



## Review Article

# A literature review on various techniques used in the process of sterilization in dental practice

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## Abstract

In dental practice, there is wide variety of different treatment modalities, according to the patient need. For a successful dental treatment, the process of sterilization plays a major role. There are variety of different instruments which are used in different procedures in routine dental practice. Some of them are semi critical instruments and some are critical instruments. Critical instruments are those which came in direct contact with blood stream, and in surgical procedures. Irrespective of the semi critical or critical instruments, sterilization is required for both the categories. There are different methods of achieving sterilization. In the prognosis of any dental treatment sterilization is of prime concern, for the success of any treatment, whether it is surgical phase or the non-surgical phase, we are supposed to maintain a sterile site. There are different procedures in daily dental practice, like from making an impression to placing a dental implant in the oral cavity, in both the cases, maintenance of sterile environment is very much retired.

**Keywords:** Sterilization, Autoclave, Dry heat sterilization, Moist heat sterilization, Hot air oven, Microorganisms.

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## 1. Introduction

The main cause of contamination and infection, is the presence of microorganisms. So to make the material or area sterile, it is very much important to remove or destroy the microorganisms, which is otherwise the main purpose of sterilization.<sup>1-7</sup> The instruments which are used in the dental field, will be contaminated with blood stream during any oro surgical procedure, will be contaminated with the salivary fluid during the routine oral procedure, which need to be clean first and then sterilize with different methods of sterilization. This helps in reducing the chances of cross infection between the dentist and the patient or in between the patient and the dentist or in between patient and patient. Thus the step of sterilization is of prime concern and much important in health care field.<sup>5-12</sup>

Sterilization, it can be defined as a process where by all forms of microorganisms including bacterial spores are destroyed. The process of sterilization can be accomplished

by two different means i.e. by physical means or by chemical means. On the other hand, disinfection can be defined as a process where by all the microorganisms which are pathogenic can be destroyed, also not necessary all the microorganisms and spores are destroyed.<sup>11-13</sup>

Micro-organisms are ubiquitous. Since they cause contamination and infection, it becomes necessary to remove or destroy them from the materials or from areas. This is the purpose of sterilization. The purpose of sterilization in microbiology to prevent contamination by the organisms, in surgery to maintain asepsis, in food and drug manufacture to ensure safety from the contaminating organisms and in many other situations. The instruments used in medical field and the dental instruments used in *the dental field* will be contaminated with the blood, body fluids etc during *the clinical procedures*, which will be cleaned and sterilized by different methods of sterilization. This reduces the chances of infection between *doctors-patients, patient-dentist, dentist-*

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patient and between patient to patient. Hence, sterilization plays a significant role in the field of health care.<sup>9-11</sup>

### *1.1. Different routes of transmission of disease are*

#### *1.1.1. Percutaneous route*

This route is found to be high risk route of spreading the infection. It includes inoculation from the microorganisms from blood and saliva, which can be transmitted through needles and sharp objects.<sup>15-18</sup>

#### *1.1.2. Direct contact*

By touching or exposing the skin, which is non intact to the oral lesions, which are infective in nature. It also includes, infective tissue surfaces, or infected fluids, splash and spatter of infected fluids.

#### *1.1.3. Aerosols or droplets containing pathogens*

Breathing any infective aerosols in the clinic, with infective material while using hand pieces or scalers or any infective droplet while coughing.<sup>16-19</sup>

#### *1.1.4. Contact indirect through fomites*

Touching any infective surface from operatory dental room.

Injury from any contaminated needle or from any sharp object will lead to transmission of different micro-organisms like hepatitis B, C and D virus, herpes simple virus I as well as II, human immunodeficiency virus, clostridium tetani.<sup>22,23</sup>

#### *1.1.5. Infection control*

Infection control plays an important role in the success of the dental treatment. As dentistry is the pre dominantly field of oral surgical procedure, which involve exposure to blood stream, involve exposure to salivary fluid, exposure to periodontal fluid as well as to other potentially infectious materials. So to avoid any type of cross contamination, infection control from every aspect is very much important. Apart from blood borne diseases, dental professionals are prone to respiratory infections also. To avoid spread of infection and cross contamination, in the clinical work area, one should wear personal protective equipment. These personal protective equipment are most commonly used in routine dental care, these includes wearing of single disposable gloves, protective eye wear, shields for the face, single to triple layer mouth masks, disposable or autoclavable gowns. The main use of these equipment's is to stop the cross contamination while doing any oro surgical procedure and to stop the spread of any single microorganisms.<sup>18-23</sup>

Sterilization process mostly work on two types of principles i.e.

1. Dry heat sterilization
2. Moist heat sterilization

Sterilization is broadly classified in to two types, i.e. physical method and chemical method.

Under the category of physical sterilization, processes comes under are, incineration, dry heat, moist heat, filtration and ionizing. And under the category of chemical method, agents comes under are, alcohols, aldehydes, phenols and cresols<sup>4-9</sup>.

#### *1.1.6. Under physical method*

Sunlight

Heat- Dry heat and moist heat sterilization.

Filtration- Asbestos filter disc

Radiation infra-red radiation, ultraviolet radiation.

#### *1.1.7. Under chemical method*

Alcohol – Ethyl alcohol

Aldehydes – Formaldehydes, glutaraldehydes

Phenols – Cresols

Halogens – Chlorine

Dyes - Acridine

Gases – Formaldehydes

### *1.2. Instruments work over steam pressure*

#### *1.2.1. Autoclave*

The principle of basic sterilization, when the steam comes in to the direct contact of cooler surface, it results as, it condenses in to water, and which results in liberation of its latent heat to that particular surface. The water which is condensed produces moist conditions for the destruction of microorganisms present. Temperature for autoclave is 121° c at 15 lbs pressure for 15 minutes.

The instruments which can be sterilized by using an autoclave are, hand piece, impression stock trays, orthodontic pliers, and all the surgical instruments. There are two types of autoclaves are present i) is prevacuum autoclave, and the ii) is gravity displacement autoclave.<sup>8</sup>

#### *1.2.2. Chemical vapor pressure sterilization*

It is also known as chemiclave. In this sterilization of the instruments is done by chemical vapor, which is totally under pressure. Most common instruments which can be sterilized by this instruments are, periodontal instruments, endodontic instruments. Burs and pliers which are corrosion sensitive.

#### *1.2.3. Dry heat sterilization*

Under dry heat sterilization, the over is electrically heated and a fan is fitted in it, which ensure the total evenly distribution of hot air in the chamber. A thermostat is also fitted in it, to maintain the specific temperature inside the chamber. Hot air oven can be used at a specific temperature of 160° c for the period of two hours. And the majority of instruments which can be sterilized by hot air oven are mainly endodontic instrument, condensers, hand instruments, burs,

pliers used in orthodontics, surgical instruments. The main advantage of hot air oven is, it does not cause rusting of the instruments, and is comparatively cheap.<sup>18,19</sup>

#### 1.2.4. Ethylene oxide sterilization

It is found to be the best method of sterilizing complex and heat sensitive instruments and the materials which are very delicate in handling. Ethylene oxide gas is used at a temperature of 10.80°C. This gas is highly explosive and inflammable. This gas is a high penetrative agent with bactericidal agent. This gas is mostly used in sterilization of towels, metals and plastic instruments.

#### 1.2.5. Glass bead sterilizer

Absorbent paper points, broaches, files and reamers should always be sterilized before every use in hot salt sterilizer. The main advantage of hot salt sterilizer lies in its use of ordinary table salt, which is very much readily available for replacement<sup>1-7</sup>.

#### 1.2.6. Dental ultraviolet sterilizer

They are available with 21 number of trays in it. Which is made up of stainless steel and that is available in different specifications. It kills the germicide by emitting the light. It is very much ideal for avoiding contamination of instruments.

#### 1.2.7. Cold sterilization

In this process sterilization is carried out at low temperature with the help of some chemicals or radiations. Radiations used in it are x rays, gamma rays, ultra violet rays.

#### 1.2.8. Hot water sterilizer

It is most commonly used in mobile dental units, for sterilizing the used dental instruments.

#### 1.2.9. Disinfection

Alcohol: Ethyl alcohol, isopropyl alcohol are most commonly used. They are most commonly used as skin antiseptics.

Aldehydes: Formaldehydes, it is most commonly used in fumigation of the surgical rooms, wards. The most commonly used method for fumigation of the wards or the surgery rooms is electric boiler fumigation method.<sup>7-11</sup>

Phenols: Most commonly used phenol derivative is chlorhexidine. It is used as mouth wash.

Halogens: Under the category of halogens, chlorine, iodine, it is most commonly used in daily water supplies, swimming pools for the process of water purification.

Povidiodine: Betadine is most commonly used as surface disinfectant. Most commonly used in oral surgical procedures.

## 2. Discussion

Every single step in dentistry, whether it is surgical step or a non-surgical step of any specialty requires sterilization very effectively, whether the step is of making normal impression irrespective of dentulous or edentulous impression, or any flap surgery or placing an implant in the oral cavity every single step requires sterilization. If at any clinical step sterilization is compromised, it may lead to the chances of failure of that particular step or may lead to formation of infection. Dentistry is predominantly a field of surgery which does include exposure to the blood as well as other potentially infectious materials, and therefore it requires very high standards of infection control to prevent cross contamination. There are various different routes of transmission of diseases like percutaneous route, direct contact, via the route of inhalation and indirect contact. New technologies will continue to enhance our ability to reduce infection risk by pathogen reduction or elimination via medical devices or environmental surfaces. These technologies (eg, endoscope sterilization, continuous room decontamination, new room decontamination technologies) must be investigated by researchers and when published in the peer-reviewed literature and shown to reduce HAI risk, integrated into infection prevention practice. Continued research and evaluation of the clinical value of these technologies are warranted as a means of reducing or eliminating environmental contamination in the transmission of pathogens and decreasing health care-associated infections.<sup>11-15</sup>

## 3. Conclusion

Sterilization is a process of killing all the microorganisms, including bacterial and in spore form. And disinfection is the process of reducing the number of infection causing microorganisms. There are different methods of doing sterilization and disinfection in day to day clinical practice. One should have a thorough knowledge of all the different options for sterilization as well as for disinfection. And for the final success, of any treatment done in the dental practice ultimately depends upon sterilization. Micro-organisms are ubiquitous. Since they cause contamination and infection, it becomes necessary to remove or destroy them from the materials or from areas. This is the purpose of sterilization. The purpose of sterilization in microbiology to prevent contamination by the organisms, in surgery to maintain asepsis, in food and drug manufacture to ensure safety from the contaminating organisms and in many other situations. The instruments used in medical field and the dental instruments used in the dental field will be contaminated with the blood, body fluids etc., during the clinical procedures, which will be cleaned and sterilized by different methods of sterilization. This reduces the chances of infection between doctors-patients, patient-dentist, dentist-patient and between patient to patient. Hence, sterilization plays a significant role in the field of health care.

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#### 5. Conflict of Interest

None.

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