

Infection Control Practices

in a Dental Laboratory

By Dr Brenda Baker, Southern Cross Dental



Dr Brenda Baker

Background

An understanding of the potentially infectious nature of all blood and body substances is critical for the implementation of infection control practices and policy. Australian infection control guidelines have been founded on the model developed by the United States Centres for Disease Control and Prevention with respect to standard and transmission-based precautions (1).

Standard precautions certify a high level of protection against transmission of blood-borne pathogens (BBP) within a health care setting and are the minimal level of infection control needed in the treatment and care of all patients to prevent transmission of any blood-borne infections such as HIV, HBV and HCV (2).

This is relevant not only in the dental surgery but also in the dental laboratory environment where the potential for disease transmission is well known and can be prevented. Standard precautions reduce the risk for infectious disease (3).

Transportation of potential pathogens to a laboratory can occur via soiled impressions and dental prostheses/appliances. Microorganisms can be transferred from contaminated impressions to dental casts. Oral bacteria can remain active in set gypsum for up to 7 days.

Goals

Dental laboratories must be aware of infection control guidelines and statutory obligations. Both dentist and laboratory should establish and implement written infection control protocols for incoming and outgoing cases and adhere to Standard Precautions all the time. The potential for cross infection from the clinic to the laboratory should be reduced by using local disinfection procedures (4).

The possibility of disease transmission should be reduced by establishing safe working conditions:

- ◆ immunization – laboratory staff are offered Hepatitis B vaccine (2)

- ◆ annual testing for blood borne viruses for all health care workers performing exposure prone procedures (5)
- ◆ barrier techniques
- ◆ aseptic techniques.

Clear written communication should be available regarding cleaning and disinfection procedures between the surgery and the laboratory to specifically outline responsibilities and outline requirements for each case (6). All clinical and laboratory staff must understand proper steps to ensure disinfection of materials entering the laboratory to avoid repeating disinfection protocols and possible laboratory contamination. Most materials should be handled and/or disinfected only once to prevent possible distortion. If there is any uncertainty with a situation and the contamination status is unknown, then the status should be assumed to be infected and standard precautions should apply (see below).

Written Infection Control Policy must:

- ◆ Be written in clear, concise and easily understood language, updated regularly and reviewed annually.
- ◆ Be readily accessible to all staff.
- ◆ Address all known state and national laws regarding Occupational Safety and Health Administration standard for BBP.
- ◆ Must include protocols for management of incidents regarding occupational exposure – counselling/post-exposure assessment and appropriate follow-up should an occupational exposure result.

Application of standard precautions?

Treat all cases as though they could transmit a BBP disease (eg. Hepatitis B, Hepatitis C and HIV).

Ensure all laboratory staff understand and follow standard precautions as outlined in Infection Control Policy and provide annual training in BBP awareness for laboratory staff.

How does exposure occur?

Laboratory staff can be exposed via:

- ◆ direct contact (cuts and abrasions)
- ◆ pathogens transported to the laboratory via contaminated impressions/prostheses
- ◆ pathogens can be transferred to dental casts from contaminated impressions (oral bacteria can remain viable in set gypsum for up to one week).
- ◆ aerosols generated during laboratory processes which can be inhaled/ingested.
- ◆ possible infection can be transferred within the laboratory from case to case by surface contact/handpieces/burs/pumice pans/dust or mist/inadequate hand hygiene.

Chain of Infection

Patients can be put at risk as a result of possible cross-contamination between prosthetic appliances with the passage of microorganisms from one person or inanimate object to another and the transfer from the dental surgery to the laboratory and then back to the dental surgery.

Cross-contamination prevention

Dentist and laboratory should both employ protocols for incoming and outgoing cases.

Hand hygiene is one of the most important measures that healthcare personnel can employ to prevent transmission of infectious diseases in any healthcare setting (7). This should be done if hands are obviously soiled and before leaving the laboratory work area. Hands should be washed with plain or antimicrobial soap/alcohol-based hand rub. Automatic hand-hygiene dispensers are convenient and encourage frequent use.

Personal protective equipment should be used wherever possible:

- ◆ *Gloves:* If disposable gloves are used, they should be powder-free (8). Hands should be washed before and after use. These type of gloves should be used for the direct handling of contaminated items and be changed and disposed of at the completion of the procedure. Utility gloves are suitable for use when cleaning or disinfecting equipment and or surfaces and should be changed and disposed of at the completion of the procedure.
- ◆ *Masks and Protective eyewear/Chin length face shield / Ventilation systems:* The potential exists for generation of sprays/splatter/aerosols when operating lathes, model trimmers and rotary equipment.
- ◆ *Protective clothing/coat/jacket:* Protective clothing should preferably be disposable or changed daily and worn all the time during the fabrication of a prosthesis.

Safe working environments

The laboratory design should incorporate the following features:

- ◆ Sufficient space – laboratory needs to be divided into specific work areas e.g. receiving/production/wet areas etc which are appropriately separated.
- ◆ Adequate water – needs sufficient water supply and ideally with automatically operating taps. The plaster trap should be inspected regularly and cleaned as needed.
- ◆ Natural light and proper ventilation – NHMRC recommends constant inflow of fresh air. Air conditioners need to be frequently cleaned as they can harbour potentially dangerous microorganisms.

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- ◆ Covered waste bins
- ◆ Impervious flooring – e.g. continuous vinyl with covered corners and kickboards.
- ◆ Floors, walls and sinks must be cleaned with detergent/water or EPA-registered hospital disinfectant/detergent regularly.
- ◆ Workbench areas should be hard, smooth and easy to clean. Stainless steel is ideal.
All fixtures and fittings should be designed for easy cleaning.

Fundamentals of Laboratory Infection Control

There should be coordination between the dental surgery and the laboratory and the dentist should clean and disinfect all items before delivery to the laboratory. There should be a designated “clean receiving area” which should be cleaned and disinfected daily and the signage could state “ Only Biologically Clean Items Permitted”.

Incoming items should be rinsed under running tap water to remove blood or saliva and then disinfected as required. Staff handling incoming items should use PPE when processing these items, then remove PPE and dispose of appropriately.

Outgoing items should be rinsed and disinfected before packaging for return to dentist.

Unit-Dose Concept

The aim is to reduce cross-contamination during prosthodontic procedures and only use enough material to complete each procedure and dispose of any excess.

Definitions

Sterilization: Any process that eliminates or kills all forms of life, including transmissible agents (such as fungi, bacteria, viruses, spore forms, etc.) present on a surface, contained in a fluid, in medication, or in a compound such as biological culture media.

Disinfection: Killing of infectious agents occurs outside the body by direct exposure to chemical or physical agents.

Cleaning: Visible contamination is removed.

Chemical Disinfectants

Must be efficient anti-microbial agent – chlorines/phenols/new generation quaternary (Quats)

- ◆ Chlorines: either sodium hypochlorite or chlorine dioxide
- ◆ Iodophors: other iodine products
- ◆ Phenols: Alcohol-based or Water-based
- ◆ New generation Quats: Dual or synergized plus
- ◆ Must not negatively affect dimensional accuracy or surface quality of impression materials and resulting cast so well-fitting functional appliances can be fabricated.
- ◆ All staff must be adequately trained to use these materials properly in accordance with Material Data Safety Sheets (MSDS) and have Hazard Communication Training.
- ◆ Must have Environmental Protection Agency (EPA) registration number.
- ◆ As a minimum, function at an intermediate-level action (hospital-grade).
- ◆ EPA registered products exist as either tuberculocidal, virucidal or hospital-grade.
 - Tuberculocidal (intermediate-level activity) kills mycobacterium tuberculosis.
 - Virucidal kills hydrophilic and lipophilic viruses.
 - Hospital-Grade kills staph aureus/salmonella typhimurium/pseudomonas aeruginosa.

INFECTION CONTROL PROTOCOLS FOR COMMON LABORATORY PROCEDURE

Dental Surgery	Dental Laboratory		
	Incoming	Manufacture	Outgoing
Impressions (rinse/clean)	Clean/Disinfect	Casts/Crowns /Prostheses	Disinfect
Casts	Disinfect	Prostheses/Appliances	Disinfect
Repairs or Cleaning of Prostheses/Appliances	Clean/Disinfect	Handle in specifically allocated area/ Disinfect regularly	Disinfect

Cleaning and Disinfection of Impressions

The dentist must clean and rinse impressions under running tap water to reduce contamination which in turns reduces the microbiologic work required of the disinfectant. Gently clean the impression with a camel's hair brush and antimicrobial detergent. Rinse again after disinfection to remove residual disinfectant from the impression surface. Dental stone can be dusted into the impression prior to rinsing to help cleaning.

Hydrophilic impression materials should be disinfected with a product that needs a minimum time for disinfection – preferably no more than 10 minutes. Viruses absorb to alginates so diligent disinfection is crucial.

Minimal distortion occurs when products have the shortest contact time with the impression. Follow the exposure/contact times on the label, then rinse and pour the model. Consult the dental material manufacturer regarding compatibility with disinfectants – if necessary do a “test-run” with new disinfectants and impression materials. Iodophors, 1:10 sodium hypochlorite, chlorine dioxide and phenols are all suitable.

The most common methods are spraying, dipping and immersion with an intermediate or high-level disinfectant and then placing the impression in a bag and sealing it closed.

When spraying:

- ◆ Rinse entire impression/tray under running water after removal from the mouth. Remove excess impression material from the non-essential areas which will reduce the amount of microorganisms and debris.
- ◆ Use only a sufficient amount as the disinfectant can be released into air which increases occupational exposure. Spray the entire impression/tray and place it in a sealed bag so exposure to vapours and liquid is reduced. When the exposure time has elapsed, remove the impression from the bag, rinse and pour. Separate the cast from the impression once the stone has fully set.
- ◆ Discard the impression material and disposable tray to general waste
- ◆ Sterilize tray if it can be reused.

Dipping/Immersion:

- ◆ This is not commonly employed as a technique.
- ◆ Use recommended exposure time and preferably immerse for as short a time as possible in accordance with manufacturer's specifications to avoid distortion of the surface texture of the cast.
- ◆ Polyether should not be immersed.

Dental Casts

These are very difficult to disinfect and it is much better to disinfect the impression. If it is absolutely necessary, place casts on edge, to help drainage and spray with iodophor or chlorine and then rinse.

Orally Contaminated Prostheses

There should be sequential mechanical cleaning and chemical disinfection to reduce organic debris and microorganisms on soiled dental appliances.

Scrub with brush and antimicrobial soap to remove debris and contamination either in surgery or laboratory. Sterilize brush or store in disinfectant. Place prosthesis in sealable plastic bag with 1:10 diluted sodium hypochlorite or other intermediate disinfectant (or initially in a container filled with ultrasonic cleaner or calculus remover for required time and then bag). If the prosthesis is placed in a bag in the ultrasonic cleaner for the recommended contact time, it should then be removed and rinsed under water. The prosthesis should be dried and the needed work can proceed.

Follow manufacturer's time recommendations on metal components to reduce corrosion.

There is almost no detrimental effect on Co-Cr alloys with short-term exposure (10 minutes).

Prior to insertion, store appliances in dilute mouthwash not in disinfectant.

Waste Management

This can include disposable trays/impression materials/contaminated items for packing. If they are unable to be disinfected, they should be disposed of appropriately in line with prescribed regulations for general waste as opposed to contaminated waste. Any sharps – i.e. scalpel blades should be placed in puncture-resistant containers.

Lathe Safety

Clean and disinfect the lathe daily and aim to reduce splatter and employ PPE including eyewear and use the plexiglass shield as a barrier. Vacuum evacuation is preferred when available.

Pumice is a possible hazard for contamination either by aerosol or direct contact. The pumice should be mixed with clean water, dilute 1:10 bleach or suitable disinfectant and tincture of green soap should be added. Change pumice daily and clean and disinfect pumice brushes and rag wheels daily – if possible use heat sterilisation.

Sterilisation

The following metal and heat-stable instruments and items may be heat sterilised if available:

- ◆ Facebow fork
- ◆ Metal impression Trays – preclean to remove residual set gypsum.
- ◆ Burs
- ◆ Rag wheels (not plastic centered)
- ◆ Laboratory knives
- ◆ Articulator mounting plates (metal only)
- ◆ Bristle brushes (not plastic centered)
- ◆ Metal handled spatulas

Laboratory items suitable for chemical disinfection after each use (Spray or immersion technique)

- ◆ Alcohol torch
- ◆ Facebow
- ◆ Articulator
- ◆ Mixing bowl and mixing spatulas (wooden or plastic handled)
- ◆ Shade/mould guide
- ◆ Wax knives (wooden handled)

Disinfection of wax bites/rims/bite registrations

Wax rims should be disinfected by the spray-wipe-spray method. Wax bites should be treated by the rinse-spray-rinse-spray-rinse technique. For adequate disinfection, these items should stay wet with disinfectant for the time recommended by the manufacturer.

After the second spray, they can be put in a sealed bag or wrapped in plastic wrap for the advised disinfection time and then rinsed again following disinfection. Bite registrations made of materials such as ZOE or compound can be handled similarly as impressions of the same material.

Maintenance of laboratory equipment

Follow directions given by manufacturer for care/cleaning/disinfection techniques and appropriate disinfectants.

Management of Environmental Surfaces

The disinfection procedures used should be similar to those utilised in the surgery with an EPA-registered hospital disinfectant with low-(HIV, HBV effectiveness claim) to intermediate-level activity depending on the degree of contamination. Surfaces should be cleaned and disinfected daily or whenever there is obvious contamination utility gloves should be used. Surface barriers may reduce the need for disinfectants.

Personal Safety Issues

Avoid eating/ drinking/ handling contact lenses/ applying cosmetics in the laboratory.

Conclusion

The protection of personnel in the dental laboratory from bloodborne pathogens is of paramount importance. Infection control guidelines in the dental laboratory must be followed in the same way as in the dental surgery. Many cases which are in transit between the surgery and dental laboratory are a source of infectious microorganisms. If proper protocols are adhered to, then impressions and appliances can become non-infectious items. It is vital to have proper communication between the laboratory and the surgery in order to successfully implement an infection control program. ◆

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By Dr Brenda Baker

BDS Hons. (Syd) MSc. Conservative Dentistry (London)

Senior Clinical & Technical Support Consultant Southern Cross Dental