



Research Paper

## Occupational Hazards in Dentistry- A Review

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### ABSTRACT

Occupational diseases are diseases or health disorders that are caused by the work or working conditions. These are also work related diseases which are multifactorial in origin. Occupation hazards in dental medicine can be grouped as biological, biomechanical, chemical, physical, legal and psychological. Dental professionals are predisposed to a number of occupational hazards, It is important that all the dental personnel remain informed regarding these hazards and preventive steps are to be implemented in working area to provide a safe environment. Therefore, the aim of the paper is to provide the information regarding occupational hazards in dentistry and to increase the level of awareness of occupational hazards among the dental surgeons.

**KEY WORDS:** occupational hazards, control measures, dental personnels

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### I. INTRODUCTION

Occupational hazards can be defined as a risk to a person usually arising out of employment. Bernardino Ramazzini, the father of occupational medicine, recognized the role of occupation in dynamics of health and diseases<sup>1</sup>.

Dentistry is defined as the evaluation, diagnosis, prevention and treatment (nonsurgical, surgical or related procedures) of diseases, disorders and conditions of the oral cavity, maxillofacial area and the adjacent associated structures and their impact on the human body; provided by a dentist, within the scope of his/her education, training and experience, in accordance with the ethics of the profession and applicable law. (As adopted by the 1997 ADA House of Delegates)<sup>2</sup>.

Occupational hazards are more among the dental professionals which includes the exposure to infections, percutaneous exposure incidents, dental materials, radiation, and noise, musculoskeletal disorders, psychological problems and dermatitis, respiratory disorders, and eye insults stress, allergic reactions, higher noise levels, accidental percutaneous exposure, radiation, musculoskeletal disorders and various micro organisms which may cause systemic infections etc <sup>2,3</sup>. Most of these hazards are accidental and can be prevented by adopting safety measures in the work places and following infection control guidelines. However, because some exposures are not preventable, immunization and appropriate post exposure management become key defense procedures<sup>4</sup>.

Studies shown that, dentists have reported more frequent and serious health problems that arise due to occupation<sup>5</sup> The current paper reviews various studies relating to occupational health hazards in dental profession, and its control measures and prevention.

### CLASSIFICATION<sup>6</sup>

These hazards can be grouped into:

- 1) Physical
- 2) Chemical
- 3) Biological
- 4) Mechanical

5) legal aspects (social aspects)

**HAZARDS FROM PHYSICAL AGENTS:** Physical hazards in dental medicine include lights, noise, vibration, heat, trauma and radiation (ionizing and non-ionizing). Physical hazards can cause problems to eyes (sight), ears (hearing disorders) and health problems related to radiation, vibration, heat and injuries<sup>7</sup>.

### **ILLUMINATION**

#### **Poor illumination**

poor illumination in the clinical setting causes eye pain, eye strain, headache and eye fatigue

#### **Excessive brightness**

Excessive brightness in the clinical setting causes fatigue and visual discomfort

#### **Prevention of poor illumination and excessive brightness-**

- Sufficient and suitable lighting
- Natural or artificial is advised<sup>6</sup>

### **NOISE GENERATED BY DENTAL EQUIPMENTS**

Dental personnel are exposed to various levels of noise in working areas. Dental hand piece, ultrasonic scalers, amalgamators, high speed evacuation devices and other items produce sound at different levels which is appreciable. Occupational noise exposure in the dental office can lead to noise-induced hearing loss<sup>3</sup>. Symptoms such as hearing loss starts with tinnitus and include more or less difficulty during speech communication. Greatest noise damage is usually caused by harmful sounds at 3000 to 6000 Hz. Hearing loss can be caused by repeated exposure to sounds at various loudness levels, measured in decibels (dB), over an extended time or by a 1-time exposure to an intense sound<sup>8</sup>.

#### **Prevention**

- Personal protection by using ear plugs and muffs which reduce high intensity sounds by 30 to 35 dB.
- The noise levels of modern dental equipment have now generally fallen below 85 Db, the widely used benchmark standard, below which the risk of hearing loss is believed to be minimal and negligible
- Avoid use of aged and worn out equipment
- Regular maintenance of the devices
- Proper acoustic treatment for dental office, walls ceilings and floors.
- Use of ear plugs
- Distance of 35cm between device and ear.
- Activation of equipments only during procedures
- Compressors to be placed outside dental office or in an isolated area.
- Periodic audiometric evaluation for early detection<sup>6</sup>

**LASERS:** All lasers are potentially hazardous particularly because of eye damage, burns and the risk of fire or electric shocks. The effect of the laser on a depends on the wavelength, beam power, degree of focus, duration of exposure and distance to target as well as the degree of absorption by the tissue. All lasers should be used with great care and never shown into the eyes<sup>8</sup>.

**INJURY:** Needles and sharps are commonly used during dental procedures and dental professionals are susceptible to injuries inflicted by contaminated needles and sharp objects. Needlestick/sharps injuries causes high risk of crossinfection. Other injuries include thermal injuries, burns and scalds from sterilizing equipment and eye injuries from acrylic and other particulate matter sustained in the laboratory environment are injuries with a low risk of cross-infection<sup>7</sup>.

**RADIATION:** Ionozing and non ionizing radiation is one of the most common hazard to dental professionals. Sources of ionising radiation are dental X-rays devices for intra-oral and extra-oral imaging. Most dental offices and clinics have x-ray machines that are in and X-ray machines are most frequently used equipment now a days in dental clinics. Exposure of dental workers to ionizing radiation was associated with potential risk of cancer. Dental staff should use certain protective barriers such as radiation monitoring badges, lead aprons. Sources of non-ionising radiation are devices used for curing or polymerisation dental materials (like composite resin, bonding agents and sealants) producing blue/ultraviolet light<sup>3</sup>.

#### **Prevention**

- Operator should leave the room or take a position behind a suitable barrier or wall during exposure of the film.
- Walls must be of sufficient density or thickness.
- The operator should stand at least 6 feet from the patient, at an angle of 90° to 135° to the central ray of the X-ray beam

- Films should never be held in place by the operator (use film holding instruments).
- Use accurate timer
- Use sound professional judgment to limit the no. of exposures
- Use lead aprons for all patients
- Wearing a radiation monitoring device
- Keeping abreast of current radiation protections recommendations

The radiographic tube should never be stabilized by the operator or patient during the exposure<sup>3,6</sup>.

### **CHEMICAL HAZARDS**

New chemicals and solutions are introduced regularly in the dental profession is one of the major factors for chemical hazards. Many of these chemicals may pose health problems<sup>9</sup>, Dentists are exposed to various types of chemicals that are hazardous which include mercury, beryllium, silica and powdered natural rubber latex (NRL).

#### **Beryllium**

Beryllium is one of the dental alloys frequently used for crowns and if inhaled while working, they can cause chronic beryllium disease (CBD).

#### **Mercury**

Mercury use in dental amalgam has potential occupational exposure to dentists. These chemicals act by local action, inhalation and ingestion. The maximum level of exposure considered to be safe is 50 µg/ cc of air<sup>3</sup>. The active component in mercurial vapour has a particular affinity for brain tissue and may cause high mercury vapour dose exposure can result in biological and neurological deficits<sup>4</sup>. 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<sup>3</sup>. Mercury poisoning can be prevented by using precapsulated alloys, Good ventilation, Excess and spilled mercury should be collected in fixer containing break resistant bottles<sup>6</sup>.

**Chemicals used in radiology :** Chemicals used in radiology can also lead to occasional health problems. Developing solutions are chemicals used in the reduction of silver bromide ions, chemicals that control the processing speed, a preservative and a hardening agent. Fixing solutions contain a neutralizer, a clearing agent, a preservative and a hardening agent. These chemicals may cause health effects. Glutaraldehyde is primarily used as a hardening agent causes skin sensitization and allergic contact. Sulphur dioxide released during the mixing process of chemical components causes bronchospasm<sup>3</sup>.

#### **Latex hypersensitivity**

Dental care providers use latex gloves for protection from patients against different biological hazards. Natural rubber latex provides excellent barrier protection, comfort, and fit, and it is inexpensive. However, in last decades, the incidence of allergic reactions to latex proteins has raised. Chemical agents involved in the production of gloves process such as benzothiazol, thiuram, and carbamate have strong allergenic potential. Cornstarch powder on the natural rubber latex gloves, might contribute to the development of latex irritation. Clinical signs of the immediate allergic reactions to latex can include rash, rhinitis, edema, urticaria, conjunctivitis accompanied by lacrimation and swelling of eyelids, mucous rhinitis, bronchial asthma and anaphylactic bronchospasm, and allergic shock<sup>2,6</sup>. Latex allergy can be prevented by self medication, prescribed medication. Sufferers from latex allergy are advised to use vinyl, nitrile or 4H gloves.

**Nitrous oxide:** Nitrous oxide (N<sub>2</sub>O) is used in dental offices, primarily as a sedative to reduce patient anxiety. Exposure to nitrous oxide in dental offices is usually small, but the exposure is continuous and occurs over the long term. Several studies linked occupational exposure to anesthetic gases like nitrous oxide with congenital malformations, spontaneous abortion and infertility. Anesthetic gases slow the rate of cell division and increase the rate of abnormal cell formation and chromosomal aberrations<sup>7</sup>. To protect workers from the health risks associated with N<sub>2</sub>O, operating rooms are often equipped with scavenging systems that vent unused and exhaled gas away from the work area. If used in high concentrations during anesthetic administration, it may cause increased absorption which may cause congenital malformations, spontaneous abortion and infertility liver and kidney damage with neuralgic disease<sup>6</sup>.

#### **Acrylic based resin**

Acrylic based resins are extensively used in dentistry for the fabrication of denture bases, orthodontic removable appliances, temporary crowns, and denture relining. Undesirable effects caused by acrylic based resins have been widely evidenced. The most common and frequently reported a problem with the patients having allergic reactions to denture base acrylic resin is mouth soreness and burning sensation. Monomers used in dentistry present severe cytotoxicity and cause hand eczema. Impression dental materials, polyethers and vinyl polysiloxanes have also significant cytotoxic potential<sup>7</sup>.

**Ethylene oxide** is a flammable, colorless, highly reactive gas used for sterilization of dental equipment, exposures to ethylene oxide may result in eye pain and blurred vision, sore throat, respiratory irritation and lung

injury, headache, nausea, dizziness, vomiting, diarrhea, shortness of breath, convulsions, skin irritation and cyanosis. Dental health care providers are usually exposed to little amount of ethylene oxide which may accumulate over their working lifetime. Chronic exposures to ethylene oxide have mutagenic potential and are linked with neurotoxicity, peripheral paralysis, muscle weakness, cancer, reproductive disorders, etc<sup>7</sup>.

**Formaldehyde:** Formaldehyde is the chemical agent routinely used in the clinical set up mainly for disinfection of operatory area. Various forms of formaldehyde (Liquid and vapour) may cause abdominal pain, nausea, vomiting and eye irritation<sup>6,9</sup>

### **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. Prevention from contamination and cross-infection can be done by effective sterilization of instruments using autoclave before and after use<sup>6</sup>.

### **PSYCHOLOGICAL HAZARDS**

Stress, chronic tiredness and burnout syndrome are the major Psychological hazards that occur among dentists. Exposure to psychosocial hazards in the workplace not only produces psychological damage to individual employees such as depression and anxiety, but also causes somatic disorders such as cardiovascular diseases, hypertension, neurological disorders, insomnia and headaches, etc

**Stress:** stress is one of the major psychological hazard that occur among dentists. 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.

**Professional burnout:** One of the possible consequences of chronic occupational stress is professional burnout. Burn out is defined 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." Prolonged experience of burn out may lead to depression, so early recognition of the symptom is important<sup>3</sup>.

### **LEGAL HAZARDS**

- In every country there are relevant statutes and regulations which apply to the practice of dentistry. The contravention of any of these may warrant that legal actions be brought against a dental practitioner particularly in developed countries where the citizens appear more aware of their 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>10</sup>.

### **ERGONOMICS IN DENTISTRY**

The dental team is at high 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 long and require much more concentration during work.

#### **Carpel Tunnel Syndrome:**

Carpel tunnel syndrome is a peripheral neuropathy caused by compression of median nerve when it passes through the carpal tunnel. This occurs more frequently in dominant hand but is frequently bilateral. The symptoms are pain and numbness in hand. Its early phase is dominated by paroxysmal paresthesia of the thumb and index finger accompanied by sensorimotor disorders of the thumb and index finger.

To reduce the risk

- Take rest between patients
- Avoid gripping instruments too tightly
- Perform active movement of wrist and hand as warm up.

#### **Back pain**

Back pain is one of the most common and troublesome of complaints among dental practitioners. Its exact causes are legion and an exact diagnosis is often difficult. It has been stated that the most common sites of pain among dentists and dental auxiliaries are in the areas of the cervical and lumbar vertebrae. The shape of the vertebral column, aging changes, weak muscles, postural practice, movements, lifting techniques, and mechanical stress have been identified as factors that contribute to neck and back pain in general. The posture of the dentist at work, with the neck bent and twisted, an arm abducted, repetitive and precise movements of the hand, are a frequent cause of the neck syndrome and of pain within the shoulder and upper extremities.

**Prevention of Neck, Shoulder and Back Disorders:** Ergonomic recommendations for minimizing the risks of back injuries focus on improving working posture and equipment design.

These include:

- **Change Posture** - Alternate between sitting and standing to reduce postural fatigue and maximize postural variety, which helps to reduce static muscle fatigue
- **Use Support** - When sitting or standing, don't lean forwards or stoop in an unsupported posture for prolonged periods. If you are sitting, sit up straight or recline slightly in a chair with good back support, and use a good footrest if necessary. If you are standing for prolonged periods try to find something to help you lean against.
- **Safe reaching** - Avoid having to reach awkwardly to equipment and work close to the patient. Keep the items used most frequently within a distance of about 20 inches (50 cm). Use assistants to help move equipment into this zone.
- **Normal arm posture** - Keep elbows and upper arms close to the body and don't raise and tense the shoulders when working. Also, ensure that hand postures are not deviated because this could lead to wrist problems.
- **Use Comfortable Equipment** - Use equipment that isn't too heavy, that can be used without awkward upper body posture, and that feels comfortable to use. Ergonomically designed equipment helps to minimize stresses on the upper extremities and the back.
- **Manage Time** - Avoid long appointment where possible, or intersperse these with frequent short rest breaks in which you change posture and relax the upper extremities<sup>6</sup>

**Precautions to be taken while performing procedures on HIV infected Individuals**

(a) Surgery to a HIV patient should be scheduled at the end of the list.

(b) only essential staff should be involved and the procedures should be performed only by experienced staff.

(c) wear two pairs of gloves, gown, head cap, mouth mask and protective eye wear (d)The procedures should be performed with minimum droplets, spatter and aerosols, utilizing high volume vacuum aspirators, rubber dams with proper patient positioning.

(e) Easily decontaminated instruments should be avoided and should be handled by experienced staff before autoclaving

(f) After the operation, all surfaces inside the surgery and equipment should be cleaned and decontaminated with appropriate disinfectants.

**DISPOSAL OF WASTE**

Sharp items including needles and scalpels and local anaesthetic cartridges, should be placed into puncture proof containers which should be securely sealed. These together with all medical waste must be disposed of in red bags, securely fastened. Non infective waste should be disposed of in thick black plastic bags securely fastened. Liquid waste should be carefully poured into a drain and then flushed with water. Spatter and splash should be avoided.

Impressions and appliances should be rinsed thoroughly to remove all visible blood and debris. Gloves should be worn when handling impressions and pouring models. Certain types of impression material (silicone, polysulphur) can be disinfected by totally immersion in glutaraldehyde (2%) or sodium hypochlorite (0.1%). Other materials (alginate, polyether) may be disinfected by submerging for several seconds in sodium hypochlorite (0.1%), which should then be wrapped in a hypochlorite saturated paper towel and kept in a closed container for the recommended disinfectant time<sup>3</sup>.

**II. RECOMMENDATIONS**

- Dentist has to upgrade their existing knowledge on occupational hazard.
- Precaution has to be taken while practicing to prevent occupational hazards.
- clinic design has to be with, sufficient lighting, ventilation, equipped with appropriate personal protective. Hepatitis B vaccination should be done periodically.

**CONCLUSION**

- Dentist has to upgrade the knowledge by participating in CDE programmes. 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.

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