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O. A. Glazunov, A. A. Gruzdeva

State institution "Dnipropetrovsk Medical Academy of the Ministry of Health of Ukraine", Dnipro, Ukraine

THE INFLUENCE OF CONDITIONS OF IRON ORE PRODUCTION ON DENTAL HEALTH OF MINERS**ABSTRACT**

The dental health of miners has specific differences from the average indicators of epidemiological surveys, which is associated with a distinct negative impact on the oral tissues of the air in the work area.

Analyzing the literature data on the impact of professional production factors of mining production on the formation of dental pathology, it can be stated that the prevalence of diseases of hard tissues of teeth, periodontal tissues and oral mucosa among workers in these industries is significantly higher than in the control group, where the influence of harmful conditions labor on the oral cavity is absent.

The purpose of the study was to assess the dental status and the structural and morphological parameters of the bone tissue of workers in iron ore production and to identify their relationship to the degree of exposure to harmful production factors.

Materials and methods of research. A total of 256 workers aged from 20 to 60 years with a work experience of 5-20 years were surveyed, who made up the main group of the surveyed. Among them were persons suffering from dust bronchitis (sample size – 95), who suffer from dust bronchitis and vibration disease – 96 workers with a vibration disease – 65. The control group consisted of 79 employees who had indirect contact with harmful industrial factors of the industrial facility, comparable in age and sex. The evaluation of the condition of hard tissues of the teeth was carried out according to the following criteria: color and transparency of the enamel according to the tooth coloring on the Vita scale, the degree of abnormal abrasion of teeth in accordance with the classification of Groshikov M.I. (1985).

Densitometric parameters were determined by the structure of the calcaneus with the use of the diagnostic complex "Osteo Syst-2000" (manufactured by the Republic of Korea).

Results of the study. At clinical examination of hard tissues of teeth, we did not notice any significant differences in the erosion of the teeth of the upper and lower jaws. At the same time, it was reliably established that the erosion of hard tooth tissues in underground miners, on the basis of index evaluation, was 1.76 times higher than in the control group. It is characteristic that a relatively high index of tooth erosion in the main group was noted in molars 2.98 ± 0.12 , and in incisors 2.65 ± 0.13 , both in the upper and lower jaws.

The most pronounced changes in the structure of bone tissue were observed in the examinees, which are constantly exposed to combined effects of vibration and a dust factor in the conditions of mining of iron ore. In our opinion, these deviations from physiological norms are associated

with discursive and metabolic disorders, which can occur when mining activity affects the workers' organism. Characteristically, changes in densitometric parameters directly depended on age and length of service.

Conclusions. When analyzing the data obtained, it becomes apparent that there is a gradual increase in the prevalence of signs of periodontal tissue diseases in miners with age, and correspondingly, with an increase in underground work experience. It should be noted, the weighting of the pathological process and the involvement of large volumes of tissues (it is mainly about the generalization of the process), as well as the growth of periodontal pathology (gingivitis of different severity, periodontitis) with an increase in work experience in harmful conditions of iron ore production and the age of the surveyed workers.

The obtained results of the study can be used for optimization of existing model of preservation of dental health workers of iron ore enterprises in the region and the development of a rational set of treatment and prevention activities.

Key words: dental status, workers, iron ore industry.

O. A. Глазунов, А. А. Груздева

ГУ “Днепропетровская медицинская академия “МЗО Украины”

ВЛИЯНИЕ УСЛОВИЙ ЖЕЛЕЗОРУДНОГО ПРОИЗВОДСТВА НА СТОМАТОЛОГИЧЕСКОЕ ЗДОРОВЬЕ ГОРНОРАБОЧИХ

Для изучения стоматологического статуса у рабочих железорудных комбинатов, проведено комплексное стоматологическое обследование 256 рабочих и контрольной группы из 79 человек. Анализ зависимости состояния твердых тканей зубов и пародонта от стажа работы и степени контакта с вредными производственными факторами у рабочих показал высокую распространенность заболеваний твердых тканей зубов и пародонта, обусловленную профессиональной вредностью, имеющую прямую корреляционную взаимосвязь от времени и степени контакта с вредными факторами. Результаты исследования могут быть использованы для организации системы охраны стоматологического здоровья рабочих исследуемого и других подобных предприятий.

Ключевые слова: стоматологический статус, рабочие, железорудная промышленность.

O. A. Глазунов, А. О. Груздева

ДЗ “Дніпропетровська медична академія “МОЗ України”

ВПЛИВ УМОВ ЗАЛІЗОРУДНОГО ВИРОБНИЦТВА НА СТОМАТОЛОГІЧНЕ ЗДОРОВ'Я ГОРНОРАБОЧИХ

Для вивчення стоматологічного статусу робочих залізорудних комбінатів, проведено комплексне стома-

тологічне обстеження 256 робітників та контрольної групи з 79 чоловік. Аналіз залежності стану твердих тканин зубів і пародонту від стажу роботи та ступеню контакту з шкідливими виробничими чинниками у робітників показав високу розповсюдженість захворювань твердих тканин зубів та пародонту, зумовлену професійними шкідливостями, які мають прямий кореляційний взаємозв'язок з часом та ступенем контакту зі шкідливими чинниками виробництва. Результати дослідження можуть бути використані для організації системи охорони стоматологічного здоров'я робочих залізрудних та інших промислових підприємств.

Ключові слова: стоматологічний статус, робітники, залізрудна промисловість.

Relevance of the topic. Recently, research has been actively carried out to study the problems of improving the organization of dental care for the general population and for certain categories of industrial enterprises [1-4].

The improvement of the technological processes of production inevitably entails changes in the state of the production environment. The intensity of industrial production in the conditions of large industrial cities adversely affects the environment and the health of the population of the region. A study of the prevalence and risk factors for the formation of various forms of pathology among occupational groups employed at iron ore enterprises are important today [5-7].

After analyzing the literature data on the impact of occupational factors of iron ore production on the formation of dental pathology, it can be noted that the prevalence of diseases of hard tissues of teeth, periodontal tissues and oral mucosa in workers of these industries is significantly higher than in the control group, where the influence of harmful conditions on the oral cavity organs is absent.

Mining industry of Dnepropetrovsk region is represented by enterprises that produce iron ore and its subsequent processing at mine-mill enterprises.

The high level of dust formation (maximum levels of which can exceed the permissible exposure limit in dozens of times) [8], intense noise exceeding the permissible norms to an average of 25-47 dB (8.9), intense gas generation and aerosols in the working area, vibration, physical overloads accompany the mining process of iron ore and affect the body of workers.

The introduction of new technological processes made it possible to reduce the occupational morbidity among miners. However, its level continues to be high (6, 9,10).

Workers of iron ore production increased the incidence of tissues diseases and mouth organs. This is explained by the fact that they are subjected to in-

tensive influence of mining dust before the rest. With the increase of professional experience, the incidence of lesions of oral cavity mucosa, periodontitis of hard tooth tissues become more common [6, 9, 10].

The purpose of the study: to evaluate the dental status, structural and morphological parameters of the bone tissue of workers of iron ore production and to identify their interrelation to the degree of exposure to harmful production factors.

Research materials and methods. A total of 256 workers aged from 20 to 60 years with the work experience of 5-20 years were surveyed, who made up the main group of the surveyed. Among them were people suffering from dust bronchitis (sample size - 95), dusty bronchitis and hand-arm vibration syndrome – 96, workers with the hand-arm vibration syndrome - 65.

The control group consisted of 79 employees who had indirect contact with the harmful industrial factors of the industrial facility, comparable in age and sex.

The evaluation of the state of hard tissues of the teeth was carried out according to the following criteria: color and transparency of the enamel in accordance with the tooth coloring on the Vita scale, the degree of abnormal abrasion of teeth in accordance with the classification of Groshikov M.I. (1985), chipped and cracked crown part of teeth in accordance with the anatomical forms of tooth crowns by group affiliation. In this case, the fact of age changes in enamel and other morphological structures of hard tooth tissues were taken into account.

Densitometric parameters were determined by the structure of the calcaneus with the use of the diagnostic complex "Osteo Syst-2000" (manufactured by the Republic of Korea).

Ultrasound-osteometry of the calcaneus allows evaluating both the density of bone tissue and the state of architectonics, which collectively characterize its strength. The bone tissue of calcaneus and vertebral bodies have a very close histological structure, in particular, the content of spongy and cortical tissues in these parts of the skeleton is approximately the same.

Examination of periodontal tissues was carried out adhering to the general medical sequence with the use of an objective assessment of oral hygiene and periodontal tissue. The degree of inflammation of the gums was determined using the PMA index in the modification of Parma (1960). Defined the periodontal index CPITN (the Communicable Periodontal Index of Treatment Needs) - the index of the need for periodontal diseases treatment, recommended by WHO for epidemiological examinations of periodontal diseases.

The level of the hygienic state of the oral cavity was assessed using the hygienic index proposed by Y. A. Fedorov and V.V. Volodkina (1971). To assess the presence and severity of periodontal diseases, the periodontal index (PI) of A.L. Russel (1956) was used.

The statistical processing was carried out by the methods of correlation and cluster analysis using standard packages of the program Statistica 6.0 (11).

The results of the research and the discussion.

It should be noted that all surveyed had an insufficient level of oral hygiene and the intensity of periodontal tissue damage increased with age.

The enamel of miners' teeth, namely the drillers, scrapermen and timberers, had a dull shade and a dark gray or yellowish-red color on the Vita scale. As the percentage, professional groups of miners were represented as follows: drillers – 64.6 % surveyed, scrapermen – 60.7 %, timberers – 78.4 %.

Disturbances in the structure of the enamel of teeth, namely, cracks were noted in 64.6% of drillers, 63.9 % of shaft men and 38.5% of scrapermen.

The change in the anatomical shape of the teeth in the form of fractures of parts, cutting edges, as well as splits of the enamel of the chewing group of teeth were noted in 96.1 % of drillers, 61.2 % of shaft men, and 61.5 % of scrapermen.

The high prevalence of abnormal abrasion of teeth was noted, especially among drillers – up to 83.9 % and shaft men to 83.8%. At the same time, the degree of pathological erasability was characterized as I and III.

At clinical examination of hard tooth tissues, we did not notice any significant differences in the erasure of the teeth of upper and lower jaws. At the same time, it was reliably established that the erosion of hard tooth tissues in underground miners, on the basis of an index estimate, was 1.76 times higher than in the control group. Characteristically, the relatively high index of tooth erasure in the main group was noted in molars 2.98 ± 0.12 , and in incisors 2.65 ± 0.13 , both the upper and lower jaws (Table 1).

Table 1

Distribution of tooth erasure indexes of miners and control group (M \pm m)

Tooth	Erasure index		Tooth	Erasure index	
	miners	control group		miners	control group
17	2,78 \pm 0,11	1,64 \pm 0,18	47	2,72 \pm 0,14	1,67 \pm 0,11
16	3,14 \pm 0,13	1,76 \pm 0,24	46	3,16 \pm 0,11	1,62 \pm 0,10
15	2,56 \pm 0,12	1,51 \pm 0,10	45	2,61 \pm 0,12	1,59 \pm 0,18
14	2,59 \pm 0,18	1,48 \pm 0,18	44	2,59 \pm 0,17	1,54 \pm 0,07
13	2,36 \pm 0,11	1,34 \pm 0,11	43	2,38 \pm 0,12	1,34 \pm 0,12
12	2,66 \pm 0,12	1,54 \pm 0,12	42	2,61 \pm 0,13	1,41 \pm 0,16
11	2,69 \pm 0,14	1,55 \pm 0,18	41	2,69 \pm 0,14	1,49 \pm 0,14
21	2,68 \pm 0,14	1,48 \pm 0,13	31	2,69 \pm 0,11	1,47 \pm 0,15
22	2,61 \pm 0,12	1,59 \pm 0,16	32	2,60 \pm 0,13	1,43 \pm 0,19
23	2,24 \pm 0,11	1,27 \pm 0,16	33	2,24 \pm 0,11	1,21 \pm 0,14
24	2,61 \pm 0,20	1,49 \pm 0,19	34	2,63 \pm 0,18	1,43 \pm 0,15
25	2,66 \pm 0,08	1,54 \pm 0,08	35	2,70 \pm 0,10	1,56 \pm 0,17
26	3,16 \pm 0,10	1,77 \pm 0,21	36	3,13 \pm 0,10	1,63 \pm 0,07
27	2,84 \pm 0,13	1,68 \pm 0,15	37	2,91 \pm 0,17	1,72 \pm 0,11

Note: 0 - no changes; 1 - loss of enamel contour; 2 - loss of enamel and dentin less than 1/3 of the surface; 3 - loss of enamel and dentin more than 1/3 of the surface; 4 - complete loss of enamel and dentin, exposed pulp or secondary dentin.

It should be noted that in the age group of 30-39 years the dentofacial system and the state of hard tissues have remained well, but the hygienic state of the oral cavity organs failed. Analysis of the questionnaire data from both the control group and the main group showed that only 68% of the respondents brushed their teeth regularly. Almost all the examinees changed the toothbrush once a year, while using different toothpastes. Features of nutrition and the nature of food of people surveyed did not differ significantly from the control group. Bad habits were noted by 68 people.

Densitometric indicators of miners are presented in Table 2.

As can be seen from the densitometric parameters presented in the table, the most marked changes in the structure of bone tissue were noted in workers who are constantly exposed to combined effects of vibration and the dust factor in the conditions of iron ore mining. In our opinion, these deviations from physiological norms are associated with the metabolic disturbances, which can occur when mining production affects the body.

Characteristically, changes in the densitometric

parameters directly depended on age and length of service.

When calculating pair correlations of the inves-

tigated parameters, it was established that the parameters of the densitometry correlated to the large extent with each other (Table 3).

Table 2

Densitometric indicators in the examined

Groups	age	sex	SOS	BUA	T-ratio	Z- ratio	BQI
Dust load	30-39 years	M	-	-	-	-	-
		F	-	-	-	-	-
	40-49 years	M	1571,5±8,5	60,4±3,3	96,7±4,1	107,1±4,5	101,9±4,3
		F	-	-	-	-	-
	50-59 years	M	1541,6±10,3	49,1±2,4	83,2±3,5	96,3±4,6	87,3±3,7
		F	1609,0±68,3	41,5±10,9	94,0±18,9	110,1±21,6	98,7±19,8
Hand-arm vibration syndrome	30-39 years	M	-	-	-	-	-
		F	-	-	-	-	-
	40-49 years	M	1559,5±6,2	48,2±1,5	85,6±2,1	94,3±2,3	88,8±2,3
		F	-	-	-	-	-
	50-59 years	M	1564,3±7,6	47,4±2,7	87,7±3,7	103,2±4,2	92,0±3,4
		F	1537,7±12,4	45,2±1,7	85,0±4,0	98,0±4,6	85,5±3,6
Vibration + dust load	30-39 years	M	1529,0±8,0	44,5±2,0	72,3±1,2	72,9±0,8	77,5±1,3
		F	1543,0±8,1	43,8±1,7	74,7±1,5	74,3±1,5	78,9±0,8
	40-49 years	M	1541,6±3,4	47,8±0,7	81,6±2,3	92,1±2,7	85,7±2,3
		F	-	-	-	-	-
	50-59 years	M	1529,1±3,8	39,9±1,2	74,3±1,5	86,8±1,7	78,0±1,6
		F	-	-	-	-	-

Table 3

The connection of indicators of dental health with densitometric indexes and comorbidity

Indexes	PMA %	CPITN	SOS	BUA	T-Score	T-Ratio	Z-Score	Z-ratio	BQI
PMA %		0,75	-0,10	-0,07	-0,07	-0,14	-0,08	-0,09	-0,14
CPITN			-0,14	-0,08	-0,10	-0,17	-0,06	-0,04	-0,17
SOS				0,41	0,59	0,77	0,56	0,70	0,78
BUA					0,43	0,66	0,40	0,60	0,67
T-Score						0,63	0,72	0,54	0,62
T-Ratio							0,60	0,82	0,88
Z-Score								0,62	0,58
Z-ratio									0,82
BQI									

Table 4

Dynamics of periodontal indicators in miners

Indexes and tests	Age							
	20-29 years		30-39 years		40-49 years		50-59 years	
	main	control	main	control	main	control	main	control
HI	2,76±0,45**	2,27±0,41	2,81±0,52**	2,29±0,43	2,97±0,56**	2,03±0,39	2,98±0,31	2,14±0,19
PMA (%)	47,03±1,07	32,12±0,9	53,32±2,1	41,27±1,3	56,42±1,8	46,19±2,0	60,56±2,4	54,32±2,6
CPITN	2,52±0,44**	1,87±0,35	2,75±0,15*	1,69±0,8	2,82±0,53**	1,92±0,36	2,88±0,17	1,97±0,43
PI	2,19±0,31	1,36±0,23	2,22±0,41**	1,41±0,27	2,64±0,18	1,57±0,13	2,85±0,52**	1,27±0,22**

Note: * The reliability of the differences between the main and control groups (p < 0.01);

** differences with the comparison group are statistically significant (p < 0.05).

Patients who formed the main group demonstrated minor complaints about violations from the periodontal complex. However, during the physical exam, changes in the mucous membrane of the oral cavity were detected, which spread to all periodontal tissues (destruction of the ligamentous apparatus, bone resorption, etc.). Important, in our opinion, is the fact that there was a tendency to manifest generalized periodontal pathology. Developing chronic processes had a mild clinical picture and poor symptoms.

In **Table 4** quoted results of the study of periodontal tissues state in miners of different ages and groups of comparison.

The hygienic index (HI) of workers in the main group over the age of 40 exceeds 2.6 points, which indicates that there is no regular oral care and speaks about the poor level of hygiene.

In workers who composed the basic and control groups of all age categories, we registered gingivitis of various degrees of severity – mostly light and middle. In the main group, the PMA index was 1.46 times higher than the control group at the age of 20-29 years, 1.22 times at the age of 40-49 years and 1.11 times at the age of 50-59 years.

Periodontal index (PI) among workers who formed the main group at the age of 20-29 years point at the formation of irreversible changes in the periodontal tissues and the PI index in 1.6 times is higher than at control group.

The CPITN index had significant differences in the workers of the main and control groups.

When analyzing the data obtained, it becomes apparent that there is a gradual increase in the prevalence of signs of periodontal tissue diseases in miners with the age, and correspondingly, with the increase of underground work experience. It should be emphasized, the weighting of the pathological process and the involvement of large volumes of tissues (it is mainly about the generalization of the process), as well as the growth of periodontal pathology (gingivitis of various degrees of severity, periodontitis) with the increase of work experience in harmful conditions of iron ore production and the age of the surveyed workers.

Conclusions. The iron-ore production workers surveyed by us had an insufficient level of hygiene and a close connection between the intensity of the lesions of hard tissues of teeth and the periodontal disease with the age ($r = 0.7$ $p < 0.05$). At determining the structure of bone tissue in miners with the help of densitometry the significant changes in the structure of bone tissue were proved, with more significant changes noted in workers whose work is associated with vibration equipment and dust effect on the body.

The data obtained from the results of examination of the periodontal condition of iron ore production workers testify to the high prevalence of periodontal diseases and the level of their prevalence has a certain dependence on the length of service in the mining industry. Increased length of service in harmful conditions of iron ore production is associated with the development of violations of the periodontal complex.

Prospects for further research. The obtained results of the study can be used for optimization of the existing model of preservation of dental health of iron ore enterprises workers in the region and the development of a rational set of medical-preventive activities.

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