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## Technical aspects of the dentist's work safety

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### Abstract

In the work of a dentist there are many factors that affect the occupational risk. They cover the area of the human factor, work organization and technical area. The latter often determines the safety and ergonomics of the workplace. The purpose of this article is to identify occupational hazards in the work of a dentist, with particular emphasis on the technical area. The method used in the article is a survey supported by observation with elements of a direct interview. The research tool used in the article is a questionnaire in the form of a checklist.

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## 1. Introduction

Occupational work carries a lot of risks, which include the area related to man, work organization and technology. One of the most common threats in recent years – both in Poland and other European Union countries – is the exposure to musculoskeletal disorders. This health problem is also – according to the European Agency for Safety & Health at Work (EU-OSHA) – a significant cause of absence from work (Niciejewska et al., 2015). Ailments of the musculoskeletal system may occur in various occupational groups. In the work of the dentist, moreover then to the risks arising from the nature of the services (contact with the patient), there are many risks that arise from technical aspects. The closer and distant environment of the dentist's work environment puts a lot of demands in the area of safety and ergonomics. Unergonomic conditions at the dentist's work carry some of the most common ailments - the already mentioned musculoskeletal disorders (Reza et al., 2019). The work of the dentist is mainly static – static effort is predominant in relation to dynamic effort. Its inconvenience is caused by monotypic exercise stress directed to the same elements of skeletal system, joints and muscles, which is often forced body position. According to literature, the range of dentists' professional activities is quite broad and includes not only dental treatment, but also prevention and rehabilitation of dentistry (Chaiklieng et al., 2015). The dentist's work takes

place under certain conditions: body position, using specific tools. All tools, devices, machines, as well as all kinds of material means, which have to protect against biological and chemical hazards affect the safety of both the dentist and the patient.

In the light of available EU-OSHA reports, every fourth employee complains of musculoskeletal disorders. Back pain, upper limbs, but also cervical segment are the most frequent problems reported by employees (including dentists), whose work is predominantly static with elements of dynamic work within the upper limbs - small wrist motor activity. In the work of a dentist - in such dental procedures as scaling, filling and tooth extraction - there is a high risk of pain in the area of the neck, shoulders and back (Chaiklieng, 2015). In this paper, hazards in the work of the dentist have been identified, with particular emphasis on the technical working environment, which has a significant impact on musculoskeletal disorders.

## 2. Experimental

The method used in the article is a survey supported by observation with elements of a direct interview. The research tool used in the article is a questionnaire in the form of a checklist. The original questionnaire has been created on the basis of several public questionnaires (in the area of

Technology - Organization - Man), among others authored by the National Labor Inspectorate, the Central Institute for Labor Protection - the National Research Institute in Warsaw and the European Agency for Safety and Health at Work. Individual questions have been adapted to the nature of the audited entity. Observation of the work of a dentist supported by a direct interview enabled a comprehensive approach to the analyzed topic. The questionnaire has been composed of three areas, each of contained several questions. The direct interview has been supported by questions from the questionnaire extended by penetrating questions. The analysis of the dentist's work and the impact of individual areas on its safety allowed to obtain clear results.

### 3. Results and discussion

The identification of hazards in the dentist's work place is shown in table 1. This is a collective list of all hazards that can be found in every dental office. In turn, the identification of factors determining safety at work in the opinion of a dentist has been defined using a questionnaire (checklist) in three areas - the human factor, the organization of work and the technical factor. The study revealed a number of important risks that affect the safety of the dentist's work. Table 2 presents the results obtained from research on the "human factor" area.

**Table 1.** Collective list of occupational hazards related to the work of a dentist

Hazards	Source of hazards	Possible consequences of the hazards
Slip and fall on the same level	Slippery floor surfaces	Injuries of the body, dislocation and sprains of the joints
Slipping, falling on the stairs	Lack of attention, urgency, bad shoes	Contusions, bone fractures
Hitting a stationary elements	Labour equipment	Bruises, cuts, abrasions
Contact with sharp hand tools	Work with sharp instruments - needles, scalpels, Tongs	Skin cutaneous, abrasions, microinjuries
Splashes of material, bones, tartar etc.	Turbine drills, lasers, dental instruments	Injuries of the eyes and skin of the face
Blood-borne virus infection	The saliva of the patient mixed with blood, the material from the respiratory tract	Hepatitis B and C and HIV
Overload of the static motion system	Work in a sitting or standing position	Backache and wrist pains
UV radiation	Composite materials hardened with HV lamps	Irradiation of the skin and eyes with direct light, clouding of the eye lens
Laser radiation	Lasers	Photophobia, conjunctival hyperaemia, cataracts, burns
The burden on the organ of sight	Looking from a very short distance to the field of work	Disorder of accommodation
Noise	Ultrasonic scaler, high-speed drills emitting high frequency sounds	Injuries to the inner ear and lowering of the hearing threshold
Vibration	High-speed turbine drills	Changes in peripheral nerves
Chemical agents acting on the skin	Disinfecting preparations and dental medications	Allergic rhinitis, allergic skin reactions
Contact with latex	Latex Glover	Allergic rhinitis, allergic skin reactions
Contact with sick patients	Work in the patient's respiratory track	Flu and respiratory diseases
Aggression of patients under the influence of pain and anxiety	Involuntary patient movements caused by pain eg kick or bite, demanding and aggressive patients	Strokes, scratches, punctures, HIV infection
Voltage in installations powered by electricity	Electric devices	Electric shock

**Table 2.** Factors (hazards) that affect the safety at work of the dentist - "human factor"

No	Factors (hazards)
1.	Aggressive patients, especially those with elevated levels of anxiety and aggressive behavior
2.	Conflicts resulting from workplace arrangements - "employer-employee", "employee-employee"
3.	Failure to comply with the permitted work limits

The work of a dentist is characterized by interpersonal relationships - "worker-employee", supervisor-employee "and employee (doctor) patient (external client)". As a result of these relationships, there are situations that have an impact

on the work climate, atmosphere, which in turn translates into the safety of performing specific tasks.

When contacting a potentially aggressive patient - in this case, it should be known that it may be reflexive or fearful aggression. The cause of injury may be blades, sharp edges and sharp elements. It is connected with the possibility of body injuries (mainly hands) as a result of contact with needles and sharp edges: tools and teeth of patients, technological materials, etc. It is necessary to pay special attention and use protective gloves. Also, do not forget to properly equip your First Aid Kit. An important threat in the work of a dentist is the emotional load, causing stress, and, consequently, burnout (Lewczuk, 2002).

Emotional workload may be related to, among others, work overload, as well as the occurrence of harmful and dangerous work environment factors - especially biological factors. The solution for limiting the above-mentioned threat may be safe, hygienic and ergonomic organization of the workplace as well as self-education. At this point, it is also worth mentioning measures supporting safety in terms of biological occupational hazards. These are all types of personal protective equipment but also technical protection of the dentist against all biological hazards.

Contact with the patient carries the risk of contact with pathogenic micro-organisms. They can be transferred by air and droplet, such as, for example, influenza virus or mycobacteria, by the dermal route - e.g. herpes virus; through body fluids, e.g. viruses - HBV, HCV, HIV (Chen W. et. al., 2013, Pereira et. al., 2018). In case of danger, it is necessary to use personal protective equipment - hands and respiratory system - and to keep the basic hygiene rules (frequent hand washing, thorough disinfection of the instrumentarium, taking care of sensitive elements of the unit - including headboards and saliva ejectors). Also appropriately selected aprons and materials protecting against biological material are the essential equipment of a dental office (Hokwerda et. al., 2006; Schacher et.al., 2009). Ergonomic solutions and elements of work clothing equipment supported by personal protective equipment are technical aspects of the safe work of a dentist. Organization of safe work in turn is a number of factors related to the proper management of the workplace, the distribution of tools, the design of equipment supporting the work of the dentist. Table 3 presents the factors that significantly affect the safe performance of the dentist's tasks.

**Table 3.** Factors (hazards) that affect the safety at work of the dentist - "organizational factor"

No	Factors (hazards)
1.	Lack of attention to reducing exercise (static)
2.	Work rate - occurrence of the operating situation and performing tasks under time pressure, which is related to the character of the given service (dental surgery)
3.	Breaks at work - non-observance of recommended breaks in work (relaxation exercises after physical-static load)
4.	The placement of tools and devices does not make it easier to maintain the correct position of the body, which also results from the nature of the work (forced body position, slightly twisted tilted forward)
5.	Difficulty in body position changing

In the work of a dentist, static and dynamic loads of the body are a significant problem. This first threat is associated with many hours of work in a standing position or in a forced sitting position, which may be the cause of, among others: pain, spine diseases, varices of the lower limbs. Dynamic load is connected with the hands of many repetitive activities and can lead to diseases within the wrists (e.g., carpal tunnel syndrome). To reduce these risks, remember to prepare an ergonomic workplace (including, among others, a suitable seat) and relaxation exercises. During the work of the dentist, remember to take special care, for example when moving on flat surfaces - remember to use shoes on non-slip soles; when

climbing - remember to use of an efficient stepladder. All the above indications are reflected in the good organization of work, which in turn determines the safety during the performance of individual tasks by the dentist. The last area of the dentist's safe work analysis concerns technical factors. These include suitably designed places for performing individual work processes, ergonomic work stations (in the case of dentists - units), safe and ergonomic sanitary and hygienic rooms, suitably adapted to the needs, possibilities and limitations of the dentist, individual workstation items, tools, objects and devices, as well as work clothing, personal protective equipment, etc.

The data presented in Table 4 are concerned on the factors from the technical area, which significantly affect the work safety of the dentist.

**Table 4.** Factors (hazards) that affect the safety at work of the dentist - "technical factor"

No	Factors (hazards)
1.	Ergonomic dental chairs - unity - unsuitable use
2.	Badly matched work shoes - no non-slip sole
3.	Incorrect work clothing - obstructing movements, quickly absorbing biological material (blood, saliva) of the patient
4.	Incorrect adaptation of the seat and desk for administrative work
5.	Noise caused by working dental devices
6.	Sharp devices and tools - risk of pins, cuts, damage to the skin and body
7.	Chemicals, dust

An important aspect of safe and ergonomic work is the unit - dental chair, which allows the doctor to perform precise and safe treatment. The dentist has easy access to the patient's oral cavity that is not burdened significantly by the musculoskeletal system. In the work of a dentist, it is important to properly match the shoes with a non-slip sole - because the floor is rarely dirty or splashed with body material, biological (saliva, blood mixed with water), which is a direct threat resulting in slips, falls, etc. A very important part of the whole environment in the work of a dentist are devices which make loud noises during work and lead to fairly large exposure to noise - technology of these devices does not currently provide for the elimination of noise or vibration. In addition, work in a sitting or standing position - despite many ergonomic solutions - causes long-lasting pressure as a result of holding the tools in clenched hand when bent at the elbow joint. This causes spinal pain and distortion in the bone-joint system, pain syndromes of the lumbosacral spine and cervical spondylosis, with migraine headaches. The consequence of taking such a forced body posture is also a disorder called the ulnar canal syndrome. Physicians often suffer from a painful shoulder syndrome with periarticular inflammation and a skin nerve compression syndrome with sensory disorders.

#### 4. Summary and conclusion

The profession of dentist is characterized by diversity and intensity of occupational hazards. The scope of activities as

well as the nature of work determines the amount of these threats. Starting from social aspects, through the organization of work to its technical background - the entire set of occupational hazards may be indicated in the work of a dentist. The dentist must be immune to the behavior of patients, have the skills to work together (a dental assistant), and often have managerial competences (while being the owner of the office). In addition to management and social competences, should be aware of the consequences resulting from exposure to a number of physical, chemical and biological agents. In addition, proper organization of work is often not only about the success of a dental procedure, or another service, but also about the safety of its implementation. The development of technology as well as the ergonomic design of the entire dentist's work environment is a priority.

Proper working conditions and awareness of safe conduct during work activities is important in the work of the dentist. The scope of activities, the diversity of threats that may affect on the health, the static and dynamic load, forced body position relative to the patient cause that the profession of dentist is considered a profession with an increased occupational risk.

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## 牙医工作安全的技术方面

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### 關鍵詞

牙医  
人体工程学  
职业风险  
工作环境的技术因素  
安全生产

### 摘要

在牙医的工作中，有许多因素会影响职业风险。它们涵盖了人为因素，工作组织和技术领域。后者通常决定了工作场所的安全性和人体工程学。本文的目的是识别牙医工作中的职业危害，特别强调技术领域。本文中使用的方法是通过直接访谈的元素观察支持的调查。本文中使用的研究工具是一份清单形式的问卷。

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