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Review Article

Occupational Hazards in Modern Dentistry: A Review

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Abstract

Dental personnel are constantly exposed to a number of specific occupational hazards. These cause the appearance of various disorders, specific to the profession, which develop and intensify with years. Being unaware of the potential hazards in the work environment makes them more vulnerable to injury. Based on relevant literature, the present paper discusses various occupational hazards like biological health hazards, stresses, latex hypersensitivity, exposure to radiation (ionizing and non-ionizing), occupational respiratory hypersensitivity, as well as factors leading to the musculoskeletal system diseases. It is therefore important that all the dental personnel remain constantly informed regarding occupational hazards and implementation of preventive strategies to provide a safe working environment.

Keywords: occupational hazards, dentistry, musculoskeletal disorders, biohazards, dermatitis

Introduction

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 and 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.) It is peculiar among the various health occupations in that it makes both artistic and scientific demands on the practitioner. Although modern dentistry has been cited as the least hazardous of all the occupations [1], many risks still challenge the status of this occupation leading to occupational hazards. Occupational hazard has been defined as the risk to the health of a person usually arising out of employment. It can also refer to work, material, substance, process or situation that predisposes or itself causes accidents...
or disease at work place. The history of occupational hazard awareness can be traced back to the 18th century when Bernadino Ramazzini, who is referred to as the ‘Father of Occupational Medicine, recognized the role of occupation in the dynamics of health and diseases [2].

In carrying out their professional work, Dental personnel are exposed to a number of occupational hazards like stress, allergic reactions, higher noise levels, percutaneous exposure incidents, radiation, musculoskeletal disorders, legal hazards etc. 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 illnesses [3]. Studies have shown that dentists report more frequent and worse health problems than other high risk medical professionals [4]. This is in consonance to other studies where occupational hazards such as interactions with patients, stress, physical strain and economic pressure negatively related to psychological well being of dental professionals [5-9]. The current paper reviews various studies relating to occupational health hazards in dentistry.

Methods

An extensive review of literature was conducted which included most of the articles published in peer-reviewed journals relating to the subject of occupational hazards in dentistry in last 10 years. The review began with the search of relevant key words linked with the dental and medical profession like occupational health, occupational disease, dental hazards, Occupational Health Hazards etc. in various search engines including pubmed. The search also targeted diseases like stress, musculoskeletal disorders, allergic reactions, higher noise levels, legal hazards etc. Reports published only in English language were included in the review. Screening of titles and abstracts was performed by one author. Full texts of potentially relevant studies were independently assessed for eligibility by two authors.

Global Prevalence of Occupational Health Hazards

A wide variety of factors are responsible for occupational hazards in dentistry. These factors can be grouped as Table 1.

A previous Italian multicenter study on infection hazards during dental practice reported that some Italian dental surgeries show high bio contamination. With regard to Legionella spp., the proportion of positive samples was 33.3% [10]. In India an investigation among Navy dentists revealed that 47% of them experienced an injury from a sharp instrument during the past six months and backache was the commonest hazard in 70.6% of the personnel followed by occasional anxiety and wrist ache [11]. Another study carried out among dental professionals in Chandigarh, India reported that injury from “sharps” was the most common occupational hazard (77%). Of the other occupational problems job related stress (43.3%), musculoskeletal problems (39.8%), and allergies (23.8%) from things used in dental clinics were most common [12]. In a study carried out among dentists in southern Thailand revealed that The most common occupational health problems were musculoskeletal pain (78 per cent) and percutaneous injury (50 per cent) [13].
Fatigue (94.7%) and back pain (91.0%) were the most prevalent physical complaints reported by Lithuanian Dentists. Hypertension, joint diseases and allergy were the most prevalent diagnosed and treated diseases during the previous 12 months [14]. An earlier survey from Belgium found that Flemish dentists reported occupational health complaints such as low back pain, 54% (stress-correlated); vision problems, 52.3% (age correlated); infections, 9%; allergies, 22.5% (mainly latex) [15]. A study in Malaysian dental schools revealed a high prevalence (93%) of musculoskeletal disorders among clinical year students [16]. A survey on occupational hazards among the clinical dental staff at the dental hospitals of Nigeria found that backache was the most frequently experienced hazard in 47% of the subjects [17]. In a study carried out among dentists and dental auxiliaries in Riyadh, Saudi Arabia to know the prevalence of hearing problems in the last five years, 16.6% of subjects reported to be suffering from tinnitus, 30% of the subjects had difficulty in speech discrimination and 30.8% of the subjects had speech discrimination in a background noise [18]. Another study conducted among dentists in Southern Iran reported that 33% of them were suffering from lower back pain while 28% had neck pain [19]. In a recent study it was found that seventy-eight percent of dental practitioners in a city in the southern state of Andhra Pradesh, India had a prevalence of at least one Musculoskeletal Disorders symptom over the past twelve months. Most common areas affected by MSD in order of magnitude were neck (52%),

<table>
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<th>Sl. No</th>
<th>Etiologic factors</th>
<th>Manifestations of diseases</th>
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| 1      | Specific working posture (Ergonomics) | a) Musculoskeletal disorders and diseases of the peripheral nervous system  
b) Carpel tunnel syndrome |
| 2      | Contact with patients | a) Percutaneous Exposure Incidents  
b) Infectious bio aerosols  
c) Respiratory and other communicable illness from patients and staff like influenza, cold sores |
| 3      | Contact with equipments, drugs, materials & X-Rays | a) Allergies from various materials  
b) Latex hypersensitivity  
c) Hazards due to Acrylate and its compounds  
d) Allergic asthma  
e) Noise generated by dental equipments  
f) Hazards from Mercury exposure  
g) Hazards due to Developing and fixing solutions  
h) Hazards due to nitrous oxide gas |
| 4      | Disease of mixed nature | a) Legal hazards  
b) Overhead expenses of a dentist, |
| 5      | Physical Agents | a) Eye injury,  
b) burns and scalds from autoclave |
| 6      | Psychological factors | a) Stress  
b) professional burnout |
low back (41%), shoulders (29%) and wrist (26%). One third of the practitioners (40%) required sick leave from their practice during the preceding twelve months [20].

Biological Health Hazards

Dentists constitute a group of professionals who are likely to become exposed to biological health hazards. These hazards are constituted by infectious agents of human origin and include viruses, bacteria and fungi. Dentist can become infected either directly or indirectly [3]. From the occupational view point percutaneous exposure incidents particularly needlestick and sharp instrument injuries represents the most efficient method for transmitting blood born infections between patients and health care workers [21]. This exposure is related to the fact that dentists work in a limited-access and restricted-visibility field and frequently use sharp devices. Percutaneous exposure incidents facilitate transmission of bloodborne pathogens such as human immunodeficiency virus [HIV], hepatitis C virus [HCV] and hepatitis B virus [HBV] [22]. Needles and drilling instruments such as burs represented the most common devices as the cause of exposure and injury [23,24,25]. Reports of a study carried out in Washington reveals that 66.7% of the percutaneous injuries are sustained by dentists [26] and most of the injuries (70%) occurred during administration of local anesthesia, recapping a needle and performing surgical procedures. In an epidemiological study of needle stick and sharp instrument accidents in a Nigerian hospital it was found that needle stick accidents during the previous year were reported by 27% of 474 HCWs, including 100% of dentists, 81% of surgeons, 32% of nonsurgical physicians, and 31% of nursing staff. The rate of needle stick injuries was 2.3 per person-year for dentists [27]. The infection risk after accidents involving contaminated blood contact depends on various factors, such as: type of exposure, inoculums size, host response, infectious material involved, and the amount of blood [28]. The emergence of blood-borne pathogens like HIV, HBV and HCV has urged dentists to adopt a number of precautions that have become generally accepted [29,30]. Needle-stick injuries should be treated immediately [31].

Stress

The dental profession is often perceived as rather stressful, and a number of studies pay attention to psychological stress and stress-related health problems in the dental population. A strict time schedule, coping with anxious patients or painful treatments are frequently referred to as major stressors, procedures connected with anaesthetization of patients, overcoming of pain and fear, unanticipated emergency situations in which a patient’s life is in danger, or procedures with hesitant prognosis [15, 32, 33, 34, 35]. Rankin and Harris [36] stated that causing pain and discomfort in patients was the source of stress that was most often stated by all examined doctors, and that this issue was more stressful for female doctors than for male doctors. Furthermore, dental practitioner reporting psychological stress would have more musculoskeletal complaints [37, 38]. In a study conducted to investigate job stressors and coping strategies among New Zealand dentists it was found that the most commonly reported stressors were treating difficult children (52%), constant time pressure (48%) and maintaining high levels of concentration (43%) [39]. A nationwide anonymous cross-sectional survey was undertaken on 2,441 GDPs in the UK. The main findings were that Health behaviours such as alcohol use was associated with work stress (r = 0.18, P < 0.001) and over a third of GDPs were overweight or obese. Sixty per cent of GDPs reported being nervous, tense or depressed, 58.3% reported headache, 60% reported difficulty in sleeping and 48.2% reported feeling tired for no apparent reason [6]. A questionnaire on various potential health effects was sent out to randomly selected Flemish dentists. It was found that the median score on the stress rating scale of 7 indicated that the dental profession is perceived as highly stressful [15]. Gortzak RA et al in their study on ambulant 24-hour blood pressure and heart rate of dentists found that Blood pressure and heart rate are shown to be significantly higher during work than during other
activities, whereas these differences could not be observed in a non-dentist population [40].

**Allergic Reactions**

An occupational allergic reaction particularly of the hands like contact dermatitis and atopic dermatitis is a common problem among dental personnel [41].

In southern Thailand Nearly one fifth (15/83, 18.1 per cent) of male dentists and just over one quarter (24/95, 25.3 per cent) of female dentists reported experiencing contact dermatitis [13] in New Zealand over 40 percent of dentists have experienced symptoms at some stage during their practising life [42].

**Latex Hypersensitivity**

Currently, gloves are worn routinely by most general dental practitioners while diagnosing and treating patients, with latex being the most commonly used glove material universally. The clinical symptoms of latex allergies include: urticaria, conjunctivitis accompanied by lacrimation and swelling of eyelids, mucous rhinitis, bronchial asthma and anaphylactic Shock [43]. In a recent study a total of 26 (16%) dental professionals reported allergy to latex gloves, of which females (27.3%) reported significantly greater allergy than males (11.8%) [44]. Vangveeravong M et al conducted a cross sectional survey to study the prevalence of latex-related symptoms, latex-sensitization. It was found that the prevalence of latex allergy in dental students is 5% and the signs and symptoms were local cutaneous reaction; pruritus, eczema and contact urticaria. The latex sensitization rate in dental students was 14.2%, which is higher than the general population [45].

**Occupational Respiratory hypersensitivity**

Allergic contact dermatitis caused by acrylate compounds is common in dental personnel; they also often complain of work-related respiratory or conjunctival symptoms. In a study conducted by Piirilä P et al twelve cases of respiratory hypersensitivity were found to be caused by acrylates among dental personnel (six dentists and six dental nurses) in 1992-97 are reported [46].

**Hazards from Physical Agents**

**NOISE**

Despite numerous technical advances in recent years, many occupational health problems still persist in modern dentistry. The danger to hearing from the dental-clinic working environment in a dental school cannot be underestimated [47]. Few dentists in south Thailand reported hearing problems [13]. The noise levels of modern dental equipment have now fallen below 85dB(A), the widely used benchmark standard, below which the risk of hearing loss is minimal [48]. Nonetheless some dentists may still be at risk particularly when older and non standardized equipments are used.

**Radiation**

Harmful radiation like Non-ionizing radiation (visible and UV light) and ionizing radiation (X-rays) can cause damage to various body cells. Ionizing radiation is a well established risk factor for cancer [49]. With the improvement in radiologic equipment and methods and radioprotection measures direct radiation injury has been virtually eliminated. In a study conducted yet the potential adverse effects of whole-body doses remain of concern with secondary radiation scattered from bones in the patient's head now representing the greatest source of radiation received by dentists and dental workers [50].

Non-ionizing radiation has become an important concern with the use of blue light and UV light (ultra-violet) to cure various dental materials. Exposure to the radiations emitted by these can cause damage to the various structures of the eye including the retina and the cornea [51]. Use of safety glasses and appropriate shields can minimize or eliminate this type of radiation hazard.

**Musculoskeletal Disorders**

Musculoskeletal complications among dentists are prevalent like other healthcare workers. Most dentists (87.2%) indicated at least one symptom of musculoskeletal diseases in the past last year [25].
A study in Greece indicated that 62% of dentists complained at least one musculoskeletal complaint, 30% chronic complaints, and 16% sought medical care [52].

Cumulative trauma disorders (CTDS) are health disorders arising from repeated biomechanical stress to the hands, wrist, elbows, shoulders, neck and back. Most common CTDS are Carpal tunnel syndrome and Low back pain [53]. Carpal Tunnel syndrome (CTS) has been associated with both repetitive and forceful work. CTS is defined as symptomatic compression of the median nerve within the carpal tunnel, which is the space between the transverse carpal ligament on the palmar aspect of the wrist and the carpal bones on the dorsal aspect of the wrist. Symptoms of carpal tunnel compression can appear from any activity causing prolonged increased (passive or active) pressure in the carpal canal. There is evidence of an association between CTS and highly repetitive work, alone or in combination with other factors [54]. Despite carpal tunnel syndrome, prevalence among dentists is not very high, about 5% [54], 56% of dental hygienists complain some symptoms of carpal tunnel syndrome [55]. Low back pain is the most prevalent musculoskeletal complaint [56]. Severe chronic back pain is reported in more than 25% of dentists with back pain [52]. In an American study, 57% of 960 dentists in a Dental Society reported occasional back pain [57]. In a recent study on Musculoskeletal disorders and symptom severity among Australian dental hygienists it was found that MSD were frequently reported by dental hygienists in the neck (85%), shoulder (70%), and lower back (68%) [58].

Musculoskeletal pain may be induced by mechanical vibrations affecting the organism through the upper limbs and causing changes in the vascular, neural, and osteoarticular systems. These changes may produce an occupational disease called vibration syndrome. But based on available literature, it cannot be considered any direct link between vibrations emitted by the working dental instruments and the incidence of symptoms characteristic of the vibration syndrome [59].

Musculoskeletal pain and disorders affect dental personal have multifactorial causes. Studies indicate that protocols preventing the multifactorial problem of dentists developing musculoskeletal disturbances such as malposition and posture and considering ergonomics are helpful [54].

Legal Hazards
In every nation there are relevant laws and regulations which apply to the practice of dentistry. The breach of any of these may warrant that legal actions be taken against a dental practitioner particularly in developed countries where the populace 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 dental professionals [2].

Conclusion
It is very clear from the above discussion that despite numerous advancements, many occupational health hazards still exist in present dental profession. It is, therefore, recommended that regular workshops and seminars various continuing dental education programs on occupational hazards be organized for all clinical dental staff periodically to update their knowledge about various newer methods and developments and, hopefully, influence their work practices.

References


