

Importance of sterilization in endodontics

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This is my third year as a resident and it has drawn my attention in gathering the importance of sterilization in endodontics. The clinical practice of diagnosing the patient in dentistry requires well-equipped instruments most of the time. The growing emphasis on infection control and sterility has become a major issue in the field of dentistry. Infection control which is essential for the favorable outcome of endodontic treatment, mainly includes bacterial elimination from the root canal, prevention of reinfection and cross infection. Hence, this report marks the importance of sterilization in the field of endodontics highlighting some of the methods that need to be paid attention during our daily clinical practices.

Maintaining asepsis around the operatory field helps in the prevention of dental reinfection. A study by Sjogren et al. showed that successful endodontic treatment relies primarily on bacterial control¹. Moreover, healing may be compromised even due to minimal bacterial contamination. Proper isolation of the involved tooth from the oral environment is very important since the oral cavity is a reservoir for tons of bacteria. In order to decrease the risk of contamination, the number of microbial flora, plaque, and calculus surrounding the teeth are initially removed through endodontic treatment. Isolation with rubber dam helps in preventing recontamination of cleaned and sterilized root canal systems. Additionally, the rubber dam also prevents the incidence of accidental swallowing of endodontic instruments and chemicals used during the treatment procedures. In the oral cavity, saliva is a reservoir for the bacterial contamination, therefore the use of cotton rolls and saliva ejectors in absorption are also important means of isolation. Use of clean and sterilized, gloves

and mask are useful tools to uphold asepsis around the operative field².

Primary motive of sterilization technique is to destroy all the microorganisms consisting of autoclave, dryheat, oil sterilization, glass bead sterilizer, and boiling water sterilizer which are used in various dental offices and hospitals. Prior to sterilization, the instruments should be disinfected to ensure a decrease in bacterial count. If not cleaned, the gross residual material left over like debris and blood in the instrument may prevent the microorganisms from being sterilized, thus should be removed manually after every use. A synthetic phenolic solution diluted 1:32, may be used as a disinfectant for holding instruments after their use³. Cleaning of instruments may be carried out by hand scrubbing, ultrasonic cleaners, or long-handled brushing cleaners. Apart from this, during these types of the cleaning procedure, one should use heavy rubber gloves and masks to prevent the spread of infection. After cleaning, the instruments should be dried well enough to prolong their long term durability.

Dry heat has the advantage of allowing files, reamers, and burs to retain their sharpness and efficiency. It helps hand instruments to retain their luster and finish⁴. Cotton pellets, gauze, cotton rolls, and towels may be sterilized using dry heat in a closed metal container. Autoclave that uses steam under pressure is one of the preferred methods of sterilization. Many instruments like restorative instruments, ultrasonic tips, rubber dam frame and clamps, clip and measuring scale of apex locator should be well sterilized using the autoclave. Autoclave sterilization is necessary after the use of files under repeated clinical conditions. However, all the files that are in a prearranged set and may not be used during the same appointment are all subjected to multiple autoclave cycles⁵. Hence, along with huge advantage, autoclave might also affect the cutting instrument by making it dull and tarnished. Sterilization of handpiece in a hot oil bath for five minutes as a method of oil sterilization eliminates pathogenic organisms and increases the operating life of equipment⁶.

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Proper cleaning, packaging, sterilization and finally distributing are mainly the basic components of infection control. Prepackaging of instruments after the autoclave is necessary to prevent contamination of instruments. Sterilization failures can still occur as a result of improper packaging which might prevent steam from reaching items inside the packaging or by absorbing plenty of moisture inside the packaging. Also, the shelf life of the packed instruments should be kept into consideration. Normally the shelf life of a product in a heat-sealed sterilization flat pouch sterilized by autoclave is 3 months, by ethylene oxide is 12 months, and by plasma sterilizer is 6-12 months⁷. The ethylene oxide and plasma sterilizers are used for heat-sensitive items, such as rubber, plastic, and flexible scopes. After sterilizing the instruments, storing should be done in clean and dust free drawers or cabinets. Furthermore, an inspection of the instrument should be done timely in order to uphold the quality of the instrument. If color changes and corrosion are noted on instruments, they should be discarded immediately. The small number K files like No. Six, Eight and Ten should only be used for one appointment as they weaken significantly after use. Gutta-percha points used for the obturation should be disinfected before placing into the root canal which is done by inserting into a solution of sodium hypochlorite for about five minutes⁸. Some of the disposable endodontic irrigation syringes should be disposed of after each patient.

One should always follow the universal precaution measures in order to prevent the spread of harmful microorganisms from one place or person to another place or person. Maintaining hand hygiene by handwashing, hand antiseptics, or surgical hand antiseptics reduces potential pathogens on the hands and also reduces the risk of cross-contamination in patients and health care professionals⁹. Handwashing products, including plain non-antimicrobial soap and antiseptic products, can become contaminated or support the growth of microorganisms¹⁰. We should always choose the hand washing products that has nonirritating properties and a broad spectrum of antimicrobial activity. Protective and effective measures such as gloves, masks, plastic face shields and safety glasses should be used. Moreover, this physical barrier like gloves and mask should be disposed of after each patient. Before the endodontic periapical surgery commences, preparation of the operative field is very necessary along with sterilized instruments. Attempts to disinfect the skin and mucous membrane is done by wiping the tissues mechanically by application of a good antiseptic solution such as tincture of povidone-iodine

which destroys the surface pathogens. Needles to be used for injecting local anesthetics should be sterilized in an autoclave. After the needle and syringe are sterile, it is important that a sterile anesthetic solution should be used. The outer surface of the glass anesthetic cartridges which are available in the drug store may be contaminated with pathogenic organisms and should be kept in a chemical disinfectant¹¹. Povidone-iodine solution (Betadine) has been accepted as an effective topical broad-spectrum antiseptic and disinfectant agent¹². It is used to disinfect the outer surface of the glass cartridges eventually reducing the surgical site infection. Therefore, implementing appropriate sterilization and disinfection procedures in appropriate time help to eliminate the chance of postoperative complications like swelling, space infections and pain.

In a dental practice, one should always implement proper infection control protocol to prevent or reduce the risk of disease transmission since transmission of dental infection can occur through infected air droplets, blood, saliva, and instruments contaminated with secretions¹³. Blood-borne infections such as HIV/AIDS, HCV, HBV and other emerging blood-borne organisms represent the main risks for the transmission of infections in our dental practice. Exposure to blood and body fluids need great concerns from both dental care providers and the patients¹⁴.

Infection control protocol for the transmission of the blood-borne pathogens consists of¹⁵:

1. HBV vaccination series should be provided to all dental health care professionals with potential occupational exposure to blood or other potentially infectious material.
2. We should use the standard precautions on infection control such as masks, protective eyewear, face shields, and protective clothing.
3. Single-use disposable instruments (e.g., prophylaxis angles, prophylaxis cups and brushes, tips for high-speed air evacuators, saliva ejectors, and air/water syringes) should be used for one patient only and discarded appropriately.
4. Rubber dams should be used to minimize blood spattering.
5. Sharp items such as needles, scalers, and burs which are contaminated with patient blood and saliva as potentially infective should be taken extra attention in order to prevent injuries.
6. We should place the used disposable syringes and needles, scalpel blades, and other sharp items in appropriate puncture-resistant containers.

7. We should not recap used needles by using both hands or any other technique that involves directing the point of a needle toward any part of the body. Also, the needles should be bent before disposal.
8. We should maintain proper hand hygiene with either a non-antimicrobial or antimicrobial soap and water when hands are visibly dirty or contaminated with blood or other potentially infectious material. If hands are not visibly soiled, an alcohol-based hand sanitizers can also be used.
9. Sterile surgeon's gloves should be used when performing oral surgical procedures.
10. Appropriate gloves (e.g., puncture- and chemical-resistant utility gloves) should be used when cleaning instruments and performing housekeeping tasks involving contact with blood.
11. Disinfection of the operatory site after each patient should be done prior and after the operatory process.

Instrument and operatory surfaces can be classified as critical, semicritical, noncritical and environmental surfaces based on the potential for disease transmission¹⁶. The critical items such as scalpel blades, burs, dental explorers and probes pierce the soft and hard tissue, whereas the semicritical items such as mouth mirrors, handpiece, anesthetic syringes do not necessarily penetrate soft and hard tissues but cross the vermilion border. Both these critical and semicritical items have a high disease risk, therefore should be sterilized either by autoclave, chemiclave, dry heat or immersion in full strength glutaraldehyde (Eight hours for sterilization 30 minutes for high-level disinfection). In addition, items used in dentistry which do not cross the vermilion border or penetrate the soft tissues, such as chair light handles, instrument trays, high touch, and work surfaces and chair controls are noncritical items with moderate disease risk, should be surface disinfected cleaned and disinfected after each use with an (Environment Protection Agency) EPA-registered hospital disinfectant. If visibly contaminated with blood, use of an EPA-registered hospital disinfectant with a tuberculocidal claim (i.e., intermediate level) after each patient. Barrier protection of surfaces and equipment can prevent contamination of clinical contact surfaces like the use of clear plastic wrap, bags, and sheets. These contact surface barriers should be removed and discarded between patients¹⁷.

Instruments that should be used during treatment of an HIV patient should be placed in an appropriate container at the point of use to prevent percutaneous

injuries during transport to the instrument processing area. Correct cleaning, packaging, sterilizer loading procedures, sterilization methods, or high-level disinfection methods should be followed to ensure that an instrument is adequately processed and safe for reuse on patients. Immediate packaged should be before sterilization. The main use of barriers like plastic wraps in clinical contact areas of the operatory site controls gross contamination and prevents the spread of every single microbe. Moreover, proper functioning of sterilization cycles should be verified by the periodic use (at least weekly) of biologic indicators (i.e., spore tests)¹⁸. Along with recent advancement in the field of sterilization, there is growing popularity of Central Sterile Supply Department (CSSD) in many renowned medical and dental institutions for infection control. The CSSD plays a pivotal role in ensuring the instruments and devices are well sterilized in a quality-assured environment and finally delivered to various users in the hospital. The equipment that is essential in CSSD mainly includes automated washer disinfector, ultrasonic cleaner, air and water jet spray guns, thermal drying cabinet, rotary sealing machine, steam sterilizers, ethylene oxide sterilizer and plasma sterilizer⁷. Thus, CSSD helps in maintaining high-grade infection control throughout the continuous reprocessing cycle of an instrument.

Studies have demonstrated that dental unit waterlines carrying water to the high-speed handpiece, air/water syringe, and ultrasonic scaler are colonized with microorganisms, including bacteria, fungi, and protozoa¹⁹. Dental unit water systems must be cleaned and disinfected periodically to control environmental biofilms, and the treatment water/irrigant should be of good microbial quality containing fewer than 500 colony forming units per milliliter of heterotrophic, mesophilic organisms²⁰. In addition, the appropriate dental water unit is essential to flush the waterlines at the beginning of a day and in-between patients. On completion of treatment, the used handpieces, ultrasonic scalars, and air-water syringes must be run for 20 to 30 seconds. On the other hand, dental units which are equipped with self-contained reservoirs (i.e. a bottle system instead of a dental unit connected to a municipal water source), could potentially be used to introduce antimicrobial irrigants or cleaners to control biofilm contamination and provide high-quality treatment water for patient care.

CONCLUSION

Proper aseptic measures should be taken in endodontics since microorganisms are the major cause of endodontic

disease. Risk of cross-infection in a dentist's office is obvious unless the instruments are properly cleaned and sterilized. Hence, it is important to enforce strict measures regarding disinfection of our hands, the field

of operation, and the instruments in our dental practice; eventually assisting to decrease the infection rate in endodontics. This might ultimately secure infection control practices in dentistry for a successful treatment.

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