

REVIEW



doi:10.5866/3.3.577

Infection Control and Prevention in Dentistry

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Article Info

Received: April 11, 2011

Review Completed: May, 12, 2011

Accepted: June, 13, 2011

Available Online: October, 2011

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ABSTRACT:

In a dental set-up, the patient's saliva mixed with blood, pus, plaque and crevicular fluid is often aerosolized and spattered, thus exposing the dental professional to potential infectious agents. This is because micro-organisms are always mixed with these body materials and they cause infectious and transmissible disease, most common of which are common cold, herpes, hepatitis and AIDS.

It therefore becomes mandatory for the dental professional to follow the universal precautions and treat every patient as being potentially infectious.

Universal precaution means that the same infection control procedures are used for all patients.

The dentist must hence be aware of these precautions and should mandatorily follow the infection control protocol in his dental set-up.

Key words: *Sterilization protocol, disinfection, infection control, universal precautions, waste disposal*

INFECTION CONTROL AND PREVENTION IN DENTISTRY

INTRODUCTION:

Infection control is the discipline concerned with preventing nosocomial or health care associated infection.

It is an essential, though often under-recognized, under-supported and at times 'taken-for-granted' part of the infrastructure.

This review article will mainly discuss the steps taken for infection control and prevention from the point of a dental set-up.

OBJECTIVES:

1. To protect the patients and members of the dental team from contracting infections (like HIV, HBV, syphilis, influenza) during dental procedures.
2. To reduce the number of pathogenic micro-

organisms in the dental environment and therefore during dental procedures, to the lowest possible level.

3. To implement a high standard of cross-infection control when treating every patient, to prevent the transmission of infection.
4. To simplify cross infection control, thus allowing the dental team to complete dental procedures with minimal inconvenience.

STRATEGY TO ACHIEVE CROSS INFECTION CONTROL:

1. ALL PATIENTS MUST BE SCREENED:

This involves a thorough recording of medical history, social history and soft tissues examination, screening of blood, any allergies, drug reactions transfusion history. This procedure helps in the following way:

- Early diagnosis of the disease
- Early treatment of previously undiagnosed conditions

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- Early availability of counseling by experienced persons
- Modification of infection control if the patient is medically compromised e.g. availability of sterile water for dental procedure

2. MEMBERS OF THE DENTAL TEAM MUST STAY HEALTHY:

Consider

- (i) Immunization: Pre-exposure and post exposure prophylaxis
- All members must be vaccinated for Hepatitis B, Influenza, Mumps, Measles, Tetanus, Rubella, Tuberculosis, whooping cough.
- Incase of exposure to a potential carrier, the dental professional must follow the post-exposure prophylaxis.

Post-exposure prophylaxis for HBV infection-the exposed worker should receive the vaccine series for Hepatitis B. Incase he is already vaccinated then he must be tested for antibodies to HbsAg and given one dose of vaccine and one dose of HBIG if the antibody levels <10SRU.

Post-exposure prophylaxis for HIV infection-the exposed worker must be tested clinically and serologically for evidence of HIV infection as soon as possible after the exposure. He should report and seek medical evaluation for any febrile illness that occurs within 12 weeks after the exposure.

- (ii) Hand washing and hand care:

- Proper hand washing destroys pathogens, removes blood, debris and contaminating micro-organisms and prevents accumulation of blood on damaged hand skin.¹

Surgical hand scrubs-act fast and have a broad range of bactericidal and residual activity.

Health care personal hand wash-have bactericidal and germicidal ingredients.

- Antiseptics used for hand wash are-Chlorhexidine (2-4%) with 4% isopropyl alcohol, Povidone iodine (7.5 -10%), Parachlorometaxylenol (2%), hexachlorophene.
- Drying is also an essential part of hand hygiene

process. One should use good quality soft, disposable paper towels.²

- Repeated hand washing may damage the skin. Use of hand creams is recommended in such cases for e.g., kerodex, foam.

3. PROVIDE BARRIERS FOR PERSONAL PROTECTION:

- PERSONAL PROTECTIVE EQUIPMENT (PPE) is the specialized clothing or equipment worn by a worker for protection against a hazard.
- PPE should be in accordance with OSHA regulations which are as follows-

CATEGORY 1- tasks that involve exposure to blood, body fluids or tissues. Every employee in this category is required to use appropriate protective measures. E.g., dentist, dental assistant, dental hygienist, lab technician.

CATEGORY 2- tasks that involve no exposure to blood, body fluids or tissues, however unplanned category 1 tasks may occasionally be required. Every employee in this category should have appropriate protective measures readily available. E.g., clerical or non-professional workers who may help clean up the office, handle instruments or impression materials or send dental materials to the laboratory.

CATEGORY 3-tasks that involve no exposure to blood, body fluids or tissues. E.g., receptionist

- Components of PPE include:
- Gloves :- are of the following types-
 - latex gloves or vinyl gloves
 - General purpose utility gloves or surgeon's sterile gloves
 - Gowns
 - Face shields, hair protection
 - Mouth masks (preferably with fluid shield)³
 - Goggles/eye wear⁴

4. PRACTICE CAREFUL ASEPTIC TECHNIQUES:

During treatment and clean-up, blood and saliva-contaminated blood can be spread by anything that has been in patient's mouth.⁵

Practicing aseptic techniques helps in limiting the spread of blood and saliva. This is done by

- Careful handling of sharp instruments: The sharp end must always point away from the hand, pass syringes with needles pointing away from anyone, pick up instruments individually.
- Avoiding injuries: recap dental syringes using One handed technique or Scoop technique.
- Limiting surface contact by using dose packaging, surface disinfectants, drapes and covers.
- Using utility gloves during clean-up.
- Minimizing aerosols and splatter- The ultrasonic scaler has been shown to produce the greatest amount of air-borne contamination followed by high speed hand pieces, air polisher and then by air/water syringes.

Diseases known to be spread by aerosol contamination are-

Pneumonic plague

Tuberculosis

Influenza

Sever acute respiratory syndrome

Legionnaire's disease

Aerosol contamination can be minimized by:

- Pre treatment mouthrinses- 2% chlorhexidine reduces the bacterial load in dental aerosol.^{6,7,8}
- High volume evacuation(HVE)-reduces contamination by more than 90%.removes 100 cubic feet of air per minute.
- The rubber dam-an effective method to reduce contamination by saliva and blood.
- Ventilation and air filtration-by filtering recirculated air and by introducing a substantial proportion of fresh air in each air change will substantially reduce residual contamination.⁹

Use of High Efficiency Particulate Air(HEPA) filter and UV chambers can effectively achieve this goal.

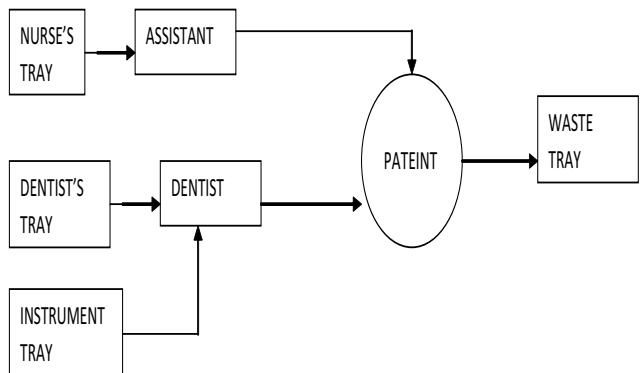
- Using disposable items such as disposable mouth mirrors, probes, explorers, suction tips, gloves, masks, gowns, needles impression tray etc.
- Proper laundry of contaminated uniforms and linen
- Personnels handling soiled clinical garments must wear protective gloves

- These garments must be placed directly into a laundry bag Hot water up to 70°C or cool water containing 50 to 150ppm of chorine would provide an antimicrobial action
- Handling of biopsy specimens and extracted teeth must be done with utmost care

5. ORGANISE INSTRUMENTS CAREFULLY:

Consider

- Tray systems
- Packaging instruments
- Sterilization pouches
- One way flow of contamination instruments and other items



6. STERILISATION AND DISINFECTION:

- Disinfectants: germicides used are of the following types
 1. High level disinfectants (sterilants) e.g. Glutaraldehyde
 2. Intermediate and low level disinfectants e.g. H₂O₂, NaOCl etc
 3. Antiseptics- essential oil compounds, chlorhexidine.

Based on the duration of exposure, the germicide could be used as sterilants (for 10-12 hrs)or as a disinfectant (for 30min)

- Immersion disinfectants:

Items that cannot be sterilized by heat or by other chemical methods should be disinfected by immersion as follows-

- Rinse out the bio burden (sanitization)
- Immerse for the disinfection time
- Rinse out the disinfectants

- Water based disinfectants are better than alcohol based disinfectants as they do not fix bio burden on to the surface. They are heavier particles that do not aerosolize easily and they are also more effective.
- Antiseptic germicides are used in the form of
 - Alcohol swabs to clean the skin surface prior to injection of medicines/anesthetics
 - Intraorally, tinctures and paints are used to clean and decontaminate surgical sites.
 - Antimicrobial rinses are beneficial in reducing microbial load
- Sterilization: common methods of in - office sterilization in dentistry are
 - *Autoclaving*: long cycle- 121°C for 15 minutes at 15psi short cycle- 134°C for 3 minutes at 30 psi
Instruments sterilized are-stainless steel instruments, hand pieces, cloth goods, glass slabs, dishes, plastic suction tips.
 - *Chemiclavens* : uses a combination of liquid chemicals (with <15% water)
The parameters for sterilizing are - 131p C for 30 minutes at 20 psi
Instruments sterilized are-hand instruments, hand pieces, carbon and diamond burs, orthodontic wires, endodontic instruments.
 - *Hot air oven* 160- 170°C for 1 hour
- Instruments disinfection: instruments and operatory surfaces can be classified as
 1. Critical : which penetrate tissue or touch bone, e.g., scissors, forceps, elevator, scaler. These must be autoclaved.
 2. Semi - critical: touch mucous membrane but don't penetrate, e.g., mouth mirror probes, tweezers, amalgam carrier. Can be either autoclaved or subjected to high level disinfection
 3. Non critical:contact only intact skin,e.g.,spatula, mixing slab and protective eyewear. These should be subjected to intermediate level disinfection.

4. Environmental surfaces : cleaned in two stages:
Pre-cleaning stage- spray the disinfectant and wipe with a clean cloth

Disinfection stage-re spray the disinfectant and leave for the recommended time .wipe off residual disinfectant using a fresh paper towel.

The use of barriers is highly recommended since it was found that the turn around time from an operatory if a disinfectant is used (8-15 min) is longer than the new surface barriers, disposal of the waste, return of the used instruments to the instruments reprocessing area (3-5min).

7. MINIMISE POSSIBLE CONTAMINATION FROM DENTAL EQUIPMENT:

- This can be done by following **barrier technique**.
- Thin plastic bags, wraps or aluminium foil may be used
- Air/water syringes, HVE and saliva ejector, syringe/couplings may be barriered to at least 6 inches below the coupling
- Surfaces to be barriered-
 1. Dental unit light handles
 2. Dental unit electrical or mechanical controls
 3. Dental chair head rest
 4. Dental chair arm rest
 5. Dental unit controls
 6. High speed hand piece couplings and hose
 7. Slow speed motor, coupling and hose
 8. Air/water syringe and hose
 9. Saliva ejector hand piece and hose
 10. HVE hand piece and hose
 11. X-ray unit handles and cone
 12. X-ray unit controls
 13. Bite blocks of the panoramic X-ray unit
 14. Intra-oral digital sensors
 15. RVG equipments
 16. Apex locators
 17. Endosonic ultrasonic units

Turbine contamination control

Also, at the end of the day, the suction lines (HVE & SE) should be cleaned with either a quaternary

ammonia compound cleaner or an enzymatic detergent used in water.

The cleaner should be sucked through the lines either aerosolized or as a liquid and let set for about 10 minutes.

After the 10 minutes soak, water should be sucked through the lines to wash out the cleaner along with the patient debris and other materials. The suction traps must be examined and replaced atleast weekly.

8. DISPOSE - OFF CONTAMINATED WASTE SAFELY

Consider - all clinical wastes such as blood soaked gauges, cotton rolls, extracted teeth, tissue waste, and contaminated sharps such as needles, surgical blades etc should be placed in closable leak proof containers or bags that color-coded or labelled. These are placed inside a second similar container or bag which is closed to prevent leakage during handling, storage and transport.

WASTE CATEGORY TREATMENT AND DISPOSAL:

CATEGORY 1-Human anatomical waste(human tissues, organs, body parts)-Incineration/deep burial

CATEGORY 2 - Animal waste(animal tissues, organs, body parts carcasses, bleeding parts, fluids, blood) -Incineration/deep burial

CATEGORY 3-Microbiology & biotechnology waste(waste from lab cultures, research and infectious agents from research and industrial lab)- Incineration/deep burial

CATEGORY 4 - Sharps (needles, syringes, scalpel, blades, glass) - Incineration/disinfection treatment/mutilation

CATEGORY 5-Medicines and cytotoxic drugs - Incineration/destruction and Disposal in secured landfill

CATEGORY 6-Solid waste(blood and body fluids)- autoclave/chemical treatment/burial

CATEGORY 7-Solid waste(disposable items)- autoclave/chemical treatment/burial

CATEGORY 8-liquid waste(waste generated from lab., and washing, cleaning, housekeeping & disinfecting activities)-disinfection/chemicals/ discharge into drains

CATEGORY 9-Incineration ash -disposal in municipal landfill

CATEGORY 10-Chemical waste -chemical treatment/ secure landfill

COLOR CODING & TYPE OF CONTAINER

YELLOW-(plastic bag) Categories 1, 2, 3 & 6

RED-(disinfected container/plastic bag) Categories 3, 6 &7

BLUE/WHITE (plastic bag, puncture proof container) Categories 4 & 7

BLACK- (plastic bag) Categories 5, 9 & 10

9. CAREFUL ASEPSIS IN RADIOLOGY:

- Use gloves while placing X-ray film in the patient mouth
- In case of use of film holders, disinfect in between patients by immersing the holder in a disinfecting solution for 10mins, rinse and then wipe dry.
- Rinse off patient saliva from the X-ray film packet before starting the film processing

10. PROVIDE A WRITTEN INFECTION CONTROL PROGRAMME:

- The staff must be trained in the following:-
OSHA regulations
Epidemiology, modes of transmission & prevention of HIV & HBV
Location & proper use of PPE and their limitations
Proper work practices and universal procedure
Action required and who to contact if unplanned
CATEGORY 1 tasks are encountered.
Meaning of color codes, biohazard symbol, precautions to follow in handling contaminated articles or infectious waste.
Protocol for post exposure prophylaxis
- Periodic evaluation and updating of cross-infection control procedures must be done.⁹
- Maintain careful records:
Documents and records must be prepared, maintained in proper form and made readily available to dental team members.

11. UNDERSTAND NATIONAL AND LOCAL GUIDELINES AND REGULATIONS.

GUIDELINES- are procedures recommended by accepted bodies of dental opinion. For e.g.,

ADA(American Dental Association) guidelines of august 1996 are the most widely followed guidelines by American practitioners.

CDC(Centre for Disease Control) guidelines of October 2003 are also the most widely applied guidelines.

REGULATIONS- are either backed by the force of law or are promoted by the general dental council. For e.g.,

OSHA(Occupational and Safety Health Administration)-is authorized to conduct workplace inspections and investigations to determine whether employees are complying with the standards issued by the agency for safer and healthier workplace.

60% reduction in fatality rate and around 40% reduction in occupational injury and illness rates has been observed ever since OSHA came into action.

EPA(Environment Protection Agency)-this gives the standards for exposure to chemicals, heat and radiation and the discharge and final treatment of waste material

STATE AND LOCAL REGULATIONS-infection control may vary from state to state particularly in areas of sterilization,waste management,sterilizer spore testing.

The dental team must be in contact with the state agencies for latest information.Two other sources are

the State Dental Association and the Infection Control Officer of local dental college.

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WHAT TO EVALUATE ¹⁰	HOW TO EVALUATE
1. Immunization of office staff	Conduct an annual review of staff records to ensure up-to-date immunizations
2. Occupational exposures to infections materials	Report the exposure.Document and review the steps that occurred around the exposure and plan to prevent it in future
3. Post exposure management And follow up	Ensure that the post exposure management plan is understood by all the staff and that The exposure evaluation procedures are available at all times
4. Hand hygiene procedures	Observe and document circumstances of Appropriate and inappropriate hand Hygiene.Review findings in staff meetings
5. Use of PPE	Observe and document use of barrier Precautions and careful handling of sharps. Review findings in staff meetings.
6. Monitoring the sterilization Process	Compare paper log of mechanical and chemical monitoring of each sterilizer load with the weekly biologic monitoring results.Document that appropriate procedures are performed if sterilizations failureoccurs.
7. Evaluating safety devices	Conduct an annual review of the exposure control plan for documentation of new developments in safety devices.
8. Microbial quality of Dental Unit Water (DUW)	Monitor and determine compliance with EPA drinking standard of not more than 500 CFU/ml of heterotrophic bacteria