectiveness of various methods used for sterilization of bur in our day-today practice should be evaluated***

***Keywords: sterilization, burs, disinfection***

## I. INTRODUCTION

There has been widespread concern over communicable disease transmitted in dental setting and both dental personnel and patients are at high risk during dental treatment. Diseases may be transmitted by indirect contact when dental instruments contaminated by one patient are reused for another patient without adequate disinfection or sterilization between uses. The process of sterilization is designed to render instruments free of all microbial life, including bacterial spores. Any procedure that eliminates bacterial spores will also kill viruses such as HIV, hepatitis C and hepatitis B.

Single use instruments have been promoted in dental practice as a strategy to prevent the transmission of blood and tissue borne pathogens from patient to patient. But then question arises “why are dental instruments reused?” Answer to this query is that material costs are indeed reduced by re-using instruments. Mandatory quality management and extend of infection control required for reusing instruments should be discussed in regards to the minimal time between appointments in clinical setups.

Dental burs are used in daily dental practice for various procedures including caries excavation, access cavity preparation, tooth preparation etc. Heavy contamination with necrotic body fluids tissue, saliva, blood and potential pathogenspose a potent vehicle for cross infection.

Dental instruments, including dental burs, used in everyday clinical practice should be sterilized before use so as to ensure harmless dental care. Preclearing and sterilization of

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bur is difficult due to complex miniature architecture of dental burs. The most commonly used methods of sterilisation includes soaking of burs in commercially available disinfectors following manual cleaning or, using ultrasonic bath.

Effectiveness of various methods used for sterilization of bur in our day-today practice should be evaluated. Thus, the present study was conducted to evaluate and compare the efficiency of commonly available decontamination methods for dental burs within the limited time between appointments.

## II. METHODOLOGY

The present invitro study was carried out in the Department of Prosthodontics, Azeezia college of Dental sciences and research Kerala, India.

Brain Heart Infusion (BHI) broth was prepared with Methicillin-resistant Staphylococcus aureus (MRSA)(fig 1) and Streptococcous Salivarins and stored overnight.

Bur samples were placed in BHI broth for two hours (fig 2). Ninety round end tapered diamond burs were selected for the study. After that these burs were randomly assigned in five groups of 15 each.

Group I: Autoclave
Group II: 70% alcohol
Group III: Hydrogen peroxide
Group IV: Glutaraldehyde
Group V: Glass bead sterilizer

All burs were hand scrubbed using detergent and cleansed in ultrasonic cleanser.

*Figure 1: Methicillin-resistant Staphylococcus aureus culture*

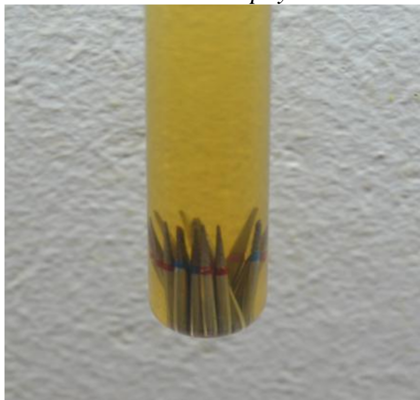

*Figure 2: samples in MRSA rich BHI broth*

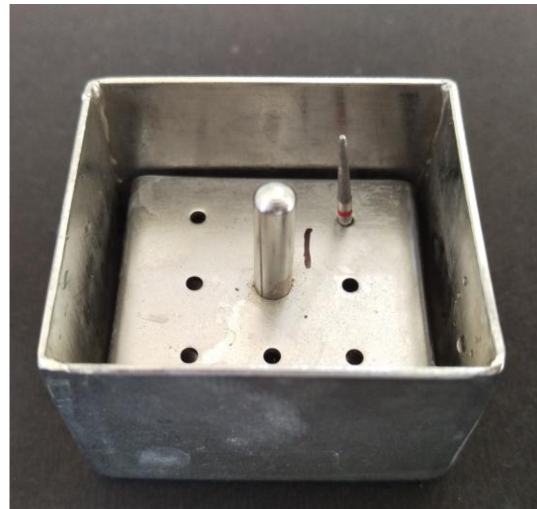

*Figure 3: sample for autoclaving*

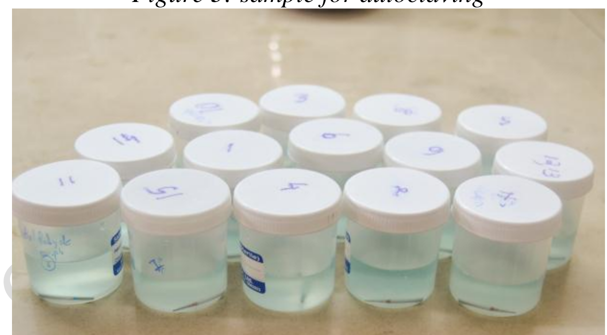

*Figure 4: bur placed in sterile container with disinfectant solution*

*Figure 5: bur transferred to BHI broth*

*Figure 6: samples incubated for bacterial growth in BHI broth*

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*Figure 7: left- BHI broth with cloudy precipitate, right- clear BHI broth with no bacterial growth*

*Figure 8: subculture of samples with positive clusters of bacterial growth*

The 15 samples in group I were placed in an endodontic instrument box (fig 3) and subjected to autoclave at 121°C for 15 min at a pressure of 15 pounds.

The 15 samples in group II were placed in a sterile plastic container (fig 4) containing 70% alcohol solution and left in it for 30 mins.

The 15 samples in group III were placed in hydrogen peroxide solution and left for 30 mins.

The 15 samples in group IV were placed in a sterile plastic container containing 2.4% glutaraldehyde solution and left in it for 30 min.

The 15 samples in group V were placed in the periphery of the glass-bead sterilizer and sterilized for 45 sec at 240°C.

Each samples were transferred to BHI enrichment broth (fig 5). The samples were incubated at 37°C. The test tubes were examined every 24 hours for a total of 72 hours, and any signs of bacterial growth were documented (fig 6). A colour change, cloudy broth and visible precipitate in the test tube were all considered indicative of bacterial growth (fig 7). If the solution remained clear throughout the incubation period, the sample was considered sterile.

Samples indicating positive growth was sub cultured using differential blood agar media. Using a sterile metal loop, you take a small sample of the broth, swiping it in a zigzag pattern across the surface of an agar plate. Agar plate is incubated at $37^0$C. Agar media was examined every 24hours for a total of 72 hours (fig 8).

Data were collected and tested for significant differences using one way ANOVA.

## III. RESULT

| GROUPS | N(SAMPLES) | GROWTH SEEN frequency | GROWTH SEEN % | NO GROWTH % |
|---|---|---|---|---|
| AUTOCLAVE | 15 | 0 | 0 | 100 |
| 70% ALCOHOL | 15 | 1 | 6.7 | 93.3 |
| HYDROGEN PEROXIDE | 15 | 9 | 60 | 40 |
| GLUTERALDEHYDE | 15 | 4 | 73.33 | 73.33 |
| GLASS BEAD | 15 | 5 | 33.3 | 66.7 |

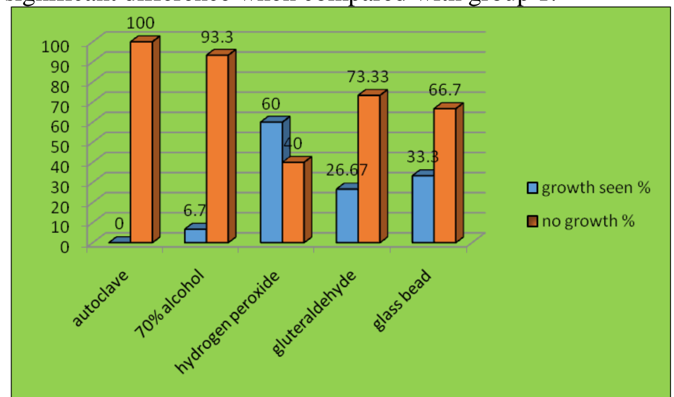
*Table 1: Descriptive statistics of groups with growth seen and no growth*

With 15 samples in each group tested, autoclave showed no positive growth while hydrogen peroxide showed nine positive growth

| GROUPS | N(SAMPLES) | GROWTH SEEN frequency | NO GROWTH frequency | ANOVA |
|---|---|---|---|---|
| AUTOCLAVE | 15 | 0 | 15 | P value 0.000 |
| 70% ALCOHOL | 15 | 1 | 14 | |
| HYDROGEN PEROXIDE | 15 | 9 | 6 | |
| GLUTERALDEHYDE | 15 | 4 | 11 | |
| GLASS BEAD | 15 | 5 | 10 | |

*Table 2: Intergroup comparison using one way anova*

Statistical analysis of results obtained show no significant difference between samples 1, 2, and 4. Whereas group 3 had significant difference when compared with group 1.




*Graph 1: Intergroup comparison*

## IV. DISCUSSION

The goal of instrument sterilization in dentistry is to protect patients from cross-contamination via instruments. The process of sterilization render instruments free of all microbial life, including bacterial spores, which are difficult to kill. Growing concern over cross contamination from dental instruments have put forth the idea of single use instruments. Studies have shown that practitioners prefer reuse of instruments than single use instruments.

For reuse of instruments through precleaning before sterilization is necessary to remove debris, by either brushing or ultrasonic cleaning. The complex architecture and the miniature design of the dental bur have made precleaning and sterilization of dental bur difficult. Ultrasonic method is an effective and time-saving method of cleaning instruments, although it is not capable of removing all contaminants. The ultrasonic cleaner uses vibratory energy, carried as sound waves in the fluid, to create suction which in turn removes biologic matter from instruments. Following the cleansing process all instruments should be given a final rinse.

Many methods have been advocated for sterilization of dental bur. The results obtained in the current study reinforce the conclusion that autoclave remains the gold standard in securing dental instruments. But the time interval between appointments have been a concern for sterilizing routine instruments like dental burs. Clinicians are always at check for an appropriate sterilizing medium that can be routinely used for disinfecting dental burs within limited time period.

In routine clinical practice, clinicians have depended on different media for sterilizing dental burs.

In the present study, immersing the burs in glutaraldehyde solution for 30 mins resulted in incomplete sterilization, which is contrary to the results of the study done by Hurtt et al. Glutaraldehyde solution cannot be relied upon completely to sterilize dental burs within this limited time period. Other demerits of glutaraldehyde as a potent disinfectant include its minimal shelf life and its toxic nature as an irritant.

Hydrogen peroxide as a disinfectantinvolves hydroxyl radicals that works by denaturing proteins and dissolving lipids, effectively destroying many types of bacterial and viral cells. The hydroxyl radical, being a potent oxidant, can react easily with macromolecules such as membrane lipids and DNA thus resulting in bacterial death. In this study hydrogen peroxide was the least effective of the samples tested, hence not recommended for routine use in sterilization of dental bur.

Therapeutics and Council on Dental Practice recommends the use of glass bead sterilizer for a period of 10 to 15 seconds at a temperature of 425-475 $^{o}$F. Glass bead sterilizer works on the principle of intense dry heat. Results of the study did not provide a positive result for glass bead sterilization technique.

Results of the study shows no significant difference between results obtained using autoclave and 70% Isopropyl Alcohols. Alcohols are rapidly bactericidal, fungicidal, and virucidal at optimal concentrations of 60% to 90% (v/v) solutions in water, and aqueous solutions of alcohols do not leave residues. As a disinfectant, it works by denaturing proteins and dissolving lipids. These attributes provide a rapid, cost-effective means of disinfection.

## V. CONCLUSION

Findings of our study revealed that autoclave was found to be the relatively best method to decontaminate burs. None of the other methods used were found to be absolutely efficacious in the decontamination of dental burs. However, among the experimental groups used in the present study, 70% alcohol was found to be the relatively best method to decontaminate burs.

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