

REVIEW ARTICLE

HAZARDS IN DENTISTRY - A REVIEW

Angabeen Anjum, Saima Akram Butt, Fizza Abidi

Department of Oral Pathology, Ziauddin College of dentistry, Ziauddin University, Karachi, Pakistan.

ABSTRACT

The comprehensive and multidisciplinary approach of occupational health has the aim of protecting and promoting worker's health. Workers live productive lives when they have assurance of their physical, social and mental wellbeing. The profession of dentistry has many occupational hazards. Different risks associated with dental medicine and dental surgery includes biological, chemical, physical, biomechanical and psychological factors. Biological risk factors may include viruses, bacteria, prions and fungi, which may cause various infections ranging from less harmful to life threatening. Health affecting chemical factors includes dental materials, medicines and disinfectants, which can cause allergies, hypersensitivity reactions, skin diseases, burns and injuries. Ionizing and non-ionizing radiation, noise, artificial lighting and dental filling curing lights are some of the physical hazards in dentistry that threaten workers lives and can cause sight and hearing problems along with other disorders. Improper posture during work, repetitive movements, prolonged mechanical straining, vibrations, etc. are some biomechanical factors, which can lead to musculoskeletal disorders, disorders of the neurological system and other health problems etc. In order to reduce such occupational perils, it is necessary to create awareness among dental workers through different awareness programs including seminars, workshops etc.

Keywords: Occupational Hazards; Dental Professionals; Needle Stick Injuries; Ergonomics, Musculoskeletal Disorders.

Corresponding Author:

Dr. Angabeen Anjum

Department of Oral Pathology,
Ziauddin College of dentistry,
Ziauddin University, Karachi, Pakistan.
Email:angabeen.anjum@gmail.com
doi.org/10.36283/PJMD8-4/013

INTRODUCTION

A risk to a person arising out of employment is an occupational hazard and may also include any work, material, substance, situation or process that predisposes, or itself causes accidents or disease, at a workplace¹. Dental health care providers are exposed to great number of occupational perils which may be biological, physical, chemical, biomechanical and psychological². Biological hazards associated with dental medicine include bacteria, viruses, prions, fungi etc. that can cause serious infections. Ionizing and non-ionizing radiation, noise, artificial lighting, polymerization light etc. are some of the physical hazards found in dental practice responsible for causing hearing and sight impairments along with other radiation related disorders. Factors that affect health care providers through their chemical properties are dental materials, medicines and disinfectants, which can cause allergies, skin diseases, hypersensitivity, burns and other injuries³. Biomechanical hazards include improper posture during work, prolonged mechanical straining, repetitive movements, vibrations, etc., which are strongly associated with musculoskeletal, neurological and other health related issues⁴.

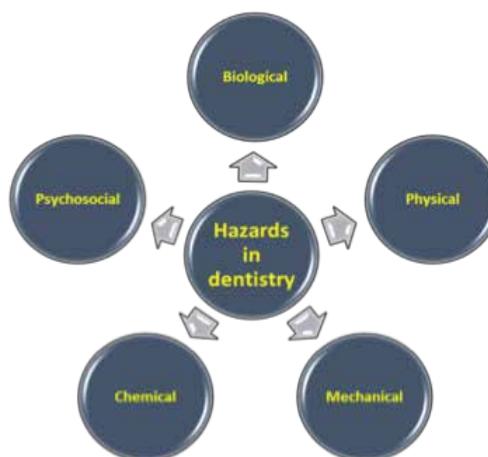


Figure 1: Types of hazards in dentistry.

Dental practice is also associated with many psychological problems including stress and chronic fatigue which not only cause mental disorders like depression and burnout syndrome but can also have somatic manifestations such as cardiovascular and digestive disorders³ (Figure 1).

DISCUSSION

The profession of dentistry requires a high degree of precision, patience and concentration. Health care providers including dental professionals are surrounded by many occupational risks, which include⁵.

BIOLOGICAL HAZARDS

Biological hazards may be caused by airborne microorganisms as well as via body-fluid transmission; the most common pathogens are bacteria, viruses (HIV, HBV, and HCV) and fungi⁶. Almost 385,000 health-care providers are exposed to these pathogens annually⁷.

One of the most common occupational hazards in dentistry is Needle stick injuries (NSI). The prevalence of needle stick injuries is higher in dental workers because of limited and restricted working area⁸. Health care providers are frequently exposed to these needle stick injuries⁹. Both Hepatitis B virus and Hepatitis C virus are leading causes of death, with HBV infection ranking tenth globally. The risk of transmission after percutaneous exposure is estimated to be approximately 6-30% for HBV, and almost 1.8% for HCV¹⁰.

Frequent use of sharp instruments, close contact with the patients' oral cavity and working with high-speed rotary instruments producing contaminated aerosols are some of the factors, which make dental practitioners more exposed to biological hazards. According to a study conducted in Washington, 20% of occupational injuries were in the dental profession¹¹.

One of the viral infections that may also affect dental professionals while providing dental services is the Zika virus (ZIKV) infection. Although it is a mosquito-borne illness like Chikungunya (CHIK) virus and dengue (DEN) but the viral RNA has been detected in a number of body fluids including saliva, urine, blood and amniotic fluid and so transmission associated with occupational exposure to these body fluids are seen. There is a major potential for exposure to ZIKV during the labor and delivery process, blood transfusion, and dental procedures¹².

Dental laboratory technicians (DLTs) are also frequently exposed to health hazards. As they work with different metals (chromium, nickel etc.), the dust released can affect their lungs and respiratory

system and can even cause pneumoconiosis, the dust related lung disease. In several studies, pneumoconiosis frequency among DLTs was reported between 10.3% and 31%¹³. Cross contamination has largely been seen through the environment including water, air and surfaces. Dental unit water systems (DUWS) have been found to be an important source of spread of microorganisms because of biofilm production, water stagnation and lack of disinfection¹⁴. Along with dental unit water lines, aerosols from air water syringes and turbines have also been found to contaminate the surrounding surface and air as they nebulize saliva and microorganisms present in patient's mouth¹⁴. Disinfection is recommended as a part of clinical guides in order to minimize the risk of cross contamination¹⁵.

HARMFUL CHEMICAL FACTORS

Chemical hazards include caustics (hydrogen peroxide, formaldehyde), organic (resins, solvents, gases), inorganic (mercury toxicity) and Latex glove allergy (contact dermatitis)¹⁶. Studies have proved that neurological and biological damages are associated with high mercury vapor dose exposure. The mercury dangers can be reduced with the help of sealed amalgam capsules with lower mercury level, proper collection and good ventilation, high suction and water irrigation and proper amalgam disposal. Allergic skin reactions caused by latex containing gloves, detergents, X-ray processing chemicals, dental materials, solvents and lubricating oils have also been documented in many studies¹⁷.

HARMFUL PHYSICAL AND MECHANICAL FACTORS

Physical and mechanical hazards include cuts from sharp instruments, eye injuries occurring from projectiles, or puncture wounds from needles or other sharps. Radiation hazards and intense noise in the dental practice are also some of the physical and mechanical hazards. Ionizing radiation (X-rays) and Non-ionizing radiation (visible and UV light) have destructive effects on body tissues. Hearing problems are increasing in dental professionals because of vibration and noise produced by hand pieces or other noise producing devices¹⁶.

HEARING LOSS

National Institute for Occupational Safety and Health has identified noise as one of the most important factors and potential hazards causing work related disease or injury¹⁸. Continuous exposure of workers to hazardous levels of noise have been found in many occupations and so the prevalence of noise-induced hearing loss (NIHL) is very high in United States¹⁹. Continuous exposure to noise has both auditory and non-auditory effects²⁰. Sleep disturbance, hypertension, decreased learning performance, interference with communication

and concentration, stress reactions, mental fatigue, annoyance and a reduction in efficiency are some of the non-auditory effects while auditory effects may include tinnitus or a temporary or even permanent hearing loss²¹. Noise related injury in workers depends on the frequency, intensity and duration of exposure. Noise producing devices that pose a serious threat to the hearing system of dentists and patients in the dental practice include high-speed turbine hand pieces, ultrasonic instruments and cleaners, high-velocity suction, low-speed hand pieces, vibrators and mixing devices such as amalgamators. The daily permissible noise level in the workplace by Occupational Safety and Health Administration (OSHA) is 85 decibels for workers continuously exposed to noise for up to 8 hours²². Patients are greatly affected because of noise produced in dental setups as it induces anxiety and fear reducing their cooperation and compliance²³. The use of earplugs and ear muffs in such environments can reduce the damage caused by noise exposure²⁴.

EYE RELATED INJURIES

Chemical, microbiological, mechanical and electromagnetic irritants are sources of eye-related injuries in the dental operator. Infection and trauma are the two important causes of eye related injuries in dental settings. Direct eye contact with air borne pathogens and splashing material including aerosols, organic dust particles (plaque, calculus and tissue residues) and saliva are important causes of eye infections. Traumatic eye injuries usually occur during providing dental services with the use of high-speed hand pieces or other rotary instruments. Dental procedures with high-risk of causing traumatic eye injuries include old fillings removal, bone removal, orthodontic applications, polishing, prosthetic preparations etc. Aerosols and foreign bodies have been found to be factors causing most of the eye related injuries. From minor manifestations like conjunctivitis to major manifestations, including corneal abrasion or even blindness can occur because of such injuries. Eye injuries have also been reported with the use of dental curing light¹. It is recommended to use eye-protecting shields including goggles and visors in order to prevent eye injuries not only for dental practitioners but for assistants and patients as well²⁵.

RADIATION HAZARDS

Radiation hazards have increased in past few decades in the medical and dental settings with the increased use of ionizing radiation²⁶. Different body systems including immune, hematopoietic, circulatory, reproductive, musculoskeletal, respiratory, nervous, digestive, endocrine and urinary systems get badly affected with long-term exposure to ionizing radiation. Skin burns, cataracts, leukemia, and several other types of cancers are

among the other adverse effects of ionizing radiation²⁷. Dental practice has potential radiation hazards because of extensive use of X-rays in this field. Lead apron, radiation resistant gloves and thyroid collar are few of the protective shields that can protect health care workers and patients from hazardous ionizing radiation²⁸. Thus, radiation hazards should be dealt cautiously otherwise ignorance in this case can even cause cancer²⁹.

HARMFUL BIOMECHANICAL ELEMENTS

Harmful biomechanical elements include repetitive movements, improper working posture, prolonged mechanical straining, vibrations etc. Damaging biomechanical factors can lead to musculoskeletal disorders, disorders of the peripheral neurological system, systemic neurological and other health problems³.

MUSCULOSKELETAL DISORDERS

Ergonomics can be defined as 'the science which is used to design products of human use in a way that the productivity and efficiency of workers can be increased with ensuring their wellbeing as well'. Sticking to the principles of ergonomics ensures higher productivity in the work place, prevention of occupational hazards and improved job satisfaction among workers. On the other hand, breaching those principles leads to serious consequences specially work related illness, among which musculoskeletal disorder ranks the highest³⁰. Musculoskeletal disorder is a major concern among medical and dental practitioners arising because of poor ergonomic practices³¹. Musculoskeletal disorders are defined as musculoskeletal complaints, symptoms or pain that reflect a number of conditions, such as back pain, neck pain, shoulder pain, pain in limbs, myofascial dysfunction syndrome, carpal tunnel syndrome, atypical facial pain³² etc. Factors involved in causing musculoskeletal pain include poor positioning, repetitive movements, prolonged static postures, suboptimal lighting³³ etc. Since, 63-93 percent is the reported prevalence of MSDs among dental professionals³⁴. Importance of physical exercise has been documented in many studies for the prevention of musculoskeletal pain³⁵.

HARMFUL PSYCHOLOGICAL FACTORS

Dentistry is considered by many healthcare workers and general public as a stressful profession. Dealing with anxious patients, strict time schedule, unanticipated emergencies, and painful treatments procedures connected with anesthetization of patients, or procedures with hesitant prognosis are frequently referred to as major stressors³⁶. These factors are responsible for causing mental disorders in dental practitioners including depression and burnout syndrome along with some somatic manifestations like digestive and cardiovascular disorders³. Lack of

job satisfaction, stress or excess workload, professional burnout and medico-legal problems are few of the causes of psychological issues¹⁶.

One of the important psychological issues confronted by dental practitioners is the burnout syndrome. It is a particular type of job related stress reaction characterized by emotional exhaustion, depersonalization and reduced personal accomplishment. It is a response to the chronic emotional strain of dealing extensively with other human beings, particularly when they are troubled or having problems. The nature of job of dental practitioners makes them prone to burnout syndrome³⁷.

BIOMEDICAL WASTE MANAGEMENT

Biomedical waste includes human and animal anatomical waste and treatment apparatus such

as syringes and needles, as well as various materials used in the health sector in the process of diagnosis, treatment, and research³⁸. Potentially hazardous dental waste includes used needles, human tissue parts, soaked cotton, extracted teeth etc., which are usually contaminated with body fluids like blood and saliva³⁹. The other seriously hazardous waste generated by the dental practice includes various chemical solvents, silver amalgam and mercury³⁹. Poor disposal of mercury and other materials like strontium, barium, polystyrene etc., is a great threat for the environment safety and occupational health, so it should be dealt cautiously⁴⁰ (Table 1).

Table 1: Hazards in dentistry and their management.

Type of Hazards	Risk Factors	Management
Physical	Broken or sharp instruments, high speed projectile, ionizing and non-ionizing radiation, heat, vibration, fire, noise.	Use of personal protective equipments, face shield, eye glasses, radiation shields, ear plugs etc.
Chemical	Alginate dust, Methyl methacrylate, cadmium, nickel, beryllium chromium, free silica particles. Latex gloves.	Use of personal protective equipments, local exhausts ventilation systems, adequate fume extraction system, HEPA filter. Use nitrile or vinyl gloves.
Biological	Contaminated body fluids, air borne pathogens, infectious splatter and aerosols, needle stick injuries, cross contamination.	Infection control procedures, use of personal protective equipments, laundry procedures, mandatory immunization, adequate housekeeping and waste management services.
Ergonomic	Repetitive movements, improper working posture, prolonged mechanical straining, vibrations, and inadequate equipment or workplace designs.	Workstation and chair adjustment to make it user friendly. Awareness programs regarding ergonomic hazards.
Psychosocial	Uncooperative or anxious patients, strict time schedule, excess workload, unanticipated emergencies, painful treatment procedures, financial pressures, constant drive for technical perfection.	Deep breathing exercises, communication with counselors, relaxation, hypnosis and desensitization technique, stress management workshops.

CONCLUSION

The profession of dentistry has many occupational hazards, which can affect the wellbeing of workers. In order to reduce such hazards, it is necessary to be aware of these risks and the ways of combating these issues. For this, different awareness programs including continuing dental education and workshops should be conducted on a regular basis. This will not only help in improving worker's productivity but also assist in giving quality care to patients.

ACKNOWLEDGEMENTS

All authors' contributions are sincerely appreciated and gratefully acknowledged. Special thanks to Prof. Dr. Mervyn Hosein for his valuable insights and suggestions that helped to improve the quality and clarity of paper.

CONFLICTS OF INTEREST

Authors have no conflicts of interest to declare.

AUTHORS CONTRIBUTION

AA and FA given the conception design of the study and provided the acquisition of data. Further, AA and SAB performed analysis and developed interpretation. In addition, AA and FA drafted the manuscript while all the authors given equal contribution in critical revision of the review.

REFERENCES

1. Fasunloro A, Owotade FJ. Occupational hazards among clinical dental staff. *J Contemp Dent Pract*. 2004;5(2):134-52.
2. Moodley R, Naidoo S, van Wyk J. The prevalence of occupational health-related problems in dentistry: A review of the literature. *J Occup Health*. 2018;60(2):111-25.
3. Matoš K, Jurec Z, Galić I, Vodanović M. Education on occupational health and health related habits among dental students in Croatia. *Acta Stomatol Croat*. 2016;50(1):49.
4. Gupta A, Ankola AV, Hebbal M. Optimizing human factors in dentistry. *Dent Res J*. 2013;10(2):254.
5. Bennadi D, Reddy V, Thummala NR. Preventive and curative measures adopted by dentists to combat occupational hazards—a cross sectional study. *Int J Pharm Pharm Sci*. 2015;7(10):416-8.
6. De Sio S, Traversini V, Rinaldo F, Colasanti V, Buomprisco G, Perri R, Mormone F, La Torre G, Guerra F. Ergonomic risk and preventive measures of musculoskeletal disorders in the dentistry environment: an umbrella review. *Peer J*. 2018;6:e4154.
7. Hbibi A, Kasouati J, Charof R, Chaouir S, El Harti K. Evaluation of the knowledge and attitudes of dental students toward occupational blood exposure accidents at the end of the dental training program. *J Int Soc Prev Community Dent*. 2018;8(1):77.
8. Kapoor V, Gambhir RS, Singh S, Gill S, Singh A. Knowledge, awareness and practice regarding needle stick injuries in dental profession in India: a systematic review. *Niger Med J*. 2013;54(6):365.
9. Shahbaz T, Raza SM, Manzoor Z, Jamshid A. Hepatitis B and C: knowledge, attitude and perception of medical students at lahore medical and dental college, lahore. *Pak J Med Health Sci*. 2014;8:789-93.
10. Almutairi R, Almutairi M, Alsugair A, Alseraikh M, Almutairi H. Senior health sciences students' perception of occupational risk of viral hepatitis and attitudes toward patients diagnosed with viral hepatitis B and C. *Int J Health Sci*. 2017;11(4):28.
11. Shaghaghian S, Golkari A, Pardis S, Rezayi A. Occupational exposure of shiraz dental students to patients' blood and body fluid. *J Dent*. 2015;16(3):206.
12. Sharma S, Tyagi A, Ramachandra S, Bhuyan L, Dash KC, Raghuvanshi M. Knowledge, attitudes, and practices among health-care providers regarding Zika virus infection. *J Int Soc Prev Community Dent*. 2018;8(1):41.
13. Yurdasal B, Bozkurt N, Bozkurt Aİ, Yilmaz Ö. The evaluation of the dust-related occupational respiratory disorders of dental laboratory technicians working in Denizli Province. *Ann Thorac Med*. 2015;10(4):249.
14. 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.
15. Savabi O, Nejatidanesh F, Bagheri KP, Karimi L, Savabi G. Prevention of cross-contamination risk by disinfection of irreversible hydrocolloid impression materials with ozonated water. *Int J Prev Med*. 2018;9(1):37.
16. Mehta A, Gupta M, Upadhyaya N. Status of occupational hazards and their prevention among dental professionals in Chandigarh, India: a comprehensive questionnaire survey. *Dent Res J*. 2013;10(4):446.
17. Ayatollahi J, Ayatollahi F, Ardekani AM, Bahrololoomi R, Ayatollahi J, Ayatollahi A, Owlia MB. Occupational hazards to dental staff. *Dent Res J*. 2012;9(1):2.
18. Alabdulwahhab BM, Alduraiby RI, Ahmed MA, Albatli LI, Alhumain MS, Softah NA, Saleh S. Hearing loss and its association with occupational noise exposure among Saudi dentists: a cross-sectional study. *BDJ Open*. 2016;2:16006.
19. Burk A, Neitzel RL. An exploratory study of noise exposures in educational and private dental clinics. *J Occup Environ Hyg*. 2016;13(10):741-9.
20. Tessier-Sherman B, Galusha D, Cantley LF, Cullen MR, Rabinowitz PM, Neitzel RL. Occupational noise exposure and risk of hypertension in an industrial workforce. *Am J Ind Med*. 2017;60(12):1031-8.
21. Qsaibati ML, Ibrahim O. Noise levels of dental

equipment used in dental college of Damascus University. *Dent Res J*. 2014;11(6):624.

22. Yousuf A, Ganta S, Nagaraj A, Pareek S, Atri M, Singh K, Sidiq M. Acoustic noise levels of dental equipments and its association with fear and annoyance levels among patients attending different dental clinic setups in Jaipur, India. *J Clin Diagn Res*. 2014;8(4):ZC29.

23. Goswami M, Singh D, Vashist B, Marwaha S. Noise levels and sound pollution associated with various operative procedures and equipments in a pediatric dental environment—A clinical study. *J Oral Biol Craniofac Res*. 2017;7(3):182-7.

24. Verbeek JH, Kateman E, Morata TC, Dreschler WA, Mischke C. Interventions to prevent occupational noise-induced hearing loss. *Cochrane Database Syst Rev*. 2012(10).

25. Ekmekcioglu H, Unur M. Eye-related trauma and infection in dentistry. *J Istanbul Univ Fac Dent*. 2017;51(3):55.

26. Awosan KJ, Ibrahim MT, Saidu SA, Ma'aji SM, Danfulani M, Yunusa EU, Ikhuenbor DB, Ige TA. Knowledge of radiation hazards, radiation protection practices and clinical profile of health workers in a teaching hospital in Northern Nigeria. *J Clin Diagn Res*. 2016;10(8):LC07.

27. Alavi SS, Dabbagh ST, Abbasi M, Mehrdad R. Medical radiation workers' knowledge, attitude, and practice to protect themselves against ionizing radiation in Tehran Province, Iran. *J Educ Health Promot*. 2017;6.

28. Singh G, Sood A, Kaur A, Gupta D. Pathogenesis, clinical features, diagnosis, and management of radiation hazards in dentistry. *Open Dent J*. 2018;12:742.

29. Chaudhry M, Jayaprakash K, Shivalingesh KK, Agarwal V, Gupta B, Anand R, Sharma A, Kushwaha S. Oral radiology safety standards adopted by the general dentists practicing in National Capital Region (NCR). *J Clin Diagn Res*. 2016;10(1):ZC42.

30. Gupta A, Manohar Bhat TM, Bansal N, Gupta G. Ergonomics in dentistry. *Int J Clin Pediatr Dent*. 2014;7(1):30.

31. Al-Mohrej OA, AlShaalan NS, Al-Bani WM, Masuadi EM, Almodaimegh HS. Prevalence of

musculoskeletal pain of the neck, upper extremities and lower back among dental practitioners working in Riyadh, Saudi Arabia: a cross-sectional study. *BMJ Open*. 2016;6(6):e011100.

32. Rambabu T, Suneetha K. Prevalence of work related musculoskeletal disorders among physicians, surgeons and dentists: a comparative study. *Ann Med Health Sci Res*. 2014;4(4):578-82.

33. Ohlendorf D, Erbe C, Nowak J, Hauck I, Hermanns I, Ditchen D. Constrained posture in dentistry—a kinematic analysis of dentists. *BMC Musculoskelet Disord*. 2017;18(1):291.

34. Vakili L, Halabchi F, Mansournia MA, Khami MR, Irandoost S, Alizadeh Z. Prevalence of common postural disorders among academic dental staff. *Asian J Sports Med*. 2016;7(2).

35. Koneru S, Tanikonda R. Role of yoga and physical activity in work-related musculoskeletal disorders among dentists. *J Int Soc Prev Community Dent*. 2015;5(3):199.

36. Revankar VD, Yadav Chakravarthy SN, Selvan AS, Ganapathy A, Prasad A. Musculoskeletal disorders and mental health-related issues as occupational hazards among dental practitioners in Salem city: A cross-sectional study. *J Pharm Bioallied Sci*. 2017;9(Suppl 1):S228.

37. Puriene A, Janulyte V, Musteikyte M, Bendinskaite R. General health of dentists. Literature review. *Stomatologija*. 2007;9(1):10-20.

38. Ranjan R, Pathak R, Singh DK, Jalaluddin M, Kore SA, Kore AR. Awareness about biomedical waste management and knowledge of effective recycling of dental materials among dental students. *J Int Soc Prev Community Dent*. 2016;6(5):474.

39. Singh T, Ghimire TR, Agrawal SK. Awareness of biomedical waste management in dental students in different dental colleges in nepal. *Biomed Res Int*. 2018;2018.

40. Bansal M, Vashisth S, Gupta N. Knowledge, awareness and practices of dental care waste management among private dental practitioners in Tricity (Chandigarh, Panchkula and Mohali). *J Int Soc Prev Community Dent*. 2013;3(2):72.