

INFECTION CONTROL IN PROSTHODONTICS

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INTRODUCTION

Infection control is an important concept in the present day practice of dentistry. Infection control is important in dental practice because the dental health care professionals are at high risk and emergence of new communicable diseases like hepatitis, HIV and prevailing diseases like tuberculosis makes it important to control the transmission.^[4]

Dental patients & dental health care practitioners (DHCP) can be exposed to pathogenic microorganisms including cytomegalovirus (CMV), HBV, HCV, herpes simplex virus types 1 and 2, HIV, Mycobacterium tuberculosis, staphylococci, streptococci, & other viruses & bacteria that colonize or infect the oral cavity & respiratory tract. Failure to properly disinfect or sterilize equipment carries not only risk associated with breach of host barriers but also risk for person-to-person transmission (e.g., hepatitis B virus) and transmission of environmental pathogens (e.g., Pseudomonas aeruginosa).^[1]

Therefore it is essential to be able to kill or inhibit their growth to minimize their destructive effects. Goal is:

- (1) To destroy pathogens & prevent their transmission.
- (2) To reduce or eliminate microorganisms responsible for the contamination.

Part of the problem lies in the fact that many practitioners and auxiliaries previously failed to comprehend or appreciate the infection potential presented by saliva and blood during treatment. The risk of potential infection was dismissed because of the splatter coming from the patients mouth, is not noticed readily. Organic debris may be transparent or translucent and dries as a clear film on skin, clothing and other surfaces.^[3] This chapter highlights various methods of infection control particularly in the field of prosthodontics to prevent the transmission of diseases between patients, dentists and lab personnel.

Infection Control^[1,4]: Infection Control is based upon the principle that transmission of infectious diseases will be prevented when any of the steps in the chain are broken or interrupted. Emphasis is paid not only to the patient protection but also to all members of the dental team. Infection control procedures involve:

- 1) Patient Screening
- 2) Personal hygiene
- 3) Personal protection
- 4) Instrument processing
- 5) Surface asepsis
- 6) Patient treatment

Sterilisation & Disinfection of patient care instruments & material used are part of Infection control protocol in health care setting including dental care.

- 1. Patient Screening:** Any treatment is performed only after a comprehensive patient evaluation. Dentist's review of the patient's medical history is mandatory at the onset of every clinical appointment. Multiple reviews give the dentist opportunities to establish baseline medical history data and to compare individual patient responses over an extended period of time as well as brief review of any infectious disease, if the patient is suffering
- 2. Personal Hygiene:** Thorough forearm and hand washing is mandatory before and after treatment. Fingernails are kept clean and short to prevent perforation of gloves and accumulation of debris. Fingernail polish is not worn. Use surgical head cap, face mask & eye protecting glasses & long sleeved clinical coats. Hair is cleared away from the face. If a clinician's hair falls in such a way that it may contact the patient or dental equipment, it is fixed at the back of the head, or a surgical cap is worn. Facial hair is covered by a face mask or shield. Jewellery is removed from the hands, arms, or facial area during patient treatment.
- 3. Personal Protection:** Gloves are worn at all times when treating patients. Masks are worn in the patient treatment area and when the dentist is manipulating the prostheses in the laboratory. In recent literature, attention has been focused on the inhibitory effects

of certain latex gloves on the setting times of poly(vinyl siloxane) putty impression material. Consequently, it has been recommended that gloves should not be worn when dispensing, mixing, or handling poly(vinyl siloxane) putty materials. However, it is better to wear synthetic gloves in place of or over latex gloves to avoid disruption of the barrier technique when such materials are used. In June 1982, the council on dental therapeutics adopted a resolution recommending that all dental personnel having patient contact including dentists, dental students and dental auxiliary personnel, and all dental laboratory personnel receive the Hepatitis B vaccine. Residents are required to have current immunizations against communicable diseases, including hepatitis B. Vaccination programme considered the most effective cross-infection control measure to protect dental personnel, and in turn their patients, from a potentially fatal disease.

4. Instrument processing: It included pre-soaking and cleaning, packaging and sterilization. The following methods of sterilization are most commonly used.

Steam at 121 degree C for 20 to 30 mins or 134 degree C for 2 to 10 mins.

Advantages – good penetration

Precautions – carbon steel corrodes, damage to plastic and rubber items, packs wet after the cycle, hard water spots instruments.

5. Surface Asepsis: There are two general approaches to surface asepsis.

- a. Clean and disinfect contaminated surfaces
- b. Prevent surface from becoming contaminated by use of Surface covers
- c. A combination of both may also be used.

According to Miller and Palenik in 1994 chemicals used for surface and equipment asepsis are:

- a. Chlorine – e.g. sodium hypo chlorite.
- b. Phenolic compounds: Water based: Water with ortho – phenyl phenol or Tertiary amylphenol or O benzyl – p – chlorophenol and Alcohol based: Ethyl or iso propyl alcohol with O phenyl phenol or Tertiary amylphenol
- c. Iodophor – butoxypoly propoxy poly ethoxy ethanol iodine complex.

6. Treating prosthodontic patients in the clinic

- a. When the dental operator is being prepared for treatment at the beginning of the day, the waterlines should be flushed for several minutes to remove bacterial growth that may have accumulated overnight. The equipments should be disinfected. A hospital level tuberculocidal disinfectant that is registered with the environmental protection agency should be used on hard surfaces in the dental office.
- b. All moving parts of the instruments especially hand pieces (table 1) should be lubricated prior to steam sterilization. The burs should be autoclaved or

maintained in high level disinfection for not less than three hours. Thorough rinsing should be followed to remove all traces of disinfectant.

- c. Touch surfaces like unit handles, light handle, light switch, chair controls, head rest knob, trolley handle, trolley and 3-way syringes cannot be disconnected and sterilized and therefore need to be treated with disinfectants or covered with a protective barrier. However instruments which enter oral cavity and are connected equipment e.g. air rotor and surgical hand pieces, ultrasonic inserts or tips, air water syringe tips and light cure probes or tips should be disconnected, sterilized and rinsed before use.^[3]

Table 1: Handpiece asepsis.^[81]

- Check unit for water retraction monthly, and add or replace antiretraction valves when indicated.
- Flush the lines in high-speed handpieces and air/water syringes by operating for 30 seconds at the beginning of the day and for 15 seconds after each patient.
- Follow the handpiece manufacturer's directions for proper maintenance, cleaning, sterilization, disinfection and compatibility with chemical agents.
- Clean the external portion with a detergent or detergent-disinfectant and rinse with water.
- Lubricate high-speed handpieces when indicated by the manufacturer and spray out excess lubricant. Depending upon the handpiece, some must be lubricated before, after, or before and after sterilization or not at all.
- Avoid spraying aerosols into the environment when operating the handpiece during processing/lubrication (for example, spray into a vacuum line).
- Package for sterilization in steam or unsaturated chemical vapor following the manufacturer's directions.
- If disinfecting a handpiece that cannot be heat sterilized, spray or saturate with the disinfectant recommended by the manufacturer. Use at least a 10-minute contact time (see disinfectant label) and thoroughly rinse with water and dry. Protect from contamination before placement at chairside.

d. Before seating the patient the operatory and chair is cleaned and wiped with a disinfectant solution, the area is sprayed and left for a minimum 10 minutes. The BDA recommends 70% isopropyl alcohol, hypochlorite solution (containing 1% available chlorine), or 2% glutaraldehyde solution for disinfecting contaminated surfaces under different circumstances. The dental chair is covered with a disposable plastic sheath, which is removed after treatment. All patients rinse with chlorhexidine gluconate 0.12% before treatment. Patients wear protective eye wear. Hands are washed with an antimicrobial cleanser before gloving. Once gloved, only the patient and barrier covered areas or areas that have been cleaned and disinfected are touched. A unit dose concept may be adopted for use in the clinic as a cross-contamination control measure. This may be applied to many items and materials in

prosthodontics, such as impression materials and waxes. The materials should be dispensed by a noncontaminated assistant prior to patient contact. This will eliminate the possibility of cross-contamination occurring via containers, tubes, and dispensers. Large, non-sterilizable items used in the operatory, such as impression material dispensing guns, articulators, face bows, water bath, silicone spray bottles, tooth shade, and mold guides are disinfected by wiping, spraying, or immersion with the appropriate disinfectant solution.

e. Disinfection of impressions:

- a. Personal protective equipment: Protective eye wear, masks and gloves should be used when handling a contaminated impression until it has been disinfected.

- b. Rinse the impression (Figure 1): Immediately after an impression is taken in the dental operator, rinse it under running water in order to remove any saliva or blood. This step is essential for allowing optimum disinfection of the impression.
- c. Disinfection techniques: Once the impression is rinsed and shaken to remove excess water, it must be disinfected. This may be accomplished by immersing the impression in, or spraying it with, an acceptable disinfectant.
- d. Disinfection of an impression by immersion: It is preferred over spraying. Spraying may not be effective because constant contact of the disinfectant with all surfaces of the impression cannot be assured. Rinse the impression with running water and shake off excess water. Place rinsed impression into a zippered plastic bag containing appropriate disinfectant. Leave it immersed in disinfectant for 15 minutes. Polyethers and hydrocolloids may be adversely affected by disinfectants; therefore their immersion time is limited to 10 minutes. Remove impression from disinfectant. Rinse with running water and shake off excess water.
- e. Disinfection of an impression by spraying (Figure 2): Spray the cleaned impression and impression tray with an acceptable disinfectant. Seal the sprayed impression in a zippered plastic bag for 15 minutes. Remove the impression from the sealed bag.



Figure 1: Rinsing of impression.



Figure 2: Disinfection of impression by spraying.

- f. Hydrocolloid impressions: A number of investigators have evaluated disinfection of irreversible hydrocolloid (alginate) sometimes with contradictory results. Based on these findings, the ADA recommended disinfecting alginates by immersion in diluted hypochlorite, iodophor or glutaraldehyde with phenolic buffer. Investigators reported significant adverse effects of specific materials with disinfectants that are non-reactive with other alginates suggesting that caution should be exercised. Given the hydrophilic nature of the material, a minimal disinfection time should be used.
- g. Rubber base impression materials: They can be disinfected by immersion in iodophor, diluted chlorine solution, glutaraldehyde or complex phenols for the time required for tuberculocidal activity. It is important to review the method of disinfection with the manufacturers to prevent distortion of the impression or loosening of the adhesive bond between the impression tray and impression material. These impressions also should be rinsed with water before pouring. It is important to inform the dental laboratory that the impression has been disinfected to prevent the laboratory personal from performing more disinfection procedures that might distort the impression. Studies by a number of investigators have shown that polysulphides and silicones are relatively stable and can be disinfected without adverse effects by immersion in most disinfectants approved for use in dentistry. Although hydrophilic, polyether impressions also can be disinfected by immersion, but exposure times should be kept to minimum (10 minutes). Disinfectants requiring exposure times greater than 10 minutes for tuberculocidal disinfection probably should be avoided with polyether. Immersion in acid glutaraldehyde actually improves the surface detail reproduction of elastomeric impressions.
- h. Zinc Oxide Eugenol (ZOE) and compound impressions: Limited data are available on disinfection of ZOE and compound impressions. Adverse effect have been reported on ZOE

immersed for 16 hours in diluted hypochlorite and on compound by all of the disinfectants tested (hypochlorite, formaldehyde and 2% alkaline glutaraldehyde). Once the impression has been disinfected it may be poured in the desired stone.

- f. Disinfection of Dental prosthesis and appliances:
- a. The ADA recommends disinfection by immersion in iodophor or chlorine compounds. Although both of these disinfectants are somewhat corrosive, studies have shown little effect on chrome cobalt alloy with short-term exposure (10 minutes) to iodophor or 1:10 hypochlorite. Damage of heat cured denture base resin has been shown to occur after only 10 minutes of immersion in a glutaraldehyde with phenol buffer, although immersion in 2% alkaline glutaraldehyde did not damage the acrylic surfaces. Given the tissue toxicity of glutaraldehyde and phenolic compounds, however iodophor or chlorine compounds are preferred for disinfection of acrylic appliances. Prostheses never should be stored in a disinfectant before insertion. After disinfection and thorough rinsing, acrylic items can be stored in diluted mouthwash until inserted.
 - b. Fixed metal/porcelain prosthesis may be disinfected by immersion in glutaraldehyde for the time recommended for tuberculocidal inactivation by the disinfectant manufacturer. In addition, several clinical studies have confirmed that fixed prosthesis can be disinfected by short immersion in diluted hypochlorite without apparent harm to the device. The higher the content of noble metal, the less the likelihood of adverse effects on the metal. Care should be taken to minimize the exposure times of metals to potentially corrosive chemicals. Iodophor probably could be used as well, but no data are available to substantiate this. Unglazed porcelain should not be exposed to any disinfectant and (porcelain firing/ glazing will suffice), fixed metal prosthesis can be sterilized with ethylene oxide or even by autoclaving, if desired. Any device that has been immersed in a disinfectant should be rinsed thoroughly before delivery to the patient.
 - c. Prosthesis or appliances that have been worn by patients should be cleaned thoroughly before disinfection by scrubbing with a brush and an antiseptic hand wash or by cleaning in an ultrasonic unit.
 - d. Dentures or other acrylic appliances that have been worn by patients and require repair should be disinfected, after cleaning and before handling should be handled (i.e. with gloves) as contaminated even after disinfection. The porous nature of acrylic makes such devices difficult to disinfect adequately.
 - e. Disinfection Of Wax Bites, Occlusion Rims, Stone Models, Custom Impression Trays & Bite Registrations: Wax rims and wax bites should be disinfected by the spray wipe spray method using an iodophor as recommended by the ADA. Rinse spray may be more appropriate for wax bites. For adequate

disinfection these should remain in disinfectant for the time recommended for tuberculocidal disinfection. After the second spray, they can be enclosed in a sealed plastic bag for the recommended time. These items should be rinsed again after disinfection to remove any residual disinfectant.

Bite registrations made of various materials such as ZOE or compound can be handled in the same manner as impressions of the same materials. These registrations also can be disinfected, using the rinse spray rinse technique, with most EPA registered hospital level tuberculocidal disinfectants used as sprays. After disinfection, the registration should be rinsed again to remove residual disinfectant.

ADA recommends that stone casts be disinfected by the spraying until wet or immersing in a 1:10 dilution of sodium hypochlorite or an iodophor. Casts to be disinfected should be fully set (i.e. stored for at least 24 hours). Investigators submerged die stone models in a variety of disinfectants and found that with 1:10 sodium hypochlorite and 1:213 iodophor, undesirable physical effects on set die stone ranged from none to minimal.

A disinfectant stone now is marketed and has been shown to have bactericidal property however this product is not yet EPA registered as a disinfectant. Several investigators have recommended adding disinfectants to gypsum during mixing (ie. As all or part of the liquid, when pouring casts). Although such products have potential for use in infection control, they do not solve the problem of the contaminated impression or tray as a source of infectious microorganisms during transit from the operatory to the laboratory.

- f. Custom acrylic resin impression trays: should be disinfected by spraying with surface disinfectants or immersing in either 1:213 iodophor or 1:10 sodium hypochlorite. They should be rinsed thoroughly to remove any residual disinfectant and allowed to dry fully before use. After use in the mouth custom trays should be discarded.
- g. Other Prosthodontic items: should be handled in a manner that prevents exposure of dental health care professionals and patients to infectious agents.^[3]

CONCLUSION

Dental safety is a key area of concern and needs to be addressed on top priority. Many Countries in the world have strong guidelines and recommendations for dental safety. In a country like India, the concept is new and needs to be advocated on the highest priority. The rationale for infection control is to "control" iatrogenic, nosocomial infections among patients, and potential occupational exposure of care providers to disease causing microbes during provision of care. Lack of Infection Control is life-threatening for both the patient and the Dental Professional and requires more efforts.

Formal programs in Infection Control and Safety must be developed and strictly followed by the entire dental health care professional.

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