Sterilization and Disinfection Methods in Dentistry

One of the primary responsibilities of dental healthcare professionals is to create a safe and comfortable environment for their patients. Keeping this in view, the American Dental Association (ADA) and the Centers for Disease Control (CDC) have devised protocols to prevent cross-infection among dental patients. This involves thorough cleaning and sterilization of all types of dental instruments, each time they are used on a patient. Before we move on to how cross-infection control is ensured in dental practice, we will familiarize you with some common terminology:

**Cleaning:** cleaning is an essential process which is performed before sterilization and disinfection of dental instruments. This involves cleaning all surfaces of dental instruments to remove blood, microbes, and debris, and to prepare instruments for the dental sterilization process. Cleaning of instruments is usually performed with water or detergents.

**Disinfection:** disinfection is a process in which all microbes are removed, except bacterial spores. Disinfection of dental instruments is usually performed with liquid disinfectants.

**Sterilization:** Sterilization is a process, which if performed properly, kills all microbes, including bacterial spores, present on the surface of dental instruments.
According to the Centers for Disease Control CDC, dental instruments have been classified into three categories, depending upon their risk for transmitting infection among patients and dental healthcare providers:

1. **Critical Instruments**: these include all instruments that penetrate oral soft tissues and bone, or are exposed to the bloodstream. These instruments should be sterilized through heat, dry or chemical sterilization, after each use. Critical instruments used in dentistry include dental forceps, scalpels, bone chisels and surgical burs.

2. **Semi-critical Instruments**: these instruments do not penetrate oral tissues. However, they come in contact with oral mucous membrane or non-intact skin. Such instruments include dental mirrors, amalgam condensers and impression trays. The CDC recommends that these instruments should ideally be sterilized after each use. However, in case this is not possible, a high-level disinfectant registered with the U.S Environmental Protection Agency (EPA) can be used.

3. **Non-critical Instruments**: these instruments only come in contact with the intact skin or mucous membrane. Such instruments include x-ray heads and pulse oximeters. These instruments have a low risk of cross-infection. Therefore, they can be cleaned with an intermediate or low-level disinfectant.
Sterilization or disinfection of dental instruments is only effective, if it is performed properly. Here are a few things that must be kept in mind by dental professionals who are involved in sterilization of dental instruments:

- **Designate a Separate Instrument Washing Area**: as discussed before, contaminated dental instruments need to be cleaned of blood and debris before sterilization. The Organization for Safety, Asepsis and Prevention (OSAP) recommends that each dental practice should create a separate place that is reserved for cleaning of contaminated dental instruments. Care should be taken to immerse the instruments into water or detergent immediately after use, to prevent drying of blood and debris. Dental professional should wear heavy gloves while washing instruments, to prevent accidental injury and cross-infection. Ultrasonic machines can also be used for improved cleaning.

- **Packaging and Storage of Instruments**: instruments that are to be used in a specific procedure, are placed in special packages before sterilization. In this way, there are minimal chances of contamination of the instruments during storage and transport, once they have been sterilized. Alternatively, sterilization cassettes can also be used to sterilize a set of instruments that are required during a specific dental procedure. These cassettes allow easier arrangement of dental instruments, and reduce chances of injury and damage during cleaning, packaging, and storage.
Different methods of sterilization are used in dentistry, based on required depth of sterilization as well as the type of dental material:

1. Sterilization Using Steam Autoclave

This is the most effective and most commonly used method of sterilization in dental practices. This is because pressurized steam in an autoclave can get rid of all types of microbes and their spores. Instruments in an autoclave are sterilized at 121°C for 15 minutes and 15 pounds pressure.

2. Dry Heat Ovens

These are electrical devices, which use dry heat to sterilize dental instruments. Since they do not require water for sterilization, much pressure is not developed inside them. Therefore, they are safer than the steam autoclaves. Since heat generation is electrically controlled, optimal temperatures for sterilization are rapidly attained. However, dry heat ovens may not be able to completely kill all microbes such as prions. Dry heat ovens are used to sterilize those instruments which do not get burnt during heating, such as glass slabs or powders.

3. Chemical Vapor Sterilization

During chemical vapor sterilization, a mixture of various chemicals such as alcohol, ketones, formaldehyde, and water are heated under pressure to form a sterilization gas. A typical sterilization procedure requires 20 minutes at 270°F, under 20 psi pressure to completed.

4. Cold Sterilization

This type sterilization is used on heat-sensitive dental instruments. Solutions such as glutaraldehyde or Sodium hypochlorite may be used for this purpose. However, this procedure requires a lot of time to acquire complete sterilization, and therefore it is not recommended. These chemicals can, however, be used for high-level disinfection purposes.

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Complete sterilization of dental instruments is imperative in obtaining perfect cross-infection protocol. Therefore, the ADA and the CDC recommends the use of various indicators to make sure that complete sterilization has taken place.

• **Biological Indicators** – this type of sterilization test involves the use of highly resistant bacterial spores such as *Bacillus stearothermophilus* (used as indicator for steam and chemical sterilization), or *Bacillus subtilis* (for monitoring dry heat sterilization).

• **Chemical Indicators** – these are heat sensitive indicators, which change color upon exposure to heat or steam. They are used in the form of tapes or strips, and are attached to the instrument packages to monitor sterilization. In case of unwrapped instruments, they are also placed in difficult-to-reach areas, to assess the level of sterilization.

It is the professional obligation of dentists to provide a safe and comfortable environment for their patients. Therefore, all dental practices should devise and implement an effective sterilization and cross-infection protocol, for the safety of the patients as well as the dental team.