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INFECTION CONTROL IN DENTISTRY- A LITERATURE REVIEW

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ABSTRACT

The first and foremost thing to understand here is 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. In the present article, an attempt has been made to present a literature review about Infection control to be practiced in Dentistry.

INTRODUCTION

The 1980s may be recognized eventually as the decade providing the greatest change in the dental profession since the science was first developed. As the challenges of HIV-1 infection were disclosed, a majority of practitioners began to implement into routine practice the CDC "*basic infection control procedures*," later renamed *universal precautions.* The recognition early in the l980s by the CDC and certain researchers that dentistry was, and for some time had been, an identifiable source of cross-infection with certain diseases, primarily hepatitis B, caused the CDC, American Dental Association (ADA), and other agencies to escalate their call for dental practitioners to make adoption of the universal precautions their highest professional priority [1].

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. In 1989, the EPA became the enforcement agency for implementation of the Medical Waste Tracking Act, which prescribes rigid rules for the disposal of potentially infectious waste.

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Routes for transmission

General routes for transmission of microbial agents in dental medicine are as follows: 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 & Aerosolization, the airborne transfer of microorganisms.

Infection control in dentistry can be discussed under the following headings: Patient's Assessment, Protective Equipment and Barrier Technique, Sterilization Methods, Role of Disinfectants, Infection Control in Dental/ Prosthodontic Laboratory Environment, Hazardous Waste Management.

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 [2].

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. 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 bloodborne pathogens. In 1989, OSHA published the "Proposed Rule and Notice Hearing".

OSHA, CDC, ADA, Office Sterilization & Asepsis Procedures Research Foundation (OSAP) recommended six basic areas for personal barrier protection: Hand-washing and hand-care, Gloves, Gowns, Masks, Protective eyewear, Rubber-dam, Hand-care and hand-washing, 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 glove

Surgical gloves

Must be sterile, best fitting, expensive, disposable & high quality with maximum possible protection against microbial contamination.

Non sterile latex gloves

Most commonly used. Available in variety of sizes(L, M, S),colors, flavours etc. Latex is sometimes allergic to the skin because of presence of cornstarch. Can be affected by environment conditions, alchohols, 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 jewellery, including rings should be removed prior to gloving.

Vinyl examination gloves

Sometimes referred to as "over gloves". The overgloves 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 & should 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 seperately 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 physical injury. Eyeglasses should have both top and side shields.

Clear plastic face shields are also available. Should be disinfected after every use (washed with soap and water followed by immersion in 2% glutaraldehyde)

Environment Barrier Protection

Includes: Surface covers & Ventilation[3].

Surface covers

Operatory surfaces (eg. 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 (eg. Impervious backed paper, aluminium 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: Moist heat (autoclave, boiling water). Dry heat (hot air ovens, flaming)

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

Radiation / Ultra-Voilet Light : Gamma rays, beta rays, lasers, etc [4].

AUTOCLAVING

Ideal method for sterilizing instruments. Steam under pressure destroys all microorganisms, including bacterial spores and the Hepatitis B Virus.

Autoclaving unwrapped Instruments

121^{o} C (250^{o} F) at 15 pounds pressure for 15 minutes, or 134^{o} C (270^{o} F) at 30 pounds pressure for at least 3 mins.

Autoclaving wrapped Instruments

121^{o}C (250^{o} F) at 15 pounds pressure for 20 minutes or 134^{o}C (270^{o} F) at 30 pounds pressure for 10 minutes

Advantages of Autoclaving are: Short efficient cycle time, Good penetration, Ability to process a wide range of materials without destruction. While the 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 160o C (320o 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: used for delicate equipments and items that is sensitive to heat. But it is not a very efficient method.

Unsaturated chemical vapor sterilizers

uses a special chemical solution containing formaldehyde and alcohol. But it causes corrosion of metal items and has 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. In a study by Warfield and Bryington, no airborne contamination was noted in open tank ultrasonic cleaning apparatus used with glutaraldehyde.

Sterilization of Dental Hand-pieces

Autoclaving with 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 (eg. 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)

Dental Impressions

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.

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 are hydrophilic (eg. Alginate) should be disinfected with a product requiring preferably no more than 10 minutes.

Some disinfectants approved for use in dentistry

Glutaraldehydes, Iodophors, Clorine compounds & Complex phenolics.

Disinfectant agents

No single disinfectant is compatible with all impression materials. A Disinfectant to be used should be registered as a hospital disinfectant and should be tuberocidal (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

Polysulphides and silicones: relatively stable and can be disinfected without adverse effects by immersion in most disinfectants approved for use in dentistry. Polyther: 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)

Alginate

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.

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 [5].

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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