ORIGINAL ARTICLE

INFECTION CONTROL IN ENDODONTIC CLINIC

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ABSTRACT

Infection control procedures are precautions taken in health care setting to prevent the spread of disease. The centre for disease control and prevention (CDC) working with the ADA, has developed special recommendations for use in dental offices.

Before u enter the examination room, all surfaces, such as the dental chair, dental light, drawer handles, and countertops have been cleansed and decontaminated. Some offices may cover this equipment with protective covers which are replaced after each patient.

Non disposable items like dental tools and handpieces are cleaned and sterilized between patients. You may not be aware that sterilization and other infection control precautions take place before your dental visit because many of these procedures occur in another area of the dental office. Disposable items like needle or gauze are placed in special bags and containers.

Infection control precautions also require all dental staff involved in patient care to use appropriate protective grab such as gloves, and sometimes masks, gowns, and eye wear.

After each patient, disposable wear like the gowns and masks are discarded. Before seeing the next patient the treatment team washes their hands and put on a new pair of gloves.

Key Words: *Sterilization, endodontic, clinic.*

INTRODUCTION

Sterilization plays a very important role in prevention of cross infection in dental practice. Pathogenic microbes may be transmitted directly from the dentist to patient or from the patient to doctor, and indirectly from patient to patient. This may occur by direct exposure or via contaminated instruments or surface; the latter is referred to as cross-contamination. Blood and saliva have been found to be high-risk sources for contracting hepatitis B, human immunodeficiency virus and herpes. In addition, mouth is a reservoir of several pathogens which can easily lead to cross-contamination.[1,2,3]

The complex miniature architecture of dental burs and endodontic files make pre-cleaning and sterilization difficult.

The prevention of cross-contamination of infectious diseases among dentists, dental staff and patients is a major concern in a dental practice. Various recommendations and guidelines are being regularly updated with the increasing scientific knowledge.[1]

This article discusses the current guidelines and recommendations for effective sterilization in endodontic office.

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PROCEDURE

Barrier techniques

The form the first line of defence against infectious and transmissiable disease as well as cross infection.[1,3]

1 Active immunization of all dental staff and auxiliary staff against hepatitis B virus.

2 Gloves must be worn when skin contacts with body fluids, mucous membrane, or contaminated items and surfaces anticipated. Between patients, the gloves must be removed and hands must be washed and re-gloved. Latex or vinyl (in case of latex allergy) gloves must be used for patient examination and procedures.

3 Heavy rubber gloves are meant to be used while cleaning instruments and environmental surfaces.

4 Hands should be washed at the start of the day, before gloving, after removal of gloves and after touching any contaminated surface. Hand washing with water and plain soap is adequate for patient examination and non-surgical procedures. For surgical purposes thorough surgical scrub techniques using anti-microbial hand scrub should be used.

5 Face masks protect the oral and nasal mucosa from body and fluid splatters. They should be changed when visibly soiled or wet.

6 Protective eye wear are indicated to shield the eyes from splatter.

7 Protective clothing like aprons wither re-useable or disposable, must be used in dental clinics. They should be changed when visibly wet or soiled. Surgical gowns re-useable or disposable should be used for surgical cases.

8 Various disposable barriers (e.g. disposable plastic shields for handpiece, disposable plastic shields for light, etc.) are available in the market which can be used routinely in dental practice.

9 For water line disinfection various disinfectants are available in the market.

10 Methods to limit contamination

11 Patient positioning.

12 High volume evacuation.

13 Rubber dam isolation.

14 Regular servicing and well-conditioned equipment.

Before patient treatment

Flush handpieces, suction tubing, ultrasonic scalers and air/water syringes. This has to be done early in the morning, and between each patient treatment.

Place disposable plastic barriers to prevent contamination of surfaces which have the potential to be touched by dentist or dental assistant e.g. light handles, dental chair head and arm rest, etc. These barriers should be changed between patients, taking care not to contaminate the areas between the barriers and upon removal.[1,2,3]

During patient treatment

Treat all patients as potentially infectious using universal guidelines.

Use protective attire and barrier techniques when contact with body fluids or mucous membrane are anticipated.

Wear gloves and change between each patient or during treatment if they are punctured or torn.

Wear a mouth mask and change it in between patients if they become wet.

Use disposable items as much as possible e.g. three way syringe tips, saliva ejector tips, etc.

Use rubber dam and high volume suction to reduce formation of droplet and splatter during treatment. Use of a antimicrobial mouth rinse before treatment is beneficial.[1,2,3,5]

After patient treatment

Flush handpieces, suction tubing, and air-water syringes.

Flushing should be done for 30 seconds between treatment and 15 mins at the end of the day.

Suction filters must be cleaned every day.

If infectious material is spilled, it should be absorbed in paper towels and/or cotton.

The area should be first cleaned by a detergent and later wiped using a disinfectant which is effective against both lipophilic and hydrophilic viruses.[1,2,3]

STEPS IN STERILIZATION

The advice sheet for infection control in dentistry issued from the department of health, UK, enumerates 3 stages for effective decontamination of instruments namely

Pre-sterilization cleaning

Sterilization

Storage

PRE-STERILIZATION CLEANING

All the instruments must be thoroughly debrided of contaminants like blood, saliva and other impurities before undergoing a sterilization cycle, as retention of these debris and contaminants may shield the microorganisms from being destroyed, thus preventing effective sterilization.[7]

Recommendations for precleaning files

Immediately after use remove stoppers and insert the files into a scouring sponge soaked with 0.2% chlorhexidine gluconate aqueous solution.

- Clean the files by using 10 vigorous in-and-out strokes in the sponge.
- Place the files in a wire mesh basket and immerse in a suitable enzymatic cleaning solution for 30 minutes.
- Follow this by 15 minutes ultrasonification in the enzymatic cleaning solution.
- Drain and rinse in running water for 20 seconds.
- Proceed to steam sterilization.

PACKAGING OF INSTRUMENTS FOR STERILIZATION

1 Packaging materials (e.g., wrapped or container systems) allow penetration of the sterilization agent and maintain sterility of the processed item after sterilization. Materials for maintaining sterility of instruments during transport and storage include wrapped perforated instrument cassettes, peel pouches of plastic or paper, and sterilization wraps (which can be either woven or unwoven).

2 Cassettes: The use of instrument cassettes facilitates instrument processing and can greatly enhance the organization of instruments. The advantage of using cassettes is that it keeps all the instruments for a specific procedure together from the chairside procedure through cleaning, rinsing, drying, and sterilization. Cassette system can re-

duce direct handling of potentially contaminated instruments before sterilization.

STERILIZATION

Various methods are currently being used for sterilization of endodontic instruments.

Autoclave

1 *Steam autoclave*- at 250°F (121°C) at 30psi, total time about one hour. There is good penetration and it maintains integrity of liquids, like hand piece lubricants, due to the 100% humidity within the chamber.

Disadvantages: Non stainless steel metal items corrode, use of hard water may leave deposits, and it may damage plastic and rubber items. Sharp instruments get dulled.

2 *Rapid steam autoclave*- at 275 °F (135°C) at 35psi, total time is 15- 20 minutes. It is very convenient and easy to operate.

Disadvantages: Requires use of distilled water and small chamber size necessitates frequent cycles. Endodontic reamers and files can be inserted into synthetic sponges and subjected to autoclaving. According to Boyd and Valez the sponges do not obstruct the autoclaving process. (6, 7)

Many studies have indicated that files sterilized using autoclave displayed complete sterilization.

Chemiclave or Chemical Vapor Sterilization

It is effective against all fungi, viruses and bacteria including spores. 2% glutaraldehyde solution and chlorine di oxide are commonly used and has been approved by the ADA. Sterilization time with 2% glutaraldehyde is 10 hours without dilution. The main drawback is this type of sterilization requires prolonged immersion and instrument turnover time is increased. Instruments also tend to corrode when such chemicals are used. Also, there is no method available to verify their effectiveness in providing complete sterilization.

Glass Bead Sterilization

Glass bead sterilization uses small glass beads 1.2 to 1.5 mm in diameter. The recommended temperature is between 217 °C to 232°C (424 °F to 450°F) and should not exceed 250°C. The duration of the cycle is between 3-5 seconds. Root canal instruments such as reamers, spreaders, broaches and files can be effectively sterilized in glass bead sterilizer at 218-246°C in 10 seconds. The disadvantage of files becoming brittle with increased susceptibility to fracture should be considered.

Hot salt sterilization

The following endodontic instruments can be sterilized in hot salt sterilizer. The temperature ranges between 425- 475°F (220- 245°C).

- 7 ft sec - paper points, cotton pellets
- 5 sec - reamers , files, broaches, burs, spreaders, pluggers, any metallic instrument introduced in the canal, silver cones.

It must be made sure that the instruments are immerse at least a quarter-inch below the salt surface in the peripheral area as the ideal temperature is present in the periphery of the sterilizer.

Ethylene Oxide Gas

Ethylene oxide (EO) is a well-known sterilizing agent. However, only recently has its use significantly emerged, based on its range of applications in the field of new medical device development and sterilization. The main advantage is its use in heat sensitive instruments.

The total time from start of cycle to the end of degassing is 14 hours. The instruments are cool and dry at the completion of cycle.

Disadvantage: Very long cycle time. If the cycle is interrupted before completion, there can be possibility of ethylene oxide exposure. It requires the use of several single use items that can be purchased only from the manufacturer.

Dry Heat Sterilization

Different temperature-time relations for holding time are 60 minutes at 320°F (160 °C), 40 minutes at 340°F (170°C) and 20 minutes at 356°F (180°C). Increasing temperature by 10 degrees shortens the sterilizing time by 50 percent. The usual recommendation is using dry heat at 320°F (160°C) for 1 to 2 hours.

Their main advantage is they do not cause instrument corrosion

PRION PROTECTION

Diseases such as Creutzfeldt-Jakob disease are caused by a proteinaceous infectious agent, or prion. Prions are extremely stable group of infectious agents composed of mainly proteins and are highly resistant to sterilization. They are able to refold into different structures, which in turn convert normal protein molecules into abnormal structures. These prions can cause cross contamination.[11]

Sterilization cycle recommended for prion protection:

Presterilization instruments should be kept wet (eg, immersed in water or a prionicidal detergent) or damp after use and until they are decontaminated, and they should be decontaminated (eg, in an automated washer-disinfector) as soon as possible after use.

Option 1 Autoclave at 273°F (134°C) for 18 minutes in a prevacuum sterilizer.

Option 2 Autoclave at 270°F (132°C) for 1 hour in a gravity displacement sterilizer.

Option 3 Immerse in 1 N NaOH (1 N NaOH is a solution of 40 g NaOH in 1 L water) for 1 hour;

remove and rinse in water, then transfer to an open pan and autoclave (121°C gravity displacement sterilizer or 134°C porous or prevacuum sterilizer) for 1 hour.

Option 4 Immerse in 1 N NaOH for 1 hour and heat in a gravity displacement sterilizer at 250°F (121°C) for 30 minutes, then clean and subject to routine sterilization.[11]

STORAGE OF DENTAL INSTRUMENTS

Storage Recommendations for Autoclaved Medical Instruments

1 Allow packages to dry in the autoclave before handling to avoid contamination.

2 Store packaged sterile instruments in a clean, dry and dust and lint free area (covered or closed cabinets are recommended.

3 Store clean and sterile materials at least 8 to 10 inches above the floor, 18 inches below the ceiling, and 2 inches from the outside walls.

4 Keep like items together—sterile with sterile and clean with clean.

5 Rotate stock with older items being used first.

6 Do not store sterile supplies under sinks or other location where they may become wet, on the floor, windowsills or other supply areas than designated shelving or cabinets.

7 Do not store sterile supplies with items not intended for clinical use, e.g., office or cleaning supplies.

8 Do not handle sterile packages unnecessarily to avoid contamination.

9 Items stored and not used within 12 months should be evaluated as to the condition of the packaging as well as the necessity of stocking infrequently used items.[1,2,3,6]

U. V cabinet

After sterilization with any above mentioned method, instruments can be kept inside the ultraviolet cabinet so that sterilization of instruments maintained for longer duration without any contamination. U V radiation is an enclosed space for the disinfection of dental instrument with exposures of 5 minutes duration according to the manufacturers' instructions. The optimum wavelength for U V radiation is 260nm during peak emission. The range of 254 nm is suitable for adequate disinfection.[1,2,3,6]

MONITORING METHODS

To ensure patient safety when it comes to instrument processing and sterilization, three methods of monitoring should be use. They include mechanical, chemical and biologic.

Biological indicators are recognized as being closest to the ideal monitors of the sterilization process since they measure the sterilization process directly by using the most resistant microorganisms and not merely testing the physical and chemical conditions necessary for sterilization.

GUTTA-PERCHA DISINFECTION

Gutta-percha cones cannot be sterilized by heat. Therefore a chair-side decontamination using a chemical agent should be adopted in routine endodontic practice to render them free of microorganisms. Even though gutta-percha cones are usually sterile during storage, they can be easily contaminated if incorrectly manipulated. NaOCl at 5.25% concentration is an effective agent for a rapid high disinfection level of gutta-percha cones. It is seen that at such a concentration even spores are eliminated.[8]

FIBRE POST DECONTAMINATION

Wipe the post with alcohol. Allow the post to air dry for 30 seconds before use.

HAND PIECE ASEPSIS

Although no documented cases of disease transmission have been associated with dental hand pieces, sterilization between patients with acceptable methods that ensure internal as well as external sterility is recommended. The inside lines of high speed handpieces may become contaminated when patient fluids retract back through air-water opening. If the hand piece is not properly processed, the retracted fluids may enter the mouth of the next patient.

Dental units manufactured after the middle 1980s have antiretraction valves already installed. Since these valves fail periodically, retraction must be routinely checked and the valve replaced when necessary. Retraction is checked by observing the tip of the water line opening at the hand piece connection when the water is turned on and then off. If a drop of water 'hangs' on the tip, retraction is not occurring. If the water is drawn back into the line, the retraction is occurring. [8, 15, 14]

METHOD OF STERILIZATION

First, the hand piece should be flushed with water by running it for 20 to 30 seconds, discharging the water into a sink or container. Ultrasonic cleaner or hand scrubbing can be done to clean the instruments. Lubricate high speed hand pieces when indicated by the manufacturer and spray out excess lubricant. Package for sterilization in steam or unsaturated chemical vapor must be done following the manufacturer's directions. If disinfecting a hand piece that cannot be heat sterilized, spray or saturate with disinfectant recommended by the manufacturer. The light port of fiber optic handpieces is wiped with an isopropyl alcohol swab after sterilization. Dry heat sterilization is not recommended for handpieces.[6]

STERILIZATION OF BURS

This involves a two-step process, cleaning and sterilization.

Cleaning:

Step 1: Wear gloves when handling contaminated instruments. Pre-soak carbide burs in a container of soapy water to loosen debris. Ultrasonic

systems may also be used to loosen debris in burs; however burs should be separated from each other in a bur block during immersion to prevent damage.

Step 2: Brush away remaining debris using a SS White stainless steel wire brush and rinse burs under running water.

Step 3: After rinsing, dry burs thoroughly by placing them on absorbent towels. Pat dry all the surfaces.

Sterilization: Proper sterilization of carbide burs is extremely important because it eliminates the threat of cross infection of patients and staff with communicable diseases. Either dry heat or steam sterilization is recommended for diamond burs, however, only dry heat sterilization is recommended for carbide burs with potential for corrosion.[8]

INSTRUMENT DAMAGE SECONDARY TO STERILIZATION

Factors responsible for instrument damage during sterilization and methods of prevention

1) Water Hardness.
2) High Temperatures.
3) Moisture and insufficient drying.
4) Strong Detergents.
5) Cold Sterilization.
6) Enzymes.
7) Ageing of instruments.

CURRENT TREND

Endodontic files and burs are classified as critical B instruments. This means that stricter requirements apply to the re-processing of such instruments. Many studies have indicated that sterility of files for reuse has shown to be less than 100%. Presently, there is a shift in thought towards focus on using single use pre-sterilized endodontic files and burs. Although, there are increased costs incurred, there are several benefits like decreased chances of cross contamination, safety in cases of legal disputes, and a simplified workflow in regarding to quality management of dental practice. [9, 11]

Single use Pre-sterilized (gamma sterilized) endodontic files and burs may soon replace and reduce the burden of sterilizing endodontic files and burs in the future. [9]

Laser Sterilization: Laser sterilization of endodontic reamers has been tried recently using carbon dioxide laser and has been proved to be 100%effective in completely eliminating the spores and holds excellent promise as effective method of sterilizing endodontic instruments in the future.

CONCLUSION

The goal of instrument sterilization in dentistry is to protect patients from cross contamination via instruments.[1,2,3,6] Pre-cleaning and sterilization of some instruments can be difficult because of their small size and complex architecture.[8,9] It is incumbent upon each dentist and endodontist to conduct their practice in a manner that restricts the spread of infection and cross contamination. By following the procedures described here, they can minimize and even prevent the possibility of cross-infection. Thus, utmost care should be taken to clean and sterilize each and every instrument before it is used in patients.

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