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Infection Control In Prosthodontics

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SUPERVISOR CERTIFICATION

I certify that this project entitled **“infection Control in Prosthodontics** " was prepared by the fifth-year student **Fatima Saad Kadhim** under my supervision at the College of Dentistry/University of Baghdad in partial fulfilment of the graduation requirements for the Bachelor Degree in Dentistry.

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DEDICATION

I dedicate this project to the ones who have always been there for me and gave me love and Inspiration along my studying career.

To my loving parents for their endless guidance and support.

To my all supportive friends specially, **Zainab, Tabark, Meena and Zahraa**; who have been my source of inspiration and gave me strength when I thought of giving up, I will always appreciate all what they've done for me.

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LIST OF ABBREVIATIONS

Abbreviations	Word
LB	Abbreviation For Pound
C	Celsius
DCNA	Dental Clinics Of North America
F	Fahrenheit
HBV	Hepatitis B Virus
HCV	Hepatitis C Virus
HDV	Hepatitis D Virus
HR	Hour
HIV	Human Immunodeficiency Virus
ID	Instrument Disinfectant
L	Liter
MG	Milli-Gram
MINS	Minutes
TB	Tuberculosis
ZOE	Zinc Oxide Eugenol

INTRODUCTION

Dentistry is a field that involves the clinician and the patient being exposed to saliva and other infectious material. Prosthodontic patients are generally a high-risk group relative to their potential to transmit infectious diseases as well as acquire them. Therefore recently, an increase in the awareness of the need for cross-infection control measures to protect against possible routes of transmission has been discussed. In a country like India, high on disease incidence and sterilization protocol need to be implemented on the highest priority. The prosthodontists are at an added risk of transmission because of the infection spreading through the contaminated lab equipment while working in the lab. Therefore, infection control is an important concept in the present-day dentistry which has be followed in the clinics as well as in the laboratory. This article gives an overview of the possible risk of disease transmission and the ways to control them through effective sterilization and disinfection protocols. Transmission of diseases: Micro-organisms capable of causing disease are present in human blood. Contact with blood or saliva mixed with blood may transmit pathogenic microorganisms **(Bhat, Shetty et al., 2007)**.

The pathogens may be transmitted among the patient, dentist, dental care worker and the lab technician. Disease transfer to the dentist and dental staff during dental care is considered an "occupational exposure" to a given pathogen on the other side the disease may also be transmitted from the dentist to the patient as well as from one patient to the other, The disease transfer from one patient to another in the dental clinics is considered as "cross infection" **(Anil Kohli, et al., 2007)** .

All healthcare professionals have a moral obligation to follow infection control concepts and procedures. The same is true of dentistry. Because oral commensals and opportunistic pathogens may be present in patient saliva, infection prevention is crucial in dentistry. Moreover, it can harbour particular infections both during the carrier stage and the infection, including SARS CoV-2. Exposure to blood and saliva aerosols is unavoidable because of the nature of dental treatments. Direct contact with environmental surfaces, tools, and equipment that have been polluted by fluids also has the potential to transmit pathogens. The danger of infection transmission in a dental office extends to the patients, the dentist, the dental assistant, the administrative and processing employees, and the personnel who handle the instruments. **(K Tomer et al., 2023)**

Aim of the review

The aim of the present review was to:

1. understand the infection control definition, mechanism and effect.
2. the importance in the treatment of prosthodontics approach.
3. find the proper most accurate way to protect the patient and dentist from infections.

Chapter One

REVIEW OF LITERATURE

1.1 Infection control

There are some procedures in infection control which are to be followed strictly to prevent any cross contamination. The main emphasis should not be only on patient protection but also on protection of the dental team.

The procedures involve (Kohn and William G et al., 2003):

1. Patient screening.
2. Personal hygiene.
3. Personal protection.
4. Instrument processing.
5. Surface asepsis.
6. Patient treatment.
7. Laboratory disinfection.

1.1.1 Patient screening

Patient history – past and present

Generally the history of a patient is taken just before examination. During the present pandemic the urgency of dental treatment should be determined before booking the patient. Before the appointment, a general history should be taken telephonically, via e-mails or other internet-based systems . A COVID-19 screening questionnaire

including symptoms, contacts and travel history should be taken. If it provides any indication of presence or possible presence of SARS-CoV-2 and the patient requires urgent treatment, extra infection control measures should be taken. During the peak epidemic period, non-emergency procedures should be postponed. If an appointment is made, the patient should be requested to come alone and wear a mask. If a patient requires assistance, only one person should be allowed while also wearing a mask and with a completed COVID-19 questionnaire. **(C.M.C. Volgenant and I.F. Persoon et al., 2020)**

1.1.2 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 and eye protecting glasses and long-sleeved clinical coats **(Phull S. and Arora A et al., 2014)**

1.1.3 Personal protection

Residents are required to have current immunizations against communicable diseases including hepatitis B , The vaccination program must certainly be considered the most effective cross infection control measure to protect dental personnel and in turn their patients from a potentially fatal disease. **(Hong Y. S et al., 2017).**

personnel should wear appropriate protective barrier such as eye wear or chin length face shields, disposable gloves, disposable masks , Infection Control in Prosthodontics Jisa Ann Alex, et, al. jisa protective garments, and other needed items when performing procedures capable of causing splash or spatter of blood or other potentially infectious materials **(Jisa Ann et al., 2016)**

Disposable gloves are single-patient-use items. The type of the gloves is chosen based on the procedure being performed. Latex exam gloves are adequate for most dental procedures unless a sterile field requires the use of sterile gloves **(Kramer A and Assadian, 2016)**

The use of powder free gloves will minimize the risk of and alleviate the symptoms of latex allergy. If the dental care provider, dental staff, or patient is allergic to latex, alternatives such as neoprene or nitrile gloves must be used. Utility gloves that are chemical and puncture resistant must be used when handling contaminated instruments, when performing operatory clean up, and for other contact with contaminated surfaces or disinfectant chemicals. Masks are worn in the patient treatment area. And when the dentist is manipulating the prostheses in the laboratory. The masks used should have at least 95% filtration rate of particles 3 to 5 microns in diameter (fig 1) . Dental care providers and dental staff must wear protective eye wear which must be optically clear, antifog, distortion free, close fitting and Shielded at the sides. The level of protection from protective garments like long sleeves, closed neck, garment length, etc. is determined by the procedure that is being performed. Generally, cotton/polyester type fabric garments are also acceptable**. (Lawrence et al., 2018)**

Mask Type	Standards	Filtration Effectiveness		
Single-Use Face Mask 	China: YY/T0969	3.0 Microns: ≥95% 0.1 Microns: ✗		
Surgical Mask 	China: YY 0469	3.0 Microns: ≥95% 0.1 Microns: ≥30%		
	USA: ASTM F2100	Level 1	Level 2	Level 3
		3.0 Microns: ≥95% 0.1 Microns: ≥95%	3.0 Microns: ≥98% 0.1 Microns: ≥98%	3.0 Microns: ≥98% 0.1 Microns: ≥98%
	Europe: EN 14683	Type I	Type II	Type IIR
		3.0 Microns: ≥95% 0.1 Microns: ✗	3.0 Microns: ≥98% 0.1 Microns: ✗	3.0 Microns: ≥98% 0.1 Microns: ✗
Respirator Mask 	USA: NIOSH (42 CFR 84) China: GB2626	N95 / KN95	N99 / KN99	N100 / KN100
		0.3 Microns: ≥95%	0.3 Microns ≥99%	0.3 Microns ≥99.97%
	Europe: EN 149:2001	FFP1	FFP2	FFP3
		0.3 Microns: ≥80%	0.3 Microns: ≥94%	0.3 Microns: 99%

3.0 Microns: Bacteria Filtration Efficiency standard (BFE).

0.1 Microns: Particle Filtration Efficiency standard (PFE).

0.3 Microns: Used to represent the most-penetrating particle size (MPPS), which is the most difficult size particle to capture.

✗: No requirements.

Fig (1-1) :- Comparison of Mask Ratings, Standards, and Filtration Effectiveness (Paddy Robertson et al., 2022)

Role of saliva in the COVID-19 transmission

Saliva is an important source of transmission due to aerosols created through natural activities such as breathing, sneezing and coughing, posing potential danger to healthy uninfected individuals as well as healthcare workers in medical facilities.

However, dental personnel who work in close proximity to the oral cavity are at a greater risk due to the extensive aerosols created during dental treatment particularly during the use of high speed drills, ultrasonic scalers and air/water syringes. SARS-CoV-2 virus has been detected in saliva samples of 87–100% of clinical patients **(L. Azzi et al., 2020)**

Infection control During the Pandemic

Once the authorities allowed dental practices to reopen after the onset of the pandemic in 2020, and after it was more understood that COVID-19 is spread more readily by airborne transmissions than contact with hard surfaces, infection control practices ramped up in the following ways **(Alsaegh A et al., 2021)**:

a) **Patient screening**: Dental practices began screening patients for COVID-19 exposure and/or symptoms prior to their arrival at the office. Patients who disclosed exposures or symptoms were told to reschedule. These practices continue today in most dental offices.
b) **Employee screening**: In addition, dental practices started to require team members to self-screen for COVID-19 exposures and/or symptoms and to stay home if there are any. Some offices also began to inquire as to the vaccination status of their employees, which, although it is not a Health Insurance Portability and Accountability Act violation, it is a sensitive topic for some.
c) **Waiting room practices**: Dental practices began posting information about hand hygiene and cough etiquette in waiting rooms. Moreover, patients were told to call upon their arrival and stay outside offices until it was time for their appointments, which begs the question about the effectiveness of hygiene alerts posted in waiting rooms.
d) **Operatory setup and maintenance**:It became more common for dental team members to remove instruments from their packaging in front of patients

rather than before their arrival. Not only does this limit exposure of these instruments to aerosols in the office but it also assures patients, who are understandably nervous about possible exposures to germs, that such instruments have been sterilized before their use.

1.1.4 Instrument processing includes

1.1.4.1 Presoaking , cleaning solutions and sterilization

Enzymatic solutions:- Removes blood and other proteinaceous material,

Non-enzymatic solustions:- Removes non-specific debris solutions

Mechanical cleaners;- Washers/disinfectors or ultrasonic **cleaners Rust inhibitors** Retards corrosion of carbon steel.

Sterilizers Steam autoclave:- Uses steam under pressure to sterilize 250F to 273F (time varies depending on size of load and autoclave), good penetration of heat into packages causes corrosion, requires drying time**.**

Oven types dry heat:- Uses dry heat at 320F for 1-2 sterilizer hr., no corrosion.

Rapid heat transfer:- Uses circulated dry heat 375F, dry heat for 6-20 mins.

Chemivave Sterilizer:- Unsaturated Uses unsaturated chemical, chemical vapor from formaldehyde and sterilizer alcohol 273F for 20 mins. **(Alex and Jisa Ann et al., 2016)**

1.1.5 Surface asepsis

There are two general approaches to surface asepsis ((**Neeeraj Rampal, Salil Pawah, et al., 2010) :**

A. Clean and disinfect contaminated surface.

B. Prevent surface from becoming contaminated. by use of surface covers.

Or A combination of BOTH, There are Chemical solutions that can be used in surface asepsis like Chlorine e.g., sodium hypochlorite, Phenolic compounds e.g., Water based - water with ortho- phenyl, phenol or tertiary, amylphenol or O benzylp-chlorophenol. Alcohol based e.g., Ethyl or iso propyl alcohol with O phenyl phenol or tertiary, amylphenol. Iodophor e.g., butoxypoly propoxy polyethoxy ethanol iodine complex.

1.1.6 Patient treatment

The responsibility for infection control procedures during patient treatment rests primarily on the dentist's ability to adhere to strict sterilization, disinfection, and barrier techniques. The use of strict system of zoning in the clinic will reduce the number of areas contaminated and there by maintain asepsis. The working area is sprayed and left for 10 mins before any procedure starts along with the wiping of the operatory and chair with a disinfectant solution. The chair is covered with a disposable plastic sheath which has to be removed subsequent to the treatment. All the patients are advised to rinse with chlorhexidine gluconate 0.12% and wear protective eye wear before the commencement of the treatment **(Alex et al., 2016)**

The operator should wash the hands with antimicrobial cleanser before gloving and should only touch the patient and the disinfected area once gloved. 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 **(Siddharth Phull, Arvind Arora et al., 2014)**.

All items leaving the clinic that are used in direct patient care or touched during patient care procedures that cannot be subjected to sterilization procedures are disinfected or placed in the phenol disinfection solution within a sealed plastic bag before departure. New latex gloves are worn for the disinfections procedure **(Villani FA et al., 2020).**

1.1.6.1 Classification of dental clinics of north america (DCNA) of the level of the risks per prevention

DCNA has classified the level of risks as per the prevention **(Wood PR. et al., 2005) :**

Class 1: Diseases like Mumps, Measles, Rubella, Fungal infection, etc., because their vaccine is available, the risk is minimal.

Class 2: Candidiasis, *Staphylococcus aureus*, and Streptococcus GroupA, etc.

Class 3: Herpes simplex, Cytomegalovirus, EBV and Varicella virus.

Class 4: HIV, HBV, HCV, HDV because there are no vaccines except for HBV and all the universal precautions should be taken as the diseases are fatal.

Class 5: Tuberculosis TB due to the highest risk of airborne transmission.no vaccines also for TB.

Standard Precautions are the minimum infection prevention practices that apply to all patient care, regardless of suspected or confirmed infection status of the patient, in any setting where health care is delivered Standard Precautions include sterilization of insruments that are concedered to be risk of transmitting infection (Table 1) and especially the commonly used instruments (Table 2)

Table 1-1: Classification of instruments based on their exposure to risks of transmitting infection **(Lakshya Rani et al, 2016), (Siddharth Phull, Arvind Arora, Yashendra, 2014):**

Type of instrument	Type of exposure	Example Ofinstruments	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
Semi-critical	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.)

Table 2-1: commonly used instruments, and their sterilization and disinfection procedure. **(KS Sumanth et al., 2019)**

Instrument	Sterilization and dis infection procedure
Mouth mirror and face mirror	Dry heat; Ethylene oxide
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
Handpieces	Manufacturer's recommendation should be followed; Ethylene oxide; Moist heat

- 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 (Naveen BH, Kashinath KR, et al, 2011).

1.1.7 Disinfection procedures

1.1.7.1 Disinfection of impressions:

American Dental Association (ADA) guidelines state that impressions should be rinsed to remove saliva, blood and debris and then disinfected before being sent to the laboratory. When considering methods of disinfection for impressions, two factors are important:

1) The effect of the treatment on the dimensional stability and surface detail of the impression

2) The deactivating effect of the impression material on the disinfecting solution, which could reduce the efficacy of the process **(Al Mortadi N and Al-Khatib et al., 2019)**. Polyvinylsiloxane, polysulfide, impression compound, and Zinc oxide eugenol (ZOE) impression materials are thoroughly rinsed under water and immersed in a 5.25% sodium hypochlorite solution for 10 minutes (9-12). Alginate and polyether impressions are rinsed under water, sprayed with a 5.25% sodium hypochlorite solution, and sealed in a plastic bag for at least 10 minutes. 2% glutaraldehyde did not affect the accuracy and dimensional stability of polyether and polyvinyl siloxane impression materials after immersion for 30 or 60 minutes **(Ismail HA et al., 2017).** Twenty-minute immersion in 2% ID 210 solution (Durr Dental, Bissingen, Germany) has no adverse effects on the dimensional stability or surface detail reproduction of rigid material such as an impression compound, impression plaster, and zinc oxide-eugenol impression material **(Amin WM et al., 2019)**

An understanding of the methods and mechanics of sterilization and disinfection is necessary to prevent bacterial cross-contamination like Disinfection of impression materials **(Table 3)** and some other materails **(Table 4)**

Table 3-1: Sterilization and Disinfection of impression material **(Alapatt JG and Varghese NM et al., 2016):**

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
Agar	Immersed 2% glutaraldehyde for 10 minutes
Polyether	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	silicon Immersed in 2% glutaraldehyde for 10 minutes, washed with sterile water

Table 4-1: Sterilization and Disinfection of some other materials **(KS Sumanth et al., 2019)**:

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

1.1.7.2 Impression trays

There are several types of impression tray , here is the sterilization of each one of them **(Jaypee Brothers et al., 2015):**

- **a.** Aluminum:- Heat sterilize via autoclave, chemical vapor or dry heat; ethylene oxide sterilization.
- **b.** Chrome-plated:- Heat sterilize via autoclave, chemical vapor or dry heat; ethylene oxide sterilization.
- **c.** Custom acrylic resin:- Discard after intraoral use in a patient; disinfect with tuberculocidal hospital disinfectant for reuse during the same patient's next visit.
- **d.** Plastic:- should be discarded.
- **e.** Disinfection of wax bites/ rims, bite registrations:- Wax, ZOE, and resin centric relation records are rinsed under water and sprayed with a 5.25% sodium hypochlorite solution and placed in a plastic bag for 10 minutes

1.1.7.3 Disinfection of casts

Stone casts are the most difficult item to be disinfected without causing any much damage. Casts requiring disinfection are sprayed with a 5.25% sodium hypochlorite solution and allowed to sit for at least 10 minutes**(alex and Jisa Ann et al., 2016)**

1.1.7.4 Disinfection of dental prostheses

Complete dentures and provisional restorations that leave the operatory are immersed in a 5.25%2 sodium hypochlorite solution for 10 minutes. Removable partial dentures with metal bases are sprayed with 2% gluteraldehyde solution and held Infection Control in Prosthodontics Jisa Ann Alex, et, al. in a plastic bag for 10 minutes **(alex and Jisa Ann et al., 2016)**

1.1.7.5 Laboratory disinfection

The dental laboratory becomes the second line of infection control barriers that protect the patients, residents, assistants, and faculty. All prostheses that enter and leave the laboratory are disinfected. All prostheses entering the laboratory are scrubbed with disinfectant solution. Those leaving the laboratory are immersed in a 5.25% sodium hypochlorite solution for a minimum of 10 minutes. Laboratory countertops are cleaned and wiped with disinfectant solution at the end of each day. Individually packaged chemicalized laboratory burs are available in the laboratory. After the desired procedure is accomplished, the laboratory bur is cleaned and placed in a new bag for sterilization. The burs are used for one patient only and then re

sterilized. For polishing the lathe, when the technician should use individually packaged sterile polishing wheels, designated for use with pumice. The addition of an antiseptic product that contained Octenidine as active agent to conventional pumice reduced the number of microorganisms by 99.999%. The mix of steribim with water reduced the number of bacteria by 99%. The wheel is wet with water to soften it before use **(Hussain SM et al., 2016).**

If prosthesis becomes contaminated during laboratory procedures, it is disinfected, and the laboratory procedure continued. Final polish is accomplished using a sterile wheel with non-contaminated Acryluster. The Acryluster is applied to the sterile wheel once before polishing to eliminate cross-contamination. Cleanup involves disposal of the plastic container and the contaminated pumice. Wheels are removed, rinsed under water, and bagged for autoclaving. Before returning to the main clinic, all items arc disinfected by immersion or spray and placed in a Lock-Tight bag. All information regarding disinfection procedures performed on Prosthodontic items sent to an outside laboratory is clearly written on the prescription form and the plastic bag. All items received from a laboratory are treated as contaminated unless the resident is informed otherwise by the dental laboratory **(Neeeraj Rampal et Al., 2010).**

Chapter Two

CONCLUSION

1. The increased awareness of the dangers of cross contamination with hepatitis B virus (HBV) and HIV during dental procedures is having a growing impact on attitudes toward infection control in the dental clinic and laboratory.
2. Lack of Infection Control is life-threatening for both the patient and the Dental Professional and requires more efforts.
3. Formal programs in Infection Control and Safety must be developed and strictly followed by the entire dental health care professional.
4. 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.
5. For a good clinical practice, good quality instruments, efficient trained auxiliary personnel, skillful clinicians are a must.
6. 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.
7. 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.

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