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RESEARCH ARTICLE

STERILIZATION METHODS USED IN DENTAL BURS- A COMPARATIVE STUDY

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ABSTRACT

Aim: The aim is to find out the effective sterilisation method used for dental burs using Enterococcus Faecalis as an indicator.
Methodology: The present study was performed on 40 detnal burs which is divided into four different groups containing 10 dental burs. Out of this group one group is kept as control and the other three groups were tested for the efficacy of sterilisation with different methods: autoclave, glutaraldehyde and glass bead sterilisation respectively.
Background: Burs are the most widely used armamentarium in all most all branches of dentistry in which sterilisation of utmost importance as a preventive measure for cross-infection. This study is done to evaluate various sterilisation methods that can be used which is of short duration and effective.
Results: In this study, we came to a conclusion that none of the sterilising methods were found to be efficacious in dental burs. However, among the three sterilisation methods autoclave and glutaraldehyde showed 60% sterility and glass bead sterilization showed 40%.
Conclusion: Amongst the sterilisation methods used autoclave and glutaraldehyde showed highest decontamination followed by glass bead sterilisation.

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INTRODUCTION

Infection control is a major issue in dentistry and medicine due to concern over communicable diseases transmitted in the clinical settings. Both the patients and the health care professionals are at the high risk of communicating diseases during treatment (SangameShwar *et al*., 2014). Diseases can be transmitted by direct contact when instruments contaminated by one patient are reused for another patient without adequate sterilisation or disinfection between procedures (Archie Morrison and Susan Conrod, 2009). Residual organic contamination insulates pathogens from the effects of sterilisation, thereby posing risk of cross-infection. Dental burs may become heavily contaminated with saliva, blood, necrotic tissue and potential pathogens during the treatment (Whitworth *et al*., 2004). It is noticed that burs have a complex architecture that makes sterilisation difficult to achieve (Harkness and Davies, 1983). The process of sterilisation is designed to render instruments free of all microbial life which can be very difficult to kill such as HIV, Hepatitis B etc., (Miller, 1991). In routine dental practice, adequate sterilisation has to be focused upon to control cross-transmission of infection. The most commonly used methods of sterilisation includes soaking of burs in commercially available chemical disinfectors such as spirit followed by glass bead steriliser, autoclaving and chemical sterilisers such as glutaraldehyde (Sheriteh, Zahra *et al*., 2010). Thus, the present study was conducted to evaluate the effective sterilisation method used for dental burs using Enterococcus Faecalis as an indicator.

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MATERIALS AND METHODS

The present invitro study was carried out in the department of microbiology, Saveetha Dental College and Hospitals, Chennai, India. This study was performed using forty dental burs. The burs are divided into four groups, ten for each group, first three groups were tested for the efficacy of different sterilisation techniques such as Autoclaving, glass bead steriliser and glutaraldehyde respectively and the forth group is kept as control. (Table 1) All the burs included in the study were pre-sterilised in an autoclaving pouch by autoclaving for twenty minutes at 121°c at a pressure of 15lbs, for standardization. To achieve a homogeneous spore suspension of Enterococcus Faecalis, a test tube containing 40ml of

normal saline was inoculated with 10µl of subculture and shaked well pre-sterilised burs were contaminated with Enterococcus Faecalis for 5minutes. After 5 minutes, contaminated burs are placed in sterile plastic bags and are subjected to autoclave at 121°c for 15 minutes at a pressure of 15lbs for the first group. In the second group, the burs are wiped for 10 seconds with 2x2 gauze soaked with surgical spirit and placed in the periphery of glass bead steriliser and sterilised for 10 seconds at 230°c. sterilisation was not done for the fourth group and was kept as control. After completion of sterilisation, each bur is put inside sterile test tube containing nutrient agar and subjected to incubation for 24 hours at 37°c and any signs of bacterial growth were documented. A colour change, cloudy broth and visible precipitate in the test tube were all considered indicative of bacterial growth. If the solution reminded clear throughout the incubation period, the sample was considered sterile. Data were collected and tested for significant differences using chi-square test.

RESULTS

Maximum reduction of Enterococcus Faecalis seen with autoclave and glutaraldehyde followed by glass bead steriliser. Statistical analysis of the four sterilised groups using chi-square analysis showed a statistically significant difference between the groups with regards to their efficacies in sterilisation of burs. The chi-square statistic is 1.0714. The P value is 0.585251. The result is not significant at P<0.05. (Table 2)

Table 1. No of groups and the sterilisation methods used for each group

Groups	Sterilisation methods
Group 1	Autoclave
Group 2	Glass bead sterilisation
Group 3	Glutaraldehyde
Group 4	Control

Table 2. Results of testing for contamination of burs

Groups	Total no of burs subjected to sterilisation.	No of burs with turbidity	No of burs without turbidity
Group 1	10	4	6
Group 2	10	6	4
Group 3	10	4	6
Group 4	10	10	0

Table 3. The chi-square statistic is 1.0714. The P value is 0.585251. The result is not significant at P<0.05

Group	With turbidity	Without Turbidity	Row totals
Group 1	4(4.67) [0.10]	6(5.33) [0.08]	10
Group 2	6(4.67) [0.38]	4(5.33) [0.33]	10
Group 3	4(4.67) [0.10]	6(5.33) [0.08]	10
Column totals	14	16	40(grand total)

In this study, we came to a conclusion that none of the sterilising methods were found to be totally efficacious in disinfecting dental burs. However, among the three sterilisation methods autoclave and glutaraldehyde showed 60% sterility and glass bead steriliser showed only 40%. (Table 3) (Fig.1)

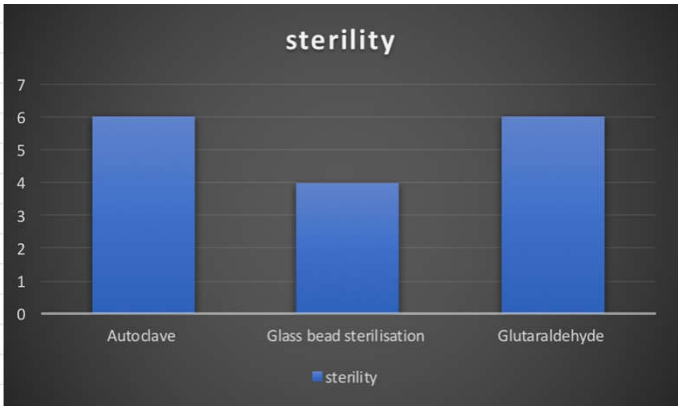

Fig.1. Results for showing the percentage of sterility of the burs in various sterilising methods

DISCUSSION

Sterilisation and pre-cleaning of dental burs can be difficult because of their small size and complex architecture. In this study, most of the used burs from dental practice were contaminated with potentially pathogenic species of bacteria and fungi. All used dental burs are a potential source of cross-infection and should be appropriately sterilised prior to reuse. The common presence of the facultative anaerobe, Enterococcus Faecalis from used dental burs influenced the selection of this bacterium as the test organism for the assay. It is a recognised human pathogen and has been isolated from saliva and in patients with post-treatment apical periodontitis. Currently, numerous articles address the transmission of blood and tissue borne pathogens from one person to the other via indirect contact. Many studies look at the viral and bacterial contamination of medical and dental instrumentation and the safety of sterilising and reusing these instruments. There have also been concerns over the transmission of pathogens by contaminated surgical instruments (Neugeboren *et al*., 1972). Smith and others found that a large number of files collected from the U.K dental community showed contamination after completion of sterilisation process. This is additional proof of unsatisfactory sterilisation methods (Smith *et al*., 2002). The majority of procedures performed in dental practice involve devices that are classified as critical or semi-critical, since they frequently breach the patients' mucosa or gingiva. There have been a number of reported transmissions of hepatitis B in dentistry, although it has been difficult to prove or disprove direct links associated with failure of decontamination of dental instruments. Nevertheless, there is clear potential for cross-infection to occur if certain basic principles are not adhered to. This is supported by in vitro evidence of the potential for transmission (Smith *et al*., 2007). The effectiveness of cleaning was not affected by variation in the size or taper of the files when an effective cleaning procedure was used. Cleaning the files in a thermal disinfector or by ultra-sonication within a container did not consistently achieve complete removal of biological debris. Placing the files loosely in the ultrasonic bath achieved the most effective cleaning, an average of 98.33 per cent of the file surface area was freed of any biological debris (Van Eldik *et al*., 2004). 80% of dentists preferred to clean hand pieces by wiping them with disinfectants, but only 17.8% of them stated that they preferred autoclave for sterilize hand pieces. However, it is known live blood cells and bacterial and viral particles can survive inside hand pieces even after thorough disinfection18. Many authors have emphasized the

hazard of cross-infection by the use of dental instruments 22. Some of these authors showed that 94% of dentists in Kuwait used autoclave to sterilize handpieces24. Kurdy and Fontaine17 showed that 30% of dentists in Saudi Arabia had sterilized hand pieces with autoclave and 90% of them autoclaved their instruments at the end the day. Al-Rabeah and Mohamed3 stated that 37.90% of dentists autoclaved hand pieces. According to Miller 22, the most common reason for not sterilizing hand pieces is the fear of damage to the equipment (Emir YÜZBASIOGLU *et al*., 2009).

In the past several years, new methods of disinfection and sterilization have been introduced in health care settings. OPA is a chemical sterilant that received FDA clearance in October 1999. It contains 0.55% 1,2-benzenedicarboxaldehyde. In vitro studies have demonstrated excellent microbicidal activity (Rutala and Weber, 2004). The FDArecently cleared a liquid high-level disinfectant (super oxidized water) that contains 650–675 ppm free chlorine and a new sterilization system using ozone. Because there are limited data in the scientific literature for assessing the antimicrobial activity or material compatibility of these processes, they have not yet been integrated into clinical practice in the United States (Rutala and Weber). Several methods are used to sterilize patient-care items in health care, including steam sterilization, ETO, hydrogen peroxide gas plasma, and a per acetic acid–immersion system (Rutala and Weber). New sterilization technology based on plasma was patented in 1987 and has been marketed in the United States since 1993. Gas plasmas have been referred to as the fourth state of matter (i.e., liquid, solid, gas, and gas plasma). Gas plasmas are generated in an enclosed chamber in a deep vacuum, by using radio frequency or micro wave energy to excite the gas molecules and produce charged particles, many of which are in the form of free radicals. This process has the ability to inactivate a broad spectrum of microorganisms, including resistant bacterial spores. Studies have been conducted against vegetative bacteria (including mycobacteria), yeasts, fungi, viruses, and bacterial spores. The effectiveness of all sterilization processes can be altered by lumen length, lumen diameter, inorganic salts, and organic materials (Rutala and Weber).

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, which can be very difficult to kill. Resterilization is simply the repeated application of a sterilization procedure to an instrument or device to remove contamination, allowin for its use in treating multiple patients. Dental burs come in a variety of shapes and sizes, all with very complex and detailed surface features. Ultrasonic cleaning can also be an effective and time-saving method of cleaning instruments, although it is not capable of removing all contamination (Archie Morrison and Susan Conrod, 2009; Sumeet Sharma *et al*., 2014). Boyd and Hoeri (1996) stated that moist heat kills microorganisms by coagulation of proteins. However, coagulation occurs only when overkill conditions are attained. Less drastic changes such as inactivation of enzymes, changes in nucleic acids and cytoplasmic membrane alterations probably kill microorganisms before coagulation occurs. The present study indicated that a complete sterilization was possible by autoclaving the instruments in an endodontic box or a plastic bag also give a good result. This is significantly similar to the findings from studies done by other researchers like (Rajkumar and Lakshminarayanan, 2001; Hurtt and Rossman, 1993; Velez et al., 1998). Normally, the autoclave gives 100% sterilization for 45 minutes (Travis and O'Callaghan, 1998). The inability to achieve this percentage in this study might be due to the autoclave time used in this study which is just 15 minutes (Boyd and Hoeri, 1996; Dheyaa Al-Jamell *et al*., 2014). The results obtained in the current study reinforce the conclusion that several methods of sterilisation employed in the dental community are unsatisfactory. Therefore, it will be wise to use single use or use and throw burs as they not only provide effective way of preventing cross-contamination.

Conclusion

Sterilisation procedures were not successful for burs that had not been previously contaminated by organic debris. This was demonstrated the group of burs that were sterilised before use. Routine sterilisation procedures for previously used burs were not effective and future research is warranted to device all effective sterilisation protocol. Future studies should focus on determining the best method of pre-cleaning these devices. If such procedures cannot be devised, perhaps the instruments should be considered single used devices. This would reduce the risk of transmission of all infectious agents. Amongst the sterilisation methods used autoclave and glutaraldehyde showed highest decontamination followed by glass bead sterilisation.

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