

## Review Article

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## Occupational Hazards in Dentistry – A Review

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### ABSTRACT

Despite numerous advances in recent years in the field of dentistry, many occupational health problems still persists. They include stress and professional burnout, allergies from various materials, musculoskeletal disorders and diseases of peripheral nervous system, Percutaneous Exposure Incidents (PEI), biological hazards, hazards due to nitrous oxide and legal hazards. Dental professionals are constantly exposed to a number of specific occupational hazards. In many cases, this exposure results in diseases which are regarded as occupational illnesses. Based on the relevant literature, this review focuses on the occupational hazards in dentistry. Being unaware of the potential hazards in the work environment makes dental personnel vulnerable to occupational injury and illnesses. Awareness of these occupational hazards and implementation of preventive strategies can provide a safe dental environment of all concerned.

**Key-words:** . Occupational hazards, Stress, Allergy, Musculoskeletal diseases, Ergonomics, Dentists

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## **Introduction**

Although modern dentistry has been described as probably among the least hazardous of all occupations, many risks remain in dental practice which continue to challenge this status. These include percutaneous exposure incidents (PEI), exposure to infectious agents including bio aerosols, musculoskeletal disorders (MSDs), eye injuries, vibration induced neuropathy, exposure to radiation, noise and dental materials and psychological conditions. When such risks cannot be engineered out of the dental clinic, appropriate occupational health and safety measures need to be adopted by dental staff and dental students. The current paper reviews studies relating to occupational hazards and occupational health problems in dental practice, updating a previous literature review.

## **DEFINITION OF OCCUPATIONAL HAZARD**

Occupational hazard can be defined as – “*A risk to a person usually arising out of employment*”.<sup>1</sup>

It can also refer to a work, material, substance, process or situation that predisposes, or itself causes accidents or disease, at a work place.

***The field of dentistry is not an exception for an exposure to occupational hazards.***

## **Methods**

An extensive literature review was conducted which included articles published in peer reviewed journals and pub med indexed journals relating to occupational hazards in dentistry. Only articles of English language were included. The review itself began with the search of the relevant Medical Subject Headings such “occupational hazards”, “musculoskeletal disorders”, “dentists” in Pub Med, the official literature search engine of the National Library of Medicine in United States. The focus of the present review would be the occupational hazards in dentistry and the occupational health problems of dentists.

## **Occupational Hazards in Dentistry**

Professionals in dentistry are exposed to many occupational hazards; their effects appear as ailments that affect the dental practitioner and tend to intensify with age.<sup>2</sup> Although identification of the risks to orthodontists and other dental professionals has been explored in several studies but the level of awareness of potential health risks for operators is very low in developing countries like in India.<sup>3</sup>

## **Hazards Encountered in Dentistry**

1. Percutaneous Exposure Incidents
2. Biological Hazards
3. Dental materials – Mercury, Developing and Fixing Solution
4. Hazards due to Nitrous Oxide
5. Legal Hazards

## **Percutaneous Exposure Incidents (PEI)**

PEI is a common problem among dental personnel. Previous studies have indicated that about half of all dentists report a recent PEI, particularly needlestick and sharps injuries, in both the United Kingdom<sup>6</sup> and in Thailand.<sup>4</sup>

A Cross sectional study was conducted by Holla R et al in the year 2014 to know the extent of occupational exposure to needle stick injuries among health care personnel of tertiary care hospitals and also to assess the relationship between occurrence of needle stick injuries with the work experience and awareness regarding universal precautions among health care personnel. Results showed that Needle stick injuries was observed among 71.9% (n=136) of health care personnel. Majority of the needle stick injuries were observed among the health care personnel who had a work experience of five and more than five years and it was found to be

statistically significant. Needle stick injuries were more among health care personnel who were unaware of universal precautions.<sup>5</sup>

A Cross sectional study was conducted by Gupta E et al in the year 2013 to assess the prevalence and response to needle stick injuries (NSIs) among nurses in a tertiary care hospital, Assam. Results showed that out of 190 nurses, 102 (53.7%) reported having one or more episodes of NSIs in their career. 38(37.3%) of injuries occurred during recapping of needles. At the time of injury, only 54(52.9%) nurses wore gloves. 62(60.8%) washed the site of injury with soap and water while 20 (19.6%) did nothing. Only 8(7.8%) of the nurses undertook post-exposure prophylaxis (PEP) against HIV/AIDS after their injury.<sup>6</sup>

A Cross sectional study was conducted by Radha R et al in the year 2012 to study the prevalence and associated factors of Needle Stick Injuries (NSIs) among the health care workers of the hospital and also to assess the level of awareness of the health care workers regarding NS. Results showed that about 57% (252 out of 441) of the Health Care Workers (HCW) had at least one episode of NSI in the preceding 12 months. Majority were Nurses (81%). The commonest devices involved was suturing needle (41%) and hypodermic needles (44%). Majority of the NSI (46 %) occurred during use of needle on the patient. About (85%) of the HCW didn't report the injury. Hepatitis B vaccination rate was very low among HCW other than doctors. Doctors had better knowledge on all counts compared to other categories of HCW. A majority of the HCW (92%) were not aware of the reporting system existing in their hospital.<sup>7</sup>

A retrospective study was conducted by Gaballah et al in the year 2012 to evaluate the risk factors of needle stick injuries (NSIs) sustained by undergraduate dental students and nurse students at the King's College London (KCL) Dental Institute. This study showed that students are at the highest risk of NSIs at the fourth year of their five year BDS course. About one-third of injuries were reported among this group of students followed by year 5 students (25%). Oral surgery clinics were the major source of incident reporting when compared with other specialised dental clinics within the institute. The left hands of the students were the most frequently affected by such injuries and then the right hands of student dental nurses. The attempt of needle recapping of conventional syringes was the least reported mechanism of injuries and constituted only 15% of the total injuries and mainly occurred in third year students. The most frequent injuries among student nurses were during disposal of the needle.<sup>8</sup>

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A Cross sectional survey was conducted by Sangwan BR et al in the year 2011 to assess the occupational exposure to blood and body fluids amongst health care workers in a teaching hospital of the armed forces. Results showed that the proportion of HCWs experiencing exposure to blood body fluid splash (BBF) and needle stick injury (NSI) during last one week was 47.1% and 31.43% respectively. The incidence density of BBF exposure was 537.14 per 100 person years and that of NSI episodes was 228.57 per 100 person years. The reasons for not using personal protective equipment (PPE) ranged from busy schedule (37.14%), non use of PPE by co-workers (67.14%, emergencies 91.43% risk that patients may get offended by PPE use by HCWs (27.141 %) to discomfort while using PPE (24.291%). All components of PPE were available as per only 34.29 percent.<sup>9</sup>

A Cross sectional survey was conducted by Sharma R et al in the year 2010 to study the prevalence and response to needle stick injuries among health care workers in a tertiary care hospital in Delhi. Results showed that a large percentage (79.5%) of HCWs reported having had one or more NSIs in their career. The average number of NSIs ever was found to be 3.85 per HCW (range 0-20). 72 (22.4%) reported having received a NSI within the last month. More than half (50.4%) ascribed fatigue as a cause in their injury. Most of the injuries (34.0%) occurred during recapping. In response to their most recent NSI, 60.9% washed the site of injury with

water and soap while 38 (14.8%) did nothing. Only 20 (7.8%) of the HCWs took post-exposure prophylaxis (PEP) against HIV/AIDS after their injury.<sup>10</sup>

## 6. Biological Hazards

A Descriptive Survey was conducted by Oyewusi C.O. et al in the year 2015 to determine the knowledge and utilization of hepatitis B infection preventive measures and influencing factors among primary health care workers in Ibadan. Results showed that the majority of the health care workers had heard of hepatitis B transmission before while many (68.1%) had experienced needle stick injury. Many (65.2%) had good knowledge of preventive measures of hepatitis B while only 37.6% put the measures into practice.<sup>11</sup>

In a study conducted by Bushra et al in the year 2012, results showed that 46.9% had eye splash from infected saliva and 43.4% had experienced glove puncture during surgical procedure < 5 times during their work. 82.3% dentists were immunized against Hepatitis B.<sup>12</sup>

A Cross sectional study was conducted by Sofola OO et al in the year 2007 to determine the frequency of occupational exposures to blood borne pathogens amongst Nigerian clinical dental students, their HBV vaccination status, and reporting practices. Results showed that Only thirty-three (37.9 percent) were fully vaccinated against HBV. Ninety (58.8 percent) of the students have had at least one occupational exposure. There was no significantly associated difference between sex, age, location of school, and exposure. Most of the exposures (44.4 percent) occurred in association with manual tooth cleaning. There was inadequate protection of the eyes. None of the exposures were formally reported.<sup>13</sup>

## 7. Dental Materials

There are many potentially toxic materials that are used in dentistry that may pose a health hazard in the absence of appropriate precautionary measures. Most of the dental materials undergo an extensive range of tests both before and after use. Even so, some dental materials are aerosolized during high speed cutting and finishing and may thereby be inhaled by dental staff. Other dental materials are volatile and may give rise to dermatological and respiratory effects. ***The dangers of chronic exposure to mercury are well documented. On the contrary, it is now recognized that the health hazards of amalgam restorations is negligible with the exception of rare allergic reactions.*** Chemicals used in radiology can also lead to occasional health problems.. In medical imaging, glutaraldehyde is primarily used as a hardening agent to prevent films from sticking together. Skin sensitization and allergic contact dermatitis after occasional exposure have been documented in case of glutaraldehyde. Mixing of processor chemical components also causes the release of sulphur-dio-oxide from decomposition of sulphite. Chronic exposure may result in bronchospasm. Ammonia, a highly soluble respiratory irritant, is another potential by-product released from the breakdown of processing chemicals.

Mercury is known to be neurotoxic and nephrotoxic. Toxic effects on the respiratory, cardiovascular and gastrointestinal systems have been shown following acute exposure to elementary mercury. Foetuses and newborn babies are more sensitive to mercury than adults and there seems to be great differences in sensibility among individuals.<sup>14</sup>

## 8. Hazards Due to Nitrous Oxide

Nitrous oxide commonly called as ***laughing gas***, is an anaesthetic agent used in operating rooms. Workers are exposed to N<sub>2</sub>O while administering the anaesthetics gas to patients. 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. Recent research shows that these systems can significantly reduce the risk of impaired fertility among female dental assistants exposed to N<sub>2</sub>O. Several human studies have shown that occupational exposure to N<sub>2</sub>O, may cause reduced fertility, spontaneous abortions, and neurologic, renal,

and liver disease as well as documented decreases in mental performance, audiovisual ability, and mental dexterity in susceptible individuals.<sup>14</sup>

## **9. 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 the 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>14</sup>

### **Management of occupational hazards**

- **Infection Control**

Based on the evidence, information, and rules, local to either the country or region, high standards of Dental Infection Control & Occupational Safety must be followed by the dental team for the safety of the patients and Dental Healthcare Workers.

#### **Rationale (Reason)**

The rationale for infection control is to “control” iatrogenic, nosocomial infections among patients, and potential occupational exposure of care providers to disease causing microbes during provision of care. The term “disease control or infection control” does not mean total prevention of iatrogenic, nosocomial infections or occupational exposures to blood and other potentially infectious material (BOPI), **it only means reducing the risks of disease transmission**

Immunization against diseases, use of practical barrier techniques, use of personal protective equipment, engineering and work practice controls, disinfection of contaminated surfaces/equipment, sterilization of instruments, and use of aseptic protocols during treatment, broadly encompass the realm of **Dental Infection Control & Safety**<sup>15</sup>

**OSHA's mission is to "assure safe and healthful working conditions for working men and women by setting and enforcing standards and by providing training, outreach, education and assistance"**<sup>16</sup>

The Occupational Safety and Health Administration (OSHA) has published **Controlling Exposure to Blood borne 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**<sup>17</sup>

As per OSHA specification, employees cannot be exposed to more than 2 micro-organisms of beryllium per cubic meter of air for an 8 hour time weighted average<sup>17</sup>

The OSHA requires employers to develop and implement a noise monitoring program when employees exposed to noise equal or exceed 85dB over 8 working hours. If this happened, OSHA requires employers to notify employees to establish and maintain an audiometric testing and to train workers how to prevent occupational hearing loss. When hazardous noise have not yet been eliminated, OSHA also needs employers to provide hearing protectors and ensure wearing them by the workers.<sup>18</sup>

### **Organization for Safety and Asepsis procedures (OSAP)**

The organization for Safety and Asepsis (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 of 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.<sup>17</sup>

**The National Institute for Occupational Safety and Health (NIOSH) in 1994** issued a warning to hundreds to thousands of medical, dental and veterinary professionals who work with nitrous oxide (N<sub>2</sub>O). The institute warns that even with preventive measures such as scavenging systems in place these workers may be at risk for serious health effect due to their exposure.<sup>14</sup>

Based on the guidelines provided by **the Centres for Disease Control and Prevention (CDC) and American Dental Association (ADA)** all dental prosthesis, impressions, orthodontic appliances and other prosthodontic materials (examples – occlusal rims, temporary prosthesis or wax bite registrations) should be thoroughly cleaned, disinfected with an EPA-registered hospital disinfectant and thoroughly rinsed before being handled in the in-office laboratory.

### **VII. Conclusion**

Occupational health risks are present in every profession. Dentistry is one of the profession. 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<sup>17</sup>

The identification and elimination of the potential risk factors should be incorporated in a standard practice management program as an integral part of orthodontic education<sup>3</sup>

Professional organizations can also assist in informing practitioners about potential hazards and methods to prevent them<sup>2</sup>

Burn-out and stress are likely to occur in dentists of all grades and specialities. Those in practice can prevent burn-out in themselves and their staff with care, recognition and planning<sup>19</sup>

**The reality of public health will always involve balancing maximum benefit and minimum harm to the public health and well-being<sup>14</sup>**

Regarding ergonomics, it is very essential to maintain an adequate work posture and that the instruments and furniture that the dentist is working with, have adequate working characteristics to prevent MSDs from developing. Dentists should control their working hours, pace of work, be aware of occupational hazards and observe their mental health. Strategies for improving mental health and reducing the effects of occupational hazards should be developed and implemented in order to secure the well being of dentists

Serious infectious due to percutaneous exposure incidents (PEI) can be avoided by use of appropriate barrier techniques and high level sterilization. Various continuing dental education programs should be organized so that dental professionals can gain knowledge about various new methods and developments<sup>19</sup>

1. Dental profession should be familiar with the major signs and symptoms of allergic reactions.
2. Dental personnel should always keep records of dental materials used. If allergic reactions occur, backtracking is necessary to identify the specific allergen.
3. Nitrile, vinile gloves should be used by the dental practitioner if sensitive to acrylate or latex gloves. If sensitivity is suspected, the patient should be informed about possible clinical tests to determine the origin of allergy example – Acrylate Patch testing.

#### 4. Cross sensitivity towards colouring agents used in dentures should be considered

Further, the research is now needed to more carefully elucidate the impact of hazards on dentists and also to identify specific risk factors and effective measures for reducing dental occupational hazards.<sup>20</sup>

The prevention and reduction of MSDs among dentists should include their education in dental ergonomics and awareness regarding the importance of work-related risk factors<sup>21</sup>

The identification of needle-stick injuries as a common cause of PEI again stresses the importance of preventive strategies with respect to potential blood-borne infections. Further research is now needed to more carefully identify effective measures for reducing PEI among dental personnel.<sup>22</sup>

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