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REVIEW ARTICLE

STERILIZATION IN DENTISTRY: A COMPREHENSIVE REVIEW

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ABSTRACT:
Sterilization means the use of a physical or chemical procedure to destroy all microbial life, including highly resistant bacterial spores. Bacterial spores are the most resistant of all living organisms because their capability to withstand destructive agents. Although the chemical or physical process used to destroy all pathogenic microorganisms including spores is not absolute, when all parameters of the sterilization process have been met, instruments, supplies and equipment are thought to be sterile. 'Sterilization of Dental Instruments' focuses on how to sterilize dental instruments after cleaning, using small steam sterilizers. It provides advice that is based on health and safety regulations and current technical guidance on sterilization within healthcare. It has been developed through consultation with various experts and end-users.
Key words: Sterilization, Dental

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INTRODUCTION

While disposable needles and forceps used for extraction of teeth are properly sterilized, hand pieces of air rotor, micrometer or a hanging motor require special attention. By merely wiping the hand-piece with alcohol disinfection is not achieved as alcohol evaporates rapidly. Contact with 70 per cent alcohol for 10 minutes acts as a disinfectant. Studies have shown that HIV is inactivated rapidly after being exposed to commonly used disinfectants. Blood spills on floor or trolley must be treated with sodium hypochlorite (household bleach) in the concentration of 1:100 to 1:10 dilution depending upon the amount of organic material like mucous and blood present on the surface or with hydrogen peroxide. A hand-piece is a sophisticated equipment and gets damaged on boiling or autoclaving (some autoclavable hand-pieces are available in the market). Burs and instruments used for root canal treatment (RCT) are generally disinfected. Use of glass bead sterilizer ensures sterilization of RCT instruments. Burs can be submerged in 70 per cent alcohol for at least 10 minutes for disinfection or autoclaved. Repair of dentures can be undertaken after treating them with hydrogen peroxide.[1- 4]

Recommendations for methods of sterilization and disinfection of dental instruments have been described,'" but no one has warned dentists of the many pitfalls and variables that may be encountered while trying to fulfill these requirements, such as the need for verification of sterilizer efficacy with bacterial spores or the time and temperature requirements for chemical sterilization/disinfection. In some dental practices, hospital disinfectants intended for environmental disinfection may mistakenly be used on instruments unless the difference is clearly explained and there has been no evaluation of the procedures dentists use for putting theory into practice.[5- 8]

Sterilization can be achieved by steam, dry heat, or chemical vapour, by bead sterilizers for small items such as root canal files, or by immersion in chemical sterilants for 6-10 h. Sterilizer efficacy must be monitored on a regular basis. The most frequently used chemical sterilizers are glutaraldehyde-based products. Safety instructions for their use must be strictly followed. These should be described in a materials safety data sheet accompanying the product. If used in a well-ventilated room, in a closed container, and if necessary, according to instructions, using personal protective equipment such as masks and gloves, there are no contraindications to the use of these products. High-level disinfection requires submersion of instruments in chemical sterilants, but for a shorter period of time than the 6-10 h needed for chemical sterilization. Before any disinfection or sterilization process, instruments must be cleaned and dried.[9- 12]

Onana et al conducted a with the participation of 33 practitioners over the 42 practicing in Yaounde allows apprehending the reality of the daily hygiene. The ways of cleaning, decontamination, disinfection or of sterilization of the premises, the dental equipment and instruments, hand-washing, disposable materials and the vaccination protection of the practitioners were analyzed. The cleaning of the floor and door mats is daily (100%); disinfection is done daily in 83% of the departments in all of the centers. The cleaning and disinfection of the dental chair is daily and is done using soap (23%) and/or bleaching-water (56%). Cleaning or disinfection of the suction machine is done with soap (24%) or with bleaching-water (47%). The hand-pieces and the turbines are cleaned and/or disinfected after each usage in (94%) with alcohol (17%) or with bleaching-water (32%) and sterilized with a heat sterilizer (45%), an autoclave(40%) or cold disinfected(15%). The frequency of the treatment of the instruments is well-respected (83%). Nevertheless the products used are very varied and are not always used in the prescribed order. Hand-washing is systematic after each

patient; 50% of the practitioners use soap bars or powered soap and 50% use an antiseptic or a disinfectant solutions. With the regard to the vaccination, only 3 practitioners were properly vaccinated against hepatitis B, tetanus, diphtheria, poliomyelitis and tuberculosis. With regard to the protection of the practitioners, 72% do not wear caps, 56% do not wear eyeglasses, 40% do not wear masks, 95% do not use rubber dams, 56% do not disinfect the radiographic films and 37% do not disinfect the impressions; the habitual attire consists of a smock worn over street clothes (78%) and street shoes (90%). The debris is burnt in 35% of the centers.[8]

A J Smith et al examined the methods used for sterilisation of re-usable instruments in general dental practice, including the installation, commissioning and testing of benchtop steam sterilisers. This was an observational study in which the policies and procedures for sterilising instruments were viewed directly by trained surveyors at practice premises. Information relating to the installation, commissioning and testing of benchtop steam sterilisers was also collected by interview and observation of records. Data were available fom 179 surgeries surveyed. Dental practices reprocess a range of instruments from critical to non-critical. The most common type of benchtop steam steriliser is a type N, or bowl and instrument (B&I) steriliser (88%). The remainder were type B, or vacuum sterilisers, though one surgery had access to a hot air steriliser. Sterilisers were usually installed by manufactures or suppliers (69%). Only 51% of sterilisers were tested on installation and 26% were commissioned, of which 38% were tested to SHTM 2010 standard. In most cases it was difficult to determine from the documentation available whether daily, weekly, quarterly or annual testing was undertaken in accordance with recognised standards. Written instructions for the operation of the steriliser were unavailable in 61% of practices. Insurance cover for pressure vessels was available in 79% of the surgeries with a B&I steriliser. In many instances there was inadequate separation of clean and dirty areas for segregating processed from unprocessed instruments. Ninety-six percent of surgeries did not have a procedure for the identification and traceability of instruments used on patients. There was no documentation of staff training in the use of sterilisers in 90% of surgeries. There has been significant uptake of the use of steam sterilisation to reprocess used dental instruments.[9]

C H Miller determined the effectiveness of standard methods of instrument sterilization beneath instrument rings. Sets of three types of dental instruments were contaminated with known amounts of bacterial spores (Bacillus stearothermophilus or Bacillus subtilis). Instrument rings were placed over the contamination and the instruments processed through standard cycles in a steam autoclave, an unsaturated chemical vapor sterilizer, a standard dry heat sterilizer, an ethylene oxide gas sterilizer or a 2.0% alkaline glutaraldehyde solution. Controls consisted of spore-contaminated instruments without rings that were not processed through any sterilizing method and that were processed through each sterilizing method. All instruments and their associated rings were cultured for the presence of live spores. The results indicate that the reliability of sterilization beneath the instrument rings used is greatest if the ringed instruments are processed through a steam autoclave or an unsaturated chemical vapor sterilizer.[10]

A C Rosa et al evaluated factors affecting long-term sterility of dental instruments sterilized in the dry-oven or autoclave at the Central Sterilizing Service of the School of Dentistry, University of Buenos Aires stored under room temperature and humidity conditions. Half of the 192 samples were placed in standard closed metal containers and sterilized in a dry-oven (D.O), and the remaining half were placed in perforated metal containers and sterilized in an autoclave (A). All the samples were placed in sterilizing paper bags for medical use. Post sterilization, each group (DO and A) was divided into: Group I: minimal handling (control); Group II: wrapping torn mechanically (1 cm); Group III: wrapping torn manually (1 cm). All the samples were stored a closed cabinet. Contamination was evaluated at 30 and 180 days, by seeding under aerobic and anaerobic conditions. Temperature was monitored throughout the experiment, and ranged between 20 degrees C and 31 degrees C (x: 24 degrees C +/- 3.9). Humidity was measured with a digital hygrometer, and ranged between 40% and 60% (x: 54% +/- 10). Group I evidenced no microbial contamination, unlike Groups II and III. Their results evidence that 1) dry oven or autoclave sterilized material that is handled properly during storage remains sterile regardless of variations in temperature and humidity; 2) improper handling affects sterility, and contamination is time-dependent.[11]

Bernhard Guggenheim et al described in detail a newly developed comprehensive system for washing, pre-disinfecting and sterilizing of dental and surgical instruments. The system consists of a combined washing and steam-operated pre-disinfection apparatus and newly developed trays, in which assorted instruments can be washed and disinfected without handling individual instruments. The system was subjected to a large number of tests. The cleaning efficiency of blood-soiled instruments was found to be excellent. The disinfection of dental instruments contaminated with bacteria, yeast and non-enveloped virus showed decimal reduction factors that were equivalent to sterilization. The trays had optimal sealing qualities. Their steam permeability was perfect even after prolonged use in N-, S- and B-type autoclaves. However, long-term tests in a clinic revealed shortcomings with regard to insufficient drying of instruments in the wash/disinfection apparatus. Furthermore, the mechanical stability of the polysulfonate tray covers needs to be improved. Occasionally, after extended use, the fit of the filters in metal trays became inadequate, in particular when trays were sterilized for 18 min at 134 degrees C for a prolonged period of time. In spite of the above-mentioned shortcomings, the system shows great labor and cost-saving potential, allowing a new approach to instrument recirculation and workflow in the dental office.[12]

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