Review Article

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DISINFECTION IN PROSTHODONTICS

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ABSTRACT:

Routinely dental care professionals are at an increased risk of crossinfection while treating patients. This occupational potential for disease transmission becomes evident initially when one realizes that most human microbial pathogens have been isolated from oral secretions. As more evidence has been gained concerning the pathogenicity and invasiveness of hepatitis-B (HBV), herpes, tuberculosis (TB), and acquired immunodeficiency syndrome (AIDS) in prosthodontics, research is evolving that relates directly to this previously neglected discipline. The aim of this review was to provide a background about the possible ways of transmission of infection spreading, and procedures recommended for preventing their spread in the discipline of prosthodontics.

Keywords: Sterilization, Disinfection, Saliva.

INTRODUCTION:

Routinely dental care professionals are at an increased risk of crossinfection while treating patients. This occupational potential for disease transmission becomes evident initially when one realizes that most human microbial pathogens have been isolated from oral secretions. Because of repeated exposure to the microorganisms present in blood and saliva, the incidence of certain infectious diseases has been significantly higher among dental professionals than observed for the general population. Hepatitis B, tuberculosis and herpes simplex virus infections are well recognized and indicate the need for increased understanding of modes of disease transmission and infection control procedures by dental care providers.

The general routes for transmission of microbial agents in dental medicine are as follows:

1) Direct contact with infectious lesions or infected saliva or blood.

2) Indirect transmission via transfer of microorganisms from a contaminated intermediate object.

3) Splatter of blood, saliva / nasopharyngeal secretions directly into broken or intact skin or mucosa.

4) Aerosolization, the airborne transfer of microorganisms.

Part of the problem lies in the fact that many practitioners and auxiliaries previously failed to comprehend

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or appreciate the infection potential presented by saliva and blood during treatment. The risk of potential infection was dismissed because of the splatter coming from the patients mouth is not noticed readily. Organic debris may be transparent or translucent and dries as a clear film on skin, clothing and other surfaces.

PRETREATMENT CONSIDERATIONS:

When the dental operatory is being prepared for treatment at the beginning of the day, the waterlines should be flushed for several minutes to remove bacterial growth that may have accumulated overnight. The equipments should be disinfected. A hospital level tuberculocidal disinfectant that is registered with the environmental protection agency should be used on hard surfaces in the dental office.

DENTAL IMPRESSIONS:

Dental impressions were one of the first laboratory items to be considered contaminated and a potential infection control problem. The first extensive study on disinfection of impressions was not published until 1981. (Sloter and McCabe, 1981). Traditionally impressions were rinsed under running water after being removed from the mouth to visibly eliminate saliva and blood. Although rinsing significantly reduces the numbers of microorganisms in most cases, it does not decontaminate the impression however rinsing before and after disinfection still should be done as part of the protocol. In 1991, the ADA council on dental materials, instruments and equipment recommended that all dental impressions be disinfected by immersion.

The time for exposure to a particular disinfectant (i.e. the immersion time) should be at least that recommended by the product manufacturer for tuberculocidal disinfection. The 1991 ADA council recommendation suggests use of disinfectants requiring no more than 30 minutes for disinfection. Impression materials that are hydrophilic should be disinfected with a product requiring a minimum time for disinfection (preferably no more than 10 minutes). Caution should be exercised when following recommendations for disinfection of a particular impression material. Some manufacturers have recommended disinfectant exposure times that are inconsistent with the recommendations of the disinfectant manufacturers for disinfecting the impressions.

Roy Storer, John F. McCabe (1981) evaluated the effect of sterilizing solutions i.e. hypochlorite-2%, glutaraldehyde-4% and formaldehyde on the surface integrity and dimensional stability of impression pastes, irreversible hydrocolloids, polysulfide and polyether impressions. They concluded that 2% glutaraldehyde solution could be used to sterilize zinc oxide eugenol and polysulfide impressions as it did not produce any dimensional changes. Materials which are known to be hydrophilic like alginate and poly ether showed dimensional changes.

Pamela Herrera et al (1986) evaluated the dimensional stability of alginate, polysulfide rubber base, vinyl

polysiloxane and polyether impressions after immersion for 30 minutes in solutions of 1% and 0.5% sodium hypochlorite, 0.5% povidine iodine, 0.13% and 2% neutral glutaraldehyde, 0.16% halogenated phenol. They concluded that disinfection of dental impressions by short term immersion in sodium hypochlorite, glutaraldehydes or halogenated phenol showed the stability of rubber base impression materials. However significant changes were noticed with alginate impressions.

Abundance of literature is available on various methods applied to disinfect the impressions, along with their effect on dimensional changes produced on casts obtained from them. M.A. Pleasure et al (1959) showed that the carriage of tuberculosis bacilli occurred in all procedures of complete denture treatments starting from impressions to try-in. They have also cited following effects of germicidals (70% alcohol, 5% Lysol, 11.5% and 10% formalin) on impression materials:

1) Two types of impression compounds softened and deteriorated in 70% alcohol and in 5% Lysol, the surface was attacked whereas formalin had no effect in all three concentrations.

2) In zinc oxide eugenol, colour change occurred with 70% alcohol, but 10% formalin had no effect.

3) In rubber base impressions colour change and bleaching of impressions to bleaching softening and deterioration.

A study conducted by M.R. Trevelyen (1974) in which he soaked alginate impressions of 2 models in glutaraldehyde and sodium hypochlorite for 16 hours. The models obtained from both groups showed dimensional changes. It was concluded that immersion in glutaraldehyde was preferable to sodium hypochlorite as magnitude of dimensional changes produced was less. Based on their observations gutaraldehyde was recommended for alginate impressions.

Disinfection of impressions:

A. Personal protective equipment: Protective eye wear, masks and gloves when handling a contaminated impression until it has been disinfected.

B. Rinse the Impression: Immediately after an impression is taken in the dental operatory, rinse it under running water in order to remove any saliva or blood. This step in essential for allowing optimum disinfection of the impression.

C. Disinfection techniques: Once the impression is rinsed and shaken to remove excess water, it must be disinfected. This may be accomplished by immersing the impression in, or spraying it with, an acceptable disinfectant.

i) **Disinfection of an impression by immersion:**

It is preferred over spraying. Spraying may not be effective because constant contact of the disinfectant with all surfaces of the impression cannot be assured.

i) Place rinsed impression into a zippered plastic bag containing appropriate disinfectant.

ii) Leave it immersed in disinfectant for 15 minutes. Polyether components and hydrocolloids may be adversely affected by disinfectants; therefore their immersion time is limited to 10 minutes.

iii) Remove impression from disinfectant.

iv) Rinse with running water and shake off excess water.

ii) **Disinfection of an impression by spraying:**

v) Spray the cleaned impression and impression tray with an acceptable disinfectant.

vi) Seal the sprayed impression in a zippered plastic bag for 15 minutes.

vii) Remove the impression from the sealed bag.

viii) Rinse the impression with running water and shake off excess water.

Hydrocolloid impressions:

A number of investigators have evaluated disinfection of irreversible hydrocolloid (alginate) sometimes with contradictory results. Based on these findings, the ADA recommended disinfecting alginates by immersion in diluted hypochlorite, iodophor or glutaraldehyde with phenolic buffer. Investigators reported significant adverse effects of specific materials with disinfectants that are non-reactive with other alginates suggesting that caution should be exercised. Given the hydrophilic nature of the material, a minimal disinfection time should be used.

Limited data are available on disinfection of reversible hydrocolloid, however research data suggest that there is no effect on dimensional accuracy of impressions immersed in an iodophor diluted 1:213, 5.25% sodium hypochlorite with a dilution 1:10, 2% acid glutaraldehyde with dilution of 1:4, and glutaraldehyde with phenolic buffer diluted 1:16 immersion in 2% alkaline glutaraldehyde has significant adverse effects on the impressions and resultant dies.

Rubber base impression materials:

They can be disinfected by immersion in iodophor, diluted chlorine solution, glutaraldehyde or complex phenols for the time required for tuberculocidal activity. It is important to review the method of disinfection with the manufacturers to prevent distortion of the impression or loosening of the adhesive bond between the impression tray and impression material. These impressions also should be rinsed with water before pouring. It is important to inform the dental laboratory that the impression has been disinfected to prevent the laboratory personal from performing more disinfection procedures that might distort the impression.

Studies by a number of investigators have shown that polysulphides and

silicones are relatively stable and can be disinfected without adverse effects by immersion in most disinfectants approved for use in dentistry. Although hydrophilic, polyether impressions also can be disinfected by immersion, but exposure times should be kept to minimum (10 minutes). Disinfectants requiring exposure times greater than 10 minutes for tuberculocidal disinfection probably should be avoided with polyethers. Immersion in acid glutaraldehyde actually improves the surface detail reproduction of elastomeric impressions.

Zinc Oxide Eugenol (ZOE) and compound impressions:

Limited data are available on disinfection of ZOE and compound impressions. Adverse effect have been reported on ZOE immersed for 16 hours in diluted hypochlorite and on compound by all of the disinfectants tested (hypochlorite, formaldehyde and 2% alkaline glutaraldehyde).

DENTAL PROSTHESIS AND APPLIANCES:

The ADA recommends disinfection by immersion in iodophors or chlorine compounds. Although both of these disinfectants are somewhat corrosive, studies have shown little effect on chrome cobalt alloy with short-term exposure (10 minutes) to iodophors or 1:10 hypochlorite. Damage of heat cured denture base resin has been shown to occur after only 10 minutes of immersion in a glutaraldehyde with phenol buffer, although immersion in 2% alkaline glutaraldehyde did not damage the acrylic surfaces. Given the tissue toxicity of glutaraldehydes and phenolics, however iodophors or chlorine compounds are preferred for disinfection of acrylic appliances.

Prostheses never should be stored in a disinfectant before insertion. After disinfection and thorough rinsing, acrylic items can be stored in diluted mouthwash until inserted. Fixed metal/porcelain prosthesis may be disinfected by immersion in glutaraldehydes for the time recommended for tuberculocidal inactivation by the disinfectant manufacturer. In addition several clinical services have confirmed that fixed prosthesis can be disinfected by short immersion in diluted hypochlorite without apparent harm to the device. The higher the content of noble metal, the less the likelihood of adverse effects on the metal core should be taken to minimize the exposure times of metals to potentially corrosive chemicals. Iodophors probably could be used as well, but no data are available to substantiate this. Unglazed porcelain should not be exposed to any disinfectant and (porcelain firing/ glazing will suffice), fixed metal prostheses can be sterilized with ethylene oxide or even by autoclaving if desired. Any device that has been immersed in a disinfectant should be rinsed thoroughly before delivery to the patient.

Prostheses or appliances that have been worn by patients should be cleaned thoroughly before disinfection by scrubbing with a brush and an antiseptic handwash or by cleaning in an ultrasonic unit.

Dentures or other acrylic appliances that have been worn by patients and require repair should be disinfected, after cleaning and before handling should be handled (i.e. with gloves) as contaminated even after disinfection. The porous nature of acrylic makes such devices difficult to disinfect adequately.

DISINFECTION OF WAX BITES, WAX RIMS, CASTS, CUSTOM IMPRESSION TRAYS & BITE REGISTRATIONS:

Wax rims and wax bites should be disinfected by the spray wipe spray method using an iodophor as recommended by the ADA. Rinse spray may be more appropriate for wax bites. For adequate disinfection these should remain for the time recommended for tuberculocidal disinfection. After the second spray, they can be enclosed in a sealed plaster bag for the recommended time. These items probably should be rinsed again after disinfection to remove any residual disinfectant.

Bite registrations made of various materials such as ZOE or compound can be handled in the same manner as impressions of the same materials. These registrations also can be disinfected, using the rinse spray rinse technique, with most EPA registered hospital level tuberculocidal disinfectants used as sprays (chlorine compounds should not be applied to ZOE). After disinfection, the registration should be rinsed again to remove residual disinfectant.

ADA recommends that stone casts be disinfected by the spraying until wet or immersing in a 1:10 dilution of sodium hypochlorite or an iodophor. Casts to be disinfected should be fully set (i.e. stored for at least 24 hours). Investigators submerged die stone models in a variety of disinfectants and found that with 1:10 sodium hypochlorite and 1:213 iodophor, undesirable physical effects on set die stone ranged from none to minimal.

A disinfectant stone now is marketed and has been shown to have bactericidal property however this product is not yet EPA registered as a disinfectant. Several investigators have recommended adding disinfectants to gypsum during mixing (ie. As all or part of the liquid, when pouring casts). Although such products have potential for use in infection control, they do not solve the problem of the contaminated impression or tray as a source of infectious microorganisms during transit from the operatory to the laboratory.

Custom acrylic resin impression trays should be disinfected by spraying with surface disinfectants or immersing in either 1:213 iodophor or 1:10 sodium hypochlorite. They should be rinsed thoroughly to remove any residual disinfectant and allowed to dry fully before use. After use in the mouth custom trays should be discarded.

OTHER PROSTHODONTIC ITEMS:

Heat stable items such as facebow forks, orthodontic pliers and metal impression trays that come in contact with oral tissues should be heat sterilized rather than disinfected.

Articulators and facebows should be cleaned and disinfected. After manipulation chairside (wooden handled spatulas should be cleaned and disinfected). Other times such as Hanau torches should be disinfected after use, or the area to be touched should be covered with a barrier such as plastic wrap to prevent contamination. Rubber bowls should be cleaned and disinfected after chairside use.

Items such as shadeguides should be cleaned and disinfected to avoid cross contamination. If iodophors are used on shadeguides, they should be wiped with water or alcohol after the exposure time to remove any residual disinfectant.

Ultraviolet light is a part of electromagnentic spectrum. It ranges from 400nm downwards to approximately 150nm. It is well established that greater germicidal effect is in the range of 240-280nm with the optimum being 253-7nm. This is widely accepted as a near maximum for bactericidal and germicidal effect. Most investigators show that the rays are absorbed by the cellular DNA chain which is the initial event in the chain of events leading to cellular death.

Robert J. Boylan et al (1987) used UV light with a wavelength of 254nm as a mode of sterilizing complete dentures, partial dentures and a rubber base impression contaminated with fine known species of microorganisms. The results showed that killing of microorganisms with greater than 98% within 15 seconds and 99% either 30 seconds and 100% in 2 minutes. They also concluded that UV light cannot be used as a sole means of disinfecting the impressions because of shadowing effect that allows the survivial of microorganisms unexposed to UV light.

PROTOCOL FOR UNIVERSAL PRECAUTIONS IN DENTAL CLINIC:

Staff protection measures:

- The wearing of gloves reduces contamination of hands with blood. They may be disposable or sterilizable gloves. If resterilization is planned, the glowed hands should be washed with soap and rinsed again. The gloves should be checked for holes and discarded if defective. The gloves that pass the test can be dried, powdered and packed for sterilization.
- Hands should be washed between patient contacts, after degloving and before regloving. Use of disinfectant scrub like chlorehexidine after washing will have a prolonged antibacterial effect against microbes ingressing through the gloves. Hands must also be washed after touching intimate objects likely to be contaminated by blood / saliva from patients and before leaving the dental treatment area.
- Clinic attire should be worn only in the dental environment and should be changed at the end of the treatment schedule.
- Use of mask is usually indicated especially during procedures that cause splashing / spattering of blood / saliva. It is recommended that

facemasks should be changed once every hour / between each patient contact, which ever occurs first.

Protective eye wear:

It may be in the form of glasses and / or a facemask. It should prevent trauma to the eye tissue from flying droplets / aerosols. Protective glasses should be washed with soap first, these rinsed with water and wiped with an appropriate surface disinfectant. Plastic safety lenses can also be immersed in alkaline glutaraldehyde solution and should be thoroughly rinsed to avoid possible irritation to skin and eyes.

Management of instruments:

They should be cleaned and dried, lubricated if necessary and packaged before loading into the autoclave. Cleaning involves an initial presoaking with detergent solution containing disinfectants to soften organic debris and begin microbial kill. After cleaning the instruments should be dried.

All moving parts of the instruments specially handpieces should be lubricated prior to steam sterilization. The burs should be autoclaved / maintained in high level disinfection of not less than 3 hours. Thorough rinsing should be followed to remove all traces of disinfectant.

- Touch surfaces like unit handles, light handle, light switch, chair controls, head rest knob, trolley handle, trolley and spectrum handpiece and 3-way syringes cannot be disconnected and sterilized and therefore need to be treated with disinfectants covered with a protective barrier. However instruments which enter oral cavity and are connected to some of the equipment e.g. air rotor and surgical handpieces, ultrasonic inserts / tips, airwater syringe tips and light cure probes / tips should be disconnected, sterilized and rinsed.

- Disinfection of surfaces involves the cleaning of surfaces, after every patient and application of a disinfectant chemical. These chemicals include alcohol (spirit), iodophor products, synthetic phenols, glutaraldehyde, chlorines etc.

- The advantages of barriers include ease and speed of insertion, standard sizes and the protection of equipment from damage by chemicals, blood and fluids.

- Spitoons should be flushed with water, scrubbed and disinfected.

- Waste buckets should be used with disposable plastic bags as liners to be changed wherever necessary.

Role of reducing aerosols in the clinic:

Preoperative mouth rinses with chlorhexidine gluconate or other suitable disinfectant mouth wash should help reduce infectious particles in aerosols. Rubber dam isolation is another method to reduce potentially infective aerosols. High volume secretion during procedures using

copious irrigation and even the routine use of saliva ejectors can restrict aerosolization.

CONCLUSION:

Dentists must use effective infection control procedures in their practices. A positive step by step approach should be used. One should determine and practice infection control and build upon them by adding new procedures to the dental routine. The current knowledge in today's society regarding infectious diseases in general and herpes, hepatitis and acquired immune deficiency syndrome (HIV) in particular dictates that all dental practices must incorporate acceptable infection control techniques

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REFERENCES:

1. Kugel G, Perry RD, Ferrari M, Lalicata P. Disinfection and communication practices: A survey of U.S. dental laboratories. J Am Dent Assoc 2000;131:786-92.
2. Leung RL, Schonfeld SE. Gypsum casts as a potential source of microbial cross-contamination. J Prosthet Dent 1983;49:210-1.
3. Williams N. The persistence of contaminated bacteria in dental laboratoty pumice. J Dent Res 1985;64:258.
4. Wood PR. Cross infection control in dentistry a practical illustrated guide.
5. Powell GL, Runnells RD, Saxon BA, Whisenant BK. The presence and identification of organisms transmitted to dental laboratories. J Prosthet Dent 1990;64:235-7.
6. Verran J, Kossar S, McCord JF. Microbiological study of selected risk areas in dental technology laboratories. J Dent 1996;24:77-80.
7. Dental laboratory relationship working Group OSAP Position paper. Laboratory Asepsis: November 1998.
8. Giblin J, Podesta R, White J. Dimensional stability of impression material immersed in an iodophor disinfectant. Int J Prosthodont 1990;3:72-7.
9. USAF Guidelines for Infection Control in Dentistry, September 2004. Available from: http://www.brooks.af.mil/dis/infcontrol.htm.
10. McNeill MR, Coulter WA, Hussey DL. Disinfection of irreversible Hydrocolloid impressions: A comparative study. Int J Prosthodont 1992;5:563-7.
11. Infection control recommendations for the dental office and the dental laboratory. ADA Council on Scientific Affairs and ADA Council on Dental Practice. J Am Dent Assoc 1996;127:672-80.
12. Matyas J, Dao N, Caputo AA, Lucatorto FM. Effects of disinfectants on dimensional accuracy of impression materials. J Prosthet Dent 1990;64:25-31