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Infection control in dentistry – A review

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Abstract

Infection control is important in the practice of dentistry because dental healthcare workers and patients are exposed to e wide variety of microorganisms through blood and oral secretions.

A long history of scientific, clinical and technological developments has led to the current recommendations for infection control in dentistry and medicine. As a result, health care workers and their patients have never been protected from occupational transmission of pathogens.

Engineering and re-emerging infection control challenges will continue to confront the health profession in the 21st century. In addition, procedures aimed at preventing the spread of infectious disease are constantly being evaluated and updated.

Among the important components of any infection control success, however, always will be remembering and understanding the rationale for appropriate practices. The routine applications of precautions such as multiple aseptic procedures, latex gloves, masks, protective eyewear, clinic coats, automated instrument decontamination devices, time-efficient heat sterilization modalities, chemical disinfectants, waste management procedures and single-use disposable items have created a safer environment for dental personal and patients alike. Hence the review aimed at stressing the importance of sterilization and disinfection in dental practice

Keywords: Sterilization, Disinfection, Nosocomial Infections

Introduction

Prevention of cross infection aspect of dental practice and health workers must adopt certain basic routines while practicing. The dental clinic is an environment where disease transmission occurs easily. The management of dental hospital plays an important role in the number of physical and human resources available in surveillance of Nosocomial infections.

The routine aseptic precautions such as multiple aseptic procedures, latex gloves, mask, eye wear, clinic coats, automated decontamination devices, time efficient heat sterilization modalities, chemical disinfectants, waste management procedures and single use disposable items have created a safer environment for dental professionals and patient alike.[1]

Killing of microorganisms is important in control of spread of infections. Sterilization and disinfection practices were first established in nineteenth century. This measure designed to reduce microbial load in an environment reduces the risk of acquiring infections. [2]

The prevention of infection is surely mandatory in surgical practice and is thereby fundamental in establishment of surgical techniques. Equally important is an awareness of the need for reduction of pathogens in general environment as the responsible surgeon is ever alert to the need for preventing cross infection among circulating personal, reducing microbes in room air, and eliminating human error and carelessness that tends to break down the chain of asepsis. [3]

Infection control refers to comprehensive and systematic program that when applied prevents the transmission of infectious agents among persons who are in direct or direct contact with the healthcare environment.

Among the various health occupations, Dentistry is peculiar in that it makes artistic and scientific demands on the practitioner. The Dentist comes in close contact with patients for long time thus falling prey to infections. The practice of Dentistry is not as hazardous but still relaxing one's vigil over the occupational hazard's aspect can prove disasterous.

With above background further we discuss in detail the aseptic procedures in dental practice with pros & cons in the procedures & latest developments in infection control of dental office.

Sterilization

Sterilization is defined as the process by which an article, surface or medium is free of all living microorganisms in vegetative or spore state. [4] The various agents used in sterilization can be classified as follows

- Sunlight
- Drying
- Dry Heat
- Moist Heat
- Filtration
- Radiation
- Low temperature plasma
- Chemical Sterilization

Sunlight

Sunlight posses' appreciable bactericidal activity and plays important role in spontaneous sterilization that occurs under natural conditions. The action is primarily due to its ultraviolet rays which are screened out by presence of ozone in outer regions of the atmosphere. [5]

Drying

Moisture is essential for growth of bacteria. 4/5th of weight of bacterial cell is due to water. Drying in air has a deleterious effect on many bacteria. [6]

Dry Heat

Flaming

Inoculating loop or wire, the tip of forceps and searing spatulas are held in Bunsen flame until they become red hot.[7]

Incineration

This is an excellent method for safely destroying materials such as contaminated cloth, animal carcasses and pathological materials.[7]

Hot air oven

This is most widely used method of sterilization by dry heat. A holding period of 160 for one hour is used to sterilize forceps, scissors, scalpels, all glass syringes, and some pharmaceutical products such as liquid paraffin, dusting powder, fats and grease.[8]

Advantages of dry heat sterilization

- Dry heat can sterilize items that cannot be sterilized in steam or chemical sterilizers, such as powders and oils, or those that are prone to rust.
- Dry heat can be used for glassware, as it will not score or erode the surface as, steam might do.
- Dry heat will not corrode or rust instruments or needles. [9]

Disadvantages of dry heat sterilization

- Heating is slow. Diffusion and penetration of heat are slow because the heat transfer medium is poor and there is distinct lack of available heat compared with steam in particular. [7]

Moist heat

Pasteurisation: The milk is heated at either 63-degree centigrade for 30 minutes followed by cooling quickly to 13 degree centigrade or lower. By these processes all non-sporing pathogens such as mycobacteria, brucellae, and salmonellae are destroyed.

Boiling

Vegetative bacteria are killed almost immediately at 90-100 degree centigrade but sporing bacteria require prolonged periods of boiling. Boiling is not recommended for sterilizing of instruments used for surgical procedures and should be regarded only as means of disinfection.

Sterilization of steam under pressure

Sterilization by steam under pressure is nearly universally applied except where penetration or heat or moisture damage is problem. Steam sterilization equipment is found in wide variety of shapes and size in hospital, clinics, microbiologic laboratories, industrial production facilities. Steam sterilization works better than some other forms of sterilization because steam destroys most resistant bacterial spores in brief exposure and heats rapidly because of mass heat transfer as it condenses. [10]

The Problems during steam sterilization are Air removal [11]. The basic techniques of removing air are Gravity displacement, Dilution by mass flow, Dilution by Pressure Pulsing, High vacuum Sterilization, Steam flush pressure Pulse, Air tightness of Sterilizer Chamber, Above atmosphere steam flush pressure, Superheated vapour, Load wetness.

Filtration

Filtration helps to remove bacteria from heat liable liquids such as sera and solutions of sugars and antibiotics used for preparation of culture media. As viruses pass through ordinary filters, filtration can be used to obtain bacteria free filtrates of clinical samples for cholera vibrious or typhoid bacilli. Bacterial toxins can be obtained by passing cultures through filters. [12] The different type of filters used are Candle filters, Asbestos filters, Membrane filters.

Sterilization by Radiation

In general radiation may be classified in two groups electromagnetic and particulate radiation. [13]

Electromagnetic radiation

Of the type of electromagnetic radiation used to destroy microorganisms are microwave, ultraviolet, gamma and X-rays have different origin. The emission of an x-ray from atom occurs when there is transition of an electron from outer shell to a vacancy in an inner shell and is produced by bombarding a heavy metal target with fast electrons in an accelerator.

Dosimentry

Dosimentry systems are used in radiation sterilization to quantity the dose absorbed in material. A Dosimentry system consist of dosimeters and all related measuring instrumentation. There are four types of dosimeters

primary standards, reference standards, transfer standards, routine dosimeters.

Gamma Processing

Industrial gamma radiation facilities have several features: a radiation shield, an isotope storage for the isotope and means of transporting the process through radiation process. The radiation shield is usually made of concrete and provides protection for personnel operating the facility. [14]

Chemical Sterilization

Only few chemical sterilant are used in health care industries. Chemical sterilizing agents can be characterized by alkylation or oxidation mode of action. The most extensively used gaseous sterilant in sterilization of medical devices are alkylating agents' ethylene oxide and formaldehyde. [14]

The most commonly used chemicals are Alkyl Epoxide Sterilant, Ethylene Oxide, Propylene Oxide, Low temperature steam Formaldehyde, Beta-Propiolactone, Oxidizing Agents, Hydrogen Peroxide, Ozone, Chlorine Dioxide, Plasma Gases.

The Mechanism of Gaseous Sterilization are of following steps

- Preconditioning
- Air Removal
- Humidity Control
- Exposure
- Temperature control
- Chemical separation
- Sterilant removal

Disinfection

Disinfection is defined as destruction or removal of all pathogenic organisms or organisms capable of giving rise to infection. [11]

Type of Disinfectants

- Chlorine
- Liquid Chlorine
- Hypo Chlorites
- Dichloramine-T
- Dichlorodimethyl
- Chloroazodin

Chlorine and Chlorine compounds

Chlorine compounds have been successfully used in medical and related fields to control infections or for treatment of wounds. Dakin's solution has been used since to disinfect open wound infection. [15]

Liquid Chlorine

One of most important commercial chlorine preparation is liquid chlorine. Although elemental chlorine is a gas it is sullied through compression and cooling as an amber liquid and shipped in steel cylinders and tank cars.

Hypochlorites

Hypochlorites are oldest and most widely used of the active chlorine compounds in field of chemical disinfection.

They are

(a) Proven and powerful germicides controlling a wide spectrum of microorganisms,

(b) nonpoisonous to humans at use concentrations

(c) free of poisonous residuals,

(d) colorless and non-staining,

(e) easy to handle.

Dichloramine-T

Chemically dichloramine-T is p-toluene sulfondi chlora mide and is prepared by action of calcium hypochlorite solution on p toluene sulfonamide followed by acidification with acetic acid.

Dichlorodimethylhydantoin

1, 3-Dichloro-5-5 dimethyl hydantoin is white free flowing powder with slight chlorine odor and slight solubility in water.[16]

Chloroazodin

Chloroazodin is an N, N dichloroazodi carbon amine and is bright yellow, flaky material with faint chlorine odor it decomposes explosively at 155^0c and its decomposition is accelerated by contact with metals. [17]

Disinfection using Ozone

Ozone is effective inactivation agent for bacteria. It is also effective virucide. Relatively low concentrations and contact times are necessary for inactivation of viruses. Ozone driven inactivation of microorganisms in waste waters required longer contact times larger doses than inactivation of microorganisms in demand free systems.[18]

Disinfection using Alcohol

Alcohols have been used as hard surface disinfectants, whereas lack of sporicidal effects limits sterilization applications for alcohol their general antimicrobial properties can be useful against surface borne bacteria and other microorganisms. As a group the alcohol possess many features desirable for disinfectant or antiseptic [19]

Aseptic procedures in dental practice

Infection control is an important part of dentistry because dental health care workers and patients are exposed to wide variety of micro-organisms via blood and oral respiratory secretions. These microorganisms may include hepatitis B virus, hepatitis C virus, Human immunodeficiency virus and other micro-organisms. Aseptic techniques and procedures are fundamental components of infection control in practice of dentistry. These techniques help to break the cycle of infection and to eliminate cross infection. [20]

Basic infection control guidelines

- All treatment personal must wear gloves and appropriate clinical attire during treatment.
- All treatment personal must wear properly fitting masks during treatment.
- All treatment personal must wear eye protection.
- All instruments and items used in oral cavity or near it should be sterilized.
- All touch and splash surfaces must be disinfected with hospital grade TURBERCULOCIDAL disinfectant.
- All waste must be disposed of properly. Waste that meets the definition of medically regulated waste must be disposed of in properly marked nags and placed in medical waste containers.
- If treatment personal leaves operatory gloves must be removed.[21]

Digital Radiography sensors and Intraoral Camera

Digital radiography sensors and intraoral cameras come into contact with mucous membranes. Accordingly, these devices should be cleaned and heat sterilized or disinfected between patients [22]

Dental Laboratory Asepsis

Dental prostheses and appliances, as well as items used in their fabrication (e.g., impressions, occlusion rims, bite registrations) are potential sources for cross-contamination.

They should be handled in a manner that prevents exposure of patients, OHCWs or the office environment to infectious agents.[1]

Handling of biopsy Specimens

To protect persons handling and transporting biopsy specimens, they must be placed in a sturdy, leak-proof

container that has a secure lid and is clearly labeled with the universal biohazard symbol.

CDC Recommendations for the Decontamination of Extracted Teeth for use in Dental Educational Settings

Extracted teeth are occasionally collected for use in preclinical educational training. These teeth should be cleaned of visible blood and gross debris and maintained in a hydrated state in a well-constructed closed container during transport. the container should be labeled with the biohazard symbol.[1]

Because these teeth will be autoclaved before clinical exercise or study, use of the most economical storage solution (water or saline) may be practical. Liquid chemical germicides can also be used but do not reliably disinfect both external surface and interior pulp tissue.

Before being used in an educational setting, the teeth should be heat-sterilized to allow safe handling. Microbial growth can be eliminated by using an autoclave cycle for 40 minutes, but because preclinical educational exercises simulated clinical experiences, students enrolled in dental programs must follow standard precautions when using these teeth in educational exercises[15].

Conclusion

To conclude, Responsibilities on dentist & health workers have been increasing day by day. Since many new micro-organisms which cause cross infections among the health workers & also the patients.

As the dentist, motivate the public to make awareness regarding possibilities of exposed to infections during their visit to dental office.

Conduct scientific programmes & conference to make awareness among public & health workers using al modern & latest technology to kill micro-organisms which cause hazardous infections in dental office.

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