Review Article

Infection control in the prosthodontic laboratory

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Although a lot of importance is given to infection control in the dental clinic, it is usually overlooked in the laboratory. This article reviews the various issues of infection control in the dental, especially the prosthodontic laboratory.

Key words: Dental laboratory, disinfection, infection control

In contrast to the dental treatment room and surgical operatories, the dental laboratory is often overlooked when planning effective infection control and exposure control measures.

Technicians are particularly vulnerable to microbial cross-contamination from the impressions they receive from dental offices. Casts poured from impressions can also harbour infectious microorganisms that can be distributed throughout the laboratory when the casts or dies are trimmed.[1]

Dental laboratories including those in private offices and small clinics, should be isolated from the possible transmission of pathogens or be properly prepared to prevent cross-contamination between patients and dental technicians.

It is essential that all dental laboratory technicians must have a basic understanding of infection transmission and be properly evaluated for the exposure risk they face from blood-borne pathogens.

TRANSMISSION OF INFECTION

Microorganisms capable of causing disease are present in human blood. Contact with blood or saliva mixed with blood may transmit pathogenic microorganisms.

Impressions, casts, impression trays, record bases, occlusal rims, articulators and dental prostheses can all transmit pathogenic microorganisms from the dental office to the dental laboratory.

Studies have reported that organisms are transmitted from impressions to casts[2] and from dentures to pumice, where they continue to live.[3]

The presence and identification of organisms transmitted to dental laboratories[4-6]

Streptococcus and *Staphylococcus* species, *Bacillus* species, *Enterobacter* species, Hepatitis virus, Herpes simplex and human immunodeficiency virus (HIV) are among the microorganisms found frequently in blood and saliva.

A study[4] has found that 67% of materials sent from dental offices to laboratories were contaminated with bacteria of varying degrees of pathogenicity.

CLINICAL AND LABORATORY DISINFECTION[4,7-9]

Barrier system

Barrier system must be followed in the laboratory routinely. It includes hand washing with plain or antimicrobial soap (or an alcohol-based hand rub if hands are not visibly soiled).

Use of personal protection equipments is a must when there is potential for occupational exposure to blood-borne pathogens.

Examples: Gloves, mask, protective eyewear, chin-length face shield, protective clothing (*i.e.*, labcoat or jacket).

Gloves

Disposable gloves should be used when there is potential for direct hand contact with contaminated items. The gloves should be changed and disposed of appropriately after completion of the procedure. Hands should be washed before gloving and after removing gloves.

Utility gloves

Should be used when cleaning / disinfecting equipment /surfaces.

Mask, protective eyewear, clothing

Must be used when there is potential for splashes, spray, spatter or aerosols. Examples: When operating lathes, model trimmers and other rotary equipment,

labcoat or jacket should be worn at all times during the fabrication process. They should be changed daily and should not be worn outside the laboratory.

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 and 2) the deactivating effect of the impression material on the disinfecting solution, which could reduce the efficacy of the process.[10]

Immersion disinfection has been preferred to spraying. Immersion is more likely to assure exposure of all surfaces of the impression to the disinfectant for the recommended time. [11]

Spraying disinfectants onto the surface of the impression reduces the chance of distortion, especially in the case of alginate, hydrocolloid and polyether materials, but may not adequately cover areas of undercuts. [12]

Thorough rinsing of the impression is necessary before and after disinfection. Rinsing before removes the bioburden present, which may prevent exposure of the surface to the disinfectant. Rinsing after disinfection removes any residual disinfectant, which may affect the stone surface after the cast has been poured.

ADA-recommended disinfectants

Chlorine compounds such as sodium hypochlorite solutions (1:10 dilution), iodophors, combination synthetic phenolics such as phenyl phenol 9%, *O*-benzyl-*p*-chlorophenol 1% and aldehydes such as formaldehydes and gluteraldehydes.[7]

Reversible (Agar) and irreversible hydrocolloid (Alginate) materials should be handled carefully to prevent distortion. In order to remove any bioburden, the impression should be gently scrubbed with an artist's brush (one-half inch bristle) and a liquid detergent. Stubborn materials can be removed by scrubbing gently with dental stone sprinkled into the impression. The impression should be thoroughly soaked by spraying with a hospital-level disinfectant. Iodophors, sodium hypochlorite (1:10), chlorine dioxide or other approved products are all acceptable. The product with the shortest contact time will allow less distortion to occur during this process. In order to prevent evaporation of the disinfectant during the contact period, impressions should be loosely wrapped in a plastic bag. After sufficient contact time, they should be rinsed, handled in an aseptic manner and transferred to the production area of the laboratory.

Polyether impression materials may be handled in the same manner as hydrocolloid materials. Polyether materials cannot be immersed in a disinfectant solution because they are hydrophilic and have a tendency to distort when placed in aqueous solutions. They are found to stand immersion for ten minutes in a disinfectant without distortion. Sodium hypochlorite (1:10) can be used.

Silicone (vinyl polysiloxane) or rubber-based impression materials may be handled in the same manner as hydrocolloid materials. These materials are much more stable and could also be immersed in any hospital-level disinfectant except neutral glutaraldehyde for the contact time recommended by the manufacturer.

Zinc oxide eugenol (ZOE) and compound impressions

ZOE impressions can be immersed in 2% gluteraldehyde or a 1:213 iodophore solution for ten minutes. Materials disinfected with gluteraldehyde should be thoroughly rinsed to remove any residual traces of the disinfectant. Gluteraldehyde is a strong irritant to the skin and mucous membrane.

For impression compound, immersion in sodium hypochlorite (diluted 1:10) is suggested.

Impression trays

Plastic disposable trays used are discarded.

Sodium hypochlorite can be used as a disinfectant on aluminium- or chrome-plated trays. But these trays should be monitored for corrosion. If corrosion occurs, an alternative disinfectant should be used.

Impression trays can also be heat-sterilized.

DISINFECTION OF OTHER MATERIALS OR INSTRUMENTS[4,5,7]

Orally soiled prostheses

Prosthetic devices may have copious amounts of calculus and other tenacious bioburden. The debris should be removed so that effective decontamination becomes possible.

Scrubbing should be done with brush and antimicrobial soap to remove debris and contamination.

Prostheses should be placed in sealable plastic bags or beakers filled with ultrasonic cleaning solution for calculus removal.

After this, the prostheses should be removed, rinsed under running tap water and dried before proceeding with the next step.

Dental prostheses

Care should be taken to not exceed the manufacturer's recommended contact time for metal components to

minimize corrosion.

There is little effect on chrome-cobalt alloy with short-term exposures (ten minutes)

Dental prostheses should be stored in diluted mouthwash and not in disinfectant before insertion.

Wax bites / rims, bite registrations

Immersion disinfection may cause distortion to some items.

Iodophor disinfection sprays should be used.

Heavy-body bite registration materials are usually not susceptible to distortion and can be disinfected in the same manner as an impression of the same material.

Non-sterilizable equipments such as some face bow components must be cleaned with soap and water and disinfected with a hospital-level disinfectant if they become contaminated. Care must be taken not to overheat the material or disinfectant while in the ultrasonic cleaner. The method of choice is spraying or soaking these items in the disinfectant in a separate container or bag.

After the recommended contact time, the item is rinsed and handled in an aseptic manner for transfer to the laboratory production area. Iodophors, chlorine solutions, glutaraldehydes or phenols are all acceptable for this step. It is important to remember that most immersion disinfectants can only be used once.

Items should never be shipped in a chemical disinfectant because of possible damage to the material due to excessive contact time with the disinfectant. In addition, if such an item (stored in chemical disinfectant during shipping) is not rinsed properly before handling, it can cause chemical burns to the human skin or mucosa.

Disinfection of casts[4,7]

It is preferable to disinfect the impression so that the resulting cast itself will not have to be disinfected because casts are the most difficult prosthodontic item to disinfect without causing damage. However, inadvertent contamination may make disinfection of the cast necessary. In such cases, casts can be sprayed with an iodophor or chlorine product, rinsed and handled in an aseptic manner for transfer to the production area. If the cast is being disinfected for shipping, it should be allowed to dry before wrapping for shipment.

Articulators and other equipment that make no patient contact but require cleaning and disinfection should be evaluated based on their construction. Most can be disinfected by spraying with a hospital-level disinfectant followed by rinsing, drying and lubrication (for items with moving parts). Prevention of contamination is better than having to use chemical agents on delicate equipments. Any item that will withstand standard heat sterilization should be sterilized before reuse.

Laboratory equipments and infection control[11]

No matter how well infection control is practised, some equipments like polishing lathes should receive special attention even in the "clean" laboratory. This will place one more barrier in the path of possible cross-contamination and reduce the chance of introducing laboratory contamination during the production cycle.

Colonization from airborne and other organisms in warm, wet pumice can be prevented by suspending the pumice in a tincture of green soap or other surfactant and possibly adding an effective disinfectant solution to the mix and then using it with the polishing lathe. The pumice should be changed daily.

Irrespective of the machine's location, if chemicals are used, appropriate Personal Protective Equipment must be employed [gloves, mask and protective eyewear].

All brushes, rag wheels and other laboratory tools should be heat-sterilized or disinfected daily. Wet rag wheels should be stored in a disinfectant solution when not in use. The lathe machine should be cleaned and disinfected daily.

Work areas should be cleaned at the end of the workday or whenever inadvertent contamination occurs.

Surface disinfection protocols are the same in the dental laboratory as in the dental clinic when needed.

ACCEPTABLE PROCESSING METHODS

Impression materials

Compound - 1:213 iodophors; 1:10 sodium hypochlorite solution

ZOE impression paste - Glutaraldehydes; 1:213 iodophors

Reversible hydrocolloid - 1:213 iodophors; 1:10 sodium hypochlorite solution

Alginate - 1:213 iodophors; 1:10 sodium hypochlorite solution

Elastomers

Polysulfide - Glutaraldehydes; 1:213 iodophors; 1:10 sodium hypochlorite solution; complex phenolics*

Polyether - 1:213 iodophors; # 1:10 sodium hypochlorite solution#; complex phenolics

Silicone - Glutaraldehydes; 1:213 iodophors; 1:10 sodium hypochlorite solution; complex phenolics

Impression trays

Aluminum - Heat sterilize via autoclave, chemical vapor or dry heat; ethylene oxide sterilization.

Chrome-plated - Heat sterilize via autoclave, chemical

vapor or dry heat; ethylene oxide sterilization.

Custom acrylic resin - Discard after intraoral use in a patient; disinfect with tuberculocidal hospital disinfectant for reuse during the same patient's next visit.

Plastic - Discard.

Disinfectant brand names

Phenyl phenol	T 36
Gluteraldehyde	Cidex, Totacide, Asep
Iodophor	Neodol 25-7
Ammonium quart compound	Kocide, Phyton 27, Adogen

Communication with dental laboratory staff[1,4]

Responsibility for disinfection of items sent to the dental laboratory lies with the dental office. All items disinfected in the dental office should be labeled indicating that such items have been decontaminated using an accepted disinfection routine.

If the dental laboratory staff have not been notified that incoming work is decontaminated, all incoming items must be disinfected.

Regulated and general waste

Unless waste generated in the dental laboratory (e.g., disposable trays or impression materials) falls into the category of regulated medical waste, these materials can be disposed of in standard waste containers. Under most circumstances, very small amounts of regulated waste will be generated in the dental laboratory. All disposables that can be considered "sharps" items (e.g. orthodontic wire, disposable blades, burs, etc.) should be disposed of in appropriate containers designated as "sharps" disposable containers or in puncture-resistant containers.[1]

Summary on infection control issues

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.

The principal potential route of transmission from the patient to the dental technician is through contaminated impressions and prostheses. It has been demonstrated that microorganisms can be recovered from casts recovered from impressions made of dental moulds experimentally inoculated with bacteria. The responsibility to have a thorough knowledge of the patient's history and to ensure that support staff members are not put at risk of cross-contamination begins with the clinician. It would seem essential therefore, that impressions be disinfected by the clinician or a suitably protected technician prior to the initiation of any laboratory procedures.

The only safe approach to routine treatment is to assume that every patient may be a carrier of an infectious agent and hence, technicians must wear gloves and carry out necessary infection control measures.

The Federation Dentaire Internationale (FDI) states that all patients' prostheses should be cleaned and disinfected before delivery to the laboratory. Similarly, the American Dental Association (ADA) recommends chemical disinfection of all impressions and prostheses.

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