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Infectious Disease and Personal Protection Techniques for Infection Control in Dentistry

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1. Introduction

Progressively gaining importance, “Infection control” is an important subject in dentistry, on which many researches have been performed in recent years. Both dentists’ and the societies’ sensibility rapidly enhances the amount of efforts made in creating a “perfect” infection control.

Dental team workers are members of a “high risk” group when dealing with patients in terms of cross infections. When the part of the body dentists mainly work on and the procedures performed are taken into account, contamination via blood and saliva can be clearly identified as a high risk. It should be kept in mind that other body fluids can also act as contamination risk factors.

For an infection to emerge, microorganisms of adequate count and a disease causing potential must contaminate the host thru a proper path. These contamination paths are specified (Esen 2007);

- Body fluids’ direct contact with the wound site during operation,
- Injuries of the skin and the mucosa with sharp objects.
- Body fluids’ and contaminated materials’ contact with eyes.
- Aerosols arise during the operation with air turbined and ultrasonic devices. Contamination via droplet infection
- Surgical smoke formed during electro-cautery or laser applications.

2. Infectious diseases of concern in dentistry

A number of infectious diseases can and should be of concern in dental procedures.

2.1 Viral infections

Herpes Simplex Virus, one of the most common types of Herpes Virus family. Among major signs of the primary infection are fever, malaise lymphadenopathy and ulcerative

gingivostomatitis. Recurrent infections in the form of herpes labialis can also occur. A herpes simplex virus infection of the fingers (herpetic whitlow) is usually caused by direct contact with a herpetic lesion or infected saliva (Malik 2008).

Transmission occurs by direct contact of the affected part of the skin. Mucosa lesions and secretions can also be responsible for the transmission. Lesion in general is characterized by vesicles and sequent crusting. When the processor symptoms are present, acyclovir can be used for treatment or at least avoiding the worsening of the symptoms. Wearing gloves when treating patients with Herpes lesions provides adequate protection for the clinician.

Varicella Zoster Virus, causative agent of both chickenpox (primary disease) shingles (secondary disease) caused by the reactivation of the latent virus residing in sensory ganglia. Mild form is chickenpox mainly encountered in children. Shingles on the other hand can be very painful.

Chickenpox is considered highly contagious and spreads via-airborne route. The non-immune dental staff may contact the disease via inhalation of aerosols from a patient who is incubating the disease. Even though masks and gloves offer some level of protection they are usually not adequate for absolute protection of the healthcare professionals.

Epstein-Barr Virus causes infectious mononucleosis and can remain latent in epithelial tissues. Can be transmitted by skin contact or blood and the virus is present in saliva, thus members of the dental team are considered in the low risk group of EBV infection.

Human Herpes Virus 6 (HHV6), A relatively new member of the Herpes Family. Generalized rash is encountered frequently in patients. The virus is present in the saliva but medical or dental staff is considered as members of the low-risk group.

Influenza, Rhino and Adenoviruses, Commonly cause respiratory tract infections. Transmission route is droplet infection members of the dental team are at risk of these infections but wearing masks and gloves offer adequate amount of protection.

Rubella (German Measles) is a toga virus capable of affecting developing foetus causing cataract, deafness etc. Route of transmission is droplets. Female members of the dental team should be warned of possible dangers because at risk are non-immune females of childbearing age. Combined vaccine applications of MMR should be administered to the members of the dental staff.

Coxsackie Virus, causative agent of herpangina and hand-foot and mouth disease. Considered as significant in dentistry due to presence of oral lesions and possibility of spreading in dental office. The virus is present in saliva and can pread via direct contact or aerosols. Gloves and masks offer adequate protection.

Human T-Lymphotropic Virus, is a retrovirus and plays a key role adult T Cell Leukemia and spastic paraparesis. Route of transmission is blood, sexual transmission and IV drug use. In dental practice, can spread via sharp instruments oriented injuries.

Hepatitis B Virus (HBV), A DNA virus causative of acute hepatitis. Hepatitis B surface antigen (HbsAg) is identified by serological tests as the main indicator of active infection. HbeAg on the other hand indicates continuing activity of the virus present in the liver and its higher levels correlates with higher levels of infectivity.

The routes of transmission are, sexual intercourse, blood transfusion, contaminated material injuries and perinatal way.

All members of the dental team should be vaccinated against Hepatitis B and maintain this vaccination schedule.

Hepatitis C Virus (HCV), is a RNA virus, causative of non-A and non-B Hepatitis. Route of transmission is similar to HBV. Following the primary infection, which is usually asymptomatic, majority of the infected individuals become persistent carriers of the virus and there is a long-term risk of chronic liver disease with cirrhosis and hepatocellular carcinoma.

Human Immunodeficiency Virus (HIV), is a RNA retrovirus and is capable of infecting various cellular components of the immune system, T-Helper cells in particular. Route of transmission is similar to HBV, through sexual intercourse, blood borne and perinatal ways. HIV infections have oral manifestations, which can be helpful for the diagnosis of the disease. Among these oral manifestations are;

- Oral Candidiasis
- Oral Hairy Leukoplakia
- Oral Necrotising Ulcerative gingivitis
- Oral Kaposi's Sarcoma

2.2 Bacterial infections

Tuberculosis, caused by M. Tuberculosis is transmitted by inhalation, ingestion and inoculation. Cervical lymphadenitis and pulmonary infections are usually encountered. Immunization with BCG vaccine adequately covers dental team members. Gloves and masks on the side must be utilized. It should be kept in mind that M. Tuberculosis is highly resistant to chemicals and heat and disinfection protocols should be strictly followed.

Legionellosis caused by Gram-negative bacteria, which usually reside in warm and stagnant water reservoirs. Is capable of causing life threatening pneumonias in elder people? Since the organism is water-borne, it can easily be transmitted via aerosols formed during routine dental procedures. There have been reports about Legionella proliferations in dental unit water systems, thus systems, which remain unused for long periods of time should be regularly checked for legionella presence. The members of the dental team should be informed about the long term risk of legionellosis.

Syphilis, caused by T.pallidum. wearing gloves offer adequate protection.

3. Personal protection methods

Dental team professionals must adapt a series of precautions in order to avoid these infections.

The priority in infection control in dentistry is laid on the enhancement of awareness levels of dentists and other team members on infection control and personal protection techniques. An education emphasizing the importance of sensibility in this subject undoubtedly is the first and the most important step of precautions (Atac & Turgut 2007).

Personal protection techniques comprise of a series of applications that aim to reduce contaminations risks. It is not a realistic option to check all patients in terms of contagious diseases and dental professionals are exposed to these sorts of risks countless times everyday. Thus the main principle in infection control is to treat every patient as if he/she is an infected patient and to apply standard protection techniques properly is a “must” in a perfect infection control (Kulekci 2000).

3.1 Routine procedure

A proper medical and dental history should be obtained for all patients at the first visit and updated regularly. On the form, inclusion of patient views about the place cleanliness where they had received medical and dental treatment is useful.

The history and examination may not reveal asymptomatic infectious disease. This means operator must obey the same infection control rules for all patients.

3.2 Immunization

Dentists and other dental team workers who are members of “the high risk group” must be vaccinated against Hepatitis B by means of personal protection (Kohn 2003). 3 doses of vaccination is required. Vaccination must be started in ten days after onset of practice and must be carried on during practice. Individuals who have been vaccinated before the onset of their practice must check their levels of immunity sufficiency against Hepatitis B (Thomas 2008). All dental health care personnel are also strongly urged to receive the following vaccinations: influenza, measles (live-virus), mumps (live-virus), rubella (live-virus), and varicella-zoster (live-virus). Besides, women who have pregnancy uncertainty are strongly recommended to be vaccinated against rubella (Molinari 2005). Vaccination against influenza may also be beneficial for professionals of dental health who are under risk of contamination with droplet infections in terms of close working distance with patients. Updates of Centre for Disease Control (CDC) must be checked and paid attention in this subject.

3.3 Hand hygiene

Providing and maintaining a certain level of hand hygiene is of great importance in protection techniques. All member of the dental team must adapt the habit of maintaining providing hand hygiene. The idea and the practice of washing the hands with antiseptics date back to 19th century. In 1846, Semmelweis reported a lower rate of infection and mortality in obstetric clinics performed by students and physicians who have the habit of washing hands with chlorine when compared with midwives who had lower levels of hand washing habits (Semmelweis 1983).

In 1961, the U.S. Public Health Service produced a training film that demonstrated hand washing techniques recommended for use by health-care workers (HCWs)(Coppage 1961). At the time, recommendations directed that personnel wash their hands with soap and water for 1–2 minutes before and after patient contact. Rinsing hands with an antiseptic agent was believed to be less effective than hand washing and was recommended only in emergencies or in areas where sinks were unavailable (Boyce & Pittet 2002). CDC published a “how to” guideline for washing hands in 1975 and 1985 and according to these

publications hands must be washed with antimicrobial soaps before and after invasive procedures performed on patients. At times when washing hands is not an option, application of water-free antiseptics is recommended.



Fig. 1. Hands should be washed before and after all procedure.

It should be kept in mind that using gloves is not an alternative to washing hands. For routine procedures other than surgical ones, normal or antibacterial soaps are appropriate (Kohn 2004). When an obvious stain is not present, alcohol-containing (% 60-95 ethanol or isopropanol) hand cleaning agents can be utilized (Garner & Favero 1986; Steere & Mallison 1975). And also, alcohol-containing agents are very affective and preferable between the procedures when hand washing facility located far away from the dental unit. Cold water must be of choice when washing hands de to the fact that exposure of the skin to hot water repeatedly may increase the risk of dermatitis. Application of liquid soaps when washing hands for a minimum duration of 15 seconds and disposable paper towels for drying hands is recommended (Figure 1). Reducing numbers of pathogen microorganisms in hand washing before surgical procedures is of great importance. This is why application of antibacterial soaps and a detailed cleaning (arms, nails etc.) followed with alcohol containing liquids are recommended (Esen 2007). Despite the fact that antibacterial effects of alcohol containing cleansers arise rapidly, they do not last long and for a longer effect, antiseptics such as trichlosane, quarterner amonnum compounds, chlorehexidine and octenidine must be included (Boyce & Pittet 2002). Rings, watches and other accessories must be taken off before surgical hand washing and no nail polishes or other artificial (acrylics) must be present (Kohn 2004). After the washing, hands must be dried with sterile towels and other surfaces must not be contacted until wearing sterile gloves. Following the procedure, after taking the gloves off, it is highly recommended to wash hands once again with regular soaps.

3.4 Single use (disposable) items

Equipment described by manufacturer as "single use", should be preferred and used whenever possible. "Single use" means that a device can be used on a patient during one treatment session and then discarded (Thomas 2008). These items are local anaesthetic

needles and cartridges, scalpel blades, suction tubes, matrix bands, impression trays, surgery burs, patient gown, working area covers.

3.5 Barrier techniques

Dental team members must utilize personal protective equipment during applications in order to protect themselves and avoid cross infections. Hardships and limitations when using these equipment must be known and valued and when using new ones, detailed information about these protects must be gained. Guidelines for using these products must be kept under record and updated under contemporary data.

3.5.1 Masks, eyewear and face shields

Contact of blood and saliva of patients with dentists' eyes and airways and contamination with aerosols formed during dental procedures is inevitable if proper precautions are not taken. A mask and a protective eyewear must be used during all applications (Figure 2, Figure 3).



Fig. 2. Protective eyewear should be worn during the procedure

Even though masks were first thought to be used by patient, today masks are mostly utilized for healthcare professionals. Dental masks must have the capacity to block 95% of all bacteria of 3-5 μm diameter and other particles (Esen 2007; Thomas 2008). If the masks get wet when dealing with a patient, they must be changed or thoroughly cleaned before using them for another patient's application.

Sides and upper edges of the protective eyewear must adapt the face well and provide protection against all kinds of infection agents (Thomas 2008). Face shields are more practical than protective glasses for dentists who also have to wear medical glasses and also a lower level of misting is experienced when using. However, wearing and keeping them at place appear to be troublesome which is why they are more often avoided by clinicians (Bebermayer 2005; Esen 2007).

3.5.2 Gloves

Gloves were first used in medical procedures by William Halstead a century ago for avoiding nurses' hands from harsh antiseptics (Randers-Pehrson 1960). Identification of diseases and their contamination routes resulting from viruses such as Hepatitis B and HIV, using gloves has been more and more popular in recent years (Field 1997). The Expert Group on Hepatitis in Dentistry suggested the use of non-sterile gloves for the first time in 1979, when dealing with patients infected with Hepatitis B and as HIV on the side spread around the world, non-sterile gloves have been concluded to be used for all patients routinely (Burke & Wilson 1989; EGHD 1979).

During all kinds of procedure in dentistry, it is impossible to avoid contact of hands with blood and saliva. This is why all clinicians must wear protective hand gloves before they perform any kind of procedure on their patients. It is strongly recommended for dental professionals to use protective gloves both in America and all over Europe (Field 1994; Molinari 2005). Gloves are mainly produced of latex or vinyl and aside from the non-sterile ones, which are appropriate for regular dental procedures, less permeable sterile ones for surgical approaches offered in sterile packs are also available on the market. However, due to the fact that using sterile gloves during routine dental procedures increase costs and seen as an economical burden, clinicians most commonly prefer non-sterile ones instead.



Fig. 3. Gloves must be worn during the operation by all working team.

A separate pair of gloves must be used for every patient and contact with surfaces when with gloves must be avoided to prevent cross infections. Not only the dentist but also other members of the dental team must put on gloves during dental procedures. When cleaning dental appliances and instruments more durable gloves than regular non-sterile ones must be utilized to prevent injuries.

Gloves are powdered to make them easier to put on. However, the powder present inside the gloves are reported to cause skin irritations (Field 1997). Wilson and Garach further reported that this powder could cause starch granulomas on surgical sites among which oral cavity is mentioned (Wilson & Garach 1981). Powder-free gloves are produced and available in the market today and they should be used when such reactions are experienced.

Allergies and contact dermatitis due to latex can be encountered in some people. Dental team members should be warned about this subject. Allergic symptoms may include local ones such as itching, redness, rash, dryness, fissures/cracking, hyperkeratosis and swelling and at times, systemic ones such as sneezing, wheezing, urticarial and red watered eyes can emerge. In such a situation latex gloves should be avoided and a medical consultation should be obtained. Latex-free gloves are also available for allergic individuals.

3.5.3 Protective clothing

Protective clothing should be utilized instead of daily clothing (Figure 4). Whenever the clinician is to deal with patients with contagious diseases, he/she should prefer long-sleeved protective clothing. This way, contact of pathogens with skin can be avoided. In case the clothing gets wet, they should be changed immediately with new ones and should be taken off when the clinician is to leave the operation area.



Fig. 4. Protective clothing should be utilized instead of daily clothing.

3.5.4 Operation room protection

- a. Floor
 - The floor covering should be impervious and non-slip. Carpeting must be avoided.
 - The floor covering should be seam free; where seams are present, they should be sealed.
 - The junctions between floor and wall and the floor and cabinetry should cove or be sealed to prevent inaccessible areas where cleaning might be difficult (BDA 2003).
- b. Work Surface
 - Work surfaces should be easy to clean and disinfection.
 - Work surface joints should be sealed to retention of contaminated matter.
 - All work surface junctions should be rounded or coved to aid cleaning (BDA 2003).

3.6 Post-exposure protocol

In case skin gets injured with contaminated instruments or open wounds come in contact with body fluids of the patient, procedure should be immediately intercepted and injured area should be rinsed with ample amount of soap and water and mucosa if involved, water should be used for flushing. If another member of the dental team gets injured, he/she should inform the dentist. According to Control Disease Center (CDC)'s recommendations, following injuries with contaminated material or contact with certain body fluids;

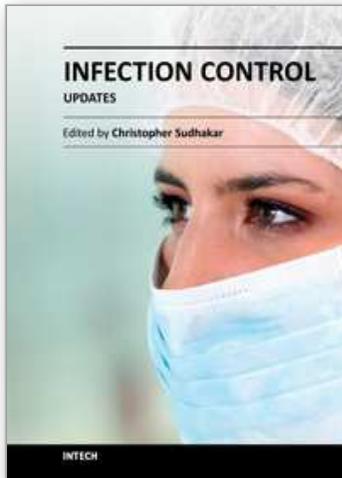
- Injury's date and time
- How and with what sort of instrument injury occurred,
- With which body fluid exposure occurred
- Details about the exposure source (information regarding the presence of any contagious disease)
- Detailed medical information of the injured,
- Precautions followed before and during the injury should be recorded in detail (CDC 2009).

If an injury with contaminated materials utilized in HIV, HBV or HCV infected patients occurs, patient's detailed medical history should be questioned and tested should be carried out for certain markers if required. CDC's post-exposure management publication regarding this subject should be referred as the guideline and necessary precautions should be taken (CDC 2001).

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Infection Control - Updates

Edited by Dr. Christopher Sudhakar

ISBN 978-953-51-0055-3

Hard cover, 198 pages

Publisher InTech

Published online 22, February, 2012

Published in print edition February, 2012

Health care associated infection is coupled with significant morbidity and mortality. Prevention and control of infection is indispensable part of health care delivery system. Knowledge of Preventing HAI can help health care providers to make informed and therapeutic decisions thereby prevent or reduce these infections. Infection control is continuously evolving science that is constantly being updated and enhanced. The book will be very useful for all health care professionals to combat with health care associated infections.

How to reference

In order to correctly reference this scholarly work, feel free to copy and paste the following:

Bahadır Kan and Mehmet Ali Altay (2012). Infectious Disease and Personal Protection Techniques for Infection Control in Dentistry, Infection Control - Updates, Dr. Christopher Sudhakar (Ed.), ISBN: 978-953-51-0055-3, InTech, Available from: <http://www.intechopen.com/books/infection-control-updates/infectious-disease-and-personal-protection-techniques-for-infection-control-in-dentistry>

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