

OCCUPATIONAL HAZARDS AMONG DENTISTS: A REVIEW OF LITERATURE

Prashant Babaji^{1*}, Firoza Samad², JN Jaiswal³, Anju Bansal⁴

1. Dr, MDS, Reader, Department of Pedodontics, Sardar Patel Postgraduate Institute of dental and medical science. Lucknow, Utter Pradesh, India.
2. MDS, Professor & HOD, Department of Pedodontics, Sardar Patel Postgraduate Institute of dental and medical science. Lucknow, Utter Pradesh, India
3. MDS, Professor & Director, Department of Pedodontics, Sardar Patel Postgraduate Institute of dental and medical science. Lucknow, Utter Pradesh, India
4. MDS, Senior Lecturer, Department of Pedodontics & Preventive Dentistry, Budha Institute of Dental College & Hospital. Patna, Bihar, India.

Abstract

Occupational hazard refers to a risk or danger as a consequence of the nature or working conditions of a particular job. Dental surgeons are exposed to a number of occupational hazards in their professional work. With advent of advanced technology, no matter how beneficial it is, can exert a negative impact also on some members of the population.

This article highlights on occupational hazards like physical, chemical, biological, psychological, musculoskeletal disorders and their effects. The aim of this paper is to increase the level of awareness of occupational hazards among the dental surgeons and also to provide information on the ways in which hazards can be reduced.

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Introduction

Dentists are usually exposed to a number of occupational hazards during their professional work. These cause the appearance of various ailments, specific to the profession, which develop and intensify with years.

In many cases they result in diseases and disease complexes, some of which are regarded as occupational illnesses¹.

Occupational hazards can be defined as a risk to a person usually arising out of employment. It can also refer to a work

material, substance, process or situation that predisposes, or itself causes accidents or disease, at a work place. Berardino Ramazzini is referred to as father of occupational medicine².

Occupational hazards can occur in the form of biohazards, neuro-muscular skeletal disorders, health hazards (disruption of the respiratory and cardio-vascular system) hearing impairment, visual problems, allergies and skin diseases^{1,3}.

Dentists during clinical practice exposes to variety of work related hazards. These occupational hazards can be classified into five types: "physical, chemical, biological, psychological and musculoskeletal disorders".

1) Physical

The dentists are at risk of physical injuries during many dental procedures. Poor illumination causes eye pain, eye strain, headache, eye fatigue where as excessive brightness leads discomfort, and visual

*Corresponding author:

Dr. Prashant Babaji
MDS, Reader
Department of Pedodontics
Sardar Patel Postgraduate Institute of dental and medical science
Lucknow, Utter Pradesh, India

Phone: 8009058818/ 09880707506

E-mail: babajipedo@rediffmail

fatigue. Eyes may be affected with conjunctivitis and keratitis while using dental curing light, computer and lasers.

Moreover use of high-speed turbines, compressor, suction and ultrasonic dental scaler results temporary or permanent hearing loss, fatigue, interface with communication by speech and decreased efficiency. Dentist can expose to both ionizing and nonionising radiation. Chronic exposures to radiation can results, somatic (body) or genetic changes.

The radiation effects are cumulative and this damage is totally painless yet life threatening, it may cause acute erythema, dermatitis, chronic skin cancer, bone marrow suppression, damaged to eye including cornea, lens and retina. Safety shields and use of eye glasses helps to protect from radiation damage⁴. Glassware and sharp needles, lancets, B.P blades, broken ampoules, test tubes are hazardous and can cause cuts, scratches, abrasions which are potential locations for infections^{2,5,6}.

Needle stick injuries and cuts from sharp objects have been reported 1-15 % of surgical procedures². Sharp instruments should be handled carefully to avoid injuries.

Aerosols were defined as particles less than 50 micrometers in diameter. The smaller particles of an aerosol (0.5 to 10 μm in diameter) can penetrate through smaller passages of the lungs and are thought to carry the greatest potential for transmitting infections.

The dental literature shows that many dental procedures produce aerosols and droplets that are contaminated with bacteria and blood. These aerosols represent a potential route for disease transmission. Splatter was defined by Micik and colleagues as airborne particles larger than 50 μm in diameter. These particles or droplets are ejected forcibly from the operating site and are too large to become suspended in the air and are airborne. Airborne infection in dentistry usually comes from aerosols due to their ability to stay airborne

and potential to enter respiratory passages.

Ultrasonic scaler has been shown to produce the greatest amount of airborne contamination, followed by the air-driven high-speed handpiece, the air polisher and various other instruments such as the air water syringe and prophylaxis angles.^{7,8,9}

The use of personal barrier protection such as masks, gloves and eye protection will eliminate much of the danger inherent in splatter droplets arising from the operative site. While preprocedural rinses will reduce the extent of contamination. The most frequently mentioned methods of removing airborne contamination from the air of the treatment room are the use of a high efficiency particulate air or HEPA (high efficiency particulate arresting) filter and the use of ultraviolet chambers in the ventilation system.⁹

2) Chemical

Dentists are exposed to various types of chemicals that are hazardous while providing care. They include mercury, beryllium, silica and powdered natural rubber latex (NRL). Most dangerous of these agents is mercury. These chemicals act by local action, inhalation and ingestion.

Mercury use in dental amalgam has potential occupational exposure to dentists. The maximum level of exposure considered to be safe is 50 $\mu\text{g}/\text{cc}$ of air^{7,8}. The active component in mercurial vapour has a particular affinity for brain tissue.

Mercury poisoning can be characterized by tumours of the face, arms or legs and may be associated with progressive, tremulous illegible handwriting with slurred speech^{4,10}.

The exposure risks from mercury can be minimized by careful handling, collecting the waste part of amalgam in closed container and subjecting it to recycling, use of proper evacuation system and avoiding the direct physical contact. The research conducted at the University of Calgary Faculty of Medicine found that exposure to

mercury caused the formation of "neurofibrillar tangles," which are one of the two diagnostic markers for Alzheimer's disease. In February, 1998, a group of the world's top mercury researchers announced that mercury from amalgam fillings can permanently damage the brain, kidneys, and immune system of children. Dental amalgam fillings have been found to affect DNA. This later can lead to cancer. Damage in human blood cells based on a number of studies in Sweden, the World Health Organization review of inorganic mercury in 1991 determined that mercury absorption is estimated to be approximately four times higher from amalgam fillings than from fish consumption.¹⁰

Inhalation of dust containing free silica or silicon dioxide in ceramic laboratories leads to silicosis. Some of the dental alloys contain beryllium and if inhaled while working on items such as dental crowns, bridges, and partial denture framework, they can cause chronic beryllium disease (CBD). As per Occupational Safety and Health Administration (OSHA) specification, employees cannot be exposed to more than 2 microorganisms of beryllium per cubic Meter of air for an 8 hour time weighted average⁸.

Formaldehyde is one of the chemical agents routinely used in the clinical set up mainly for disinfection of operatory area. Liquid and vapour forms of formaldehyde may cause severe abdominal pain, nausea, vomiting and eye irritation⁵. Occupational Safety measures should be followed to minimize the side effects due to chemical agents.

Latex gloves (dusted with cornstarch powder) form an efficient barrier against most pathogens. Unfortunately most of the professionals are allergic to latex content of gloves. The powder in latex gloves itself is not the allergen. It only provides binding sites for latex protein, and aids in carrying the protein into the skin. It has also been reported that airborne powder particles can

cause asthmatic allergic reactions or even anaphylaxis. Dental personnel should also note that latex is present in other personnel protective equipments like masks, eyewear, and clinical gowns. The clinical symptoms of latex allergies include: urticaria, conjunctivitis accompanied by lacrimation and swelling of eyelids, mucous rhinitis, bronchial asthma and anaphylactic reaction. Most allergic reactions can be managed by self medication, prescribed medication. Sufferers from latex allergy are advised to work in latex free environment and use vinyl, nitrile or 4H gloves.^{1,3}

Dental products such as acrylics, resins and polymer materials used in restorative dentistry represent a major advance in dentistry; but these products may act as allergens in part of the population^{4,9}.

Because allergy is a reality, dentists have to deal with it, so dental personnel should be familiar with the major signs and symptoms of allergic reactions, including anaphylaxis. Allergic patch test can be done to determine type of allergen.

Dental personnel should always keep records of dental materials used, if allergic reaction occurs, backtracking is necessary in order to identify the specific allergen. Avoid direct contact of material which cause allergy. Local exhaust ventilation systems can significantly reduce the peak concentration of acrylate vapour in the breathing zone of dental technicians.

However, the local exhaust ventilation is not efficient in reducing the concentration of airborne acrylic dusts^{3,7}.

3) The biological hazards

The biological hazards are constituted by infectious agents of human origin and include viruses, bacteria and fungi. Transmissible diseases currently of greatest concern to the dental professional are HIV, HBV, HCV and Mycobacterium tuberculosis. A dentist can become infected either directly or indirectly, i.e by a cut or wound, needle stick injury, aerosols of saliva, gingival fluid and natural organic dust particles.

The following are the main entry points of infection: epidermis of hands, oral epithelium, nasal epithelium, epithelium of upper airways, bronchial tubes, alveoli and conjunctival epithelium. In order to overcome from the infection spread, a thorough knowledge about the infection, mode of transmission and safety measures is necessary. During many dental procedures, the use of a rubber dam will eliminate virtually all contamination arising from saliva or blood¹.

Prevention from contamination and cross-infection can be done by effective sterilization of instruments using autoclave before and after use. Legnani et al. made an assessment of the aerosol contamination resulting from dental procedures. Air contamination was measured by means of the Surface Air System method and the "plate" method (Air Microbial Index). It was proved that during working hours the average air bacterial load increased over three times, and the air load levels were 1.5 times (aerobic bacteria) and 2 times (anaerobes) greater as compared to the initial load.¹¹

The Occupational Safety and Health Administration (OSHA) has published *Controlling Occupational Exposure to Bloodborne Pathogens in Dentistry*. These OSHA guidelines are designed to protect the employee, not the patient. The OSHA blood-borne pathogen standard is a comprehensive rule that sets forth specific requirements. OSHA guidelines are designed to prevent the transmission of blood-borne diseases to employees. It includes requirements for an exposure control plan, exposure control precautions, laundry procedures, mandatory hepatitis B vaccinations, housekeeping standards, and waste disposal regulations.¹²

4) Psychological Hazards

a. Stress

Dentists encounter numerous sources of professional stress, beginning in dental clinic. Stress can be defined as the biological

reaction to any adverse internal or external stimulus physical, mental or emotional that tends to disturb the organism's homeostasis.

Dentists perceive dentistry as being more stressful than other occupations. Coping with difficult or uncooperative patients, over workload, constant drive for technical perfection, underuse of skills, low self-esteem and challenging environment are important factors contributing to stress among dentist. Dunlap J and Stewart J in their survey on 3,500 dentists found that 38 percent were frequently worried or anxious, 34 percent of the respondents felt physically or emotionally exhausted, and 26 percent said they always or frequently had headaches or backaches.^{1,13,14}

b. Professional burnout

One of the possible consequences of chronic occupational stress is professional burnout. Meslach and Jackson (1986) define burn out as: "A syndrome of emotional exhaustion, depersonalization and reduced personal accomplishment that can occur among individuals who do people work of some kind." Burnout is best described as a gradual erosion of the person. Prolonged experience of burn out may lead to depression, so early recognition of the symptom is important¹⁴. In a study of three dental specialities Humphris *et al* reported that general dentists and Oral surgeons had the highest levels of burnout and that orthodontists had the lowest levels of burnout.¹⁵

c. Anxiety disorder and Depression

Anxiety disorders are chronic and relentless and can grow progressively worse if not treated. Two common and potentially overlapping anxiety disorders are panic disorder and generalized anxiety disorder, or GAD. In panic disorder, feelings of extreme fear and dread strike unexpectedly and repeatedly for no apparent reason They are accompanied by intense physical symptoms like feeling sweaty, weak, faint, dizzy, flushed or chilled; having nausea, chest pain, smothering sensations, or a tingly or numb

feeling in the hands. GAD is characterized by chronic exaggerated worry and tension, even though little or nothing has provoked it.¹⁴

Depressive disorder often occurs with anxiety disorders and substance abuse. Major depression is an illness that involves the body, mood and thoughts. It affects the way people eat, sleep, feel about themselves and think about things. Studies have indicated that both anxiety and depressive disorders are observed frequently in dentists.¹⁴

Coping with Psychological hazards

The goal of coping with stress is to offset the negative effects of stress by using appropriate coping strategies. Coping can be done by, participating in activities that make to feel better, going to movies or participating in religious, social or other activities.

Stress management workshops focusing on stress relievers may include deep breathing exercises; progressive effective relaxation of areas of the body; listening to audiotapes of oral instructions on how to relax; meditation; information on the topics of practice and business management, time management, communication and interpersonal skills.

These workshops should be structured to help improve dentists' coping skills and equip them to deal more effectively with the stressors intrinsic to the profession.¹⁴

Physical exercise, such as regular walking or working out at a health club, cannot be underestimated as a stress reliever. Such activities result in burning up the additional supply of adrenaline those results from stress, and they allow the body's functions to return to a more normal state. Physical exercise helps develop greater self-esteem, self-control and self-discipline.

People's personalities and temperaments have a significant impact on their perceptions of stress. Those who have strong, positive self-images and know how to relax so as to reduce mental and emotional

pressures also cope better with stress, as do people who are open to being helped by others.

Stressors such as failing to meet personal expectations, seeing more patients for financial reasons, working quickly to see as many patients as possible for financial reasons, earning enough money to meet lifestyle needs and being perceived as an inflictor of pain are all stress-producing situations and has to be taken care. Break the large task into small ones. Application of relaxation, hypnosis and desensitization technique helps in stress management. Anxiety disorder and depression can be treated with antianxiety or antidepressant drugs and psychotherapy¹⁶.

5) Musculoskeletal disorder

Musculoskeletal disorders are common health problems reported among dentists. Its prevalence reported to be between 38-82%. Musculoskeletal disorders are a group of conditions that involves: Nerves, Tendons, Muscles and supporting structures such as intervertebral discs¹.

It has been reported that young and less experienced dentists experience more musculoskeletal disorders compared to older and experienced one⁴.

Common musculoskeletal problems are, low back pain, shoulder pain, headache, hand and wrist pain. Low back pain is more prevalent than other types. The cause of musculoskeletal problem is due to, repeated unidirectional twisting of the trunks, working in one position, prolonged static periods and operators flexibility^{4,17,18}.

At work, the dentist assumes a strained posture (both while standing and sitting close to a patient who remains in a sitting or lying position), which causes an overstress of the spine and limbs.

Back pain syndromes diagnosed in dental workers originate from spine degeneration in its different phases. The posture of the dentist at work, with the neck bent and twisted, an arm abducted, repetitive

and precise movements of the hand are frequent cause of the neck syndrome and of pain within the shoulder and upper extremities¹⁹.

Puriene A et al²⁰ reported Fatigue and back pain as most common prevalent and chronic physical complaints among Lithinium dentists.

The dentist makes constant monotonous movements, which stress the wrist and elbow joints. Also of consequence are mechanical vibrations. A number of dental doctors suffer from a defect of the median nerve and of the cubital nerve. A consequence of the defected median nerve in the carpal canal is the so-called tunnel syndrome. Its early phase is dominated by paroxysmal paraesthesiae of the thumb and index finger, which occur almost without exception at night and which are accompanied by sensomotor disorders of the thumb and index finger²¹.

Pains of the epicondylus, appearing at first during strain and special movements, gradually intensifying and radiating along the forearm, point to an inflammation of the epicondylus of the humeral bone. Operations carried out during extractions stress not only the elbow joint and the wrist joint but may result in chronic tendon sheath inflammation¹⁹.

Prevention includes maintaining correct body posture while treating patients, taking adequate rest, doing some exercises.

Common musculoskeletal disorders occurring among dentists. Following are the classification of some of the musculoskeletal disorders seen commonly among dental practitioners.¹⁹ (Table 1).

Organization for Safety and Asepsis Procedures (OSAP)

The Organization for Safety and Asepsis Procedures (OSAP) is the only evidence-based, non-governmental organization in the world that concentrates solely on the provision of information, education and publications on the subject of

dental infection control and occupational safety and health. OSAP also has a unique constituency comprised of three major categories: clinicians, educators and trainers, and the dental industry. All three groups are represented on the Board of Directors and play a role in developing well reasoned, science-based, practical solutions to the world's complex infection control and safety issues.¹²

No	Type of musculoskeletal disorders	Symptoms
1)	Neck and shoulder disorders	
a)	Myofascial pain disorder	Pain and tenderness in the neck, shoulder and arm muscles. Painful trigger points upon touch.
b)	Cervical Spondylosis	Intermittent / chronic neck and shoulder pain or stiffness, headache, hand and arm pain, numbness, tingling and clumsiness
c)	Thoracic Outlet Syndrome:	Pain in the shoulder, arm or hand, numbness, tingling of fingers, muscle weakness / fatigue, cold arm or hand.
d)	Rotatory Cuff Tendinitis / Tears.	Pain and stiffness in the shoulder associated with backward and upward arm movements. Weakness of rotator cuff muscles
2)	Hand and Wrist Disorders:	
a)	DeQuervain's Disease	Pain in thumb and wrist area when grasping, pinching, twisting.
b)	Carpel Tunnel Syndrome:	Hand or finger numbness, pain, tingling, burning, clumsiness. Eventual muscle weakness and atrophy. Symptoms often worse with increased activity.
c)	Guyon's Syndrome	Symptoms begin with a feeling of pins and needles in the ring and little fingers
3)	Back Disorders:	
a)	Herniated Spinal Disc	Back and leg numbness, tingling, pain, weakness. Worsens with coughing, sneezing, sitting, driving, bending forward
b)	Lower back pain:	Pain, Stiffness in lower spine and surrounding tissues
c)	Sciatica	Pain from lower back or hip radiating to the buttocks and legs. Leg weakness, numbness, or tingling. Possible causes are prolapsed intervertebral disc pressuring the sciatic nerve; worsened with prolonged sitting or excessive bending / lifting.

Table 1. Classification of some of the musculoskeletal disorders.

Recommendations for occupational hazards in dentistry

Dentist has to upgrade his existing knowledge by participating in continuing dental education. Universal precaution has to be taken while practicing to prevent occupational hazards. Dental clinic design has to be made with, sufficient lighting, ventilation, engineering control measure and equipped with appropriate personal protective.

Conclusions

Occupational health risks are present in every profession. Dentists are one such professional group. In spite of these hazards we cannot refrain from providing care and serving community. Sufficient knowledge and adequate information regarding occupational hazards and its prevention will contribute in providing quality care to patients without any doubt.

Declaration of Interest

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