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EVALUATION OF STATIC LOAD IN DENTISTS' WORK BY MEANS OF OWAS METHOD

OCENA OBCIĄŻENIA STATYCZNEGO W PRACY LEKARZA STOMATOLOGA ZA POMOCĄ METODY OWAS

A b s t r a c t

In this study, the work of the dentist and the identification of musculoskeletal disorders have been characterized. The analysis and compatibility with literature on the identification of musculoskeletal disorders resulting from professional work of dentists have been presented. The authors assessed the occupational risks associated with static load on the position of the dentist by means of the OWAS method.

Keywords: risk, *dentist*, *work*, *security*, *OWAS*

S t r e s z c z e n i e

W niniejszym artykule scharakteryzowano pracę lekarza stomatologa oraz dokonano analizy literaturowej dotyczącej identyfikacji dolegliwości mięśniowo-szkieletowych będących skutkiem pracy zawodowej lekarzy stomatologów. Autorzy pracy dokonali oceny ryzyka zawodowego związanego z obciążeniem statycznym na stanowisku lekarza stomatologa z zastosowaniem metody OWAS.

Słowa kluczowe: ryzyko, *lekarz stomatolog*, *praca*, *bezpieczeństwo*, *OWAS*

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1. Introduction

Professional work is related to a variety of risks for the employee. 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 [1]. Ailments of the musculoskeletal system may occur in various occupational groups. According to studies conducted by the European Foundation for the Improvement of Living and Working Conditions (Eurofound), in the last decade in the European Union, a group of the following professional sectors is most exposed to musculoskeletal disorders: agriculture and fishing, industry, hospitality and civil engineering [2]. In Poland, there is no data that would give the answer to the question of how many people in the workplace are exposed to a risk factor of musculoskeletal disorders. However, it has been estimated that these symptoms occur most often in the industry, agriculture and fishing. Many studies also point to the high prevalence of musculoskeletal disorders among health care professionals, especially nurses, physiotherapists, surgeons and, finally, dentists [3]. 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 [4], the range of dentists' professional activities is quite broad and includes not only dental treatment, but also prevention and rehabilitation of dentistry.

It is possible to see the effect of prevention if the evaluation of musculoskeletal disorders is done correctly, is relatively simple, clear and regards the position of entire body. OWAS is such a method, and it was used in this assessment of musculoskeletal disorders in the dentists' work.

2. Risk assessment of musculoskeletal disorders by means of the OWAS method

The risk evaluation of developing disorders of the musculoskeletal system on the dentist position has been carried out based on the OWAS method (Ovako Working Posture Analysis System). This method is one of the simplest and most commonly used methods for assessing the risk of developing musculoskeletal disorders related primarily to static loads. The OWAS method is particularly useful for assessing various activities at work. The main task of this method is to select all the items as the most important from the point of view of the load. Therefore, the problem of unusual and onerous position at work is the foreground [6]. This method takes into account the position of the body, exerting force, the time to maintain the load and type of body position, whether forced or unforced. The first task in assessing the performance of this method is called: photography of the day, timing of the working day or specifying individual actions performed by the employee (in this case the dentist) during the shift. The estimation is pointed to activities recognized in the timing. Finally, the essence of the analysis is introduction of changes in the work place in accordance with measurement results in the intention of reducing the risk of developing musculoskeletal disorders [6]. The diversity of body position takes into account the position of the torso, arms and legs.

The external load includes the weight below 10 kg, 10 to 20 kg and over 20 kg. The body position must be established by code for each separate action in the timing (e.g. 1 1 2 1). The first three digits in turn are assigned to the torso, arms and legs. The fourth digit of the code is characterized by an external force which directly affects the employee during their work activities. The essence also determines the type of employee's position (forced, unforced) and the total time of breaks [6]. The classification of body position (back) provides indicators from 1 to 4, where the position of the arms is determined by codes from 1 to 3, and the legs are numbered from 1 to 7. External load can be classified with codes from 1 to 3 [7]. Table 1 presents the location codes of body parts (by OWAS category) while Table 2 shows the ranking of an external force which acts during operation – grey marked codes of individual body parts refer to the dentist's work.

Table 1

Codes of the body parts by OWAS category – based on [8]

Torso (back)	Code	Arms	Code	Legs	Code
Upright position	1	**Both elbows below shoulder joint**	**1**	**Sitting position**	**1**
Leaning forward	2	One elbow above the shoulder joint	2	Upright standing position on two legs	2
Sprained positions	3	Both elbows above shoulder joint	3	Upright standing position on one straight leg	3
Leaning forward and sprained	**4**			Upright standing position on two legs bent	4
				Upright standing position on one leg bent	5
				Position on the one or two knees	6
				Walking	7

As a result of the analysis of the dentist's work and photographs of a working day, operating codes were received (concerning various parts of the body during work). It was selected The part of the photo of a working day which takes the most time in the entire process of dentist's work was selected- dental procedures in a sitting position with slightly twisted torso, inclined forward. During the work elbows of the dentist are located below the shoulder joint. Table 2 shows the number of codes of external force acting on the employee in accordance with gender and age. According to the characteristics, dental tools do not exceed 10 kg.

Total code of worker burden connects four labels: the position of the body (back), the position of the arms, legs and the position of the external. According to the scheme for the dentist, the following code has been established. Table 3 indicates categories of static load in the dentist's work. There are individual digits of the code determined in the OWAS matrix.

Table 2

Codes of external forces acting on the employee – by gender and age (based on [7])

Men	Code	Women and juvenile men	Code	Juvenile girls	Code
Up to10 kg	**1**	Up to 5 kg	1	Up to 2 kg	1
From 10 to 20 kg	2	From 5 to 10 kg	2	From 2 to 6 kg	2
More than 20 kg	3	More than 10 kg	3	More than 6 kg	3

Table 3

Assessment categories of static load in the OWAS method – based on [8]

Legs		**1**			2			3			4			5			6			7		
External forces		**1**	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
Torso	Arms																					
1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	1	1	1	1	1	1
	2	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	1	1	1	1	1	1
	3	1	1	1	1	1	1	1	1	1	2	2	2	2	2	3	1	1	1	1	1	2
2	1	2	2	3	2	2	3	2	2	3	3	3	3	3	3	3	2	2	2	2	3	3
	2	2	2	3	2	2	3	2	2	3	3	4	4	3	4	4	3	3	4	2	3	4
	3	3	3	4	2	2	3	3	3	3	3	4	4	4	4	4	4	4	4	2	3	4
3	1	1	1	1	1	1	1	1	1	2	3	3	3	4	4	4	1	1	1	1	1	1
	2	2	2	3	1	1	1	1	1	2	4	4	4	4	4	4	3	3	3	1	1	1
	3	2	2	3	1	1	1	2	3	3	4	4	4	4	4	4	4	4	4	1	1	1
4	**1**	**2**	3	3	2	2	3	2	2	3	4	4	4	4	4	4	4	4	4	2	3	4
	2	3	3	4	2	3	4	3	3	4	4	4	4	4	4	4	4	4	4	2	3	4
	3	4	4	4	2	3	4	3	3	4	4	4	4	4	4	4	4	4	4	2	3	4

The final result of the evaluation is to determine the static load according to assessment categories. As it results from the matrix, in the dentist's work the load fell into category "2". It is important to assign for each category the total time in which the position is sustained. Table 4 shows the number of such information.

In the analysis of musculoskeletal system load by means of the OWAS method, the time, repeat rate and duration of a particular activity are very important factors. The final risk assessment takes into account the duration of certain OWAS categories. A three-stage evaluation system is carried out on the basis of the data contained in Table 5.

Table 4

Description of categories in the evaluation of static load – based on [6]

Category	Activities for improving the working conditions
1	Positions taken during operation are natural. The load is optimal or acceptable. There is no need to change the position.
2	Position or positions taken during operation may affect the motor system. The load is almost acceptable. There is no need to change the position, but you should take into account the need for such changes in the near future.
3	Position or positions taken during working hours have a negative effect on the motion. The load is large. Changes in the workplace must be carried out as quickly as possible.
4	The position or positions at work have a very negative effect on the motion. The load is very high. Changes in the workplace must be carried out immediately.

Table 5

Classification of static load, taking into account the time of maintaining one position – based on [6]

Load	Body position at work by OWAS category	Time to maintain one position (% of working shift)
Small	Position unforced of category 1	≤ 70
	Position forced of category 1 or unforced category 2	≤ 50
	Position forced of category 2	≤ 30
Average	Position unforced of category 1	> 70
	Position forced of category 1 or unforced category 2	50–70
	Position forced of category 2	30–50
	Position forced of category 3 or 4	≤ 30
High	Position forced of category 1 or unforced category 2	> 70
	Position forced of category 2	> 50
	Position forced of category 3 or 4	> 30

In Table 5 the forced and unforced positions have been highlighted. A forced position is a position which imposes a construction on the workplace or operations type. Unforced position is a position that, in contrast to the forced one, may be amended or modified in accordance with the preferences of the employee [6].

From the characteristics of the dentists' work and photographs of a working day it hasresulted that the time to maintain the characteristic position of body is more than 50% but less than 70%. Due to the fact that the dentist at work leans torso forward and twists it slightly, it can be assumed that the forced position, the "2" category maintains the position for 60% of the time. This gives finally a large load for particular workplace.

3. Conclusion

The OWAS method allows for the full assessment of musculoskeletal disorders risk, which affects the whole body and takes into account the load of upper limbs, lower limbs and back. This method has advantages and disadvantages. The advantages are the following: the opportunity to take different actions at work, both because of the position of the body and the time of exerted forces, as well as the possibility of using the method for each work station. The disadvantage of this method is that it is a qualitative method and fraught with subjectivity of the evaluated person [6]. The risk analysis of musculoskeletal disorders of the dentist by means of the OWAS method is an attempt to draw attention to one of the most common threats, which has been recently closely connected to both doctors and specialists in ergonomics. Musculoskeletal disorders are in fact the most common consequence of non--ergonomic working conditions, inadequate posture when performing work and excessively long time in which this position is dominant. Musculoskeletal disorders are among the most commonly reported symptoms associated with the performance of work.

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