

INFECTION CONTROL IN DENTISTRY – AN UPDATE

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Article Info	ABSTRACT
Received 23/06/2018	As the challenges of HIV-1 infection were disclosed, a majority of practitioners began to
Revised 16/07/2018	implement into routine practice the CDC "basic infection control procedures," later
Accepted 19/07/2018	renamed universal precautions. (MMWR, 1988) In the present article, an update on some
-	recent trends is being presented on Infection Control in Dentistry highlighting the
Key words:-	importance of various barrier techniques in preventing cross-contamination.
disinfection,	
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infection, AIDS,	
hepatitis	

INTRODUCTION

In the 1980s; Center for Disease Control & Prevention (CDC) and various other associations recognized Dentistry as being an identifiable source of cross-infection with certain diseases, primarily the **hepatitis B & AIDS.** American Dental Association (ADA) and other agencies escalated Dental practitioners to make adoption of the universal precautions to their highest professional priority. (*Infection Control, ADA, 1989*) [1-3].

In 1987, OSHA enforced their pronouncement that all health care workers exposed to potentially infectious blood-borne diseases must practice the universal precautions. Additionally, OSHA extended the Hazards Communication Standard for safe handling of potentially hazardous chemicals to include dental facilities. (*Federal Register, 5th December, 1987*)

In 1989, the EPA became the enforcement agency

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for implementation of the **Medical Waste Tracking Act**, which prescribes rigid rules for the disposal of potentially infectious waste [3].

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Methodology: An extensive research was done in PubMed and Scopus bibliographic data bases on the topic Infection Control in Dentistry using following mesh words like disinfection, sterilization, microbes, infection, AIDS, hepatitis from the year 1995 till 2018 and 101 articles were found out of which 10 potential articles were shortlisted and analyzed as per the scope for the present research paper.

General routes for transmission of microbes: Direct contact with infectious lesions or infected saliva or blood, indirect transmission via transfer of microorganisms from a contaminated intermediate object, spatter of blood, saliva or nasopharyngeal secretions directly onto broken or intact skin or mucosa & the airborne transfer of microorganisms [4,5].

Important to understand the difference between 'Disinfection' and 'Sterilization': *Disinfection* is the



destruction of most microorganisms, but not necessarily all, particular highly resistant microbial spores, whereas *Sterilization* is the complete destruction of *all* microorganisms including bacterial and mycotic spores, regardless of their resistance.

Patient's Assessment in Dentistry: Dentists and dental staff members have always known that they are susceptible to many diseases in the dental office. Tuberculosis, AIDS and Viral Hepatitis have been the diseases in the forefront. These diseases must be recognized and proper precautionary and protective methods are utilized [6].

Tuberculosis: TB is a chronic, communicable disease. The micro-organisms are carried through the air as small airborne particles less than 5um in size. "Droplet nuclei" are produced by a person with untreated TB during breathing, coughing, sneezing, speaking or forced exhalation.

The risk group of tuberculosis consists of: Patients with HIV infection, People with medical conditions that increase the risk of tuberculosis, Foreign born people from high prevalence countries, Low income populations, Alcoholics and intravenous drug users & Residents of long term care facilities (including prisons) [7,8].

Diagnostic Testing for TB History involves; Physical examinations, Mantoux Tuberculin Skin Test, Chest X-Ray & Bacteriologic and/or Histologic examinations

ACQUIRED IMMUNE DEFICIENCY SYNDROME (**AIDS**): The Centers for Disease Control (CDC) defined AIDS as "the presence of a reliably diagnosed disease at least moderately predictive of an underlying cellular immune deficiency in a previously healthy patient" [9].

HIV Risk Behaviors / Groups involve people with multiple sex partners, heterosexual, homosexual or bisexual, People who use intravenous drugs, People who received hemophiliac treatment, People who received a blood transfusion before spring 1985, Steady sexual partners of people & Infants born to people with AIDS.

Oral Manifestations of AIDS includes; Oral Candidiasis, Oral Hairy Leukoplakia, Intraoral Kaposi's sarcoma (strongly suggest a diagnosis of AIDS), Primary and Recurrent Herpes Simplex Virus, Infections Papilloma's & Necrotizing ulcerative periodontitis [10,11].

Diagnostic Testing for AIDS include Enzyme Linked Immunosorbent Assay (ELISA) & Western Blot Test.

Viral Hepatitis: It is the inflammation of the liver. HBV infection is a major cause of acute or chronic hepatitis, cirrhosis, and primary hepatocellular carcinoma worldwide. Globally, there are more than 300 million carriers of the virus, with approx. 90% of the carriers living

in the less developed countries. Asia is the most prevalent region and accounts for approx. 75% of the world's HBV carriers. Among deaths caused by cancer, HBV related cancer mortality rates are only 2nd to those related to smoking [12].

It is transmitted by percutaneous and nonpercutaneous modes, both of which have significance in dentistry. Dental treatment involves the use of many small, sharp instruments, which provides multiple opportunities for inadvertent percutaneous wounds of the operator. Nonpercutaneous dental transmission includes the transfer of infectious body fluids such as saliva, blood and a mixture both. Transmission occurs primarily via the horizontal mode that is among the staff, patients and family members who associate with one another. Immunization of susceptible hosts can be achieved with the use of hepatitis B vaccine (plasma-derived vaccine, Recombinant DNA vaccines).

Protective Equipment and Barrier **Technique:** Infections can be transmitted in the oral health care setting through: Direct contact with blood, saliva and other secretions; indirect contact with contaminated instruments, operatory equipment and environmental surfaces; Contact with airborne contaminants present in droplets, spatter or aerosols of oral and respiratory fluids. Because all infected patients cannot be identified by medical history, physical examinations, or lab tests, blood and body fluid precautions must be observed routinely in the care of all dental patients. The techniques used to interfere with initial step in the infectious disease process are called barrier techniques. They provide a physical barrier between the body and a source of contamination [13].

Barrier Protection can be divided into Personal Barrier Protection & Environmental Barriers in Dental Office Control.

Personal Barrier Protection: It has been estimated that a drop of saliva may contain upto 600,000 bacteria, and a spoon excavator of dental plaque may contain an avg. of 200 million bacteria. *Palenik CJ, Dent Asepsis Rev 5(9); 1984.* In 1986, CDC initiated standards designed to protect workers from occupational exposure to blood borne pathogens. In 1989, OSHA published the "Proposed Rule and Notice Hearing".

OSHA, CDC, ADA, Office Sterilization & Asepsis Procedures Research Foundation (OSAP) recommended 06 basic areas for personal barrier protection like: Handwashing and hand care, Gloves, Gowns, Masks, Protective eyewear & use of Rubber dam.¹⁴

Hand care and handwashing: Hands must be washed before gloving and after gloves are removed. This keeps the level of bacteria to a minimum and reduces the irritating buildup of skin bacteria that multiply under the



gloves. It also removes most transient bacteria that contaminate the hands through pinholes and tears.

Gloves: OSHA stipulates that gloves are required in dentistry when treatment providers come in contact with potentially infectious secretions or for contact with oral mucous membranes. *Instructions, Feb 27, 1990.*

Four types of gloves can be identified for use in dentistry: Sterile surgical gloves, Non-sterile latex gloves, Vinyl examination gloves & Utility gloves.

Non sterile latex gloves: These are most commonly used gloves & are available in variety of sizes (L, M, and S), colors, flavors etc. Latex is sometimes allergic to the skin because of presence of cornstarch, Can be affected by environment conditions, alcohols, disinfectant chemicals, soaps etc. and hence should be stored and used with caution. According to Martin et al (1988), Morgan et al (1989), Otis et al (1989), and Skaug N (1976), almost all types of gloves has pinholes present and thus should be used with caution. To minimize the amount of tears and holes in latex gloves, all types of jewelry, including rings should be removed prior to gloving [14].

Vinyl examination gloves: Sometimes referred to as "over gloves". The over gloves can be slipped on over the regular gloves for a brief period (eg. to briefly examine another patient or to answer the phone, etc.), and removed when contact with the initial patient resumes.

Heavy utility gloves: For handling contaminated instruments or supplies, when using chemical sterilants, and during general cleaning of the treatment area. These are re-usable & must be puncture resistant.

Gowns: According to OSHA; the use of gown, aprons, or lab coats is required when splashes to skin or clothing with body fluids are likely to occur. Unprotected street clothing should be changed and clinic attire should be worn only in the dental environment and should be changed at the end of the treatment schedule. Clinic attire should be handled separately from family laundry and should be of such materials that hot water, regular laundry detergent, and bleach can be used.

Masks: Covers the mouth and nose. Reduce inhalation of potentially infectious aerosol particles. Accorded to one of the earliest study by Robertson OH, in 1943, air transmission within enclosed spaces plays an important role in the communication of many bacterial and viral diseases, especially those of the respiratory tract. Face masks should be changed every hour or between each patient contact (whichever occurs first). Underhill TE et al (1986) demonstrated that glass or synthetic fiber masks are better than paper, cloth or foam masks. Should be properly

disposed off after every use and not left hanging around the neck.

Protective Eyewear: Eyes must be protected from aerosols which may contain large amount of bacteria and can physically damage the eyes. Protects both infection and from physical injury. Eyeglasses should have both top and side shields. Clear plastic face shields are also available. These must be disinfected after every use (washed with soap and water followed by immersion in 2% glutaraldehyde).

Environment Barrier Protection: Includes: Surface covers & ventilation.

Surface covers: Operatory surfaces (e.g. Light handles, chair switches, head rests, handpiece hoses, unit controls, air water syringe controls) should be protected during treatment and disinfected after treatment to avoid cross-contamination for the next patient. An effective cover should be impervious to water (e.g. Impervious backed paper, aluminum foil, or plastic covers)

Ventilation: Reduces bacterial aerosols in the dental environment. When ventilation is inadequate or is not feasible, portable electronic air cleaners or high efficiency particulate air filters can be used.

Sterilization Methods: Heat can be either Moist heat (autoclave, boiling water) or Dry heat (hot air ovens, flaming).

Chemical: Vapor (Ethylene Oxide) & Liquid (glutaraldehyde)

Radiation / **Ultra-Violet Light** : (gamma rays, beta rays, lasers, etc.)

Autoclaving: It is by far the most ideal method for sterilizing instruments. Steam under pressure destroys all microorganisms, including bacterial spores and the Hepatitis B Virus.

Autoclaving unwrapped Instruments: 1210 C (2500 F) at 15 pounds pressure for 15 minutes, or 1340 C (2700 F) at 30 pounds pressure for at least 3 to 4 mins.

Autoclaving wrapped Instruments: 1210C (2500 F) at 15 pounds pressure for 20 minutes, 134 °C (270⁰ F) at 30 pounds pressure for 10 minutes.

Advantages of Autoclaving are Short efficient cycle time, Good penetration its Ability to process a wide range of materials without destruction.

Disadvantages of Autoclaving are Corrosion of unprotected carbon steel instruments, dulling unprotected cutting edges, Possibility that packages may remain wet at



the end of cycle, possible deposits from use of hard water & possible destruction of heat sensitive materials.

Dry Heat Sterilization: Hot Air Ovens: Capable of destroying all known organisms at 1600 C (3200 F). Time required for sterilization depends on the size of the load and whether the instruments are wrapped or not. Wrapped instruments need approx. 1.5 hours.

Dry Heat Sterilization: Rapid Heat Transfer: Utilizes controlled internal air flow system, unwrapped instruments: 6 minutes & Wrapped instruments: 12 minutes.

Chemical sterilization by Vapor: Ethylene oxide gas sterilizers: These are used for delicate equipment and items that are sensitive to heat. Disadvantage is that it is not a very efficient method. Unsaturated chemical vapor sterilizers use a special chemical solution containing formaldehyde and alcohol. And its disadvantage is it leads to corrosion of metal items and lower penetration

Chemical / Cold Sterilization: Can be used for delicate and heat sensitive equipment. According to CDC and ADA's Council on Dental Therapeutics, all quaternary ammonium compounds and phenols have been declared unacceptable for use in dentistry.

Chemical Sterilants: CDC does not classify Iodophor preparations as sterilants. **Glutaraldehyde** is almost universally accepted as the most efficient disinfectant and cold sterilizing solution.

Sterilization of Dental Hand pieces:

Steam: Proper preparation and bagging is required, should be removed immediately after sterilization and should not be allowed to remain in a damp condition because corrosion and damage may occur & Normal temperature and pressure is used. **Chemical vapor** is an alternate method.

Sterilization of Dental Burs: Disposable burs available which can be thrown after single use. A bur holder (e.g. Silicone bur holder) is required to organize burs during sterilization as damage can occur by galvanic action from metal to metal contact. Burs can be sterilized by: Dry heat, ethylene oxide, Chemical Vapor and Autoclaving (not recommended for carbon steel burs)

Infection Control in Dental Laboratory Environment: Dental impressions are contaminated with saliva and sometimes blood. Prosthesis and appliances are "tried in" in the process of their construction and thus go from laboratory repair are grossly contaminated. All of these items are potentially infectious and must be disinfected or sterilized before handling in the laboratory. **Dental Impressions:** First extensive study on disinfection of impressions was published by Storer and McCabe, 1981. Rinsing of impressions under running water after removal from mouth to visibly eliminate saliva and blood. This reduces the no. of microorganisms in most cases, but does not decontaminate the impression.

Disinfection methods for Dental Impressions:

Immersion Spraying: Short term submersion or "dunking" It has been argued that spraying does not assure exposure of all surfaces to disinfectant. In 1991, the ADA Council on Dental Materials, Instruments and Equipment recommended that all dental impressions be disinfected by immersion.

Immersion Time: ADA Council recommended suggests use of all disinfectants requiring no more than 30 minutes for disinfection. Impression materials that is hydrophilic (e.g. Alginate) should be disinfected with a product requiring preferably no more than 10 minutes[15].

Disinfectant agents: Some disinfectants approved for use in dentistry: **Glutaraldehyde**, **Iodophors**, **Chlorine compounds & Complex phenolics**.

Disinfectant agents: No single disinfectant is compatible with all impression materials. A Disinfectant should be used that is EPA registered as a hospital disinfectant and should be tuberculocidal (that also kills both hydrophilic and lipophilic viruses). Disinfectants should not be used repeatedly for disinfection of impression unless they are approved for reuse (i.e. Glutaraldehyde).

Elastomeric Impressions: Poly sulphides and silicones: relatively stable and can be disinfected without adverse effects by immersion in most disinfectants approved for use in dentistry.

Polyether: Can be disinfected by immersion with most disinfectants (but should be used with caution). Hydrophilic in nature and thus exposure time should be kept to a minimum (10 mins).

Irreversible Hydrocolloid Impressions: ADA recommends disinfecting alginates by immersion in diluted hypochlorite, Iodophor or Glutaraldehyde with phenolic buffer. Should be used with caution and minimum exposure time should be used, given the hydrophilic nature of the material.

Reversible Hydrocolloid Impressions: Can be disinfected with: Iodophor diluted 1:213, 5.25% Sodium hypochlorite diluted 1:10, 2% acid Glutaraldehyde with phenolic buffer diluted 1:16. 2% alkaline Glutaraldehyde has significant adverse effects on the impressions and resultant dies.



Disposable items: such as polishing points, strips, wheels, disks, brushes, rubber mixing bowls etc. should be discarded after use or if reusable then should be sterilized with ethylene oxide.

Unit dose concept: Minimizes cross contamination of impression materials, waxes, compound, petroleum jelly, indelible pencils, and other items, during prosthodontic procedures. It refers to the dispensing of an amount of materials, which is sufficient to accomplish a particular procedure, before patient contact. Any excess is discarded [15].

CONCLUSION: Infection control protocols should be applied in the dental lab in the same manner as in the dental office to protect the employees from blood borne pathogens as mandated by OSHA regulations. Many of the items transported between the dental office and the dental lab are potential sources of infectious microorganisms. The dentists and lab technicians must communicate their infection control protocols as applied to items transported between facilities.

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