

OCCUPATIONAL HAZARDS OF DENTISTRY

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Annals of Agricultural and Environmental Medicine, Lublin, Poland

Szymańska J: Occupational hazards of dentistry. *Ann Agric Environ Med* 1999, 6, 13–19.

Abstract: Dental professionals are susceptible to a number of occupational hazards. Relying on relevant literature, the present paper discusses selected occupational hazards - occupational biohazards, stressful situations, and latex hypersensitivity, as well as factors leading to the musculoskeletal system diseases and diseases of the peripheral nervous system.

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Key words: occupational hazards, dentistry, biohazards, occupational diseases.

INTRODUCTION

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 suctions, 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 short-sightedness.

Many clinical situations may be a source of stress for the dental practitioner.

Dental medicaments and materials as well as disinfectants used in dental surgeries cause allergies and skin diseases. Moreover, the adverse effects of mercury

and nitrous oxide are well-known, less so those of visible blue light.

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 prions, viruses, bacteria and fungi. Table 1 shows occupational biohazards present in the working environment of dental personnel.

A dentist can become infected either directly or indirectly. In the first case, microorganisms can pass into 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 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 upper airways, epithelium of bronchial tubes, epithelium of alveoli, and conjunctival epithelium.

Table 1. Biological health hazards in dentistry.

Category	Name	Transmission to humans	Effect on humans
Prions	Prion causing Creutzfeldt-Jacob's disease (progressive subcortical degenerative encephalopathy in humans)	Directly (cut, infection)	I – Creutzfeldt-Jacob's disease
Viruses (<i>Adenoviridae</i>)	<i>Adenoviridae</i>	Air-droplet, directly	I – adenoviral fever
Viruses (<i>Coronaviridae</i>)	<i>Coronaviridae</i>	Air-droplet	I – mild upper airways diseases
Viruses (<i>Flaviviridae</i>)	Virus of hepatitis C (HCV)	Directly (cut, infection), through blood, blood serum and other human body fluids	I – hepatitis, frequently in the form of a chronic cirrhosis; C – hepatic carcinoma
Viruses (<i>Flaviviridae</i>)	Virus of hepatitis G (HGV)	Directly (cut, infection), through blood, blood serum and other human body fluids	I - hepatitis
Viruses (<i>Hepadnaviridae</i>)	Virus of hepatitis B (HBV)	Directly (cut, infection), through blood, blood serum and other human body fluids, especially wound exudate, saliva, semen, vaginal secretion; through sexual intercourse, from mother to foetus	I – hepatitis, frequently in the form of a chronic cirrhosis; C – hepatic carcinoma
Viruses (<i>Hepadnaviridae</i>)	Virus of hepatitis D (HDV = Delta + HBV)	Directly (cut, infection), through blood, blood serum and other human body fluids	I – hepatitis, frequently in the form of a chronic cirrhosis;
Viruses (<i>Herpesviridae</i>)	<i>Herpes simplex virus</i> (HSV)/Simple herpes virus (type 1 and 2)	Directly: through kissing (most frequently – type 1), through sexual intercourse (most frequently – type 2), through a cut in the skin, through hand contact	I – herpes: vesicular inflammation of tunica mucosa of oral cavity and urinary – sexual organs, skin inflammations (eczema and vesicular eruption), keratitis, encephalitis
Viruses (<i>Orthomyxoviridae</i>)	Viruses of influenza (type A, B, and C)	Air-droplet	I – influenza, pneumonia
Viruses (<i>Paramyxoviridae</i>)	Virus of parotitis	Air-droplet, directly	I – parotitis (mumps, childhood and developmental age diseases), possible complications: cerebrospinal meningitis, encephalitis, pancreatitis, orchitis
Viruses (<i>Picornaviridae</i>)	Virus of hepatitis A (type 72 of human enteroviruses)	Faeces-food, directly	I – hepatitis A, gastritis enteritis (mostly in youth)
Viruses (<i>Reoviridae</i>)	Reoviruses	Air-droplet, directly	I – reoviral fevers
Viruses (<i>Retroviridae</i>)	Human Immunodeficiency Virus (type HIV-1, HIV-2)	Directly (through blood, sexual intercourse – homo- and heterosexual), through placenta to foetus	I – AIDS (acquired immunodeficiency syndrome), atrophy of cellular immunity through gradual destruction of lymphocytes T, progressive neuropathy, accompanying infections, death; C - neoplasms
Viruses (<i>Retroviridae</i>)	Human leukaemia viruses from T cells (HTLV-1, HTLV-2, HTLV-5)	Directly through blood, sexual intercourse), food (with mother's milk)	I, C – leukaemia of adults, encephalitis
Viruses (unclassified as yet)	Unidentified hepatitis viruses transmitted through blood	Directly (through blood)	I - hepatitis
Bacteria (Gram-negative facultative anaerobic bacteria)	<i>Actinobacillus actinomycetemcomitans</i>	Orally, air-droplet	I – localized juvenile periodontitis (LJP – localized juvenile periodontitis)
Bacteria (<i>Actinomycetes</i>)	<i>Actinomyces gerencseriae</i>	Orally, directly (cuts)	I – actinomycosis, nodular-suppurative lymphadenitis
Bacteria (<i>Actinomycetes</i>)	<i>Actinomyces israelii</i>	Orally, directly (cuts)	I – actinomycosis, nodular-suppurative lymphadenitis

Table 1 (continuation). Biological health hazards in dentistry.

Category	Name	Transmission to humans	Effect on humans
Bacteria (<i>Actinomycetes</i>)	<i>Actinomyces pyogenes</i>	Orally, directly (cuts)	I – actinomycosis, nodular-suppurative lymphadenitis; T - toxic
Bacteria (<i>Actinomycetes</i>)	<i>Actinomyces</i> spp.	Orally, directly (cuts)	I – actinomycosis, nodular-suppurative lymphadenitis
Bacteria (Gram-negative anaerobic bacteria)	<i>Bacteroides fragilis</i>	Endogenic resulting from cuts, operation, bites	I – pneumonia, oral cavity inflammation, periodontitis, dermatitis, inflammation of female genitals, enteritis, septicaemia
Bacteria (Gram-negative facultative anaerobic bacteria)	<i>Cardiobacterium hominis</i>	Air-droplet	I - endocarditis
Bacteria (Gram-negative anaerobic bacteria)	<i>Eikenella corrodens</i>	Directly, air-droplet	I – oral cavity infection, infection of intestines
Bacteria (Gram-negative anaerobic bacteria)	<i>Fusobacterium necrophorum</i>	Directly, endogenic (resulting from damaged tissues)	I – infections of oral cavity, respiratory system, urinary-sexual system, skin, connective tissue, bone, intestine
Bacteria (Gram-negative aerobic coccus bacteria)	<i>Moraxella catarrhalis</i>	Air-droplet, directly	I – pneumonia, endocarditis, meningitis
Bacteria (Gram-negative aerobic coccus bacteria)	<i>Neisseria flavescens</i>	Air-droplet, directly	I – meningitis, septicaemia
Bacteria (Gram-negative aerobic coccus bacteria)	<i>Neisseria meningitidis</i>	Air-droplet, directly	I - meningitis
Bacteria (Gram-positive anaerobic coccus bacteria)	<i>Peptostreptococcus anaerobius</i>	Air-droplet, directly	I – pyogenic infections
Bacteria (Gram-negative anaerobic coccus bacteria)	<i>Porphyromonas</i> spp.	Air-droplet, directly	I – endogenic infections of oral cavity and tooth canals
Bacteria (Gram-positive coccus bacteria)	<i>Streptococcus</i> spp. (<i>S. bovis</i> , <i>S. equi</i> , <i>S. mutans</i> , <i>S. salivarius</i> etc.)	Air-droplet, directly	I – pneumonia, endocarditis, inflammations of oral cavity, urinary tract, and of other organs, dental caries
Fungi (imperfect fungi, anascogenic yeasts)	<i>Candida albicans</i>	Directly	I – candidiasis of skin, nails, oral cavity, vagina, rarely internal organ candidiasis – usually occurring in specific microclimatic conditions (high humidity and temperature) and in decreased immunity; A – endogenic allergic reactions
Fungi (imperfect fungi, anascogenic yeasts)	<i>Candida tropicalis</i>	Directly	I – candidiasis of skin, nails, oral cavity, vagina, rarely internal organ candidiasis – usually occurring in specific microclimatic conditions (high humidity and temperature) and in decreased immunity;

I – infectious or invasive activity; C – carcinogenic activity; A – allergenic activity; T – toxic activity.

[2, 4, 5, 8, 10, 13, 17, 18, 20, 22, 23, 24, 25, 26, 27, 31, 32, 34, 35, 36, 39, 42, 44, 46, 47, 48, 49, 50, 53, 56, 58, 60, 63, 64, 68, 69, 76, 78]

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 [3, 54]. Dental procedures causes major changes in the microbiological environment of a dentist's surgery. Legnani *et al.* [43] made an assessment of the aerosol

contamination resulting from dental procedures. Air contamination was measured by means of the Surface Air System method and the "plate" method (Air Microbial Index). It was proved that during working hours the average air bacterial load increased over three times, and the air load levels were 1.5 times (aerobic bacteria) and 2 times (anaerobes) greater as compared to the initial load.

STRESS

Stress situations form an inherent part of a dentist's everyday work. Although seldom discussed, they should be considered in view of the hazards connected with this profession, a profession which requires that a dentist should act in two roles: as a psychotherapist and a manually skilled operator.

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 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. Everybody knows how difficult it is to overcome the fear in children and win the confidence of a young patient [6, 11, 40], especially in dental surgery cases. Other problems are associated with the treatment of older people [52] or the mentally retarded [65]. Good communication between doctor and patient has a positive influence upon a stricter observance of the doctor's recommendations by the patient [19, 37]. 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 [45]. Achieving a proper motivation in a patient requires a lot of tact and patience both on the part of the doctor and his assistants [79]. However, one should not forget that a dentist himself is also a source of fear – negative impressions associated with his behaviour and professional skills.

Reduction or complete elimination of a patient's fear are very important. In most patients this can be accomplished through the doctor's proper behaviour, pleasant atmosphere, calmness and patience [7]. Corah *et al.* [14] proved that the following personal characteristics of a dentist help in reducing a patient's fear: ability to work fast, friendly attitude, calmness, moral support connected with meeting of patient's expectations half way. Empathy and communicativeness form the basis of achieving full satisfaction resulting from the treatment.

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 dentist [15, 16, 30, 41, 74] 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.

The following factors, such as the necessity to keep a proper professional standard, aspiration to achieve technical perfection, causing pain or fear in patients, the necessity to cope with cancelled visits or late arrivals by patients, having to cope with different levels of cooperation

with patients, were recognised as very important sources of stress in everyday dental practice.

Moreover, it takes a definite time to carry out a precise dental operation. When the patients fail to cooperate, or when the surgery is painful, it is necessary to reduce the time. This forces the doctor to concentrate and mobilize his mental and physical resources, which increases the stress on his organism. A recurrence of such situations in the doctor's practice inevitably leads to stress [55].

Rankin and Harris [66] 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.* [74], 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.

A questionnaire study, which included 1563 Polish dentists, indicated that the level of mental burden resulting from work is different depending on the place of work, post occupied and type of professional speciality. It was discovered that the feeling of highest burden was among dentists working in industrial health care departments and specialised care institutions, and the lowest in district outpatient departments. Managerial personnel and young assistants stated that their work burden was the highest. Prosthodontists and maxillofacial surgeons feel their work burden is the highest, and paradontologist regard it as the lowest. The feeling of work burden becomes more intensive with the increase of responsibility, additional work and duties, as well as with higher qualifications and a lower self-estimate of their health state [21].

In many dentists an inseparable presence of stress situations may trigger painful thoughts, emotions or fears. It may also contribute to the development of such immediate reactions as increased tension, higher blood pressure, tiredness, sleeplessness, touchiness, depression. In the group of dentists examined by Gortzak *et al.* [33], both the blood pressure and the rate were significantly higher during their clinical work than in their free time. The sample group did not exhibit significant differences in the blood pressure measured in those two periods.

Reitemeier's psychophysiological investigations on dentists [67] revealed that dental work involves high psychic stress. Epidemiological values of occupational diseases completed the objective assessment of strain effects and consequences. One of the representative conclusions is: inclusion of the dentist in occupational care.

LATEX HYPERSENSITIVITY

Gloves and a mask form an integral part of dentist's protective equipment. Latex gloves dusted with cornstarch powder are most often used. The gloves and the mask form an efficient barrier against most pathogens, and as recently proven – they also constitute a very good

barrier against viruses, provided the gloves and the mask are intact [28]. However, they may also be a source of allergies – primarily in those persons who use rubber products on a regular basis. In this respect, dentists belong to a group at particularly high risk.

Since the beginning of eighties, the number of cases of immediate allergies to latex has increased dramatically [12]. The most important risk factor of immediate allergies is repeated exposure to latex products [12, 29, 80]. Atopy is another essential factor contributing to the increased number of allergic cases. Turjanamaa *et al.* [80] 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 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 allergies to latex. Palczyński and Walusiak [59] include, among other hypothetical causes for appearance and the increased number of cases of immediate allergies to latex, improved diagnosing and notifiability of allergies, increased occurrence of allergic diseases in the general population, appearance of low quality rubber gloves with high allergenic potential, changed location of rubber-tree plantation, changed locations of storage of latex products – extended time of storage, changes in the production process, damage to skin barrier – allergic and contact irritation dermatitis, creams used in dermatitis – making the penetration of allergens easier, increased content of latex aerosol in hospitals, increased exposure to cross-allergens (exotic fruit), increased use of ethylene oxide for speeding up the growth of rubber-trees and for sterile packaging of latex products.

The clinical symptoms of latex allergies include: urticaria, conjunctivitis accompanied by lacrimation and swelling of eyelids, mucous rhinitis, bronchial asthma and anaphylactic shock [77, 80]. 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 airways. This powder is not biologically neutral, as was previously thought. It is allergenic and takes part in immediate allergic reactions. The powder does not include detectable proteins but, as some studies demonstrated, the health service employees who had an anaphylactic reaction to the dusting powder were positive in skin tests [29, 39]. Starch particles combined with latex protein allergens become airborne, and consequently they are inhaled, or absorbed by our skin [12, 73]. The intensity of aerosol effect grows with the increased use of rubber gloves [77].

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. This refers to 37.7% of work time [75]. 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.

Back pain syndromes diagnosed in dental workers originate from spine degeneration in its different phases. Neck discopathy results in cervical nerve pains or cervico-acromial pains, which are particularly common among dental practitioners [70, 71, 72, 75]. 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 extremities [51].

Lumbar and lumbosacral discopathy arouses pain in the loins and the low back which radiates to the lower extremities, more often right than left. This can be explained by a greater stress on the right side of the body when the doctor works with a sitting patient.

The dentist makes constant monotonous movements, which stress the wrist and elbow joints. Also of consequence are mechanical vibrations [1].

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 sensomotor disorders of the thumb and index finger as well as by the atrophy of the thenar [57, 61, 75].

The necessity of keeping the upper limbs extended upwards in a bent and abducted position, without the possibility of resting the hands on the elbows is conducive to a defect of the elbow nerve. While bending the forearm, the medial head of the triceps muscle goes into the sulcus of the elbow nerve, which facilitates a pressure on the nerve.

Pains of the epicondylus, appearing at first during strain and special movements, gradually intensifying and radiating along the forearm, point to an inflammation of the epicondylus of the humeral bone [75].

Operations carried out during extractions stress not only the elbow joint and the wrist joint but may result in chronic tendon sheath inflammation.

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 [62].

CONCLUSION

The review of the above described, relatively less known hazards to which dentists are exposed in their everyday work, indicates the need for special medical care for this professional group.

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