Infection Control in Prosthodontics: A Review

Debarchita Sarangi

Senior Lecturer, Department of Prosthodontics and Crown & Bridge, Institute of Dental Sciences, Siksha 'O' Anusandhan (Deemed to be University), Bhubaneswar 751003, Odisha, India

Abstract

Dentists and dental office personnel are exposed to a wide range of potential pathogens and have high chances of infection transmission not only in the clinic, but also in the laboratory. A proper sterilization and disinfection protocol must be followed. This shall prevent cross-contamination of disease among the dental health care providers. Prosthodontics is a branch in dentistry which includes manipulation of various materials, equipment, their use and instrumentation for rehabilitation of patients. Patients in the geriatric group are of special importance in this branch. A strict protocol for infection control is mandatory to combat any kind of transmission and cross-contamination between the dental office personnel and patient and vice-versa. This article shall discuss the various modalities of sterilization and disinfection followed from a prosthodontist's point of view, in the clinic and the laboratory also.

Keywords: *Dental Clinic; Dental Laboratory; Disinfection; Infection Control; Sterilization.*

Introduction

According to the Centre of Disease Control guidelines, sterilization is a process that destroys or eliminates all forms of microbial life and is carried out in health-care facilities by physical or chemical method. In disinfection refers to the elimination of many or all pathogenic microorganisms, except bacterial spores, or inanimate objects. Cleaning means the removal of any visible organic or inorganic soil from objects or equipment or surfaces, mechanically or manually with water and some detergent or enzymatic agents. Decontamination means removal of pathogenic organisms that would make an object safe to use, handle and discard.[1]

Dental health care providers are exposed to infectious material and potentially infectious materials within the dental office, dental lab and also while handling equipments, materials, etc.[2] Patients in the prosthodontic clinic usually belong to the vulnerable group due to increased age, decreased immunity, compromised health status. Prosthodontists, their staff and also their patients are at a higher risk for possible transmission of micro-organisms and cross-infection due to the use of added equipment and material in the clinic and the laboratory. Thus, infection control is of utmost importance. Even though advances in this field are commendable, the principles of infection control have always been basic. This has to be equally prioritized just as any other procedure to ensure safety, both ways. For a good practice, a sufficient number of materials, instruments and equipment should be available and hence the sterilization has to be managed and routinely done.[3,4,5] Therefore, awareness among clinicians and auxiliaries are a must for overall safety.[6] Dental casts, Impressions, Impression trays, occlusal rims, etc. are commonly used in prosthodontic practice. This article shall review the procedures that should be employed for sterilization and disinfection of these objects in a prosthodontic clinical and laboratory set-up.

General Protocol for Infection Control: Infection control is a comprehensive procedure and there are five steps towards achieving it. They are: Evaluation of patient; Personal Protection; Cleaning and Sterilization of Instrument; Disinfection; Asepsis in the Laboratory.[7] Microorganisms may be transmitted through direct contact with blood; oral fluids; conjunctival, nasal and oral micro-droplets; patient materials, etc. These can be transmitted through indirect contact with contaminated objects and inhalation of long-standing aerosol containing the micro-organisms suspended in

the air.[2] DCNA has classified the level of risks as per the prevention. Diseases like Mumps, Measles, Rubella, Fungal infection, etc. come under Class 1, because their vaccine is available, the risk is minimal. Candidiasis, Staphylococcus aureus, and Streptococcus Group A, etc. are classified under Class 2. Herpes simplex, Cytomegalovirus, EBV and Varicella virus are classified under Class 3. HIV, HBV, HCV, HDV are classified under Class 4 because there are no vaccines except for HBV and all the universal precautions should be taken as the diseases are fatal. Due to the highest risk of airborne transmission, TB is categorized under Class 5. There are no vaccines also for TB. Inpatient evaluation, the above risks have to be identified and proper precautions should be taken.[8,9]

Personal protection employs the barrier mechanism. Not only in the dental office, this is highly recommended in dental laboratory procedures. Use of Personal Protective Equipment like disposable gloves, over-gloves,mask, eye-wear, face-shield, protective coat, and overcoats are essential to prevent contamination through potentially harmful splashes, spray, spatter and aerosols during clinical procedures using rotary instruments and inlaboratory procedures using model trimmers and lathe.[10,11,12,13] Instruments have been classified into 3 types based on their exposure to risks of transmitting infection as described in the **Table I**.[14,15]

Table I. Classification of instruments based on their exposure to risks of transmitting infection

Type of instrument	Type of exposure	Example of instruments	Sterilization method
Critical	Used in invasive procedures which penetrate soft-tissue, bone, enter or contact blood or other sterile tissue	Scalpels, surgical burs, forceps, scalers,bone-chisel	Should be sterilized after every use by pressure, heat, chemical vapor
Semicritical	Do not penetrate soft tissue or bone. Contact mucosa Contact non-intact skin	Mirrors, reusable impression trays, amalgam condensers	Should be sterilized after each use if sterilization is not applicable,disinfection with high-level disinfectant should be done. (high-level disinfectant is labeled as "sterilant/disinfectant" as registered by the US Environment Protection Agency)
Non-critical	Come in contact with intact skin	External components of X-Ray heads, Sphygmomanometer cuffs, Pulse-oximeter	Requires intermittent or low-level disinfection after each use (such a disinfectant is called "hospital disinfectant" as registered by the US Environment Protection Agency. These are not labeled for tuberculocidal activity.)

Most prosthodontic equipment and instruments are semi-critical: Mechanical cleaning of the instruments using disinfectors, washers, ultrasonic cleaners, rust inhibitors should precede the sterilization process. Presoaking instruments should be done with enzymatic solutions and non-enzymatic solutions for removal of blood, proteins anddebris, respectively. Instruments can then packed and sterilized using pressure, dry heat and unsaturated chemical vapor.[16] There are chlorine-based compound and phenolic compounds which are used for surface disinfection and asepsis. These clean and disinfect contaminated surface; prevents surface contamination by use of surface covers or may do both.[17]

Infection Control: Prosthodontics perspective:

Disinfection of Laboratory: The general protocol for disinfection should also be followed in the laboratory. But, the risk status of an object is not always known. In that case, the object should be treated as high-risk. Isolation of the objects should be done and any instrument or device that comes in contact with them should be sterilized. Disinfectant should be carefully chosen such that metallic surfaces are intact and there are no dimensional changes of impressions/prostheses.[18,19] Instruments, attachments, rag wheels,etc. should be disinfected after every case.[20]

The instruments used frequently in the prosthodontic practice have been enlisted in **Table II**; metal framework and denture in **Table III**; Impression materials in **Table IV**; other materials in **Table V**along with their recommended method of sterilization and disinfection.[21]

Table II: Some commonly used instruments, and their sterilization and disinfection procedure

Instrument	Sterilization and disinfection procedure
Mouth mirror and face mirror	Dry heat; Ethylene oxide
Handpieces	Manufacturer's recommendation should be followed; Ethylene oxide; Moist heat
Carbon steel hand instruments	Dry heat; Ethylene dioxide
Stainless steel instruments, Tissue retraction pluggers	Dry and Moist heat;Chemical vapor; Ethylene oxide
Dampen dish	Moist heat;Ethylene oxide
3-way syringe	Dry and Moist heat;Chemical vapor; Ethylene oxide
Saliva ejectors and evacuators	Ethylene oxide
Impression trays, Aluminium trays, Metal trays, Resin trays	Moist heat, Chemical vapor, Ethylene oxide

Ethylene oxide is usually used at a concentration of 450-800mg/l. Moist heat sterilization is achieved by Autoclaving at 121°C for 15 to 20 minutes at 15 lb pressure/square inch.[21,22]

Table III: Sterilization and Disinfection of Metal framework and Denture[21,22]

Vitallium metal framework	**Immersed in Sodium hypochlorite and rinsed with water**
Denture	After rinsing the denture with running water and kept in an ultrasonic cleaner, the denture is immersed glutaraldehyde solution for 12 hours. Then again it is cleaned with running water, scrubbed in chlorhexidine followed by contact with chlorine dioxide for 3 minutes. Then sterilization is done with ethylene oxide.

Table IV: Sterilization and Disinfection of Impression Materials[6,21,22]

Impressions compound	Immersed in 2% Iodophor solution for 20 minutes
Zinc oxide eugenol	Immersed in 2% glutaraldehyde for 10 minutes
Alginate	Sodium hypochlorite spray-rinse-spray; then kept under damp gauze or in a sealed packet for 10 minutes Immersed 2% glutaraldehyde for 10 minutes
Agar	Spray with sodium hypochlorite, rinse, spray again and stand under damp gauze for 10 minutes
Polyether	Immersed in 2% glutaraldehyde at room temperature for 1 hour, then rinsed with sterile water for 45 seconds; Drying for 10 minutes
Polysulfide	Rinsed in normal water for 45 seconds, Immersed in 2% Glutaraldehyde solution for 30 minutes. Or Immersed in 5.25% sodium hypochlorite solution for 15 minutes Rinsed in normal water.
Addition silicon	Immersed in 2% glutaraldehyde for 1 hour, rinsed in sterile water
Condensation silicon	Immersed in 2% glutaraldehyde for 10 minutes, washed with sterile water

Table V: Sterilizationand Disinfection of some other materials

Wax bites, Occlusal rims, Bite registrations	Immersed in a 5.25%sodium hypochlorite solution and kept in a plasticbag for 10 minutes.[17]
Casts	Immersed in a 5.25% sodium hypochlorite solution and kept in a plastic bag for 10 minutes.[17]
Pumice	Antiseptic with Octenidine or Benzoic acid to conventional pumice is added; Pumice once used should be discarded after each use.[22]

Conclusion

For a good clinical practice, good quality instruments, efficient trained auxiliary personnel, skillful clinicians are a must. Infection control within the operatory and laboratory are the only way for a safe practice not only from dental health care personnel's point of view, but also patient's. There are no other substitutes for maintaining the disinfection and sterilization protocol in the dental office before, during and after any procedure and every assistant, technician, the attendant should be trained by the clinician for abiding by the protocol.

Conflict of Interests: None

Ethical Permission: Approved

Funding: Nil

References

1. Cdc.gov. 2020. Introduction disinfection & Sterilization Guidelines at: <https://www.cdc.gov/infectioncontrol/guidelines/disinfection/introduction.html> [Accessed 16 April 2020].
2. Jisa Ann Alex, et al. Infection Control in Prosthodontics Indian J Dent Adv 2016; 8(1): 41-45
3. Gyorfi A, Fazekas A. Significance of infection control in dentistry: a review Fogorvosi Szemle 2007; 100(4): 141–152
4. Ling ML, Ching P, Widitaputra A, Stewart A, Sirijindadirat N. APSIC guidelines for disinfection and sterilization of instruments in health care facilities. Antimicrobial Res Infect Cont 2018; 7(1): 25
5. Chidambaranathan AS, Balasubramanium M. Comprehensive review and comparison of the disinfection techniques currently available in the literature. J Prosthodont. 2019;28:e849–e856
6. Alapatt JG, Varghese NM, Joy PT, Saheer MK, Correya BA. Infection Control In Dental Office: A Review. JDental Medical Sci2016 Feb;15(2):10-15.
7. Alex JA, Sudhir N, Taruna M, Reddy R, Infection Control in Dentistry; Dental Clinics of North America 1996; 40(2):114-8.
8. Brandt RM, Cofey JP. Infection Control in a Prosthodontic residency program. J Prosthodont 1993; 2:55-7.
9. Wood PR. Cross infection control in dentistry a practical illustrated guide. 2005
10. Dental laboratory relationship working Group OSAP Position paper. Laboratory Asepsis: November 1998
11. Giblin J, Podesta R, White J. Dimensional stability of impression material immersed in an iodophor disinfectant. Int J Prosthodont 1990;3:72-7.
12. USAF Guidelines for Infection Control in Dentistry, September 2004. Available from: http://www.brooks.af.mil/dis/infcontrol.htm.
13. CDC, guidelines for disinfection & sterilization in health care facilities 2008
14. Lakshya Rani et al. Sterilization Protocols in Dentistry–A Review J. Pharm. Sci. & Res. 2016; 8(6) : 558-564
15. Siddharth Phull, Arvind Arora, Yashendra. Sterilization and Disinfection In Prosthodontics. Ind J Dent Sci 2014; 6(4):112-6.
16. Neeraj Rampal, Salil Pawah, Pankaj Kaushik. infection control in Prosthodontics. J Oral Health Comm Dent 2010; 4(1):7-11
17. Infection control recommendations for the dental and the dental laboratory. ADA Council on Scientific Affairs and ADA Council on Dental Practice. J Am Dent Assoc. 1996 May;127(5):672-680.
18. Cottone JA, Terezhalmy GT, Molinari JA. Practical Infection Control in Dentistry. 2nd edition. USA. 1996; Williams & Wilkins
19. Sammy KC, Benjamin SN. Infection Control Mechanisms Employed by Dental Laboratories to Prevent Infection of their Dental Technicians/ Technologists. J Oral Health Craniofac Sci. 2016;1:1-11.
20. Naveen BH, Kashinath KR, Jagdeesh KN, Mandokar RB. Infection Control In Prosthodontics. Journal of Dental Sciences and Research. 2011 Feb;2(1):93-107.
21. KS Sumanth et al. Infection Control Protocol In Prosthodontics – A Review International J Scien Res 2019; 8 (3): 75-78.