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Review article

Strategic Occupational Hazards Affecting Dental Profession And its Management: A Review

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ABSTRACT

Occupational diseases are diseases arising from or out of activity in the workplace. It is resulting from

exposure to physical, chemical, biological, psychosocial or ergonomics factors in the workplace. The presence of these factors in the workplace is essential for occupational diseases to occur; e.g., exposure to lead in the workplace will lead to lead poisoning, and presence of silica in the workplace will cause silicosis. It must be recognized, however, that other factors, such as individual susceptibility, characteristics of exposure to those substances (example duration of exposure, concentration of substance, and condition of the substance) does have a role in the developing of occupational diseases. Occupational diseases of dentistry have, in general, received scant attention. The chief cause of this is lack of awareness among occupational dental physicians. Exposure to various chemical substances is one of the causes of occupation-related dental disorders. The present review aims to focus the attention of dental physicians towards this important problem.

KEYWORDS: Occupational hazards; Dentistry; Biohazards; Occupational diseases.

INTRODUCTION

Carrying out their professional work, dentists are exposed to a number of occupational hazards. 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. Some of dental restorative materials can be potentially harmful to dental personnel and patients and can cause allergic contact dermatitis, asthma, and conjunctival symptoms. In carrying out their professional work, dentists are exposed to a number of occupational hazards. 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. Close contact with the patients, with their saliva and blood, exposes the dentist to occupational biohazards, mainly of the contagious kind. Strained posture at work destabilizes the osteoarticular system and causes overburdening of the spine. The overburdening also affects certain groups of muscles and joints. This brings about diseases of the musculoskeletal system and of the peripheral nervous system. Also,

the functioning of the respiratory, cardiovascular and alimentary systems is disrupted. The noise of suction, saliva ejectors, turbines, engines, amalgamators, compressors, etc., causes impaired hearing. A limited surgical area and its artificial lighting results in eye strain, conjunctivitis, blurred vision or shortsightedness. Many clinical situations may be a source of stress for the dental practitioner. This paper reveals a series of factors responsible for the same.

DENTAL RESTORATIVE MATERIALS AND ALLERGIC REACTIONS

Scot et al.¹ mentioned several manifestations of allergic reactions that have oral and facial involvement. These include angio-oedema of the lips and tongue, urticaria of the face and erythema multiforme of the skin, lips and oral mucous. Allergic contact dermatitis may not only appear on the hands, but is also associated eyelids, as reported by Guin² and Fowler³. Contact allergy involving the oral mucous, according to Scot et al.¹, is a poorly understood clinical entity that is infrequently described. Contact allergy is also often mistaken for chronic trauma caused by fractured teeth, fractured restorations, ill-fitting prosthesis or parafunctional oral habits.

Dental personnel should therefore be aware of the possible allergens that they, as well as their patients, are exposed to, so that they can make informed decisions once faced with contact allergic symptoms. Previous allergic reactions in patients and personnel should always be noted (as type IV hypersensitivity may be triggered as a result of a previous exposure to allergen). Lonnroth and Shahnava⁴ suggested, on the basis of a survey in Sweden among dental personnel, that there is a correlation between hand dermatitis, age eczema in childhood and high fever. They did not find a correlation, however, between asthma, frequent washing of hands and hand dermatitis.

BIOLOGICAL HEALTH HAZARDS

A dentist can become infected either directly or indirectly. In the first case, microorganisms can pass into an organism, through a cut on the skin of his/her hand while performing a medical examination, as a result of an accidental bite by the patient during a dental procedure, or through a needle wound during an anaesthetic procedure. An indirect infection occurs when an infectious agent is transmitted into the organism through the so-called carrier. The following are the main sources of indirect infection: aerosols of saliva, gingival

fluid, natural organic dust particles (dental caries tissue) mixed with air and water, and breaking free from dental instruments and devices. The following are the main entry points of infection for a dentist: epidermis of hands, oral epithelium, nasal epithelium, epithelium of the upper airways, epithelium of bronchial tubes, epithelium of alveoli, and conjunctival epithelium.

In dental procedures such as processing of tooth tissues (carietic defects, denture abutments), filling procedures, removal of dental concretions, dentists use tools with a slow-speed, turbine, or ultrasound burs which spray around the bacterial flora included in the oral cavity^{5,6}. Dental procedures cause major changes in the microbiological environment of a dentist's surgery.

LEAD EXPOSURE

Chronic Lead exposure favours the formation of cheilitis, fissures, ulcers and epithelial desquamation of the tongue, palate and other parts of the oral mucous membranes. Exposure to lead is, generally, detected by blood analysis which is "routinely used as a tool for monitoring and screening of the body burden, though it is well-known that blood lead levels drop markedly within one month after cessation of exposure^{7,8}.

Lead, a heavy metal pollutant, is known to deposit in the central nervous system, causing developmental problems and calcified tissues including bone and teeth. Primary (deciduous) teeth have been used as an indicator for lead exposure in a number of studies because they reflect the body burden of lead accumulation in chronic exposure⁹. Tooth damage can be caused by any process that results in a loss of the integrity of the tooth surface. Dental caries is the commonest form of tooth damage and is caused by bacterial infection. Other forms of damage are erosion, abrasion, attrition, discolouration and fracture and they result from mechanical or chemical assault to the tooth structure. Lead in the tooth is found mainly in dentine and originates from lead in blood that accumulates during the entire life¹⁰.

LATEX HYPERSENSITIVITY

Latex gloves dusted with cornstarch powder are most often used. Since the beginning of the eighties, the number of cases of immediate allergies to latex has increased dramatically¹¹. The most important risk factor of immediate allergies is repeated exposure to latex products^{11,12}. Atopy is another essential factor contributing to the increased number of allergic cases. Turjanmaa et al.¹³ established that atopy was 2.2-4.5 times more

frequent in those health service employees who were allergic to latex than in those who were not allergic. It is estimated that 2.8-17% of the employees of the health service are allergic to latex. 8.8% of dentists were found to be allergic. The increased use of rubber gloves to prevent infections caused by immunodeficiency viruses (HIV) and hepatitis viruses is closely related to the number of persons suffering from allergy to latex. The clinical symptoms of latex allergies include: urticaria, conjunctivitis accompanied by lacrimation and swelling of eyelids, mucous rhinitis, bronchial asthma and anaphylactic shock^{13,14}. Corn-starch or the so called absorbable dusting powder also plays an important role in latex allergies, manifesting itself in the reaction on the part of the airways. This powder is not biologically neutral, as was previously thought. It is allergenic and takes part in immediate allergic reactions. There are three basic categories of adverse latex gloves associated conditions: irritant, allergic and immediate, or type I hypersensitivity allergy. The first two types (irritant and allergic contact dermatitis are painful and temporarily debilitating, but without the potential for serious reactions. The third type (immediate or type I hypersensitivity) is the least common but the worst type of reaction, sometimes leading to anaphylaxis¹⁵. Sufferers from latex allergy should rather use vinyl or nitril gloves, while it is advisable for severe sufferers to work in latex-free environment.

ACRYLATE AND ITS COMPOUNDS

Dental polymer materials based on methacrylate, its polymer, and polyelectrolytes, seem to be a major cause of contact dermatitis in dental personnel^{16,17}. Dentistry uses a variety of different polymer materials. The setting of restorative materials and adhesives is initiated chemically by mixing two components or by visible light. In both cases, polymerization is incomplete and monomers, not reacted (also known as free monomers), are released. These free monomers may cause a wide range of adverse health effects such as irritation to skin, eyes or mucous membranes, allergic dermatitis, asthma and paraesthesiae in the fingers. Additionally, disturbances of the central nervous system such as headache, pain in the extremities, nausea, loss of appetite, fatigue, sleep disturbances, irritability, loss of memory, and changes in blood parameters may also be noted.

STRESS: The psychological aspects of dentist-patient cooperation are very important. In

everyday clinical practice a dentist has to adopt an individual attitude towards a patient, depending on his/her mental state and personality. In most cases, the knowledge of psychology, good communication skills and the establishment of a proper relation between dentist and patient are the most crucial factors deciding whether the prophylactic steps and the treatment will be successful. Good communication between doctor and patient has a positive influence upon a stricter observance of the doctor's recommendations by the patient^{18,19}. The course of doctor-patient relations significantly affects patient's health action and the results of treatment. A doctor is aware of the power of his/her words, recommendations and instructions. He/she may positively influence a patient's emotions and motivations. Achieving a proper motivation in a patient requires a lot of tact and patience both on the part of the doctor and his assistants²⁰. The role prescribed to a doctor regarding his/her power to reduce or strengthen the fearful attitude in a patient constitutes a considerable mental burden to a doctor. It is not only the necessity of meeting a patient's high expectations that is stressful. Many clinical situations are the source of stress to a dentist²¹⁻²⁴ and these include, among others, procedures connected with anaesthetisation of patients, overcoming of pain and fear, unexpected emergency situations in which a patient's health or life is in danger, or procedures with uncertain prognosis. Rankin and Harris²⁵ stated that causing pain and discomfort in patients was the source of stress that was most often mentioned by all examined doctors, and that this factor was more stressful for female doctors than for male doctors. According to Simon et al.²⁴, administering an anaesthetic injection is rarely discussed, but forms a significant source of stress in this profession, and is a problem for many doctors. Unskilled planning of a treatment may be a source of frustration and pain associated with failure both to a doctor and a patient.

DENTAL EROSION

Dental erosion is the chemical wear of the hard tissues of the teeth (dentin and enamel) due to chronic and/or frequent exposure to internal (i.e. gastric or eating disorders, vomiting, alcoholism, salivary hypo-function) and/or external (i.e. environmental, occupational, dietary) acids. Epidemiologic studies report a wide range of prevalence (5% to 50%) varying across different age and occupational groups, geographic areas,

and cultures. Distinguishing dental erosion from other types of tooth wear (attrition and abrasion), specifying underlying etiologic factors, and recognizing this condition in its early stages can be challenging. Due to workplace acid exposures (sulfuric, hydrochloric, nitric, tartaric, chromic, phosphoric, or acetic acids), workers in certain occupations (i.e. in mineral, battery, chemical, tin, dyestuff, fertilizer, and also metal (galvanizing, plating, silicone sealing, acid pickling) industries) are at higher risk of developing dental erosion.

According to the appraised studies on dental erosion and workplace airborne acid exposure:

- Dental erosion usually occurs at the labial surface of anterior teeth
- Canines are affected less than central and lateral anterior teeth
- Areas unprotected by lips/cheeks are at higher risk of developing erosion
- Prevalence is higher in battery and galvanizing workers
- significant correlation exists between 'duration of acid exposure' and 'severity of erosion'

Erosion can affect both the enamel and dentin tissues, and both the occluding and non-occluding surfaces of teeth. When acids touch the surface, they diffuse through the acquired pellicle (an organic film made of salivary proteins and glycoproteins) and the hydrogen ion of the acid dissolves the enamel crystal. First the prism sheath area, and then the prism core area, dissolves. This leads to the typical honeycomb appearance at the early stages of erosion. Later, acid diffuses into the interprismatic areas of enamel, and eventually into the region below the surface²⁶⁻²⁸. Tooth surface becomes softened and then diminishes. Once the softened tooth surface has faced mechanical insult (tooth brushing, etc.), it cannot remineralize. In vitro studies have shown that erosion in dentin can occur even at pH levels as high as 6.0 and that compared to enamel, chances that dentin will remineralize are lower²⁹. The first dentin area to be affected is peritubular dentin. Intertubular areas as follow, leading to rough, porous surfaces. The process may eventually involve pulp tissue²⁸. During a clinical examination for dental erosion, a polished (silky-glazed) appearance of enamel, broad concavities within the enamel surface, cupping of occlusal surfaces due to dentin exposure, increased incisal translucency, and hypersensitivity are common findings. The margins of the erosive defects are usually rounded. The edges of the amalgam restorations may be

elevated, and incisor teeth are frequently shortened and chipped³⁰. Patients with active dental erosion have unstained tooth surfaces and are more likely to suffer from hypersensitivity.

When dental erosion is suspected to result from acidic exposures in the work environment, any study on this population should also address possible confounders and effect modifiers. If possible, biological make up of the patient's oral cavity (including the salivary properties, etc.), dental care practices (regular visits to dentist, toothbrushing, etc.), eating/drinking habits (acidic drinks, excessive citrus fruits, etc.) along with specific medical disorders and medication use (acid reflux, eating disorders, antidepressants, etc.) should be reviewed and controlled for during any data analysis.

MUSCULOSKELETAL DISORDERS AND DISEASES OF THE PERIPHERAL NERVOUS SYSTEM

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. The overstress negatively affects the musculoskeletal system and the peripheral nervous system; above all, it affects the peripheral nerves of the upper limbs and neck nerve roots. Neck discopathy results in cervical nerve pains or cervico-acromial pains, which are particularly common among dental practitioners³¹⁻³³. The posture of the dentist at work, with the neck bent and twisted, an arm abducted, repetitive and precise movements of the hand, are, according to Milerad and Ekenvall, a frequent cause of the neck syndrome and of pain within the shoulder and upper extremities³⁴. A number of dental doctors suffer from a defect of the median nerve and of the cubital nerve. An early syndrome of a defected median nerve shows in acroparaesthesiae. 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 sensorimotor disorders of the thumb and index finger as well as by the atrophy of the thenar³⁵. The long-term effect of all those adverse circumstances occurring in the work of the dental doctor may lead to diseases described as cumulative trauma disorders.

HAZARD MANAGEMENT³⁶: Management of hazards in the workplace comprises of the identification, assessment and control of hazards

and the education and supervision of employees in respect of hazards.

The duties of employers are to:

- Identify all new and existing hazards by surveying the place of work;
- ASSESS the hazards to decide which are significant; and
- Control significant hazards by:
- Elimination: This is the first option and “all practicable steps” must be taken to achieve this, e.g. substitution of a hazardous substance with a less harmful one.
- Isolation: This is the second option applied when elimination is not practicable, e.g. placing contaminated sharps in a sharps container.
- Minimisation: Where elimination or isolation cannot be achieved, the employer must take all practicable steps to minimise the likelihood of harm from the hazard, e.g. using capsules instead of bulk mercury.

Minimising the hazard is effected by:

- Training employees in the nature of the hazard;
- Provision and use of personal protective equipment;
- Monitoring employees’ exposure to the hazard; and
- Monitoring employees’ health relative to hazard exposure.

VACCINATION

All dental therapists are subject to occupational exposure and should be offered vaccination against Hepatitis B virus. Vaccination of employees should be available at the employer’s expense and should be initiated before assignments to tasks that may result in an exposure. Vaccination is not necessary if the employee has previously received the full course of HB V vaccination, if antibody testing reveals immunity, or if the vaccine is contraindicated for medical reasons. Employers are encouraged to monitor the Hepatitis B status of staff and the results shall be shared between the employee and employer. The employer may be represented by the occupational health department of the organization.

TRAINING

- All employees will receive training in the use and safe handling of hazardous materials before they are required to handle these materials. This training will be reviewed and updated where appropriate. All such training will be recorded.

- All employees will be trained to emphasize the importance of drugs being stored in a secure manner to prevent unlawful access.

MATERIALS/DRUGS

- All materials/drugs used in a dental practice must be stored in a manner that prevents accidental or unlawful access, e.g. secure/lockable cupboard or filing cabinet.
- In storage, take special precautions to avoid child access.
- Follow your employer’s protocol for disposal of expired and obsolete drugs.
- Keys to any lockable cupboards shall be kept in a safe/secure place and available to dental staff only.

CONCLUSION

Dentists, as well as dental personnel and their patients are constantly exposed to a number of specific occupational hazards. 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. Dental products such as acrylics, resins and polymer materials used in restorative dentistry represent a major advance in dentistry. Although these products may act as allergens in part of the population, one should keep in mind that every technology, no matter how beneficial, can exert a negative impact on some members of the population. The reality of public health will always involve balancing maximum benefit and minimum harm to the public health and well-being.

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