

# Sterilization in Endodontics: A Newer Concept

Debkant Jena<sup>1</sup>, Sumit Dash<sup>1</sup>, Siba Prasad Jena<sup>2</sup>, Naomi Ranjan Singh<sup>2</sup>, Swapna Kumari<sup>3</sup>

<sup>1</sup>Professor, <sup>2</sup>Senior Lecturer, <sup>3</sup>Tutor, Department of Conservative Dentistry & Endodontics, Institute of Dental Sciences, Siksha 'O' Anusandhan (Deemed to be University), Bhubaneswar, Odisha, India

## Abstract

In the endodontic procedure the treatment consists of different types of working procedures, such as isolation in the area of a tooth by rubber dam, opening access cavity with burs and cleaning and shaping of the canal after that compact obturation of canal. In every phase of treatment sterilization instruments are needed to prevent blood born diseases like HIV, Hepatitis B, and other blood-borne infections. In-depth knowledge of sterilization protocol in every step to clean the instrument is the key to infection control. Sterilization refers to the process in which complete removal microorganisms and spores from the surface treated. The widely used method is heat-based sterilization by autoclave. Till the invention of autoclave, dry heat method was used for sterilization in all areas of dentistry. This review article describes the various method used in endodontics for sterilization.

**Keywords:** Sterilization; Infection; Control; Blood; Endodontics.

## Introduction

One of the most important regions of cross-infection in the dental clinic was due to improper handling and sterilization. Control of infection was an important factor in providing comprehensive dental care. Another important matter of concern was the prevention of cross-contamination to dental staff and the other patients in daily dental practices by contaminated instruments.<sup>1</sup>

Blood and saliva are important carriers of infection such as Hepatitis B, HIV and other blood-borne diseases. In endodontic treatments includes various procedure which involves blood contamination during the procedure therefore making it sterilize every instruments both rotary and hand files after every patients.<sup>2</sup>

Sterilization is the procedure that kills the bacteria and

another microorganism, pathogenic and non-pathogenic in vegetative or spore form the surface of the material to be sterile. The item free from living microorganisms is defined as sterile.<sup>3</sup> Chemical sterilization was used for the thermosensitive instrument, which cannot go for moist heat sterilization. For other than thermosensitive instruments all other instruments can be sterilized in an autoclave. An autoclave was used for sterilization for all instruments used in dental clinic.<sup>4</sup>

It was important to ensure that all microorganisms are killed after the sterilization process. So the quality management on time to time basis was an important part of the sterilization procedure.<sup>5</sup> To check the reliability of the sterilization the biological indicators are used such as spore strips which changes color after completion of sterilization if the autoclave is working in good condition. The indicator strips check the efficiency of the sterilizer to kill the bacteria.<sup>6</sup>

Sterilization of the instruments used in the operatory will only prevent the cross contaminations. If these instruments not sterilized properly may lead to cross-contamination. Most common method used for sterilizing these instruments are autoclave, ethylene dioxide gas, glass bead sterilizer and dry heat sterilizer.<sup>7</sup> Chemical disinfectants have the bacteriocidal effects on

---

### Corresponding Author:

**Prof. Debkant Jena**

Professor, Department of Conservative Dentistry & Endodontics, Institute of Dental Sciences, Siksha 'O' Anusandhan (Deemed to be University), Bhubaneswar, Odisha, India

e-mail: debkantjena@soa.ac.in

microorganisms after 15 minutes of exposure but not effective against spores and viruses. The most common method for sterilization was autoclave in a short period. Critical instruments are those that are used to penetrate soft tissue and bone. These types of instruments has to be sterilized after each use.<sup>9</sup>

**Difference between Disinfection and Sterilization:** It is important to know the difference between disinfection and sterilization both procedures can remove pathogens from the treated surface.<sup>10</sup> The process of removing pathogens but leaving the spore was known as disinfection and process to remove both pathogens and spores called sterilization.<sup>11</sup>

**Cleansing and Disinfection (Presterilization):** After completion of the patient first step of the sterilization process is to remove blood and debris from the endodontic instruments. Debris consists of protein and residue of blood and dentinal shavings.<sup>12</sup> Washing can be done by hand with disinfectant liquid or ultrasonic washer. The ultrasonic process is better as compare to hand washing because it can break the organic component.<sup>13</sup>

The study conducted by Sureshchandra et al<sup>14</sup> compares the various method of cleansing and disinfection with use of 3 material like 3% hydrogen peroxide, manual brushing and 70 % alcohol and in test group manual brushing 1% sodium hypochlorite and ultrasonic bath in the result showed that test group were more efficient. Azarpazhooh et al<sup>15</sup> Showed that the ultrasonic group has more potential to clean the endodontic instruments.

**Disinfection of Root Canal Filling Materials:** Materials used for sealing root canal are gutta-percha. Before using the GP points in the canal the GP points dipped into 5% Sodium hypochlorite sterilizes the points. Gutta-percha cones contains zinc as a component which helps the cones to inhibits some amount of bacteria to adhesion.<sup>16</sup>

Some studies show that during the production of GP points in the factory unit 30% of samples are contaminated with bacteria (staphylococcus spp). So if the GP point crosses the apical foramen chances of infection are more if not sterilized before placing it into the canal. Sterilization with the heat may alter the size and shape of the cone, so autoclaving is not indicated. Can be done by Sodium hypochlorite in concentrations of 0.5–5% (NaOCl), Chlorhexidine, 2% (CHX), Hydrogen

peroxide, 3%.<sup>17</sup>

**Sodium Hypochlorite and Chlorhexidine:** 5% Sodiumhypochlorite was used for sterilization of cones. One of the main side effects was corrosive effects on most endodontic instruments. Rutala et al<sup>18</sup> who showed in the SEM scan that the use of both solutions can alter the tensile strength when placing the cone for 10 min. Eldik et al observed that 5% sodium hypochlorite for 5 min is one of the most effective method of reduction of bacteria from the surface of Gutta Percha points.<sup>19</sup>

**Sterilization of Endodontic Instruments:** After cleaning the instruments by hand washing or ultrasonic wash. The drying and wrapping should be done to all the instruments, the most common method from last twenty-year used are autoclave, glass bead sterilization for 45 seconds at 240°C, UV lights, Laser sterilization and glutaraldehyde. Many authors showed in their study that autoclave remove all bacteria and spores and virus with temperature 121 °C for 15 min for endodontic instruments.<sup>20</sup>

UV light lamps sterilization works on thermal heat which causes activation of nucleic acid through the induction of thymine dimers. The disadvantage of UV lamps is they act only on the surface where direct there is contact to the light. 2% glutaraldehyde was a suitable method to sterilize the endodontic instruments and other dental instruments. The disadvantage is highly toxic in nature and it requires 12hr duration to sterilize the instrument which is difficult in clinical practice.<sup>21</sup> In the advancement of sterilization protocol the Laser was used as a chairside tool to sterilize reamers by CO<sub>2</sub> laser published in the work by Boyd at al.<sup>22</sup> the author found that complete sterilization of reamer was observed using argon laser. Various studies showed that the autoclave process of rotary instruments may lead to fracture during biomechanical preparation in the root canal treatment due to cyclic fatigue. To preserve the fracture 6% hypochlorite was used to reduce the microbiological load.<sup>23</sup>

**Burs: Decontamination and Sterilization:** Diamond burs used in the endodontic process to remove the caries and initial access cavity preparation after use can be dip into the ultrasonic bath for 15 min and after that can be autoclave prevent cross infection to other patients.<sup>24</sup>

**Changes in the Physical and Mechanical Properties of Endodontic Instruments Subject to the**

**Sterilization Process:**

**Cyclic Fatigue and Torsional Stress**<sup>25</sup>: One of the main reasons of the fracture of endodontic instruments is due to cyclic fatigue during root canal treatment. The instrument goes under cyclic stress followed by compressive loading stress which led to the fracture of instruments which again depends on the number cycles i.e., more cycles leads to more chance of fracture. Other stress was torsional which leads to complete rotation inside the canal and fracture in the endpoint where the canal is blocked or calcified. To overcome these effects NiTi files have evolved now have shape memory.

**Roughness, Corrosion, and Reduction of Cutting Capability**<sup>25</sup>: Roughness and corrosive effect on NiTi instruments during irrigation by Sodium Hypochlorite cause micro pitting phenomenon and oxygen in the autoclave causes formation of nitric oxide which causes roughness on the instruments and it may also cause a reduction in the cutting ability of NiTi instruments.

**Conclusion**

Based on various studies done by the author the most effective method for sterilization of endodontic instruments is the autoclave process. The glutaraldehyde sterilization was more potent to kill the pathogens from the treated surface as compared to the glass bead sterilization. Presterilization is help full in removing the debris and pathogens from the surface to 40 % in the count. Ultrasonic bath better than the handwashing technique.

**Funding Statement:** None

**Conflict of Interest:** None

**Ethical Permission:** Approved

**References**

1. Miller CH. Infection control and of control. *Den Clin North Am* 1991; 35:339-55
2. Limbhore M, Saraf A, Medha A, Jain D, Mattigatti S, Mahaparale R. Endodontic hand instrument sterilization procedures followed by dental practitioner. *Unique Journal of Medical and Dental Sciences*. 2014 Oct-Dec; 2(4):106–11.
3. Ferreira MM, Michelotto ALC, Alexandre AR, Morganho R, Carrilho EVP. Endodontic les: Sterilize or discard? *Dental Press Endodontics*. 2012 Jan-Mar; 2(1):46–51.
4. Rajkumar K, Lakshminarayan L. The effectiveness of two commonly used method of sterilizing endodontics. *J Indian Dent Assoc*. 2001;72:245-8.
5. Council on dental materials, instruments and materials. Council on dental practice, council on dental therapeutics. *J Am Dental Association* 1998;16:241-8.
6. Holland MR. A review of sterilization and disinfection in dentistry. *Oral Surgery, Oral Medicine, Oral Pathology*. August 1955;8(8):788-95.
7. Morrison A, Conrod S. Dental burs and endodontic procedures effective? *Journal of Canadian Dental Association*. 2009; 75(1):39.
8. Venkatasubramanian R, Jayanthi, Das UM, Bhatnagar S. Comparison of the less by 4 different method: an in vitro study. *J Indian Soc Pedod Prev Dent* 2010;28(1):2-5.
9. Limbhore M, Saraf A, Medha A, Jain D, Mattigatti S, Mahaparale R. Endodontic hand instrument sterilization procedures followed by dental practitioner. *Unique Journal of Medical and Dental Sciences*. 2014 Oct-Dec; 2(4):106–11.
10. Sriraman P, Neelakantan P. Asepsis in operative dentistry and endodontics. *International Journal of Public Health Science*. 2014 Mar; 3(1):1–6.
11. Kumar AS. Evaluation of sterilization at dental clinics in Hyderabad City – A cross-sectional study. *Journal of Advanced Medical and Dental Sciences Research*. 2015 Apr Jun; 3(2):38–41.
12. de Sousa SMG, Bramante CM. Importance and method of cleaning endodontic Rev *Fac Odontol Bauru, FOB*. 1999; 7(3/4):59–62.
13. Morrison A, Conrod S. Dental burs and endodontic procedures effective? *Journal of Canadian Dental Association*. 2009; 75(1):39.
14. Suresh Chandra B. Meeta M, Rajaram N. Endodontic procedures effective? *Endodontology*. 2011 Dec; 23(2):45–8.
15. Azarpazhooh A, Fillery E. Prion disease: the implications for dentistry. *J Endod*. 2008 Oct; 34(10):1158-66.
16. Van Eldik DA, Zilm PS, Rogers AH, Marin PD. An SEM evaluation of debris removal from endodontic tiles after cleaning and steam sterilization procedures. *Aust Dent J*. 2004 Sep;49(3):128-35.
17. Perakaki K, Mellor AC, Qualtrough AJ. Comparison

- of an ultrasonic cleaner and a washer-disinfector in the cleaning of endodontic files. *J Hosp Infect.* 2007 Dec;67(4):355-9.
18. Rutala W, Weber D. CDC guideline for disinfection and sterilization in healthcare facilities, 2008. Page 70.
  19. DA Van Eldik, PS Zilm, AH Rogers, PD Marin. Microbiological evaluation of endodontic files after cleaning and steam sterilization procedures. *Australian Dental Journal* 2004;49(3):122-127.
  20. S. A. Aasim, A. C. Mellor, A. J. E. Qualtrough. The effect of pre-soaking and time in the ultrasonic cleaner on the cleanliness of sterilized endodontic Files. *International Endodontic Journal* 2006;39:143–149.
  21. P Parashos, P Linsuwanont, HH Messer. A cleaning protocol for rotary nickel-titanium endodontic instruments. *Australian Dental Journal* 2004; 49:(1):20-27.
  22. Boyd KS, Sonntag KD, Crawford JJ. Efficacy of sterilization of endodontic files after autoclaving in a synthetic sponge. *Int Endod J.* 1994;27(6):330-333.
  23. Mitchell BF, James GA, Nelson RC. The effect of autoclave sterilization on endodontic files. *Oral Surg Oral Med Oral Pathol.* 1983;55(2):204-207.
  24. Archie Morrison, Susan Conrod. Dental Burs and Endodontic Files: Are Routine Sterilization Procedures Effective?. *Jada* 2009;75(1):39a-39d.
  25. Plotino G., Costanzo A., Grande N.M., Petrovic R., Testarelli L., Gambarini G. Experimental evaluation on the influence of autoclave sterilization on the cyclic fatigue of new nickel-titanium rotary instruments. *J. Endod.* 2012;38:222–225.