

# Occupational Hazards in Dentistry: A Review

## Abstract

The dentist and his team members are exposed to a number of hazards peculiar to the profession. Bernadino Ramazzini mentioned three principal causes of occupational hazards i.e., posture, repetitive motion and stress. The commonest occupational illness documented is musculoskeletal pain, backache being more common. Professional Burn out a consequence of occupational stress can cause incapacity for work. Exposure to the infectious agents like human immunodeficiency virus (HIV) and stress related Dysthymia are serious one. Dental Hygienists may suffer from back pain and Carpel tunnel syndrome due to repetitive wrist and hand moments. Injuries of the oral cavity which occur as a direct result of the occupation are common like Heavy metal lines, Plumbism, occupational dental erosion etc. Application of ergonomics and administrative measures contribute in reducing the occupational hazards in profession. Stress related problems like professional Burn out can be reduced by taking help from the colleagues, organizing regular breaks, having strong family ties. Infectious diseases can be prevented by proper barrier and vaccination. Mercury poisoning can be prevented by use of triturators and proper mercury disposal. Accurate and systemic record maintaining, Obtaining consent are some of the keys to avoid medicolegal problems. Radiation Hazards can be avoided by using ALARA (as low as reasonably achievable) principle, adequate shielding and personal monitoring. Risk in the dental laboratory can be avoided by proper decontamination methods. Prevention of hazards is important than treatment. Local organizations should organize workshop and seminars on occupational hazards periodically. Government needs to coordinate occupational health services, train and strengthen professional expertise in occupational health.

## Key Words

Occupational hazards; ergonomics; occupational health; professional burn out; carpel tunnel syndrome

Abhay Kulkarni<sup>1</sup>, Preeti Nair<sup>2</sup>, Tejas Kulkarni<sup>3</sup>, Kaustubh Patil<sup>4</sup>, Ashwin Kodgi<sup>5</sup>, Rutuparna Sasane<sup>6</sup>

<sup>1</sup>Senior Lecturer, Department of Oral Medicine Diagnosis and Radiology, PDU Dental College & Hospital, Solapur, Maharashtra, India

<sup>2</sup>Professor & Head, Department of Oral Medicine Diagnosis and Radiology, People's College of Dental Sciences and Research Centre, Bhopal, Madhya Pradesh, India

<sup>3</sup>Senior Lecturer, Department of Oral Medicine Diagnosis and Radiology, Dr DY Patil Dental School, Pune, Maharashtra, India

<sup>4</sup>MDS, Consultant, Periodontics and Oral Implantology, Pune, Maharashtra, India

<sup>5</sup>Assistant Professor, Department of Prosthodontics, Nanded Rural Dental College and Research Centre, Nanded, Maharashtra, India

<sup>6</sup>Senior Lecturer, Department of Prosthodontics, Terna Dental College and Hospital, Navi Mumbai, Maharashtra, India

## INTRODUCTION

The Indus valley of India & Pakistan has yielded evidence of dentistry being practiced as far as back 7000 BC. Dentistry in the present era has definitely achieved the status of a valuable profession.<sup>[1]</sup> The dentist & sometimes with his team members are exposed to a number of hazards peculiar to this profession. Occupational hazards can be defined as the risk to a person usually arising out of employment or it can be also refer to a work, material, substance, process, or situation that predisposes or itself causes accidents or disease at work place.<sup>[2]</sup> The occupational hazards found among the dentists & other clinical dental workers

are similar world wide & include a wide range of risks & sometimes legal hazards.<sup>[3]</sup> The health hazards are produced due to negligence & can cause harm if not controlled. Prevention of unsafe conditions in the work place is central to the practice of this profession. Occupational health & dental waste management can and should be considered as an integral part of a broader delivery of public health services.<sup>[4]</sup> Bernadino Ramazzini (1633-1714), an Italian physician, published his systematic study of occupational disease in a book in 1713 entitled '*De Morbis Artificum Diatriba*' i.e., *Diseases of Workers*. He pointed out that in medical practice attention is hardly paid to occupational

hazards.<sup>[2,5]</sup> Scully c. Cawson,<sup>[6]</sup> K Park,<sup>[5]</sup> Bailoor D N, Nagesh KS,<sup>[3]</sup> Al- Khatib, Ishtayeh,<sup>[7]</sup> are various authors who have classified occupational hazards in many ways. They are mainly- hazards to specific body systems, physical and chemical dangers, biological hazards, mechanical hazards, psychological hazards and medico legal problems.

#### CAUSES AND PREDISPOSING FACTORS

Bernadino Ramazzini mentioned three principal causes of occupational hazards i.e., posture, repetitive motion and stress.<sup>[2]</sup>

**Posture:** Postural stress is assuming an extreme posture. Working the arms abducted away from the body, overextended shoulder and the hunched places may create requirement of higher muscular force and increases the risk for injury.

**Repetitive motion:** Repetitive hand disorders are predominantly caused by constant flexion and extension motions of the wrist and fingers. Chronic repetitive movements, working for too long a period without rest and forceful work with extended use of vibratory instruments are the other causes.<sup>[8]</sup>

**Stress: Professional burnout syndrome:** It is long term consequence of stress. The reasons for stress include imperfections in operating skills, inefficient patient management and even poor ergonomics.<sup>[9]</sup> Increasing number of graduate dentists that enter the profession is also a factor for stress.<sup>[7]</sup> Further symptoms of professional burn out syndrome like somatic complaints, interpersonal problems, insomnia, irritability and suicidal ideation may begin to more closely resemble a psychological mood disorder known as *Dysthymia*.<sup>[9]</sup>

Other causes of work related hazards in dentistry include- Working in a static position, exposure to microbial aerosols and various chemicals, exposure to patient saliva and blood, a limited surgical area with artificial lighting results in eyestrain, conjunctivitis, blurred vision or short sightedness. Musculoskeletal disorders cause cumulative physiological damage that can lead to a career ending disability.

#### HAZARDS TO DENTAL SURGEON

The common problems are

1. **MUSCULOSKELETAL PROBLEMS:** are the commonest in dental practice, the most being pain in the neck. Between 30-80% of dentists this practitioners and more in dentists who practice two handed dentistry.<sup>[10]</sup> Hard work for more than 8 hours without rest may cause: Cervical spondylosis, Low back pain, Varicose veins, Knee and ankle

joint osteoarthritis, Rarely scoliosis and other vertebral column problems.

2. **STRESS RELATED PROBLEMS** are inherent part of dentist's everyday work. This is particularly true of dentists who feel professionally isolated.<sup>[11]</sup> *Professional burnout* (syndrome being burned) , a long term consequence of occupational stress, is considered to be a factor that explains a substantial proportion of incapacity for work. Burn out syndrome persons may feel irritated, miss work, provide low quality services/ patient attention, look sleepy/ sad and other symptoms lead to alcohol consumption, auto medication and consumption of illegal drugs.<sup>[12]</sup>

3. **INFECTIOUS DISEASES** are mainly transmitted through the sources of body fluids of blood with contaminated dental instruments. Microorganisms are transmitted in the dental environment by touch, splatter and aerosols.<sup>[6]</sup> Other routes of transmission are percutaneous, and trauma.<sup>[13]</sup> Microbial agents of most concern in dentistry includes - *Hepatitis viruses*, most important being hepatitis B, hepatitis C, hepatitis D, and non-A and non-B viruses. Hepatitis B is a relatively common infection. Risk for *HIV Infection* after percutaneous and mucous membrane (eyes, nose, mouth) exposure to HIV infected blood is approximately 0.3% to 0.09%, respectively.<sup>[6]</sup> *Herpatic infections* can be transmitted to clinical dental staff can cause *primary herpatic stomatitis* or *herpatic whitlow*. *Shingles* likely to develop as a reactivation of virus. *Chickenpox* is highly contagious and spreads particularly by airborne route. The *common cold* and other respiratory virus's route of infection is probably by droplet or contact spread. *Coxsackie viruses* cause Hand, foot and mouth disease and *herpangina* can spread by contact and in aerosols. *Tuberculosis*, if active and untreated is a possible hazard to the dental staff, since the bacilli appear in the sputum and saliva. *Sexually transmitted diseases* (e.g., syphilis) are predominantly transmitted by close contact of mucosae. *Legionella* is caused by aerosols generated in dental operations, causing immunological reaction.<sup>[14]</sup>

4. **ALLERGIC REACTIONS:** Dentistry has its share of allergens like x-ray processing solutions, monomer liquid, some cements and latex gloves. Other allergens are glutaraldehyde, epoxy resins, metals. Allergic contact dermatitis manifests as soreness, peeling, scabbing, crusting, papules, drying, swelling, thickening, redness, scaling and

vesicles.<sup>[15]</sup> Latex gloves dusted with cornstarch powder in some individuals produce urticaria. Chlorhexidine occasionally causes contact dermatitis and severe allergies.<sup>[6]</sup> Methacrylates causes irritation to skin, eyes, mucous membrane, asthma, paresthesia in fingers, CNS disturbances as headache, loss of memory and sleep disturbances.<sup>[3]</sup> White hand syndrome can be caused by penetration of monomer into the skin resulting in numbness or parasthesia of fingers and palms.<sup>[6]</sup> Orthodontist and Prosthodontist are commonly associated with hypersensitive reactions to resin base materials, in removable appliances and bonding material respectively after dermal contact.<sup>[16]</sup> X-ray processing chemicals cause conjunctivitis, dermatitis, bronchitis.<sup>[6]</sup> Formaldehyde which is used for biopsy fixation and in endodontics can cause ocular and respiratory irritation and dermatitis. Eugenol can cause dermatitis. Tooth colored filling material has several contact allergens like epoxides and benzyl peroxide.<sup>[6]</sup> *Dry hand syndrome* results from drying and cracking of skin due to frequent washing of hands and handling plaster of paris.<sup>[6]</sup>

**5. MERCURY HANDLING PROBLEMS:** High exposure to mercury vapor can cause biological and neurological damage. The health risk from amalgam due to mercury is greater for members of dental office teams than for the patients.<sup>[17]</sup> The most common route is through lungs by inhalation of vapours.<sup>[18]</sup> The maximum level of exposure considered to be safe is 50 micrograms/cc of air.<sup>[3]</sup> The symptoms of mercury poisoning include ataxic gait, convulsions, numbness in mouth and lips, constriction of visual field, difficulty in speaking.<sup>[17]</sup> Contact hypersensitivity consists of an inflammatory and sometimes vesiculating reaction of the skin when exposed to mercury. Nixon *et al.*,<sup>[10]</sup> described a dentist and his assistance suffering from profuse salivation, insomnia and irritability due to mercury poisoning. Foetotoxic effect in pregnant female staff may occur where work practices are poor.<sup>[6]</sup>

**6. MEDICOLEGAL PROBLEMS:** These are due to the services rendered by the dentists having come under the consumer protection act. The contravention of any of the regulations may warrant that legal actions be brought against a dental practitioner particularly in developed countries where the citizens appear more aware of rights. To help assure a safe work environment in dental treatment, the hazard awareness and prevention of

legal risks should be made known to all clinical workers of the dental hospital.<sup>[14]</sup> *Professional negligence* is defined as a 'failure to exercise reasonable skill and care'. The legal problems can be divided into two main categories i.e., error of commission and error of omission that is giving wrong treatment and withholding the correct treatment respectively. Other possible areas could be professional misconduct and breach in the government rules. Every practitioner is expected to possess a certain degree of skill and to exercise care to the same standard as that exercised by majority of his/her colleagues. Some of the examples of negligence are failure to give antibiotic prophylaxis against infective endocarditis, ear and nerve damage following condylectomy, damage to inferior dental nerve by endodontic treatment without radiographs and transmission of Hepatitis B due to inadequate sterilization etc.<sup>[6]</sup>

**7. EYE AND EAR PROBLEMS:** These are due to trauma, carelessness during laser and high levels of noise. Conjunctivitis, corneal abrasions or even dangerous penetrating wounds are caused by small particles that can be projected from the bur with air turbine speeds. Plaster of paris contains small quantities of lime and quartz that can cause damage to eye. Herpetic keratitis is one of the worst ocular infections can be caused by splash of saliva in dental office.<sup>[6]</sup> Nodular headaches and loss of visual acuity is caused by using color monitors in the clinics and if the computer field is not sufficiently illuminated.<sup>[3]</sup> Eye injuries may occur from projectiles such as bits of calculus.<sup>[19]</sup> Retinal damage may occur if a person directly looks at the beam of light curing unit.<sup>[18]</sup> Hazard to hearing can be caused by older high speed handpieces. Other sources of noise are compressor and suction.<sup>[8]</sup> Ultrasonic scalars may produce slight tinnitus after prolonged use.<sup>[6]</sup>

**8. RADIATION HAZARDS:** These are mainly from ionizing radiations, as in X-rays, but these may be from non-ionizing radiations like the light sources from curing composite materials and occasionally other sources such as lasers.<sup>[3]</sup> Ionizing and non ionizing radiations can cause intense conjunctivitis and keratitis. Radiation induced cancer is a stochastic effect since greater exposure increases the probability of cancer but not severity.<sup>[20]</sup> Chronic effects of radiation are skin cancers and bone marrow suppression. Genetic effects may lead to congenital defects in the employee's offspring.<sup>[3]</sup> Stochastic effect include

the shortening of life, the induction of cancer and leukemia, and genetic effects.<sup>[21]</sup> cancer induction has probably no threshold dose. Even a small radiation dose may increase the patient's statistical probability of cancer development.<sup>[22]</sup> Non-stochastic effects may arise in the haematopoietic system, with occasional hypoplasia. Dermatological effects may include brittle, cracked, or grooved nails, the disappearance of body hair and fingerprints, and chronic radio dermatitis. Recently study suggests that dental X-rays can harm heart. Radiation from dental X-rays can trigger heart disease and strokes. The research states that radiation kills monocytes, that result in higher levels of monocyte chemo-attractant protein-1 and leads to cardiovascular disease.<sup>[23]</sup>

**9. BIO-WASTE DISPOSAL AND RELATED PROBLEMS:** Biomedical waste is a waste generated during the diagnosis and treatment. The waste can cause pollution and health hazard if not properly disposed.<sup>[6]</sup> These health hazards affects the occupants in the institutions and spreads in the vicinity of the institutions. Blood, body fluids and body secretions which are constituents of biomedical waste harbor most of the bacteria, viruses and parasites that cause infections. HIV, Hepatitis, Tuberculosis, pneumonia, diarrhoeal diseases, tetanus, and whooping cough are diseases spread due to improper waste management. Injury from sharps and exposure to harmful chemical waste and radioactive wastes also causes health hazards to employee in the institutions. Improper practices such as dumping of biomedical waste in municipal dustbins, open spaces etc., leads to spread of diseases and can affect general public's health.<sup>[24]</sup>

**10. NITROUS OXIDE AND ANESTHETIC VAPORS:** In high levels may impair performance and the well-being of those exposed.<sup>[25]</sup> Levels of nitrous oxide in the dental environment have been reported to vary from 500-100 ppm and several studies on occupational safety and health report that with nitrous oxide 25-400 ppm is safe level. Nitrous causes depression of vitamin B 12 absorption. Long term effects may cause interference with DNA synthesis which prevents production of both leukocytes and red blood cells by bone marrow.<sup>[17]</sup> Wilson *et al.*, reported increased incidence of congenital malformations, certain cancers and kidney disease in the dental office personnel who were exposed to nitrous oxide.

**11. MISCELLANEOUS:** Inhalation of methyl methacrylate vapors can cause respiratory problems

like pneumoconiosis. Common cold may have an occupational risk in dentistry by droplet spread from the patients. Skin infections are common in dental personnel, especially in those wearing gloves routinely, and in those with chronic disease such as diabetes. The other problems associated with skin is Maceration (Water logging) which results from repeated hand washing and occasionally candidosis secondary to maceration.<sup>[6]</sup> It has been confirmed with the studies that there is an increase of heart bit of maxillofacial surgeon- an occupational hazard- during the pre-induction phase of general anesthesia.<sup>[26]</sup>

#### HAZARDS TO DENTAL AUXILIARIES

Dental hygienists work in somewhat hunched position and may suffer from back pain. Repetitive wrist and hand movements causing weakness in the hand and wrist may be a causative factor for carpal tunnel syndrome.<sup>7</sup> occupational allergic eczema is more common among nurses, surgical assistants, and other auxiliaries than among doctors because of their continual contacts with drugs and antiseptics.<sup>[21]</sup> Technicians may be at risk from infections if work practices are not good. Oral microorganism can be transferred to the dental laboratory on clinical material such as dental impressions and occlusal records.<sup>[27]</sup> Cawson *et al.*,<sup>[6]</sup> reported a rare incident of mycoplasmal infection apparently transmitted from acrylic dental appliances brought from clinic. Dental technicians handling methyl methacrylate can have Localised distal sensory neuropathies to the hands.<sup>[8]</sup> Pneumococci can be caused by materials such as silica, beryllium, chromium and cobalt. Renal damage and hypertension may be caused by cadmium which is present in acrylic base powders. Allergic skin reactions may be caused by cobalt. Occupational asthma although is rare, has been precipitated in dental technicians by methyl methacrylate and cyanoacrylates. Formaldehyde, glutaraldehyde, cobalt, nickel, beryllium and chromium are other potential causes for the same.<sup>[6]</sup> Hot wax knives and Bunsen burners are often causes of burns. Lung cancer in dental technicians is well recognized and higher of lung cancer in dental technician due to the predisposing agents such as asbestos, nickel etc. Technicians using methyl methacrylate may notice symptoms of induced occupational asthma and dermatitis. Developers for radiographs contain hydroquinone; fixative contain acetic acid and sodium thiosulphate can cause dermatitis, conjunctivitis and bronchitis.<sup>[6]</sup>

Occasionally dental staff, especially resident hospital staff is the victim of assault, especially by psychiatrically disturbed patients or drug abusers. Many patients attending dental casualty units have drunk too much alcohol and potentially dangerous incidents should be defused where possible.<sup>[28]</sup>

### HAZARDS IN THE ORAL CAVITY FROM VARIOUS OCCUPATIONS

Injuries of the oral cavity, which occur as a direct result of the occupation of the person, are of rather common occurrence. The dental personnel should be aware of such hazards. Some of the examples of occupational injuries are as follows: Localized aberration in cobblers, carpenters, musicians. Stomatitis and carcinoma of lip in fishermen, pavers etc. staining of teeth and pigmentation in bronzers, cement workers etc. Ptyalism in bronzers, dentists etc. Caries in bakers and candy makers. Stomatitis and leukoplakia in hot food tasters. Anesthesia and parasthesia of tongue in wine and liquor tasters.

**Heavy Metal Lines:** Chronic poisoning with heavy metals (e.g. mercury, lead and bismuth) may result in a dark brownish to blue-black discoloration, deposited as a line or band on inflamed marginal gingiva. Lead poisoning (plumbism) is characterized by the presence of bluish or blackish line around the teeth.

1. Occupational dental erosion: Occupational acid exposure might increase the risk of dental erosion. Evidence for occupational dental erosion is limited to battery and galvanizing workers. Industrial workers other than battery or galvanizing manufactures might also be at a higher risk of dental erosions.<sup>[29]</sup>
2. Periodontal attachment loss: Occupational exposure to acid mists is positively associated with periodontal disease, assessed by periodontal attachment loss.<sup>[30]</sup> Chronic irritation of tissues by acids is also responsible for increased frequency of infections.<sup>[31]</sup>
3. Mucosal changes: Occupational exposure to sulfuric acid mists has been described in association with ulcerative mucosal lesions, due to irritation.<sup>[30]</sup> Vianna *et al.*,<sup>[32]</sup> observed that when lip sealing is absent, there is an increase in the association between occupational exposure to acid mists and ulcerative lesions of the oral mucosa.
4. Mercury exposure in industry: Increased exposure to mercury vapour in the workplace affect oral health and cause such as mucosal

ulcerations, gingivitis or periodontitis and sudden loosening or exfoliation of the teeth.<sup>[30]</sup>

5. Risks of genetic damage: micronuclei are the chromosomal material originated from DNA constitutes an assay for screening the risk of genetic damage in individuals exposed to mutagenic agents. Significant increase in the structural aberrations or oral micronuclei has been reported in employees who manipulated petroleum fuel derivatives.

### CONTROL AND PREVENTION

There is no doubt that potential health hazards in dentistry are great, application of ergonomics and administrative measures contribute greatly in reducing the hazards. Musculoskeletal symptoms and headaches can be controlled by frequent breaks in between if working for long hours. The postural problems can be prevented by ergonomically designed chairs and tables. Persons with carpal tunnel syndrome should be treated by taking rest, Vit B complex supplementation, steroid injections and endoscopic carpal tunnel surgery. Professional burn out can be reduced by organizing regular breaks from work and having strong family ties. Taking mini breaths, exercise like aerobics, meditation is some of the simple prescription for stress management. Dysthymia, a pervasive mood disorder can be treated with anti-depressants. The risk of infectious diseases should be avoided by wearing safety glasses, masks and caps. Vaccination against hepatitis B, use of autoclaves, use of disposables and even the use of rubber dam are key for precaution against infectious diseases.<sup>[6]</sup>

Accurate and systemic records are the backbone of honest practice and these are some of the precautions for prevention against medicolegal problems.. In case of child patient it is necessary to take consent from the concerned parents.<sup>[3]</sup> ALARA principle should be followed to avoid radiation hazards, protective barriers as lead aprons and lead gloves, use of personal monitoring devices, equipment monitoring and use of fast films are some of the other measures.<sup>[6]</sup> Bio waste disposals should be carefully disposed off and must be discarded in a clearly labeled rigid sharp containers and incinerated.<sup>[33,8]</sup> In dental laboratory, whatever comes should be decontaminated. Different methods of decontamination for different materials like impressions, stone cast surface, removable prosthesis and bite blocks are surface disinfection and rinsing in water. For burs, metal crowns and bridges use of ultrasonic cleaning and sterilization

should be done.<sup>[13]</sup> Occupational dental erosion can be controlled by education, use of fluoride mouth rinses, desensitizers or tooth mousse.<sup>[34]</sup> Metal lines can be reduced by elimination of chipping lead paint in the interior of old houses and also elimination of these metal from medicine.<sup>[35]</sup>

### CONCLUSION

Dentists are one of the professional groups where the occupational health risks are present. Prevention of health hazards is much more important than treatment. Local organizations should organize workshops and seminars on occupational hazards periodically. Government needs to coordinate occupational health services with overall health services and strengthen professional expertise in occupational health.

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