

CROSS INFECTION CONTROL IN DENTISTRY

Dr. Debabrata Biswas*, Dr. Saurav Banerjee**, Dr. Rima Biswas***

ABSTRACT

Infection control is as senile as illness control in healthcare settings. Dentistry presents a high risk due to the risk of disease transmission in dental clinics and laboratories. This literature enlightens us with an overview of the procedures to follow at the clinic and laboratory in order to prevent cross contamination.

KEY WORDS

Covid 19, PPI kit, masks, gloves, face shield, goggles, aerosol, sterilization, transmission.

ABOUT THE AUTHORS

*Associate Professor, Dept. of Prosthodontics, Burdwan Dental College & Hospital, W.B.

**Assistant Professor, Dept. of Prosthodontics, Burdwan Dental College & Hospital, W.B.

***Intern, Kalinga Institute of Dental Sciences, Odisha

CORRESPONDING AUTHOR

Dr. Debabrata Biswas

Associate Professor

Dept. of Prosthodontics, Burdwan Dental College & Hospital, W.B.

INTRODUCTION

Dental patients are high risk patients with the potential for transmission and infection as well due to exposure of various microorganisms present in the blood and saliva mostly.¹ There is also concern about cross contamination and diseases transmission from one patient to the next. These microorganisms are capable of creating infectious diseases from common cold to AIDS. This article guides us about the precautionary measures to safeguard dentist, his assistant, laboratory technician along with the patients.²

PATH OF TRANSMISSION:

DIRECT CONTACT :

Any breach or cut in the skin, how smaller it may be, can be large enough for micro-organisms to enter the blood stream and other body tissues.³

If this type of breach comes in contact with the body fluid from a similar breach in the skin of an infected person, the micro-organisms can pass from the infected person to uninfected one. So, wearing of gloves is necessary.⁴

INDIRECT CONTACT:

This requires a vector, i.e. a vehicle acting as a carrier between two parties.⁵

Ex.: needle stick injury.

AEROSOL EFFECT : When air is released from a pressurized can, a fine spray of tiny droplets is formed.⁶ Being so fine these droplets remain suspended in the air for a long time. This is called the aerosol effect.

In dentistry bacteria can be aerosolized when using an air rotor, 3-way syringe etc.⁷

Protections:

1. High speed suction.
2. Pre-operative mouthwashes.
3. Wearing of mask.

CIRCLE OF INFECTION.

Circle of cross contamination is demonstrated in fig:1

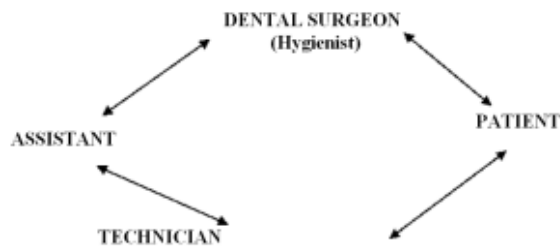


Fig: 1 [8]

Unless this circle is broken cross-contamination will continue.

CIRCLE OF INFECTION:

Should we apply the same cross-infection control procedures for all patients?

The answer is always YES. Although we take medical history for every patient, not every patient is willing or able to tell us their full medical history, particularly if they are carrying a disease which has yet to fully incubate.^{9,10}

For this reason we must apply same cross-infection control protocol procedures for all patients.¹¹

DISEASE	AGENT	ROUTE	INCUBATION PERIOD	POTENTIAL COMPLICATIONS
COVID 19	Retrovirus	Aerosol, Droplets	1-14 days	Severe Respiratory distress, Death
AIDS	Retrovirus	Blood, Sexual Contact, Saliva	Upto 8 Yrs.	Death
HEPATITIS A	Virus	Open wound	2-7 wks.	Disability.
HEPATITIS B	Virus	Blood, Saliva Airborne Respiratory droplets.	11/2-5 Month.	Disability, Death
NON-A NON-B	Virus	-Same-	-Same-	-Same-
HEPATITIS D	Virus	-Same-	-Same-	-Same-
CANDIDA	Fungus	Saliva	48-72 hrs.	Oesophagitis
HERPETIC CONJUNCTIVITIS	Virus	Blood, Saliva airborne respiratory Droplets.	6-10 Wks.	Potential blindness
HERPES SIMPLEX II	Virus	Blood, Saliva, Sexual Contact.	up to 2Wks.	Painful lesions
HERPETIC WIHTLOW	Virus	Blood, Saliva, airborne resp. Droplets.	2-12days	Painful disability
STAPHYLOCCAL Bacteria STREPTOCOCCAL INF.		Blood, Saliva	<10days.	Skin lesions, Rh. Heart diseases.

DISEASE SPREAD PROCESSES.

1. PATIENT TO DOCTOR.
2. DOCTOR TO PATIENT.
3. PATIENT TO PATIENT
4. HOSPITAL/CLINIC TO COMMUNITY.
5. HOSPITAL/CLINIC TO DOCTOR'S FAMILY.
6. COMMUNITY TO PATIENT.

PATIENT TO DOCTOR

MICROBIAL SOURCES	MODES OF DISEASE TRANSMISSION	MECHANISM OF ENTRY	PREVENTIVE METHODS
1. PATIENTS ORAL	Direct contact	Breaks in the skin	Routine wearing of gloves, proper hand washing rinsing and drying, contain immunizations
	Droplets and/or	Inhalation	Wearing masks, using rubber Dams, preoperative mouth rinsing, high volume evacuation, minimal use of three ways syringe.
		Breaks in the skin	-Same as in case of direct contact
	Indirect contact	Cuts, Punctures or	Safer handling of contaminated sharp instruments.
		Breaks in the skin.	Use of heavy duty gloves during cleaning. Certain immunizations.
2. PATIENTS SKIN LESION	Direct contact	Breaks in the skin	Wearing of gloves.

DOCTOR TO PATIENT.

1. DOCTOR'S HAND	Direct contact	Mucous membrane of patient.	Routine wearing of glove. Certain immunizations.
	Indirect contact	Bleeding onto items Used on patients.	Routine wearing of gloves, proper hand washing, rinsing and drying, instrument sterilization, proper surface disinfection, certain immunizations.
^CAVITY	Droplets and/or aerosols	Inhalation	Wearing masks, using face shields/s patter guard.
		Mucous membrane Of the Patient.	-Same -

UNIVERSAL PRECAUTIONS

According to US occupational safety and Health Administration (OSHA) the dentist should learn the following which includes^{12,13}:

Determinations if there is a problem	The major routes of cross-infection should be known and adequate preventive methods should be there.
Engineering Controls	Engineering Controls

Cleaning, Disinfection and Sterilization

Cleaning prior to disinfection or a sterilization is must.¹⁴

Cleaning means renewal of gross surface deposits such as blood, saliva and vomitus. To be done - Brush By - Ultrasonic Cleaner.

Disinfection: A Surface is said to be disinfected when most but not necessarily all of the microorganism on its surface have been destroyed.¹⁵

Sterilization: The process of completely eliminating microbial viability.¹⁶

Work Practice: Work practice controls are methods that reduce the likelihood of exposure by altering the manner in which the work is performed. An example is cleaning of instruments before sterilization.¹⁷

Personal protective equipment (PPE): PPE includes gloves, gowns, shoe covers, head cap, mask, respirators, eye protection, face shield and goggles.¹⁸

HOSPITAL/CLINIC TO COMMUNITY

MICROBIAL SOURCES	MODES OF DISEASE	MECHANISM OF	PREVENTIVE METHODS
PATIENTS ORAL CAVITY	Indirect Contact	Exposure of individuals outside The hospital (ex. Dental lab or waste Handlers).	Proper handling of infections Wastes. Correct disinfection of impressions prosthesis.

TRANSMISSION ENTRY

UNIVERSAL PRECAUTIONS.

US Occupational safety and Health Administration (OSHA) has developed a four step process. Employing these processes could minimize exposure.^{19,20}

1. Determination if there is a problem.
2. Engineering controls.
3. Work Practices.
4. Personal Protective equipments (PPE)

Five reliable ways of rendering something sterile:

Steam under pressure in an autoclaves.

Options	Minimum Temperature (°C)	Minimum holding time (min)
A	134	3
B	126	10
C	121	15
D	115	30

1. Chemiclave : Unsaturated chemical vapour other than water in an autoclave. (ex alcohol & formaldehyde at 132°C)[21]
2. Ethylene Oxide / Formaldehyde gas.
3. Dry heat: This method has the lowest cost but the longest cycle time.

Temp (°C)	Time (mins)
160	120
170	60
180	30

Glass-bead sterilizer is a Specialized variation of this type.²²

1. Using a chemical sterilant recognized as effective. Ex: glutaraldehyde.

In the USA the Environmental Protection Agency maintains a list of recognized disinfectant / sterilant chemical germicides.¹¹

CHEMICAL USED FOR STERILIZATION AND DISINFECTION IN DENTISTRY.

1. GLUTARALDEHYDE SOLUTION:

Can be used for both sterilization and disinfection.

2. IODOPHOR SOLUTION.

3. QUATERNARY AMMONIUM COMPOUNDS (QUATS):

Ex - Benzalkonium Chloride,
Dibenzalkonium Chloride,
Cetylpyridinium Chloride etc.

4. PHENOL:

Ex.-Cresols,
Biphenols,
Resorcinols.

5. ALCOHOLS:

Ex - Ethyl alcohol,
Isopropyl alcohol.

6 ALCOHOLS MIXED WITH CHLORHEXIDINE GLUCONATE.

7. OXIDISERS:

Ex.- Hydrogen peroxide Zinc peroxide
Sodium perborate
Potassium
Permanganate.

8. SODIUM HYPOCHLORITE.

PRECAUTIONS IN DENTAL LABORATORY:

Though often separated from each other by a great distance the sterility and disinfection chain must not be broken at any point.²³

The dental surgeon and the technician must discuss the problem and decide on a united approach.²⁴

SURGERY PROCEDURES:

Any laboratory work that has been in the patients mouth, be it denture, bridge, inlay or crown or tiny in stages of the same, must be;

- a) Decontaminated and cleaned of all gross debris, blood, saliva by washing under running water.
- b) Disinfected; either by 2% glutaraldehyde solution or by household bleach diluted 1:10 for a period of 10 mins.^{25,26}

c) Sealed in a plastic bag.

These procedures should be carried out wearing clean gloves.

DENTAL LABORATORY PROCEDURES.

Washing -Disinfected Household bleach Iodophor Solution.

a) All incoming work must be assumed to be contaminated.

b) Appliances that do not contain metal should be scrubbed with detergent to remove debris and then soaked in dilute hypochlorite solution for 10 mins before they are worked on. If the prosthesis is of chrome - cobalt or stainless steel it can be scrubbed with detergent and left to soak in chlorhexidine digluconate or undiluted iodophor.²⁷

c) Impression: If the tray are not disposable they must be placed in high level disinfectant and allowed to soak for a period recommended by the manufacturer.

It is then ultrasonically cleaned and autoclaved or at least re-disinfected, dried and sealed for return to the practice.^{28,29}

- Impressions compound, Zinc oxide eugenol : Immersed in 2% ID 210 solution for 20 minutes, immersed for 10 minutes in 2% glutaraldehyde.

- Irreversible hydrocolloid : Spray with sodium hypochlorite, rinse, spray again and stand under damp gauze or in sealed bag for 10 minutes. Immersed in 2% glutaraldehyde for 10 minutes

- Reversible hydrocolloid : Spray with sodium hypochlorite, rinse, spray again and stand under damp gauze for 10 minutes³⁰

- Polysulphide : Rinsed for 45 seconds with water and immerse for 30 minutes in 2% glutaraldehyde. Immersed for 15 minutes in 5.25% sodium hypochlorite solution and rinsed in water.

- Addition reaction silicone materials: Immersed in 2% glutaraldehyde for 1 hour, rinse in sterile water

- Condensation reaction silicone materials: Immersed in 2% glutaraldehyde for 10 minutes and washed with sterile water

- Polyether : Immersed in 2% glutaraldehyde for 1 hour at room temperature, rinsed with sterile water for 45 seconds and dried for 10 minutes³¹

d) All packaging materials should be disposed of and on no account should be reused.

There is an evidence of transmission of hepatitis due to reuse of packaging material (box used to send the work).³²

e) Pumice Slurry also produces cross-infection hazards in dental laboratory. Aerosol formation via lathes poses a hazard for lungs and eyes. Contact

between operators uncovered hand and slurry is also an obvious crosscontamination risk.³³

The bacterial count of pumice slurry before and after disinfection.

Before disinfection the count = 107 - 108 cfu/g

After disinfection = 103 cfu/g

(with sodium hypochlorite)

it comes down to

In order to reduce the potential hazard of aerosol and splatter particles from lathe, high velocity evacuation is essential. The dental lathe should be positioned so that their splatter is directed towards wall. Plastic shield can also be used.³⁴

Safely glasses is also essential during using lathe.³⁵

Before polishing any contaminated prosthesis, it should be soaked in 3% hexa chorophene or 5% sodium hypochlorite or 2% glutaraldehyde for disinfection.

(f) Now the microorganisms which are generally transmitted to dental laboratories are :

Enterobacter cloacae,

Klebsiella oxytoca,

Pseudomonas aregenosa,

Gr A Streptococcus,

Staphylococcus aureus,

Mycobacterium tuberculosis,

Chlamydia, Mycoplasma.

Transfer of virus are generally less.³⁶

Surface roughness is also a factor in transmitting microorganisms.³⁷

Yeast and smaller bacteria are found in higher number in rough surfaces, Silicone impressions have also been found to lodge large number of Candida albicans.³⁸

DISCUSSION

The potential for cross - contamination in dental practice demands that more attention be given to the routes of transmission. Measures capable of preventing such transmission of potentially fatal disease must be in routine use.³⁹

Personal protection can be achieved by a combination of immunization procedures and protective clothing .

So, clinician and the laboratory staffs, should collaborate to control potential contamination hazards to give a better tomorrow to the patients and for themselves also.⁴⁰

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