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Infection control

It refers to a comprehensive and systemic program that, when applied prevents the transmission of infectious agents among persons who are in direct or indirect contact with the health care environment. Healthcare associated infections are caused by a wide variety of organisms and cause a range of symptoms from minor discomfort to serious disability and in some cases death. Implementing safe and realistic infection control procedures requires the full compliance of the whole dental team.

Instruments used frequently in dental practice generate spatter, mists, aerosols or particulate matter. Unless precautions are taken, there is a high possibility that patients and dental health care personnel (DHCP) will be exposed to blood and other potentially pathogenic infectious material. DHCP include dentists, dental hygienists, dental assistants, dental laboratory technicians (in-office and commercial), students and trainees, contract personnel, and other people not directly involved in patient care but who could be exposed to infectious agents (such as administrative, clerical, housekeeping, maintenance or volunteer personnel).

Standard Precautions must be applied by all healthcare staff at all times in healthcare settings, regardless of whether a patient's infectious status is confirmed, suspected or presumed.

Why is Infection Control Important in Dentistry?

1. Both patients and dental health care personnel (DHCP) can be exposed to pathogens.
2. Contact with blood, oral and respiratory secretions, and contaminated equipment occurs.
3. Proper procedures can prevent transmission of infections among patients and DHCP.

▶▶ Infectious disease occurs as a result of invasion of micro-organisms in to living system, or due to the actions of the products of micro-organisms or a combination of both. Micro-organisms that may responsible for disease in a human host are: Bacteria, Viruses, Fungi and Protozoa.

Concepts of disease transmission:

1. **Infection** is the multiplication of an infectious agent(micro-organisms) with in the host.
2. **Invasion** is the process in which micro-organisms enter the host cell.
3. **Virulence** is the ability of an agent (micro-organisms) to cause disease after it has invaded the host.

Transmission of Infection:

The two principle modes of disease transmission in which infectious diseases are acquired in dentistry are:

1. Contact

a. Direct contact: Human-human touch. Contact with microorganisms at the source.

b. Indirect contact: Human-object/animal-human touch.

Contact with contaminated items such as surfaces especially dental office equipment and/or instruments including contaminated sharps.

2. Droplet Infection

a. Splatter of blood, saliva or nasal secretions onto broken mucosa or skin.

b. Airborne by aerosols of microbes.

The three principle routes of entry of microorganisms into the body are:

1. Inhalation

a. Direct inhalation: Inhalation of small particles of moisture (spatter) generated when a person coughs or sneezes, or when water is aerosolized to a fine mist during dental procedures. Risk of disease transmission is usually limited to persons in close proximity to the droplet source.

b. Indirect inhalation: Inhalation of particles <5 microns in diameter formed by dehydration of airborne droplets in the air for long periods of time or which settle on surfaces and can be readily reintroduced to the environment.

2. Ingestion: Whereby droplets of saliva/blood or particles from instruments are swallowed.

3. Autoinoculation/percutaneous injury: Autoinoculation occurs as a result of the operator touching his/her own mucous membrane or nonintact skin surface with contaminated patient care items or contaminated personal protective barriers. Percutaneous injuries are those that occur as a result of breaking the skin especially with a contaminated sharp instrument.

The common infectious condition :

Dental patient and Dental Health Care Workers(DHCW) may be exposed to a variety of micro-organisms via blood or oral or respiratory secretions including:

1. Viral Hepatitis ► hepatitis B&C are the more prevalent to DHCW.
2. Herpes virus infections ► herpes simplex virus is the more prevalent to dental health workers.

3. Syphilis.
4. Acquired Immune Deficiency Syndrome (AIDS) ► caused by human immunodeficiency virus (HIV).
5. Tuberculosis(TB) ► caused by bacteria (*Mycobacterium tuberculosis*).
6. Upper respiratory tract infections.

Control of Infectious Disease

The effective procedures of infection control are designed to kill or to protect against contamination(micro-organism shared between people) by using the proper equipment and supplies.

The principles of infection control are:

1. **Stay healthy:** dental personnel should be stay healthy. Strategies include
 - a. immunizations.
 - b. post exposure management and medical follow-up by a qualified health care professional.
 - c. Routine hand hygiene procedures; and maintaining hand health.
2. **Avoid contact with blood and body fluids:** Strategies include
 - a. handle sharp instruments with care, use safety devices when appropriate, correctly manage occupational exposures to blood.
 - b. Wear personal protective equipment (PPE) (gloves, protective clothing, and face and eye protection).
3. **Limit the spread of contamination:** by
 - a. covering surfaces using surface barriers or cleaning and disinfecting surfaces that are likely to become contaminated.
 - b. minimizing sprays and splashes to reduce contamination (high volume evacuation)
 - c. properly disposing of medical waste.
4. **Make objects safe for use:** by
 - a. cleaning and sterilizing.
 - b. patient care items that contact bone, enter previously sterile tissues, or touch mucous membranes before use.
 - c. monitoring sterilization processes; and following manufacturer's instructions for use and sterilization.

Basic infection control procedures or later renamed by the Centers for Disease Control (CDC) as the Universal Precautions

1. Personal barrier techniques:

(a) Hand Hygiene

Hand hygiene in health care facilities is the most important aseptic procedure in the prevention of health care associated infections. Hand

hygiene significantly reduces microbes on the hands and protects both patients and the dental staff. Handwashing products include plain soap and agents with antimicrobial activity. The wearing of gloves does not replace handwashing, but is an adjunct providing consistent protection from blood-borne pathogens.

Hand hygiene is important because:

- Hands are the most common mode of pathogen transmission
- Reduce spread of antimicrobial resistance
- Prevent health care associated infections

(b)Gloves .Gloves used for:

1. Protect the dental team members from direct contact with patient microbes.
2. Protect patients from contact with microbes on the hands of the dental team members.

Gloves should be:

1. Changed between patients and are not to be washed with detergents at any time.
2. Torn or punctured gloves should be removed as soon as possible .

(c)Masks. Facemasks should be worn to→

1. Prevent spatter from patients' mouths or splashes of contaminated solutions and chemicals from contacting the mucous membranes of the mouth and nose. (whenever there is a risk of aerosolizing, spraying, spattering, or splashing of patients' oral fluids or chemicals used at chairside or in other parts of the office).
2. The reduction in the inhalation of airborne particles .

(d) Eyewear

▶The eyes due to limited vascularity and lower immune abilities are susceptible to macroscopic and microscopic injury(risk from the herpes simplex virus and hepatitis . Protective eyewear should be worn by all dental personnel involved in treatment in the form of glasses and/or face shield to prevent trauma to the eye tissue from flying droplets or aerosols..

▶Protective eyewear should be available to the patients as well as the dental personnel. The supine position 'renders the patient susceptible to falling objects in the head and neck area.

▶All protective eyewear should be cleansed after every appointment. Eyewear should be washed with soap first, then rinsed with water and a surface disinfectant can be used later.

(e) Protective clothing

Protective clothing is the outer layer or covering of garments that would first be contacted by the contaminating droplets, generating sprays, splatter, splashes or spills of body fluids, contaminated solutions or chemicals. This protection can be provided by high neck, long sleeve, knee length garments.

2. Immunization

All dental health care workers should be immunized by taken a vaccine against the most prevalent infectious disease because they are at risk of infection.

3. Medical history of patient

Complete screening of patient medical history must be taken.

4. Intraoral Barrier Technique

1. Rubber dam . It should be used whenever possible for improved vision and access and to reduce dental personnel's exposure to microorganisms in patient's blood and saliva.
2. Preprocedural mouthrinse Patient's use of an antimicrobial mouthwash of 0.12 percent chlorhexidine gluconate solution for 30 seconds prior to intraoral procedures reduces the number of viable oral organisms.

(2) Instrument processing(sterilization of instruments)

Instrument processing involves:

(a) Presoaking and cleaning

- Presoaking of contaminated instruments keeps them wet until a thorough cleaning can occur. This procedure prevents blood and saliva from drying on the instruments and facilitates cleaning of instrument which is achieved by;
- Hand scrubbing of contaminated instruments.
- Ultrasonic cleaning is a mechanical cleaning system that reduces handling of contaminated instruments and has been shown to be effective in removing dried blood and saliva.

(b) Packaging

After cleaned instruments have been rinsed and dried, they are to be packaged in functional sets before sterilization.

(c) Sterilization

- Sterilization: It is a process of removing or killing all viable micro-organism including substantial No. of resistant bacterial spores using physical & chemical procedure.
- Disinfection: It is a process of removing or killing most, but not all, viable organism (e.g bacterial spores) using physical & chemical procedure.

- Sanitization: The process of removing organic debris in order that disinfection can occur.
- Bacteriostatic: An agent that will inhibit increases in the number of bacteria.
- Bactericidal: An agent that will destroy (kill) bacteria, fungi or viruses.
- Instruments which can tolerate heat are
 - generally sterilized by one of the following methods
 - 1. Steam under pressure — gravity displacement or prevacuum sterilizer
 - 2. Dry heat — static air or forced air
 - 3. Unsaturated chemical vapor.

1). Heat sterilization :

1. Steam, Vapor Under Pressure (Autoclave): For sterilization to be effective, items being processed require exposure to direct steam contact at the required temperature and pressure for the specified time. Pressure serves as the means to obtain the high temperatures needed to kill microorganisms.

2. Dry heat sterilizes less efficiently than moist heat because as proteins dehydrate and dry, their resistance to denaturation increases. A higher temperature is required for a dry heat unit than for a steam processor. Actual time needed to sterilize instruments will depend on the size and arrangement of the load, the type of wrapping material and unit efficiency. A typical dry heat cycle is 1 hour at 170°C or 2 hours at 160°.

3. Chemical Vapor (Chemiclave) : Chemical vapor sterilizers use a specific mixture of formaldehyde, alcohols, ketone, acetone and water under pressure at 132°C (270°F) to achieve sterilization. Sterilization requires 20 to 40 minutes and the chemical solution must only be used once.

2). Chemical sterilization(disinfection):

A few plastic reusable items must be sterilized including:

1. Rubber dam frames.
2. X-ray **positioning** rings.
3. Rulers, and orthodontic de banding guns.

Because these items may melt in heat sterilizers thus, the dental office must resort to use of a liquid sterilant at room temperature for processing these heat labile items. This involves use of one of the several products consisting of 2.0%-3.2% solution of glutaraldehyde for a contact time of 10 hours.

(d) Drying, cooling, storage and distribution of instruments

- Drying → Instrument packages sterilized in steam become wet and must be allowed to dry before handling so that the packages do not tear.
- Cooling → of warm packages must be done slowly to avoid formation of condensation on the instruments. Using fans to cool down items should also be avoided as, it causes undue circulation of potentially contaminated air around the packs.
- Storage → sterile instrument packages are stored in a cool, dry, protected area, up off the floor, a few inches away from the walls and ceilings and away from sinks, heat sources, and overhead pipes.

(3) Radiographic asepsis

- For operator A convenient way to prevent spread of contamination on film packs is to use plastic disposable covers on the packs before they are placed into the patient's mouths. When the covers are subsequently removed and discarded, the film packs are free of contamination, and can be handled without gloves. or use gloves.
- For patient Simply using plastic barrier material on the portions of cone and tube head and on the exposure switch will reduce the cross contamination between patients.

(4) Use of disposables For patients

Using of disposable items to prevent patient-to-patient cross-contamination
Numerous disposable items are available in dentistry which include :

Gloves, masks, gowns, surface covers, patient bibs, saliva ejector tips, air water syringe tips, high volume evacuator tips, prophylaxis angles, prophylaxis cups, some instruments, impression trays, fluoride gel trays and high speed hand pieces.

(7) Asepsis of Operatory Surfaces

It is essential to maintain a "disinfected environment" within the working area. **There are two general approaches to surface asepsis :**

1. To clean and disinfect contaminated surfaces.
2. To prevent the surface from becoming contaminated by the use of surface covers.

Environmental cleaning Contaminated worktops must be disinfected between patients. The surgery (dental chair, dental unit, worktops and floors) must be thoroughly cleaned at least every day and more frequently if there is obvious contamination. All cleaning agents must be used in accordance with the manufacturer's instructions.

Disinfection of the following surfaces should be carried out as :

(a) Delivery system

Contaminated by → direct transfer, splatter and aerosolization.

These surfaces should be cleaned and disinfected before the next patient is attended.

A cleaner - disinfectant should be applied to the contaminated surface either by spraying or by using a saturated pad. Active agents in disinfectant products include hypochlorite, iodophor, water based synthetic phenol, alcohol based synthetic phenolics compounds. Any such products can provide surface asepsis when used properly.

the simplest and the most cost effective method of protecting the delivery system is perhaps through the use of barrier materials, such as plastic food wrap, plastic bags, aluminium foil or custom made barrier covers should be discarded and replaced after completion of each patient.

(b) Dental patient chair

The dental patient chair should be smooth with a minimum of accessories.

All chair functions should be controlled from a foot switch to avoid contamination of hand operated switches.

The head rests should be covered by disposable covers and the underside of chair arms should be properly cleaned and disinfected.

Common switches in the chair have a number of cracks and crevices to harbour micro-organisms. These switches should be covered by a clear plastic.

(c) Dental operator stool

Covering the lever with plastic barrier material will control cross-contamination. Care should be taken that the operator does not touch the seat covering with contaminated hands. Cleaning and disinfecting porous seat covering may be done with soap and water.

(d) Cabinetry

All support cabinetry should be made from materials that can withstand repeated cleaning and disinfection. The sinks should be of stainless steel or porcelain

(e) Major utility systems

Air → The dental treatment room should be properly air conditioned and should have excellent air circulation with an exhaust to the outside

Water → Purifying measures for water systems include use of a water sediment filter and softening and/or de ionization of incoming water supply.

The suction apparatus→ The sediment trap on the incoming tube is a real source of contamination for the staff. The trap should be placed in a well lighted and accessible area and cleaned daily.

The air compressor→ intake filter must be placed in a clean, cool and dry area.

(f) Tubing and hoses

Bacteria form a biofilm that coat the Inside of these tubes enter the flowing water inside the tubes and exit through the handpiece or airwater syringe, which could be reduced by:

- activating the control unit to flush water through the dental unit water lines.
- Bacterial filters can be placed into the waterline of the handpiece and airwater syringes.
- The tubings should be preferably straight, not coiled; smooth on the outer surface, free of grooves and made of non absorbent materials.

(g) Handpieces and hand instrument

All instruments and items that are used in the mouth must be heat sterilized between patient sessions. Included in this are handpieces, ultrasonic and sonic scalers, curing light tips, matrix retainers, cutting, finishing and polishing instruments.

All dental handpieces should be heat/pressure sterllizable which should be thoroughly scrubbed with soap and water, rinsed and all traces of water removed from the internal and external parts before lubrication and sterilization.

Hand instruments should also be properly sterilized. Dry heat or chemical vapor pressure sterilization is normally the most practical method for these items. Caution must be exercised, to ensure that the items are dry before sterilization to prevent corrosion.

→Healthcare Risk Waste Management

Healthcare risk waste is categorized as waste contaminated with body fluids, items soiled with blood and saliva, and other infectious waste. It must be handled and disposed of safely in order to protect human health and the environment . Items listed as clinical waste include:

- Patients' cups, Cotton wool rolls, Gloves, Patient bibs, Tray paper, Plastic saliva ejectors, Masks, Used rubber dam, Contaminated sharps(Needles/disposable syringes).