

Disinfection Procedures in Dental Office: An Overview

Nihar Ranjan Sahoo¹, Rashmita Sahoo²

¹Assistant Professor, Department of Dental Surgery, Maharaja Krishna Chandra Gajapati Medical College & Hospital, Berhampur, Odisha, India, ²Tutor, Department of Oral Medicine and Radiology, Institute of Dental Sciences, Siksha O Anusandhan, (Deemed to be University), Kalinga Nagar, Bhubaneswar, Odisha, India

Abstract

Disinfection & Sterilization if done properly, it can prevent transmission of many diseases among the doctors, healthcare personnel and patients. The risk of infection is high in the dental office because the oral cavity is rich in aerobic, anaerobic bacterial flora and many viral pathogens. The method of disinfection and sterilization depends on the use of the medical devices: **Critical** instruments (pierce the tissue) should be sterilized, **Semi critical** instruments (come in contact with the mucosa) should be sterilized & **Least critical** instruments (touch the Surfaces during treatment) & should be disinfected. Cleaning should be done by high-level disinfection and sterilization. Current guidelines of disinfection and sterilization must be strictly followed by doctors, healthcare personnel.

Keywords: Disinfection, Dental Office, Sterilization.

Introduction

The risk of infection is high in dental practice as the oral cavity is a host for many commensal and parasitic pathogens. The susceptibility of infection to hazardous diseases like Hep-B & C, HIV & TB, etc through dental treatment procedure is an area to concerned. Orthodontists are more susceptible to contracting hepatitis.¹ At least we should try to reduce the number of infectious organisms to a certain extent so that our immune system can protect from infection and eliminate cross-contamination.

Lister (1867), introduced antiseptic techniques in surgery, also known as Father of Modern Antiseptics. The arrival of autoclave drastically changed the method of sterilization in modern times. So many chemicals with germicidal effects were discovered in the recent times.²

Corresponding Author:

Dr. Rashmita Sahoo

Tutor, Department of Oral Medicine and Radiology,
Institute of Dental Sciences, Siksha O Anusandhan,
(Deemed to be University), Kalinga Nagar,
Bhubaneswar, Odisha, India
e-mail: drrsahoo@gmail.com

Disinfection: Disease transmission doesn't have any specific route. It can pass through direct or indirect contact or even without contact also. All healthcare personnel who always engage with various patients are particularly at a higher risk of contracting disease. Patients particularly with transmissible diseases either viral or bacterial make a constant source of contamination.

Pathway of transmission

According to the Council of Dental Therapeutics the goals of infection control programs are:

- minimizing the number of infectious pathogens to a certain extent where the body immune system will be to resist the infection.
- Disrupting the pathway of infection & terminate cross-contamination.
- considering each patient/instrument as a potential carrier of disease.
- protecting patients, practitioners & other health workers from infections.³

Sterilization is making a substance-free from all pathogens both in the *vegetative or spore state*.

Disinfection is making a substance free from all pathogens except bacterial endospores. **Antiseptics** are mild disinfectants applied to living subjects. **Antisepsis** is preventing infection by the inhibition of growth of bacteria, viruses, fungi on living surfaces such as skin

& mucous membranes. For sterilization & disinfection different chemical agents are used. Disinfection indicates cleaning and application of a disinfectant on a surface or object.⁴

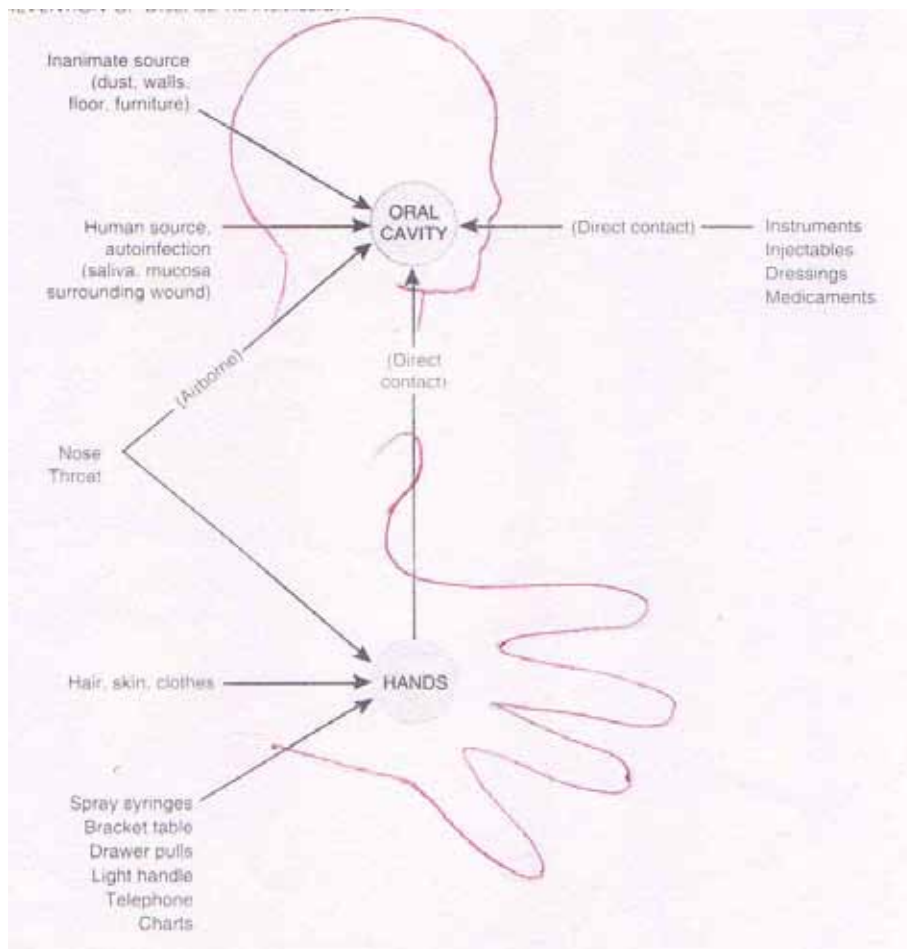


Figure 1. Pathway of transmission

Ideally, a disinfectant should:

- Have stability, high penetrating power and a wide spectrum of activity.
- Be compatible with other disinfectants and noncorrosive.
- Be effective with organic matter & both in alkaline & acidic medium.
- Be nonirritating, safe & easy to use.

Disinfectants used in dentistry are as follows:

- Aldehydes

- Chlorine products
- Alcohols
- Synthetic phenols
- Iodine products

Aldehydes:

- **Formaldehyde:** 10% formalin with 0.5% sodium tetraborate is used as a disinfectant. Its gas is used for the disinfection of instruments that are sensitive to heat. It should be used carefully as it is toxic if inhaled.

- **Glutaraldehyde:** Generally 2% glutaraldehyde solution is used for disinfection and the instrument or object should be placed 20 mins. It is preferred to formaldehyde as it is less toxic & less irritant, can safely be used with all kinds of instruments.

Chlorine products: Sodium hypochlorite solution is mixed with distilled water to prepare the disinfectant. It should be used after thorough cleaning of the surfaces. It acts by damaging the cell wall and blocking the enzyme system to protoplasmic poisoning. It is unstable and corrosive to metals and softens plastic. It produces constant odor and can irritate eye & skin.

Alcohols: Isopropyl alcohol (60-70%) is generally used as a disinfectant. It kills bacteria by denaturation of the protein. But to be effective the surface should be devoid of saliva or blood. It rapidly evaporates from used surfaces.

Synthetic Phenol: Synthetic phenols like Lysol and Cresols are commonly used as disinfectants. Chlorine compounds such as Chlorphenols & Chloroxyphenols have less effect as disinfectant & are less irritating. They damage the cell membrane and cause cell lysis. Its effectiveness depends on contact with bacterial cells.

Iodine products: Iodophores (*Povidone-iodine*), the most commonly used disinfectants are a combination of iodine compound & surface-active agents. These are more effective than aqueous or alcoholic compounds of iodine. Iodine binds with the bacterial cell protein and destroys them.

Surface-active agents: They commonly known as wetting agents. E.g. soaps/detergents & quaternary ammonium compounds/emulsifiers. Quaternary ammonium compounds (QAC) have *cationic surface* but soaps/detergents have *anionic surface*. Commonly available QACs are Cetrimide & Benzylkonium chloride. QAC decreases the surface tension between the bacterial cell wall and the object, so it helps in wetting the bacterial surface with the disinfectants and kills them. The effectiveness depends on the concentration, degree of contamination and presence of other compounds. According to the American Dental Association (ADA) alcohol/QAC/phenolic compounds should not be used as the only method of disinfection in dentistry as they are not effective against bacterial spores and viruses.

Vitawipe: It is a disposable disinfectant cloth, contains *alkyl dimethyl chloride* [7.1%], *poly hydrochloride* [3.2%] & inert ingredients [89.7%]. To wipe contaminated surfaces it should be dampened with water. It removes the microorganism physically without having any chemical effect. It should be discarded after the color change of the indicator or after use in case of a Hep-B virus infection.⁴

Infection control procedures:

Instrument disinfection: Instruments are the main media for cross-infection. So they should be disinfected & sterilized thoroughly or sterile disposable instruments should be used. *Milton Schaefer of the University of Southern California School of Dentistry* has divided and described the different pathways of cross-infection and the method to handle as follows:

1. **Critical:** Instruments (scalars, scalpels, and other tissue-cutting instruments) that goes into the mucosal tissue should be sterilized.
2. **Semicritical:** Instruments (hand instruments and pliers) that comes in contact with the mucosal tissue should be sterilized.
3. **Least Critical:** Instruments & Surfaces (Worksurfaces, three-way syringes, chair light handles) that comes in contact during treatment should be disinfected.

Instrument processing: Used instruments first placed in a solution consisting of detergents, enzymes, or detergents with disinfectants until it starts to disintegrate the organic tissue and sometimes begin to kill the pathogens. Then the instruments are cleaned either manually or with the help of an ultrasonic cleaning machine. Heavy-duty utility gloves and protective goggles must be worn during hand cleansing. But manual cleaning is time-consuming and there is a chance of an accident.

Mechanical Cleaning: Combining the use of powerful vibrations and disinfectant solution in an ultrasonic machine increases the effectiveness of cleaning. Continuous vibration makes proper contact of the instruments with the disinfectant solution.⁵ The instruments should be kept submerged in the cleaning solution during the whole cleaning procedure.



Figure 2. Ultrasonic cleaner machine

It should operate for **6-10 mins** or until the surface is visibly cleaned but the time should be **15mins** if the instruments are placed in a cassette. Thorough rinsing of instruments is done after cleaning.

After cleaning the instruments should be packed & sealed in an appropriate wrapping material before sterilization to prevent recontamination. Cloth wrapping for autoclave/steam sterilization, polyfilm paper pouches that are self-sealed for chemical vapour sterilization and paper wrapping for dry heat sterilization may be used. Metal trays with lids that don't need any wrapping should be sterilized by dry heat. Perforated trays and trays without lids should be sterilized by chemical vapour or steam sterilization so that steam can pass through the perforation. According to ADA recommendations the sterilization method for different items used in the dental office are as follows;

Rubber items and saliva ejectors: It is always safe to use disposable one and dispose of after use. Because it may get damaged in the process of heat sterilization and cold sterilization with ethylene oxide is not effective.

Handpieces: Cold sterilization with ethylene oxide sterilization and dry or moist heat sterilization can be used.

Stones: Diamond stones are sterilized by dry heat/chemical vapor/ethylene oxide gas except polishing stones which are sterilized by chemical vapour/ethylene oxide gas only.

Impression trays: Chrome plated trays are sterilized by any method of sterilization but plastic or acrylic trays are sterilized by ethylene oxide or glutaraldehyde.

Stainless steel hand instruments can be sterilized by moist/dry heat, chemical vapour/ethylene oxide gas. Three-way syringes, NiTi wires are sterilized by

chemical vapour/glutaraldehyde. Chemical vapour is used in the case of E-chain & ligature wires.⁶

Orthodontic pliers: For high-quality stainless steel pliers all method of sterilization can be used. But for low-quality pliers dry heat sterilization is preferred. For pliers with plastic parts cold sterilization with ethylene oxide is used.

Ultrasonic tip, Gloves & gauze, Tongue blade, lip & cheek retractors, Matrix band, spatula & light cure tip should be autoclaved. Ultrasonic cord should be sterilized by vapoclave and glutaraldehyde. **Glass slab & dapsendish** should be sterilized by dry/moist heat and vapoclave.

Stagers et al studied the effects of different method of sterilization on different orthodontic wires. They found that the tensile strength of TMA wire is increased in case of dry heat sterilization but moist heat & ethylene oxide sterilization had no effect. The tensile strength of Sentalloy wires is increased due to dry or moist heat sterilization whereas no effect found in the case of SS wire.⁷

Jones M.L found that Chrome plated pliers are more resistant to deterioration and maintained the original shape, size & looks better than SS pliers after various method of sterilization.⁸

Sterilization monitoring: ADA has recommended regular monitoring of sterilizers to maintain the quality of the dental treatments. It is appropriate for a dental office to monitor sterilizers every week.

Biological monitoring: The most important way called biological indicators is done by the use of highly resistant bacterial spores. Spores of *Bacillus stearothermophilus* and *Bacillus subtilis* are used as biological indicators for steam & chemical vapour and dry heat & ethylene oxide gas sterilization respectively. **Spore strips** (filter paper strips impregnated with spores) for dry/moist heat, cold sterilization, **Spore vials** (small paper or disk spores) for steam/ethylene oxide, **Spore ampules** (glass ampules of spore in culture medium) for moist heat sterilization.

Chemical monitoring: Chemicals are placed inside or outside of the packs or trays. It changes the color to indicate the efficacy of the sterilizer. Internal chemical indicators are more accurate.

After sterilization the instruments must remain

untouched, protected from the environment till it becomes cool. The sterile instruments & trays must be kept in clean, less dust place which must be dry & moisture-free. Sterile instruments & trays or cassettes should be opened up at chairside for use. In the process of cleaning & sterilization there is a chance of corrosion of instruments due to the contact of two dissimilar metals and different chemicals. Hence to prevent this, 1) instruments should be cleaned properly and rinsed with distilled water. The surface should be free of blood, saliva, or other contaminants. 2) good quality steam should be used in the autoclave and should be deionized. Below 6.4 pH of the steam can cause pitting and corrosion. 3) Chrome-plated and stainless steel instruments must be autoclaved separately to prevent any electrolytic action.⁶

Surface protection procedures: Surfaces like different handles, controls, light cure units, micromotor & ultrasonic handpieces, three-way syringe etc which are touched by the dental surgeon during treatment should be cleaned with disinfectants or protected with a barrier. After every patient the surfaces should be cleaned by using **disinfectants** like alcohol/iodophore/glutaraldehyde/chlorine products/synthetic phenols. The chair surfaces can be covered by impermeable **barriers** and must be discarded after every patient. They can be of plastic films, laminated paper plastics, aluminum foil etc and different sizes and shapes. The merits of this method are its easy & speedy insertion and protection of equipment from the harmful effects of chemicals and body fluids. But the cost, storage & disposal difficulties are the main drawbacks.

Tubing and hoses: As the surfaces remain moist always it creates a good environment for the growth of the bacteria and forms a biofilm. So regular checkup of the tubing and hoses should be done even if, there is an anti-retraction system. The suction tube should be flushed with fresh water before each patient and disinfected at the end of the day with a disinfectant like sodium hypochlorite. All water tubings should be cleaned by flushing water for 3-5 mins if the system has not been used for long times. Similarly the handpieces must be cleaned for 30 secs with air & water to remove anything that has come inside during use. Air compressor or tank should be emptied daily to prevent the growth of microorganisms in the tank. **Rubber dam** is used as a barrier to control the airborne contaminants. It reduces the infectious particle in the aerosols to a significant amount.⁹ According to **ADA** use of mouth wash just before the procedure can reduce the number of

pathogens in the mouth but it does not affect the number of pathogens that could be aerosolized.

Disinfection of removable appliances: Removable appliances are always coated with saliva and plenty of microorganisms due to its continuous use in the oral cavity. So during any adjustment protective glasses and full face-mask should be used. It also should be disinfected by placing the appliance in a germicide container.

Oral Safe is a germicide-deodorant and it is safe if occasionally swallowed. In an earlier study it was seen that 99 % of microorganisms are destroyed if the appliance is submerged for 10 mins in Oral safe. **H. Petit et al** described a method in which they combined germicide-deodorant with ultrasonic cleaning for better effects. They found that in three minutes use of this procedure 10 times more microorganisms are killed than the passive submersion method.¹⁰

Dental laboratory practices: All Impressions, occlusal bite records and devices which comes in contact with patients' saliva, blood or debris must be thoroughly rinsed to remove them and then put in disinfectant solution like glutaraldehyde/formaldehyde before sending to the laboratory.

Conclusion

As a sterile environment is mandatory for dental treatment it is necessary that everybody in a dental office should have some knowledge about disinfection and should be maintained. The process of maintaining sterility in the dental office is more complex than it appears. So it is the responsibility of all (patient, staff & the professionals) to carry out their duty with utmost purity and clarity. Hep- B, pneumonia, AIDS and other serious contagious diseases can be contracted in a dental office. So it is indispensable to use proper sterilization procedures for moral, professional & medico-legal point of view. Technological advancement and invention of newer machinery made the sterilization and disinfection procedure easier. The use of disposable barrier technique and different chemical agents for disinfection has further decreased the responsibility of dental staff to create a pure aseptic condition for the dental treatment.

Conflict of Interests: None

Ethical Permission: Approved

Funding: Nil

References

1. Starnbach H, Biddle P. A pragmatic approach to asepsis in the orthodontic office. *Angle Orthod.* 1980;50(1):63–66.
2. Ananthanarayan R, Paniker CK. Bacteriology of water, air, milk and food. In: Arti Kapil., editor. *Text Book of Microbiology.* 9th ed. India: University press; 2013. pp. 630-2
3. Woo J, Anderson R, Maguire B, Gerbert B. Compliance with infection control procedures among California orthodontists. *Am J Orthod Dentofacial Orthop.* 1992;102(1):68–75.
4. Kirchoff ST. Sterilization in orthodontics. Part 1. Sterilization and disinfection [published correction appears in *J Clin Orthod* 1987 Jun;21(6):407]. *J Clin Orthod.* 1987;21(5):326–328.
5. Spolyar JL, Johnson CG, Head, Porath RL. Ultrasonic Cold Disinfection, *J Clin Orthod* 1986; 20 (12): 852-3
6. Masunaga MI, Sterilization in Orthodontics. Part 3. Corrosion of Instruments *J Clin Orthod* 1987; 21 (5): 331-2.
7. Staggers JA, Margeson D. The Effects of Sterilization on the Tensile Strength of Orthodontic Wires *Angle Orthod* 1993; 63(2):141-4.
8. Jones ML. An initial assessment of the effect on orthodontic pliers of various sterilization/ disinfection regimes. *Br J Orthod.* 1989;16(4):251-258.
9. Cochran MA, Miller CH, Sheldrake MA. The efficacy of the rubber dam as a barrier to the spread of microorganisms during dental treatment. *J Am Dent Assoc.* 1989;119(1):141–144.
10. Petit H, Kolstad R, Chu S. Disinfection of removable appliances. *J Clin Orthod.* 1985;19(4):293–295.