

## Operative dentistry STERILIZATION

### Lec.7

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#### **STERILIZATION:**

Is a term referring to any process that eliminates (removes) or kills all forms of microbial life, including transmissible agents (such as fungi, bacteria, viruses, spores form, etc). Sterilization provides, a method of instrument recycling that can be monitored and documented to show that conditions for control of disease transmission were indeed established. Since most instruments contact mucosa and/or penetrate oral tissues, it is essential that reused instruments be thoroughly cleaned and sterilized by accepted methods that can be routinely tested and monitored.

#### **DISINFECTION:**

Process of destruction or removal of organism, capable of giving rise to infection. These are capable of killing vegetative bacteria, fungi, viruses and less effect on resistant bacteria spores.

#### **ANTISEPSIS:**

Destruction or inhibition of microorganism in living tissues thereby limiting or preventing harmful effects of infection. A disinfectant applied to a living tissue is antiseptic

#### **Accepted methods of sterilization**

There are five accepted methods of sterilization:

1. Steam pressure sterilization (autoclave)
2. Chemical vapor pressure sterilization (chemi-clave)
3. Dry heat sterilization (dryclave)
4. Ethylene oxide sterilization
5. Hydrogen Peroxide Plasma

## **1. STEAM PRESSURE STERILIZATION (AUTOCLAVING)**

- Sterilization with steam under pressure is performed in a steam autoclave.
- For a light load of instruments, the time required at 250° F (121 ° C) is a minimum of 15 minutes at 15 lbs pressure.
- Time for wrapped instruments can be reduced to 7 minutes if the temperature is raised to approximately 273° F (134° C) to give 30 lbs of pressure.
- Time required for the sterilizer to reach the correct temperature is not included.
- Manual sterilizers should have both a temperature and pressure gauge so temperatures can be related to corresponding temperatures required for sterilization.

### **Advantages of autoclaves**

- 1- Autoclaving is the most rapid and effective method for sterilizing cloth surgical packs and towel packs.
- 2- Other methods are not suitable for processing cloth packs.
- 3- Autoclaves handle trays and paper-bagged instruments.

### **Disadvantages of autoclaves**

- 1- Items sensitive to the elevated temperature cannot be autoclaved.
- 2- Autoclaving tends to rust carbon steel instruments and burs.
- 3- Steam appears to corrode the steel neck and shank portions of some diamond instruments and carbide burs.

## **2. CHEMICAL VAPOR PRESSURE STERILIZATION (CHEMICLAVING)**

- Sterilization by chemical vapor under pressure is performed in a Chemiclave.
- Chemical vapor pressure sterilizers operate at 270° F(131° C) and 20 lbs pressure.
- They are similar to steam sterilizers and have a cycle time of about half an hour.
- Like ethylene oxide sterilizers, they must be used with a prescribed chemical by the manufacture.

### **Advantages of Chemiclaves**

Carbon steel and other corrosion-sensitive burs, instruments, and pliers are said to be sterilized without rust or corrosion.

### **Disadvantages of Chemiclaves**

- 1- Items sensitive to the elevated temperature will be damaged.
- 2- Instruments must be lightly packaged in bags obtained from the sterilizer manufacturer.

3- Towels and heavy cloth wrappings of surgical instruments may not be penetrated to provide sterilization.

### **3. DRY HEAT STERILIZATION (Conventional dry heat ovens)**

- Dry heat sterilization is readily achieved at temperatures above 320<sup>0</sup> F(160° C).
- Conventional dry heat ovens have heated chambers that allow air to circulate by gravity flow (gravity convection).
- Packs of instruments must be placed at, least 1 cm apart to allow heated air to circulate.
- Individual instruments must actually be at 160° C temperature for only 30 minutes to achieve sterilization

#### **Advantages of dry heat**

- 1- Carbon steel instruments and burs do not rust, corrode, or lose their temper or cutting edges if they are well dried before processing.
- 2- Rapid cycles are possible at high temperatures.

#### **Disadvantages of dry heat**

- 1- High temperatures may damage more heat-sensitive items, such as rubber or plastic goods.
- 2- Sterilization cycles are prolonged at the lower temperatures.
- 3- Heavy loads of instruments, crowding of packs, and heavy wrapping easily defeat sterilization.

### **4- ETHYLENE OXIDE STERILIZATION**

- a. Ethylene oxide sterilization is the most gentle method for sterilizing complex instruments and delicate materials.
- b. Automatic devices sterilize items in several hours and operate at temperatures below 100° C.
- c. Less expensive devices operate overnight to produce sterilization at room temperature.
- d. Porous and plastic materials absorb the gas and require aeration for 24 hours or more before it is safe for them to remain in contact with skin or tissues,.
- e. Units with large chamber sizes hold more instruments or packs per cycle.

### **5- HYDROGEN PEROXIDE PLASMA**

- a. Alternative technologies to sterilize temperature-sensitive equipment are being developed.

- b. A new hydrogen peroxide plasma sterilizer, the Sterrad 50, was recently introduced. It is a smaller version of the Sterrad100. The Sterrad 50 contains a single shelf for placement of instruments to be sterilized within a rectangular chamber, whereas the Sterrad 100 has two shelves and a cylindrical chamber.
- c. The operational design of the two sterilizers is similar except that the Sterrad 50 consists of two hydrogen peroxide vapor-diffusion stage-plasma cycles.
- d. The sterilization cycles of the Sterrad 50 and Sterrad 100 are 45 minutes and 72 minutes, respectively.

## **BOILING WATER**

It is done for 10-30 minutes.

Kill vegetative bacteria and spores but is inactive against viruses.

It is not recommended for sterilization of instruments for surgical procedure as it is ineffective against many bacterial and fungal spores.

It is useful for reducing viable levels if no better method is available.

## **NEW METHODS OF STERILIZATION**

Various new methods of sterilization are under investigation and development.

-The microwave oven has major limitations for sterilizing metal items without damaging the machine and reaching all sides of the instruments.

-Use of peroxide vapor sterilization is under development .

-Ultraviolet light is not highly effective against RNA viruses such as HIV and is not very effective against bacterial spores. Incomplete exposure of all surfaces and poor penetration of oil and debris are other limitations.

## **LIQUID STERILANTS/HIGH-LEVEL DISINFECTANTS**

- Liquid sterilants are those that can kill bacterial spores in 6 to 10 hours.
- These sterilants are high-level disinfectants and are registered by Environmental Protection Agency.
- Sterilants used for high-level disinfection of items for reuse are glutaraldehydes at 2% to 3% concentrations.
- Greater dilutions are not encouraged for repeated use.
- Organic matter and oxidation reduce activity of reused disinfectant baths.
- Placing wet items into disinfectant trays dilutes the solution.
- Glutaraldehydes are irritating, sensitizing to skin and respiratory passages, and can be toxic as indicated in manufacturers' safety data sheets. Keep trays tightly covered in a well-vented area.
- *Do not. use 2% glutaraldehyde solutions to wipe counters or equipment (e.g., dental unit and chair).*

- Most glutaraldehydes require 20 minutes to kill tuberculosis bacteria in contrast with some synthetic phenol complexes and alcohols that act in 10 minutes or less and are much less toxic.

## **USES OF HIGH-LEVEL DISINFECTION**

Rule:

- According to the Centers for Disease Control, instruments that penetrate tissues or contact mucosa are termed critical or semi-critical and require cleaning and heat or gas sterilization before reuse.
- High-level disinfection is used mainly for plastic items that enter the mouth and that cannot withstand heat sterilization.
- Disinfection for 20 to 90 minutes in glutaraldehyde germicides is not appropriate for instruments used in the mouth.
- Most require 6 or more hours for sterilization.

## **VACCINES FOR DENTAL HEALTH-CARE WORKERS**

Although the possibility of transmission of blood borne infections from dental workers to patients is considered to be small, It is recommends that all dental workers, who might be exposed to blood or blood-contaminated substances in an occupational setting be vaccinated for HBV also other vaccine-preventable diseases; accordingly, vaccination against influenza [H5N 1 influenza virus' (bird flu virus), H 1 N 1 influenza virus (swine flu virus) measles, mumps, rubella, and tetanus.

## **HANDWASHING AND CARE OF HANDS**

DHCWs should wash their hands before and after treating each patient (i.e., before glove placement and after glove removal) and after barehanded touching of inanimate objects likely to be contaminated by blood, saliva, or respiratory secretions. Hands should be washed after removal of gloves because gloves may become perforated during use, and DHCWs' hands may become contaminated through contact with patient material. Soap and water will remove transient microorganisms acquired directly or indirectly from patient contact

## **USE AND CARE OF SHARP INSTRUMENTS AND NEEDLES**

Sharp items (e.g., needles, scalpel blades, wires) contaminated with patient blood and saliva should be considered as potentially infective and handled with care to prevent injuries.

## **STERILIZATION OR DISINFECTION OF INSTRUMENTS.**

### **Methods of Sterilization or Disinfection of Dental Instruments**

- Before sterilization or high-level disinfection, instruments should be cleaned thoroughly to remove debris.
- Persons involved in cleaning and reprocessing instruments should wear heavy-duty (reusable utility) gloves to lessen the risk of hand injuries.
- Placing instruments into a container of water or disinfectant/detergent as soon as possible after use will prevent drying of patient material and make cleaning easier and more efficient.
- Cleaning may be accomplished by thorough scrubbing with soap and water or a detergent solution.
- All critical and semi critical dental instruments that are heat stable should be sterilized routinely between uses by steam under pressure (autoclaving), dry heat, or chemical vapor, following the instructions of the manufacturers of the instruments and the sterilizers.
- Critical and semi critical instruments that will not be used immediately should be packaged before sterilization.

## **CLEANING AND DISINFECTION OF DENTAL UNIT AND ENVIRONMENTAL SURFACES**

- After treatment of each patient and at the completion of daily work activities, countertops and dental unit surfaces that may have become contaminated with patient material should be cleaned with disposable toweling, using an appropriate cleaning agent and water as necessary.
- Surfaces then should be disinfected with a suitable chemical germicide. Including: phenolics, iodophors, and chlorine-containing compounds.

- A fresh solution of sodium hypochlorite (household bleach) prepared daily is an inexpensive and effective intermediate-level germicide. Concentration (1/4 cup of bleach to 1 gallon of water) is effective on environmental surfaces that have been cleaned of visible contamination. Caution should be exercised, since chlorine solutions are corrosive to metals, especially aluminum.

## **DISINFECTION AND THE DENTAL LABORATORY**

- Laboratory materials and other items that have been used in the mouth (e.g., impressions, bite registrations, fixed and removable prostheses, orthodontic appliances) should be cleaned and disinfected before being manipulated in the laboratory, whether an on-site or remote location .
- These items also should be cleaned and disinfected after being manipulated in the dental laboratory and before placement in the patient's mouth.

## **USE AND CARE OF HANDPIECES AND OTHER INTRAORAL DENTAL DEVICES ATTACHED TO AIR AND WATER LINES OF DENTAL Unit:**

- Routine between-patient use of a heating process capable of sterilization (i.e., steam under pressure {autoclaving}, dry heat, or heat/chemical vapor) is recommended for all high-speed dental handpieces, low-speed handpiece components used intraorally, and reusable prophylaxis angles.
- Manufacturers' instructions for cleaning, lubrication, and sterilization procedures should be followed closely to ensure both the effectiveness of the sterilization process and the longevity of these instruments.
- Internal surfaces of high-speed handpieces, low-speed handpiece components, and prophylaxis angles may become contaminated with patient material during use. This retained patient material then may be expelled intraorally during subsequent uses. Restricted physical access -- particularly to internal surfaces of these instruments—limits cleaning and disinfection or sterilization with liquid chemical germicide.
- Surface disinfection by wiping or soaking in liquid chemical germicides is not an acceptable method for reprocessing high-speed handpieces, low-speed handpiece components used intraorally, or reusable prophylaxis angles.
- Other reusable intraoral instruments attached to, but removable from, the dental unit air or water lines (such as ultrasonic scaler tips and component parts and air/water syringe tips) should be cleaned and sterilized after treatment of each patient in the same manner as handpieces.

- Some dental instruments have components that are heat sensitive or are permanently attached to dental unit water lines. Some items may not enter the patient's oral cavity, but are likely to become contaminated with oral fluids during treatment procedures, including, for example: handles or dental unit attachments of saliva ejectors, high-speed air evacuators, and air/water syringes. These components should be covered with impervious barriers that are changed after each use or, if the surface permits, carefully cleaned and then treated with a chemical germicide having at least an intermediate level of activity.

## **DISPOSAL OF WASTE MATERIALS**

- Blood, suctioned fluids, or other liquid waste may be poured carefully into a drain connected to sanitary sewer system.
- Disposable needles, scalpels, or other sharp items should be placed intact into puncture-resistant containers before disposal.
- Solid waste contaminated with blood or other body fluids should be placed in sealed, sturdy impervious bags to prevent leakage of the contained.