DOI: 10.7860/JCDR/2014/9314.4488

Original Article

Dentistry Section

Decontamination Methods Used for Dental Burs – A Comparative Study

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ABSTRACT

Aims and Objectives: Infection control and modes of sterilizations are the key factors to avoid cross transmission of infection in the field of dentistry. Transmission of disease or infection is noted with improper sterilization of reused instruments. Dental burs are the most important tool in any endodontic or conservative procedures of teeth involving tooth contouring, restorative filling procedures and endodontic procedures. Hence, the present study is undertaken to assess the efficacy of different methods of sterilization or decontamination which are routinely used in dental clinics.

Materials and Methods: For the present study 96 round diamond burs were selected and divided into 6 groups. These burs were used for the access cavity preparation to get contamination and subjected for bacteriological culture. After getting base line date burs were subjected to manual scrubbing, hot air oven, glass bead sterilizer, ultrasonic cleaner and autoclave to get post decontamination data.

Results: The study revealed that mean colony forming units/ml of *Streptococcus mutans* decreased maximum for autoclave with 80% reduction, for *Lactobacilli* 76% reduction and for *Candida albicans* maximum reduction seen for glass bead sterilizer with 74%.

Conclusion: Findings of our study revealed that none of the methods used were found to be absolutely efficacious in the decontamination of dental burs. However, among the experimental groups used in the present study, autoclave was found to be the relatively best method.

Keywords: Autoclave, *Candida albicans,* Diamond burs, Glass bead sterilizer, Hot air oven, *Lactobacilli, Streptococcus mutans*, Ultrasonic cleaner

INTRODUCTION

Infection control is a major issue in medicine and dentistry because of concern over communicable diseases transmitted in health care settings. Both dental personnel and patients are always at risk of communicating diseases during treatment [1]. It is a century old observation that disease may spread between patients and staff and amongst patients through a variety of channels. The use of effective infection control procedures in the dental office will prevent cross contamination that may extend to dentist, dental staff, dental technician and patients [1,2].

Infection control procedure in the office are divided into two major categories depending on the how the procedure interfere with development of disease. They either interferes with spread of disease agent by reducing the contamination or they remove the disease agent after contamination has occurred [3].

Dental burs are used in clinical dentistry for various procedures some of which includes caries excavation, access cavity preparation and crown reduction. During these procedures burs may become heavily contaminated with necrotic tissue, saliva, blood and potential pathogens and identified as potential vehicle for cross infection. In routine dental practice, adequate disinfection and sterilization has to be focused upon to control cross transmission of infection [4]. The most commonly used methods of sterilization includes soaking of burs in commercially available disinfectors followed by manual cleaning or, using ultrasonic bath or, autoclaving [5].

Burs are unique by virtue of their complex architecture which makes pre-cleaning and subsequent sterilization difficult to achieve. Inadequate sterilization causes cross infection among the patient and transmission of disease between the patient and dental personnel [6,7].

Thus, the present study was conducted to evaluate and compare the efficiency of commonly available different decontamination methods for dental burs.

METHODOLOGY

The present invivo study was carried out in the Department of Pedodontics and Preventive Dentistry, Bapuji Dental College and Hospital Davangere, India. Prior to the conduction of study ethical approval was done, then informed consent from the parents / guardians of the pediatric patients was obtained after thoroughly explaining them about the procedure details and treatment outcomes. The study is a single blinded study were pediatric patients were randomly selected from the outpatient department in the college.

Ninety six round diamond burs (no.18) were selected for the study. After that these burs were randomly assigned in six groups of 16 each.

Group I: Uncontaminated burs.

Group II: Contaminated burs subjected to manual scrubbing.

Group III: Contaminated burs subjected to hot air oven.

Group IV: Contaminated burs subjected to glass bead sterilization.

Group V: Contaminated burs subjected to ultrasonic cleaner.

Group VI: Contaminated burs subjected to autoclave.

All the experimental group burs were used for the access cavity preparation in primary teeth. After that burs were removed from the airotor hand piece with sterile tweezer. These contaminated burs were carried in transport medium to the Department of Oral Pathology, and 0.05 ml was taken with the help of inoculating loop and streaked on Mitis Salivaries agar for selective culturing of *Streptococcus mutans*, on Rogosa SL agar for selective culturing of *Lactobacilli* and on Sabourauds with chloramphenicol agar for *Candida albicans*. These plates were incubated for 48 hrs at 37°C in a standardized procedure.

Following incubation numbers of Colony Forming Units (CFU'S) of mutans *Streptococci*, *Lactobacilli* and *Candida albicans* at the end of two days were counted with colony counting machine.

	Before Decontamination			After Decontamination		
Group	*Streptococcus mutans*	*Lactobacilli*	Candida albicans	*Streptococcus mutans*	*Lactobacilli*	Candida albicans
Control	0.5 ± 0.3	0.3 ± 0.2	0.2 ± 0.2			
Manual scrubbing	17.9 ± 0.7	11.4 ± 1.1	6.3 ± 0.8	7.0 ± 0.8	5.7 ± 0.5	4.6 ± 1.0
Hot air oven	17.4 ± 1.1	9.8 ± 0.9	6.1 ± 1.0	4.8 ± 0.8	3.4 ± 0.5	1.8 ± 0.5
Glass bead	18.0 ± 0.8	12.1 ± 1.0	6.5 ± 0.7	4.9 ± 0.5	3.3 ± 0.8	1.3 ± 0.5
Ultrasonic	18.2 ± 1.0	12.1 ± 1.1	6.3 ± 0.8	5.5 ± 0.5	4.7 ± 0.5	3.5 ± 0.5
Autoclave	17.9 ± 0.9	8.8 ± 1.2	4.3 ± 0.7	3.7 ± 0.5	2.1 ± 0.4	0.9 ± 0.3

[Table/Fig-1]: Showing mean and Standard deviation of the Colony Forming Units/ml of *Streptococcus mutans*, *Lactobacilli* and Candida albicans, before and after decontamination

	Before Decontamination		
Group	*Streptococcus mutans*	*Lactobacilli*	Candida albicans
Manual scrubbing	61%	50%	27%
Hot air oven	72%	65%	69%
Glass bead	73%	74%	80%
Ultrasonic	69%	61%	44%
Autoclave	80%	76%	79%

[Table/Fig-2]: Showing percentage of reduction of microorganism among experimental group

Decontamination methods

Group 1: Control

Sixteen uncontaminated burs were used as control group.

Group 2: Manual Scrubbing

The effectiveness of manual scrubbing was tested using bur brush. Sixteen contaminated burs were subjected to 40 strokes of bur brush by holding the bur with a sterile tweezer and brushing from the shank to the working end. This procedure was done under running water, after completion of procedure burs were placed in screw- cap tube containing transport medium amies.

Group 3: Hot Air Oven

Sixteen contaminated burs after cleaning under running tap water with detergent were kept in a sterile bur stand and placed in hot air oven for 60 minutes at 160°C. After complete sterilization burs were recovered and placed in transport medium amies.

Group 4: Glass Bead Sterlizer

Sixteen contaminated burs after cleaning under running tap water using detergent were submerged in a glass bead sterilizer at a distance of 2 mm from the wall of the sterilizer for 15 sec at 230°C with a sterile tweezer. The glass bead sterilizer was controlled by thermostat and the light indicated the attainment of the required temperature.

Group 5: Ultrasonic

After cleaning under running tap water with detergent, 16 contaminated burs were placed in ultrasonic cleaner containing solution which was non ammoniated, non ionic and phosphate free. After that burs were removed aseptically and placed in transport medium amies. Effectiveness of ultrasonic bath was confirmed by aluminum foil test.

Group 6: Autoclave

After cleaning under running tap water with detergent, 16 contaminated burs were cleaned under running tap water and placed in sterile bur stand and autoclaved for 16 minutes at 121°C under 16 psi. Sterilization monitoring of autoclave was done with color changeable chemical tape. After decontamination method, collected test samples were carried for the microbiological processing to obtain the specific culture.

STATISTICAL ANALYSIS

Results were expressed as Mean ± Standard deviation (SD), range values and number of percentages. Kruskal-Wallis ANOVA was used for multiple group comparisons followed by Wilcoxon's Rank Sum test (Mann-Whitney test) for group wise comparisons of reduction in colony forming units/ml.

RESULTS

Maximum reduction of *Streptococcus mutans* and *Lactobacilli* seen with Autoclave followed by Glass bead, Hot air oven, Ultrasonic, Manual scrubbing and for 3 glass bead was found to be effective.

When intergroup comparison done for *Streptococcus mutans* Gr (Group) II to Gr III, Gr IV, Gr V, Gr VI ; Gr III to Gr VI; Gr IV to Gr VI; Gr V to Gr VI was found to be statistically significant.

When intergroup comparison done for *Lactobacilli* Gr II to Gr IV; Gr II to Gr V; Gr III to Gr IV; Gr III to Gr V; Gr IV to Gr VI ; Gr IV to Gr V was found to be statistically significant.

When intergroup comparison done for *Candida albicans* Gr II to Gr III, Gr IV, Gr V, Gr VI; Gr III to Gr IV, Gr V, Gr VI; Gr IV to Gr V, Gr VI was found to be $p<0.01$ and statistically significant [Table/Fig-1-2].

DISCUSSION

Preservation of dental arch and its function is the main motive behind pediatric dentistry. Retention of the primary teeth is needed until they are naturally exfoliated. There are several advantages of preserving the natural primary teeth. Primary teeth help in preserving the arch length, play an important role in mastication, esthetics, speech and act as space maintainers for permanent teeth and have psychological advantage of conserving rather than extracting the tooth [8, 9].

Most of the pathologies of pulp and periapical tissues of teeth are directly or indirectly related to the microorganisms. Therefore, to effectively diagnose and treat endodontic infection, one should have the knowledge of bacteria associated with endodontic pathology [10].

However, there are few studies concerning root canal microbiota of primary teeth. Marsh and Largent in one study found that *Streptococci mutans* were found 30% to 52% of the cases [11, 12] and *Candida albicans* were found in 21% of infected root canals [10, 13].

Currently, numerous articles address the transmission of blood and tissue borne pathogens from one patient to another via contaminated devices. Many studies look at the bacterial and viral contamination of dental and medical instrumentation and the safety of sterilizing and reusing these instruments. There have also been concerns over the possible transmission of prions by contaminated surgical instruments [14].

Some studies have also shown that reuse of instruments is common and that cleaning of these instruments may not always be effective. For example Lowe, Burke et al., conducted a survey of general dentists in Scotland and found that 93% of those who answered the survey reused matrix bands on multiple patients in their practices. Although 99% of respondents used a steam autoclave to sterilize

instruments, they used a variety of pre sterilization cleaning methods, ranging from a pre-soak only to a combination pre-soak, ultrasonic cleaning and hand scrubbing [14].

Dental burs are identified as potential vehicle for cross infection in dental orifice due to their contact with saliva, blood, teeth and bone [3,6,15]. While most of the dental instruments are effectively cleaned after use, the diamond bur is often neglected and only brushed or immersed in a mild disinfectant prior to reuse [16].

Manual scrubbing of dental bur is simple and cheap but it may not be effective, it also takes time for instruments to be cleaned properly and it may not be possible in busy practice and also aerosols of pathogenic microorganisms may be produced by hand cleaning with contamination of the sink [17,18].

Council on dental materials, instruments and equipments also stated the dry heat oven is the preferred method for sterilization of dental burs but produce little rusting or dulling of instruments, also they are inexpensive to purchase but have substantially longer processing time than an autoclave [19].

Bead sterilizers have been commonly used for the fast chair side sterilization of endodontic instruments, because it can easily be placed in the operatory, burs could be sterilized immediately before, during and after the surgical procedures but precleaning of instruments is recommended [3, 20]. It is found that glass bead sterilization is most effective method of destroying fungal contaminants as and when compared to autoclave and other groups.

Ultrasonic cleaning has been shown to be effective in removing dried blood and saliva from the dental instruments and remains an important system that enhances dental personnel safety during instrument handeling [21].

Under proper conditions steam under pressure (Autoclave) can destroy all microorganisms including bacterial spores and it is found to be relatively the best method to decontaminate dental burs, yet it has some limitations like it increases the fracture susceptibility, decreases the cutting efficiency and life span of burs, which all should be weighed against its benefits.

CONCLUSION

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

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FINANCIAL OR OTHER COMPETING INTERESTS: None.

Date of Submission: **Mar 18, 2014**
Date of Peer Review: **Apr 17, 2014**
Date of Acceptance: **May 15, 2014**
Date of Online Ahead of Print: **May 28, 2014**
Date of Publishing: **Jun 20, 2014**