

The Dentists Health: Occupational Risks in Dentistry and Its Control Measures - A Review

Type of Manuscript: Review Article

Running Title: Occupational Risks in Dentistry

Thejeswar EP
Graduate Student

Saveetha dental college, Saveetha University, Saveetha institute of medical and technical sciences

N.P.Muralidharan
Professor

Department of Microbiology

Saveetha dental college, Saveetha University, Saveetha institute of medical and technical sciences

Corresponding Author

Thejeswar EP

Graduate Student

Saveetha dental college, Saveetha University, Saveetha institute of medical and technical sciences

162, Poonamallee High Road

Chennai-600077

Tamil Nadu, India

Abstract: The aim of this study is to identify various occupational risks involved in the field of dentistry. Dental professionals are exposed to a number of microorganisms. These include exposure to infections including cytomegalovirus, Hepatitis B virus, herpes simplex virus type 1 and 2, HIV Virus, staphylococci, streptococci as well as many virus and bacteria. Thus, this review shows the causes, mode of transmission, diagnosis, and prevention of infections in dentistry. Many infectious agents may be present in blood or saliva, as a consequence of bacteremia and viremia associated with systemic infections. A set of infection - control strategies should reduce the risk of transmission of infectious diseases caused by the bloodborne pathogen such as HIV and HBV. Occupational risks remain the main concern, thus proper vaccination must be administrated. The reason for the review is to identify all situations or events that could affect the safety of workers in the dental profession and to safeguard them from these potential infections.

Keywords: Occupational hazards, Health Risks, Vaccination, Transmission, Saliva.

Introduction

An occupational hazard is defined as a risk to a person usually arising from the employment. According to the WHO the term "Hazard" refers to an inherent property of an agent, or a situation having the potential to cause adverse effects when an organism, system or population is exposed to that agent[1]. Occupational health hazards are not uncommon. Although dentistry is least hazardous than other occupations many risks still persist in the status of this occupation[2]. Studies have shown that dentists report more frequent and worse health problems than any other high-risk medical professionals[3]. These hazards cause the appearance of various ailments that are specific to the profession and that develop and intensify over years. Occupational hazards can occur in the form of biohazards, neuro-muscular, Skeletal disorders, health hazards, hearing impairment, visual problems, allergies and skin diseases, psychological problems, percutaneous exposure incidents(PEI), exposure to infectious agents(bioaerosols), vibration induced neuropathy have been known as occupational hazards of dentistry[4]. In many cases, they result in diseases and disease complexes, some of which are regarded as occupational illnesses. During treatments contact with the patients, with their saliva and blood exposes the dentist to various risks, mainly of the contagious kind. Strained posture at work can lead to overburdening of the spine. This affects certain groups of muscles and joints. The noise of suctions, saliva ejectors, turbines, engines, amalgamators, compressors can lead to the impaired hearing, Artificial lighting causes eye strain, conjunctivitis, blurred vision or short-sightedness[5].

An allergic reaction is usually hypersensitivity reaction, is caused by the immune system in response to a foreign substance[6]. Restorative products like acrylics, resins, and polymer materials used in dental practices can cause an allergic reaction. Hypersensitivity to allergens can also be referred to as immune-mediated injury. Some dental restorative materials can cause potential harm to dentists and can lead to allergic contact dermatitis, asthma, and conjunctiva symptoms[7].

Bernardino Ramazzini, known as the father of occupational medicine, recognized the role of occupation in health and diseases.

The practice of dentistry has a variety of work-related hazards. These include:

- Working for hours at high level of concentration
- Working with anxious patients
- Exposure to microbial aerosols

- Exposure to various chemicals used in dental practice

The dental environment is associated with a high risk of exposure to various microorganisms. The Infectious agents may be present in the blood or in saliva, as result of bacteremia or viremia related to systemic infection[8]. Microorganisms can enter organism, through a cut on the skin while performing a medical procedure. The following are the main sources of indirect infection: aerosols of saliva, gingival fluid, natural organic dust particles mixed with air and water[9]. Where such risks cannot be taken out of the dental clinic, appropriate health and safety measures need to be considered by dental staff. Being unaware of these potential hazards in can make dental personnel more prone to injury and illness. Awareness of these occupational hazards and its preventive strategies can provide a safe dental environment for dental professionals[10].

Various routes of spreading harmful microorganisms in a dental office:

- Blood-borne route,
- Direct contact with a patient,
- Contaminated equipment and
- Water droplet route[11].

The greatest risk for the dentist are viruses spread through blood (hepatitis B and C viruses, HIV virus) which cause serious health and life-threatening diseases. The occupational hazards can be further divided into five different types: "physical, chemical, biological, psychological and musculoskeletal disorders".

Physical Hazards

The dentists are at height risk of physical injuries during various procedures. Poor illumination causes eye pain, eyestrain, headache, eye fatigue, whereas excessive brightness leads to discomfort, and visual fatigue. Eyes may be affected with conjunctivitis and keratitis while using dental curing light, computer, and lasers[12]. The hearing may be affected due to use of high-speed turbines, compressor, suction and ultrasonic dental scaler results in hearing loss. The dentist can get exposed to both ionizing and nonionizing radiation. Chronic exposures to radiation can results, somatic (body) or genetic changes[13].

Chemical Hazards

Dentists are exposed to various types of chemicals that are hazardous to health. They include mercury, beryllium, silica etc. Highly dangerous of these agents is mercury. The chemicals act by local action, inhalation, and ingestion. The maximum level of exposure considered to be safe is 50 µg/ cc of air, the active component in mercurial vapour has a particular affinity for brain tissue. Mercury poisoning can be characterized by tumours of the face, arms, legs and may be associated with progressive, tremulous illegible handwriting with slurred speech[14].

Ergonomics

The dental team has the higher risk of neck and back problems due to the limited work area and impaired vision associated with the oral cavity. These working restrictions frequently cause a clinician to assume stressful body positions to achieve good access and visibility inside the oral cavity. Furthermore, dental procedures are usually longer and require much more concentration during work[15].

Musculoskeletal Disorder

Musculoskeletal disorders are most common health problems reported among dentists. Musculoskeletal disorders are a group of conditions that involve: Nerves, Tendons, Muscles and supporting structures such as intervertebral discs. It has been reported that young and less experienced dentists experience more musculoskeletal disorders compared to older and experienced one. Common musculoskeletal problems are low back pain, shoulder pain, headache, hand and wrist pain[16]. Low back pain is more prevalent than other types. The cause of a musculoskeletal problem is due to, repeated uni-directional twisting of the trunks, working in one position, prolonged static periods and operator's flexibility.

Latex Hypersensitivity

Latex Gloves are most commonly used during treatments by a dentist as one of the protective barriers. Latex gloves are usually dusted with corn starch powder. They form an efficient barrier against most pathogens and also constitute a very good barrier against viruses, provided they are intact. However, they may also be allergic to few individuals who use rubber products regularly[17]. Allergy to latex gloves is the most commonly reported cause of dermatitis in dental personnel in various studies around the world. An alternate source of latex gloves can be vinyl and nitril gloves.

Eye Injuries

Eye injuries in prosthodontic practice are very common due to the usage of high speed rotating instruments which are often hot, sharp and infected. Very common symptoms include lacrimation, pain, conjunctivitis, and blurring of the vision. Painful reactions arise when materials such as methyl methacrylate accidentally splashed into the eye; in addition, pumice can also cause abrasion. Curing lights are used for polymerization of composite restorative materials[18]. They emit intense blue light with varying wavelength when can cause degeneration of the retina.

Noise Hazard

Dentist professionals are exposed to different levels of noise dental clinics which leads to hearing disorders. Ultrasonic scalers can be the potential hazard to auditory system of the dentist on regular usage[19]. Damage to the operator hearing is possible through air when hearing the sound arising from the ultrasonic scalers. The noise levels of modern dental equipment's have been reduced, which has minimal risk of hearing loss[20].

Radiation Hazards

Dental personnel are exposed to ionizing as well as a non-ionizing type of radiations. Ionizing radiation is a major risk factor for cancer. Almost most dental offices and clinics have x-ray machines that are in frequent use, the exposure of these radiations has a major drawback. Protocols such as standing behind protective barriers and also use radiation monitoring badges must be considered. Direct radiation injury has been greatly eliminated by improvements in equipment and methods and protective measures[21]. Precautions, like wearing lead aprons and lead layered walls, must be used.

Biological Hazards

The biological hazards are caused by infectious agents of human origin and include bacteria, viruses, and fungi. Most common transmittable diseases in dentistry include HIV, HBV, HCV, and Mycobacterium tuberculosis. These infections affect dentists either directly or indirectly i.e. by a cut or wound, aerosols of saliva or even by needle stick injury.

The main entry points of infection include:

- Epidermis of hands,
- Oral cavity,
- Nasal cavity,
- Epithelium of upper airways,
- Bronchial tree,
- Alveoli and
- Conjunctiva.

In order to avoid the spread of infection, a thorough knowledge of the source, mode of transmission and safety measures are necessary.

Infectious Diseases

Many microorganisms are potentially transmissible from patients to the dental professional, the following organisms are of the greatest importance due to their intrinsic frequency or the severity of the eventual occupational infection:

- hepatitis B virus (HBV);
- hepatitis C virus (HCV);
- hepatitis Delta virus (HDV)
- human immunodeficiency virus (HIV);
- Herpes simplex virus (HSV);
- human Cytomegalovirus (CMV);
- Treponema pallidum, etiological agent of syphilis;
- Mycobacterium tuberculosis;

Infectious Diseases, such as hepatitis B virus (HBV), hepatitis C virus (HCV), Herpes B virus and, human immunodeficiency virus (HIV), are transmitted during dental procedures. These are usually present in the saliva, blood and expired air of infected individuals[22]. Needlestick and other sharps injuries and contaminated instruments play a role in the transmission of infectious diseases. Infection control procedures, such as attention to general hygiene, personal protective measures, sterilization/ disinfection and HBV immunization remain the best defence for the dentist, thereby helps to prevent transmission of infectious diseases[23].

Transmission of the Infection Through Blood and Blood Products

Blood-borne pathogens - It transmits through the blood of an infected patient. Bloodborne pathogens can be transmitted when infectious blood gets introduced into the bloodstream of a person. Transmission of bloodborne pathogens in the clinic can occur through the following routes of transmission:

Parenteral exposure - In this type, the infected blood is introduced directly into your body through a cut/break in the skin[24].

Mucous membrane exposure - In this type, the infected blood enters your body through contact with a mucous membrane found in your eye, nose or mouth.

saliva-droplet - This is transmitted through the droplet of saliva, generated during treatment by an infected patient. In this type the transmission occurs when microbes travel on relatively large respiratory droplets that people sneeze or a cough, they travel only short distances less than 3 feet. These droplets are loaded with infectious microbes. They usually spread directly if people are close to each other[25]. When the contaminated hand touches the nose or eyes, the infection is able to enter the new person.

Water-droplet infections - Through a water droplet aerosol emitted from a handpiece of a dental unit which may contain microorganisms present in a unit reservoir or developing in biofilm within its tubing unit[26].

Psychological Factors

Occupational stress occurs when dealing with difficult or uncooperative patients and also due to work overload. Professional burnout is common among dentist, all professional due to emotional and psychological terminologies. In some cases, it may cause Generalized Anxiety Disorders and tension[27]. High levels of occupational stress among dentists are correlated with hypertension, neurological and mental problems, cardiac problems, alcohol consumption and suicide.

Legal Hazards

All countries have regulations which apply to the practice of dentistry. Improper treatment leads to the warrant which progresses into legal actions be brought against a dental practitioner. Many dentists in different part of the world graduate from the dental schools in debt because of the costs of their education[28]. Dentists should follow proper protocol starting with case history till completion of treatment along with consent of the patient. So sound practice and sound earning, which is essential for good living and good relationship.

Control Measures

The dentist has to upgrade his existing knowledge by participating in continuing dental education. Universal precaution has to be taken while practicing preventing occupational hazards. Dental clinic design has to be made with, proper lighting, ventilation, and equipped with appropriate personal protective[29].

Blood is the most important source of infections such as HIV and HBV in dental practice. Protective measures against these infections should focus primarily on preventing these types of exposures to blood as well as on delivery of Hb vaccination. Under current technology, it is recognized that the risks of accidental percutaneous injuries in dental practise cannot be reduced to zero[30]. While the risk of HBV transmission could be eliminated by immunization, the risk of exposure to the blood of HIV infected individual is a special concern to dental health care workers. It is important to have proper infection control measures when performing invasive procedures on individuals with known HIV infection. Dental health care workers who consider themselves at increased risk of HIV infection should arrange confidential testing[31].

1) Immunisation

All dental health care workers are advised to be immunized with vaccines against HBV, and few other diseases.

2) Protective Coverings

Uniforms must be changed regularly. Gowns or aprons should be worn during procedures.

Hand protection Gloves must be worn for procedures involving contact with blood, mucous membrane. Extra pair of gloves should be used for each patient. If a glove is damaged, it must be replaced immediately. Sharp instruments and needle should be handled with great care to prevent unintentional injury.

3) First aid and Inoculation injuries

It occurs when the event of a skin puncture occurred by a contaminated instrument, the wound should be encouraged to bleed and washed thoroughly with running water. There is the possible transmission of infection, hence appropriate serologic testing, medical evaluation, and follow-up must be done by accident. Hence the address and contact telephone of the patient concerned should be recorded.

4) Instrument Sterilization

All instruments must be cleaned thoroughly before sterilization by rinsing and scrubbing with detergent and water. The splashing of water must be avoided. Items which will penetrate tissues must be sterilized in an autoclave or hot air steriliser. Items which will touch mucous membrane but not penetrate tissues should similarly be sterilized by heat.

5) Disposal of Waste

Sharp items including needles and scalpels and local anaesthetic cartridges must be disposed of safely In. Hospitals and clinics. Noninfective waste should be disposed in thick black plastic bags securely fastened. Liquid waste should be carefully poured into a drain and then flushed with water.

6) Lab Transfer Objects

Impressions and appliances in the laboratory should be rinsed thoroughly to remove blood and debris. Gloves should be worn when handling impressions and pouring models. Certain types of impression material can be disinfected using glutaraldehyde (2%) or sodium hypochlorite (0.1%). Other materials (alginate, polyether) also must be washed and disinfected.

A study showed that the fact that only 3.70% of dentists in Chennai city are free from risk factors of MSDs and the remaining 96.30% of dentists are at various levels of risk factors of MSDs (34.68%—very minimal risk, 57.91%—moderate risk, 3.37%—high risk, and 0.34%— very high risk)[32].

Conclusion

As this review shows, many occupational health problems are common in modern dentistry. Immunization against various infectious diseases like HBV is very essential for every dental professional. Dentists should control their working hours, the pace of work, be aware of occupational hazards and observe their mental health. Serious infectious can be avoided if proper barrier techniques used with high-level sterilization. Various dental education programs should be organized to keep them safe and healthy. Ideal protocols about preventive measures must be printed and pasted inside every dental office which can remind them of the safety precautions.

References

1. Chopra SS, Pandey SS. Occupational hazards among dental surgeons. *Medical Journal Armed Forces India* 2007;63(1):23-5.
2. Fasunloro A, Owotade FJ. Occupational hazards among clinical dental staff. *J Contemp Dent Pract* 2004;5(2):134-52.
3. K Park. Occupational health. Park's Text Book of Preventive and Social Medicine. 20th Ed. Jabalpur India: M/S Banarsidas Bhanot Publishers, 708-723.
4. Leggat PA, Chohanadisai S, Kedjarune U, Kukiattrakoon B, Yapong B. Health of dentists in southern Thailand. *International dental journal* 2001;51(5):348-52.
5. Brooks SL, Rowe NH, Drach JC, Shipman C, Young SK. Prevalence of herpes simplex virus disease in a professional population. *The Journal of the American Dental Association* 1981;102(1):31-34.
6. Babaji P, Samadi F, Jaiswal JN, Bansal A. Occupational hazards among dentists: A review of literature. *Journal Of International Dental And Medical Research* 2011;4(2):87-93.
7. Hovius M. Disinfection and sterilisation: the duties and responsibilities of dentists and dental hygienists. *International dental journal* 1992;42(4):241-44.
8. Castiglia P, Liguori G, Montagna MT, Napoli C, Pasquarella C, Bergomi M, Fabiani L, Monarca S, Petti S. Italian multicenter study on infection hazards during dental practice: control of environmental microbial contamination in public dental surgeries. *BMC public health* 2008;8(1):187-89.
9. Myers HL, Myers LB. 'It's difficult being a dentist': stress and health in the general dental practitioner. *British dental journal* 2004;197(2):89-91.
10. Durgha K, Sakthi DR. Occupational hazards and its impact on quality of life of dentists. *IOSR J Dent Med Sci* 2014;13(7):53-56.
11. Prabhu S, John J, Saravanan S. Knowledge, attitude and perceived barriers towards practice of evidence based dentistry among Indian postgraduate dental students. *IOSR Journal of Dental and Medical Sciences* 2012;4(1):46-51.
12. Reddy V, Bennadi D, Satish G, Kura U. Occupational Hazards among Dentists: A Descriptive Study. *J Oral Hyg Health* 2015;3(185):2332-336.
13. Leggat PA, Kedjarune U, Smith DR. Occupational health problems in modern dentistry: a review. *Industrial health* 2007;45(5):611-21.
14. Tadakamadla J, Kumar S, Swapna LA, Reddy S. Occupational hazards and preventive practices among students and faculty at a private dental institution in India. *Stomatologija* 2012;14(1):28-32.
15. Roshene R, Loganathan S. Ergonomics and Musculoskeletal Disorder as an Occupational Hazard in Dentistry-A Pilot Study. *Journal of Pharmaceutical Sciences and Research* 2017;9(5):712.
16. Muralidharan D, Fareed N, Shanthi M. Musculoskeletal disorders among dental practitioners: does it affect practice?. *Epidemiology Research International* 2013;2(1):14-17.
17. Ratzon NZ, Yaros T, Mizlik A, Kanner T. Musculoskeletal symptoms among dentists in relation to work posture. *Work* 2000;15(3):153-58.
18. Marshall ED, Duncombe LM, Robinson RQ, Kilbreath SL. Musculoskeletal symptoms in new south wales dentists. *Australian dental journal* 1997;42(4):240-46.
19. Al Wassan KA, Almas K, Al Shethri SE, Al Qahtani M. Back & neck problems among dentists and dental auxiliaries. *J Contemp Dent Pract* 2001;2(3):17-30.
20. Shugars D, Miller D, Williams D, Fishburne C, Strickland D. Musculoskeletal pain among general dentists. *General Dentistry* 1987;35(4):272-76.
21. Rustemeyer T, De Groot J, Von Blomberg BM, Frosch PJ, Scheper RJ. Cross-reactivity patterns of contact-sensitizing methacrylates. *Toxicology and applied pharmacology* 1998;148(1):83-90.
22. Samuel AR, Jacob C, Muralidharan NP. Occupational risk of hepatitis B among dental professionals by estimation of the anti-HBs. *Journal of Pharmacy Research* 2017;11(8):54-57.
23. Mikov I, Turkalj I, Jovanović M. Occupational contact allergic dermatitis in dentistry. *Vojnosanitetski preglod* 2011;68(6):523-25.
24. Katelaris CH, Widmer RP, Lazarus RM. Prevalence of latex allergy in a dental school. *The Medical journal of Australia* 1996;164(12):711-14.
25. Chohanadisai S, Kukiattrakoon B, Yapong B, Kedjarune U, Leggat PA. Occupational health problems of dentists in southern Thailand. *International dental journal* 2000;50(1):36-40.
27. Rankin KV, Jones DL, Rees TD. Latex glove reactions found in a dental school. *The Journal of the American Dental Association* 1993;124(5):67-71.
28. Verrusio AC, Neidle EA, Nash KD, Silverman Jr S, Horowitz AM, Wagner KS. The dentist and infectious diseases: a national survey of attitudes and behavior. *The Journal of the American Dental Association* 1989;118(5):553-62.
29. Tarlo SM, Sussman G, Contala A, Swanson MC. Control of airborne latex by use of powder-free latex gloves. *Journal of Allergy and Clinical Immunology* 1994;93(6):985-89.
30. Seggev JS, Mawhinney TP, Yunginger JW, Braun SR. Anaphylaxis due to Cornstarch Surgical Glove Powder. *Survey of Anesthesiology* 1991;35(3):168-70.
31. Porter K, Scully C, Theyer Y, Porter S. Occupational injuries to dental personnel. *Journal of dentistry* 1990;18(5):258-62.
32. Arthistri AS, Jain AR, Philip JM, Krishnan CV, Chandran CR. A Novel Method for the Risk Assessment of Dental Practitioners in Chennai City for Occupational Musculoskeletal Disorders. *Biology and Medicine* 2016;8(5):17-19.