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An Objective Approach to Physical Therapy in Patients After Hip Arthroplasty

Obiektywizacja postępowania fizykalnego u chorych po endoprotezoplastyce stawu biodrowego

DOI: 10.36740/ABAL202103101

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SUMMARY

Aim: The main aim of the study was to assess the effects of hip arthroplasty and rehabilitation on pain, physical fitness and everyday functioning.

Materials and Methods: The study involved 25 HOA patients, including 19 women and 6 men, after hip arthroplasty. The patients were assessed before and after the procedure. The results were used to conduct descriptive, graphical and statistical analyses.

Results: Surgical treatment and rehabilitation improved joint mobility and had a positive influence on the subjective feeling of pain, resulting in pain reduction or elimination. The treatment also increased the patients' ability to ambulate.

Conclusions: 1. HOA is a common diagnostic and therapeutic problem that affects more women than men. 2. Since the study showed a high overweight and obesity rate, it is important to educate patients about the effects of physical activity on controlling one's body weight and inform them that overweight and obesity are risk factors for HOA. 3. The treatment used in study patients reduced or eliminated the pain, improved joint mobility and increased the patients' ability to ambulate, which had a positive effect on the quality of life.

Key words: hip osteoarthritis, arthroplasty, physical therapy and rehabilitation

Słowa kluczowe: choroba zwyrodnieniowa stawów biodrowych, endoprotezoplastyka, postępowanie fizykalno-usprawniające

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INTRODUCTION

It is estimated that in the developed countries, osteoarthritis (HOA) occurs in 1 in 7 people over the age of 25 years and in 1 in 3 people over the age of 65 years. There are 4 to 8 million OA patients in Poland, most of them over the age of 75 [1-7].

HOA causes functional deterioration, pain and limited joint mobility, which impair joint function and decrease overall physical fitness. Early HOA symptoms include pain in the inguinal area, on the lateral side of the hip or in the region of the greater trochanter of the femur. Sometimes, the pain radiates along the lateral surface of the thigh towards the knee joint [8-14].

Limited mobility, if neglected and untreated, can lead to fixed hip contractures, which considerably impair musculoskeletal function. As the degenerative changes progress and contractures develop, muscles become weaker, resulting in their functional failure.

The initial conservative treatment consists in the elimination of risk factors, including obesity and joint overload, for instance due to work, and also in the elimination of pain and maintaining the highest possible level of hip mobility and muscle strength in the affected limb.

The more advanced degenerative changes are treated surgically. Hip arthroplasty is the most common type of arthroplasty [4-7].

Arthroplasty is aimed at improving the quality of life by reducing pain and increasing joint mobility. An arthroplasty procedure allows the patient to start ambulating soon after surgery, which is particularly important in older patients.

The use of X-rays is the basic method of diagnostic imaging in osteoarthritis. Typical radiographic findings include joint space narrowing, subchondral bone sclerosis and osteophyte formation.

PREOPERATIVE REHABILITATION

Preoperative rehabilitation is aimed at preparing the patient for arthroplasty. To prepare for the procedure, patients learn how to use crutches safely, get out of bed and chair, go up and down the stairs and get in and out of a car; they also learn how to avoid movements that may trigger implant dislocation [15-27].

In the preoperative period, it is also important to maintain the highest possible level of limb function and improve muscle strength.

AIM

The aim of the study was to assess the effects of hip arthroplasty with physical therapy and rehabilitation on pain, physical fitness and everyday functioning.

The following research problems were formulated:

What were the effects of hip arthroplasty and physical therapy on pain reduction in study patients?

Did the treatment help improve physical fitness and increase the walking distance?

How did the treatment improve the patients' ability to perform activities of daily living such as using stairs, their ability to ambulate and their physical activity?

MATERIALS AND METHODS

The study was conducted in a group of 25 patients (19 women and 6 men) with hip osteoarthritis after arthroplasty, treated at a hospital department of orthopaedics and traumatology in Skarżysko Kamienna. The data collected from study patients were entered into an Excel database created for the study on an on-going basis. All calculations were performed using the SPSS Statistics 21.0 software. Participation in the study was anonymous and voluntary. The study data were analysed using descriptive, graphical, and statistical methods. The statistical relationship between the characteristics analysed in the study was assessed using the Shapiro-Wilk test, a chi-squared test and the Wilcoxon test.

RESULTS

The study group consisted of 19 women and 6 men after hip arthroplasty.

The majority of study patients were overweight (60%). As many as 20% of study patients had a tendency towards obesity and only 20% had a normal body weight.

Most study patients (56%) were over the age of 65 years and 11 patients (44%) were under 65 years of age.

The majority of study patients (56%) lived in a city or town and only 11 people (44%) lived in a rural area. 14 patients (56%) were manual workers and 11 patients (44%) were intellectual workers.

Most study patients had to reduce (52%) or partially limit (32%) their physical activity before the procedure.

14 study patients (56%) were able to fully resume their physical activity while the others (44%) resumed their physical activity only to some extent.

Walking short distances (40%) and using stairs (32%) were the most difficult activities before the procedure.

Before the procedure, most study patients (68%) could walk 80-100 metres and two people (8%) were only able to walk less than 50 metres (8%).

After the hip arthroplasty procedure, 9 study patients (36%) could walk 1000 metres and more without rest, 24% could walk 500 metres and 8 study patients (32%) were able to walk 150-200 metres.

All study patients underwent rehabilitation at the hospital department.

The majority of study patients (60%) indicated that they had undergone rehabilitation before surgery.

Most study patients (72%) were able to use stairs without problems after the arthroplasty procedure.

Study patients reported very pronounced improvements (60%) or partial improvements (40%) in joint mobility.

Most study patients were pensioners or were on disability pension (68%).

The majority of study patients (52%) fully resumed their physical activity while the other patients (48%) only partially returned to the previous level of physical activity.

The most commonly used rehabilitation procedures included kinesiotherapy (96%), muscle strengthening exercises (68%), physiotherapy (76%) and cryotherapy (68%) (Table 1).

The data collected in the study were statistically analysed to determine whether hip arthroplasty and rehabilitation had a significant effect on pain reduction and physical fitness improvement.

The first stage of the analysis sought to test the distribution of variables. The Shapiro-Wilk test ($p < 0.05$) showed that the data deviated from a normal distribution. When using non-parametric testing and analysis, the assumption of a normal distribution of variables was tested first. The Shapiro-Wilk test was used, which showed that the distribution of at least one variable was not normal ($p < 0.05$).

The significance level was set at $p = 0.05$ in all analyses.

The Wilcoxon test for tied pairs was used to measure changes in pain severity and the range of physical fitness. The following hypotheses were formulated:

Null hypothesis H_0 : median values are equal in both measurements.

Table 1. Type of rehabilitation used in patients after surgery

What rehabilitation did you receive after surgery?	Answers
Kinesiotherapy	24
Individual exercises	12
Stretching exercises	5
Muscle strengthening exercises	17
Physiotherapy	19
Ultrasound therapy	5
Cryotherapy	17
Magnetic field therapy	5

Table 2. The Wilcoxon test for pain severity before and after surgery and for walking distance before and after surgery

		N	Z
Pain severity after surgery – Pain severity before surgery	Negative ranks	25	-4.428
	Positive ranks	0	
	Ties	0	
	Total	25	
What distance were you able to walk without rest after surgery? – What distance were you able to walk without rest before surgery?	Negative ranks	1	-3.897
	Positive ranks	23	
	Ties	1	
	Total	25	

N – number of patients; *Z* – test statistic; *negative ranks* (the value decreased) – the result was higher in the first measurement; *positive ranks* – the result was lower in the first measurement (the value increased); *ties* – identical results in both measurements

Alternative hypothesis H: median values are different in both measurements.

In both cases, the changes turned out to be statistically significant ($p < 0.05$).

Negative ranks (the result was lower in the second measurement), which mean pain reduction, were reported in 25 study patients; therefore, all patients experienced reduced pain after surgery (Table 2). The median value of pain severity before surgery was $Me = 8$, which means that half of the patients complained of pain whose severity was 8 or more. After the procedure, half of the patients rated their pain at 2 points or less ($Me = 2$) (Table 3). Consequently, the procedure turned out to be very effective: statistically significant changes ($p < 0.05$) were recorded, which were positive for the patients.

The second aim of the analysis was to determine whether hip arthroplasty and rehabilitation helped improve physical fitness and increase the distance walked without rest.

All study patients declared that they had resumed their physical activity (52% fully and 48% partially).

Next, the study tested whether resuming physical activity was correlated with pain after surgery. A chi-squared test (χ^2) was used. The results are presented below.

Pain severity after the procedure did not influence study patients' return to physical activity (p is over 0.05). 55.6%

Table 3. Detailed data for the Wilcoxon test

	Min	Max	Q25	Me	Q75
Pain severity before surgery	6.0	10.0	7.0	8.0	9.0
What distance were you able to walk without rest before surgery?	0.0	4.0	0.0	0.0	1.0
Pain severity after surgery	1.0	3.0	1.0	2.0	2.5
What distance were you able to walk without rest after surgery?	1.0	4.0	2.0	3.0	4.0

Me – median; *Min* – minimum result; *Max* – maximum result; *Q25* – first quartile; *Q75* – third quartile

of those who experienced a pain reduction after surgery declared that they had resumed their physical activity after treatment and physical therapy; 44.4% said they had partially resumed their physical activity. 42.9% of those who did not notice a change in pain declared that they had fully resumed their physical activity; 57.1% partially resumed their physical activity (Table 4). The differences between the groups were not statistically significant.

The third aim of the analysis was to assess whether hip arthroplasty and rehabilitation improve the patients' ability to perform activities of daily living such as using stairs, their ability to ambulate and their level of physical activity.

In order to analyse this research objective, any walking difficulties before the procedure were assessed. Almost half of the patients declared that their ability to ambulate before surgery had been considerably limited (48%), a slightly lower proportion of study patients reported a partially limited ability to ambulate (44%) and 8% of the patients experienced no such difficulties before surgery.

The analysis also looked at the presence of a correlation between walking difficulties before surgery and the age of study patients. Fisher's test was used. Walking difficulties in study patients were not age-dependent ($p > 0.05$). An analysis of the cross-plot may suggest that these limitations were less common in patients aged 65 years and younger (18.2% did not have any walking difficulty) when compared to those over the age of 65 (no one selected the "no limitation" answer); however, the test result shows that these differences are not statistically significant (Table 5). Consequently, the presence of a correlation cannot be confirmed.

When asked about the most difficult activities before surgery, study patients listed walking (40%), using stairs (32%), carrying heavy objects (16%) and getting in and out of a car (12%).

The patients were also asked about their ability to use stairs without difficulty after surgery. After surgery, 72% of study patients did not report any limitation of their ability to use stairs. The other 28% admitted that they were unable to use stairs without difficulty (Table 6).

The study verified whether a limited ability to use stairs was age-dependent. No statistically significant correlation

Table 4. Resuming physical activity

		After surgery, joint pain	
		Decreased	Remained unchanged
Did you resume physical activity after surgery and physical therapy?	Yes	N 10 % 55.6	3 42.9
	Partially	N 8 % 44.4	4 57.1
Total		N 18	7
		% 100.0	100.0

Table 5. Ambulation before the procedure

		Age		
			Up to 65 years	Over 65
Describe your ability to ambulate before the procedure.	Considerably limited	N	5	7
		%	45.5	50.0
	Partially limited	N	4	7
		%	36.4	50.0
	No limitation	N	2	0
		%	18.2	0.0
Total	N	11	14	
	%	100.0	100.0	

Table 6. Using stairs vs age

		Age		
			Up to 65 years	Over 65
Can you use stairs without difficulty after surgery?	Yes	N	8	10
		%	72.7	71.4
	No	N	3	4
		%	27.3	28.6
Total	N	11	14	
	%	100.0	100.0	

Table 7. Correlation between age and rehabilitation

		Age		
			Up to 65 years	Over 65
Are you currently receiving rehabilitation?	Yes	N	10	8
		%	90.9	57.1
	No	N	1	6
		%	9.1	42.9
Total	N	11	14	
	%	100.0	100.0	

was found ($p > 0.05$). The proportion of patients declaring they were able to use stairs without difficulty was similar in those aged 65 years and younger and those over 65 years of age.

Rehabilitation was conducted in 72% of study patients. The most common reasons for undergoing rehabilitation were as follows: to follow the postoperative instructions (46.7%), to maintain the highest possible range of motion and muscle strength (33.3%) and to improve the function of the operated joint (20%).

The study also verified whether receiving rehabilitation was age-dependent. The results are presented in Table 7. No correlation was found between the variables *Are you currently undergoing rehabilitation?* and age, as shown by the p value over 0.05.

DISCUSSION

HOA is more common in women than in men, with obesity and overweight being the main predisposing factors. The degenerative process affects not only the joints, but also soft tissues such as tendons, synovial bursae, joint

capsules or ligaments [4-7]. Rehabilitation is aimed at preventing disease progression and helping the patient learn correct postural patterns to reduce overload. All physical therapy measures should be initiated as soon as possible [15-27].

The study was conducted in twenty-five patients with HOA. The majority of study patients were female, which confirms that the predisposition to coxarthrosis is more common in women. Overweight and obesity are very strong risk factors for HOA; the vast majority of study patients were overweight or obese.

Most study patients were manual workers. Overload and mechanical injuries predispose patients to osteoarthritis. According to most study patients, HOA limited their physical activity and the ability to perform activities of daily living, which also resulted in changes or limitations in their work activity.

The vast majority of study patients were able to walk short distances of 80 to 100 metres without rest. After treatment, the walking distance without rest increased to 1000 metres and more in 36% of study patients and to 500 metres in

24% of study patients. A considerable improvement was achieved in the patients' health and quality of life.

According to a study by Kunikowska [20], rehabilitation in patients with hip osteoarthritis improves their health.

A study by Demszczyzak [24] revealed that hip arthroplasty improves the quality of life of the patients, reducing or eliminating hip pain and increasing the range of motion in the hip joint.

According to a study conducted by Iwaniszczuk et al [21], arthroplasty has a positive influence on the quality of life as it improves the range of motion and eliminates pain in the hip joint.

The results of the present study are consistent with the findings reported by other authors. They confirm the efficacy of rehabilitation and surgery in combatting pain and improving the limited ranges of motion in the joints. The assessments conducted in study patients prove that the treatment they received had a beneficial effect on their quality of life.

According to the European Health Interview Survey (EHIS) results from 2014, overweight and obese individuals constituted 36.6% and 16.7% of the Polish population aged 15 years and older, respectively (53.3% when combined). This result is higher than the average for the 28 European Union member states (34.8% for overweight and 15.4% for obesity).

It is also a warning sign that the number of people with obesity, caused by an unhealthy diet and lack of exercise, has been increasing in Poland and worldwide.

The results of the present study indicate that hip arthroplasty used together with pre- and postoperative rehabilitation helps improve patient functioning in all categories of everyday life. It is crucial that all patients participate in a physical therapy and rehabilitation programme before and after the surgical procedure.

CONCLUSIONS

1. Hip osteoarthritis is a serious and widespread diagnostic and therapeutic problem that affects more women than men.
2. Since the study showed a high overweight and obesity rate, it is important to educate patients about the effects of physical activity on controlling one's body weight and inform them that overweight and obesity are risk factors for the development of hip osteoarthritis.
3. The treatment used in study patients reduced or eliminated the pain, improved joint mobility and increased the patients' ability to ambulate, which shows its efficacy and its positive effects on the quality of life.
4. The majority of study patients underwent rehabilitation before surgery; however, the need for rehabilitation both before and after surgery should be more highlighted.

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A – Research concept and design, B – Collection and/or assembly of data, C – Data analysis and interpretation, D – Writing the article, E – Critical revision of the article, F – Final approval of article

Informacja prasowa

DZIAŁANIE PRZECIWBÓŁOWE – KRIOSTYMULACJA

Kriostymulacja jest metodą coraz powszechniej stosowaną w leczeniu reumatycznych i innych chorób układu ruchu, urazów, obrzęków, oparzeń itp.

Firma KRIOMEDPOL Sp. z o.o. opracowała proste i niezawodne urządzenie, które umożliwia skuteczne i efektywne stosowanie kriostymulacji, zapewnia pełny komfort i bezpieczeństwo pacjenta.

Strumień pary azotu uzyskiwany za pomocą urządzenia **KRIOPOL R** u wylotu dyszy, na końcu elastycznego węża osiąga temperaturę roboczą (-160°C) już po ok. 30 s od włączenia urządzenia.

Intensywność nadmuchu regulowana jest skokowo w zależności od wielkości ochładzanej powierzchni.

Działanie przeciwbólowe niskiej temperatury umożliwia pełną kinezyterapię stawów. Kriostymulacja nie może w chwili obecnej eliminować leczenia farmakologicznego, jakkolwiek leczenie to przy zastosowaniu kriostymulacji jest wyraźnie mniej intensywne.

Zmniejszenie bólu aktywizuje chorego, poprawia jego kondycję psychiczną i zachęca do wykonywania ćwiczeń, których w stanie bólowym nie mógłby wykonać. Istotnym aspektem kriostymulacji jest doskonała tolerancja zabiegu.

U chorych leczonych tą metodą, znacznie zmniejszyła się liczba wykonywanych dostawowych blokad sterydowych.

Dostawowe podawanie leku stanowi potencjalną możliwość zniszczenia chrząstki - metoda nieinwazyjna, jaką jest nadmuch miejscowy, stanowi szansę zupełnego uniknięcia jatrogennego traumatyzowania tkanek.

W niektórych przypadkach dzięki kriostymulacji udaje się uniknąć zabiegu operacyjnego u chorych, u których ze względu na patologiczny rozrost błony maziowej, istniały wcześniej wskazania do wykonania synowektomii.

Zabieg oziębiania powoduje mocne przegrzanie endogenne stawów aż do przekroczenia ciepłoty wyjściowej o około 3°C- 4°C i utrzymania się jej do 3-4 godzin.

Po kuracji niskimi temperaturami następuje: • Usmierzanie bólu, • Obniżenie aktywności procesu zapalnego, • Obniżenie napięcia mięśni, • Zmniejszanie się obrzęków, • Poprawa stanu klinicznego i funkcjonalnego polegająca na zwiększeniu zakresu ruchomości chłodzonych stawów i wzroście siły mięśniowej, • Złagodzenie stanów pooperacyjnych, • Skrócenie czasu leczenia kontuzji.

Wskazania: • Reumatoidalne zapalenie stawów (RZS), • Choroba reumatyczna, • Łuszczycowe zapalenie stawów, • Zesztywniające zapalenie stawów kręgosłupa (ZZSK), • Dna moczanowa, • Niedowłady spastyczne, • Fibromialgia, • Naderwania przyczepów ścięgien i więzadeł, • Przykurcze stawowe i mięśniowe, • Przeciążenia mięśni, • Pierwotna i wtórna osteoporoza – zespoły algodystroficzne, • Słuczenia i ich następstwa (dolegliwości bólowe, obrzęki, wysięki), • Świeże oparzenia skóry, • Odnowa biologiczna, • Bóle głowy, • Nerwobóle kręgosłupa szyjnego, • Zwichnięcie barku, • Zespół bolesnego barku, • Entezopatie, • Sztywność stawowa po złamaniach wyrostka łokciowego • Stany pooperacyjne kręgosłupa, • Dyskopatie lędźwiowe, • Rwa kulszowa, • Zespół ostrego lędźwiobólu, • Zespół bolesnego kolana, • Po rekonstrukcji więzadeł krzyżowych przednich stawu kolanowego, • Chondromalacja rzepki, • Usunięcie łąkotki przyśrodkowej, • Skręcenie stawu kolanowego, • Zwichnięcia rzepki, • Słuczenie mięśni brzuchatych łydki, • Zapalenie ścięgna Achillesa, • Skręcenie stawu skokowego, • Ostrogi piętowe.

Przeciwwskazania: Pacjenci z niewydolnością krążenia obwodowego z następowym upośledzeniem trofiki skóry i tkanki podskórnej oraz z miejscowymi odmrożeniami.

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Rehabilitation in Patients with Involutional-Dystrophic Skin Changes

Rehabilitacja pacjentów z inwolucyjno-dystroficznymi zmianami skórnymi

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SUMMARY

Aim: The study was aimed to assess the effectiveness of rehabilitation in patients with involutional-dystrophic skin changes.**Materials and Methods:** The study was performed in the clinical department of the Ukrainian Research Institute of Medical Rehabilitation and Balneology, Odesa Regional Clinical Medical Center, and the Kherson Regional Clinical Hospital in 2016–2020. 287 women of middle age (average age 46.47 ± 1.97 years) with signs of functional changes in the skin were involved in the study. They were randomly divided into two groups. Patients in the control group ($n = 187$) received routine cosmetic treatment. Patients of the main group ($n = 100$) were injected intradermally and subcutaneously with platelet-enriched plasma. Assessment of the effectiveness of the rehabilitation was performed before the first procedure and in 3 and 6 months after its completion. Statistical processing was performed using software Statistica 13.0 (TIBCO, USA).**Results:** After 3 months of follow-up after PRP-therapy demonstrated an increase in the thickness of the epidermis by 16.7%, the level of hydration increased by 26.9%, the level of TEV by 29.5%, an increase in the elastic properties of the skin by 31.8%, and an increase in the microcirculatory network by 23.1% compared to baseline before the procedure of PRP therapy ($p \leq 0.05$).**Conclusions:** The proposed method can be used as a stand-alone complex conservative therapeutic method of treatment. The combination of activation massage and regenerative stimulation by the introduction of PRP should be carried out simultaneously during treatment throughout the course.**Key words:** rehabilitation, ageing, skin, PRP**Słowa kluczowe:** rehabilitacja, starzenie, skóra, PRP

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INTRODUCTION

Medical rehabilitation is a set of measures, which includes ways to accelerate restitution, stimulate regenerative processes, identify and strengthen compensatory mechanisms, correct the body's resistance and immunity. Along with drug therapy, non-drug methods that influence the mechanisms of sanogenesis, in particular the mobilization of specific reactions responsible for adaptation to a specific effect, which leads to the activation of nonspecific stress-implementing systems [1].

Restoration of body functions is based on both urgent (short-term) and long-term mechanisms of adaptation, and the magnitude of the rehabilitation effect in general depends on the proper application of various influences that simultaneously affect the mechanisms of recovery and pathogenetic mechanisms of specific pathology [1-3].

In the presence of pathological changes in the connective tissue, a combination of degenerative-dystrophic processes of

the discs and intervertebral anatomical formations with skin lesions often occurs. They include age-associated involution changes and the effects of harmful environmental factors. Often such lesions are based on local thermal and mechanical influences, which require the restoration of the regenerative abilities of morphological elements of the skin [4].

Among the tools that affect the regenerative processes, along with preformed physical factors, exercise therapy, massage and other manual techniques are widely used [5]. In recent years, biotechnologies of regenerative medicine have been introduced into practice, one of which is the use of platelet-enriched plasma (PRP), a new therapeutic tool of autologous nature, which has been widely used in sports medicine, in particular in the treatment of chronic tendinopathy and entesopathy. Clinical studies that have used PRP injections as a therapy for discogenic low back pain report good results [6].

The effect of PRP therapy on the regenerative processes of skin and spine pathology has not been studied so far. The effect of such drugs on the effectiveness of rehabilitation in combined pathology has not been studied.

The study was aimed to assess the effectiveness of rehabilitation in patients with involutinal-dystrophic skin changes

MATERIALS AND METHODS

The study was performed in the clinical department of the Ukrainian Research Institute of Medical Rehabilitation and Balneology of the Ministry of Health of Ukraine, as well as the Odessa Regional Clinical Medical Center of the Ministry of Health of Ukraine and the Kherson Regional Clinical Hospital in 2016-2020.

287 women of middle age (average age 46.47 ± 1.97 year) with signs of functional changes in the skin were involved in the study. All patients required rehabilitation of impaired skin function (code b810 by ICF, LA22123-6 by LOINC) [7,8].

General sample (n=287) was randomly divided into two groups. Patients in the control group (n = 187) received cosmetic measures in the form of ultrasonic peeling, cleansing, nourishing facial masks. Patients of the main group (n = 100) were injected intradermally and subcutaneously with platelet-enriched autoplasm up to 5 ml, which was obtained by double centrifugation.

Ultrasound scanning of the skin and laser Doppler flowmetry (LDF) were used to assess the structural features of the epidermis, dermis and subcutaneous fat. Dynamic control of skin structures included the study of the initial state of the skin at certain points of the face (center of the cheek, center of the forehead, outer corner of the eye), which we set as standard. Assessment of the effectiveness of the rehabilitation was performed before first procedure and in 3 and 6 months after it completion.

Statistical processing was performed using software Statistica 13.0 (TIBCO, USA)

RESULTS AND DISCUSSION

According to the classification of involutinal-degenerative changes of facial skin, 3 morphological types have been identified [9], which characterize the nature and severity of age signs: wrinkled, deformed and mixed.

Analysis of the condition and structural changes of the skin allowed us to identify 3 morphological types and age gradation of involutinal-degenerative changes. Types of morphological involutinal changes are presented in Table 1.

For the wrinkled type, the characteristic dominant feature is wrinkles on the face and skin. This type of aging

is characterized by dry skin, pronounced „goose bumps” in the orbital region, wrinkles of the upper and lower eyelids, „corrugation” in the upper lip and chin.

A distinctive feature of the deformation type is a decrease in the elasticity of the soft tissues of the face and neck, with a typical picture of a „tired person”, which intensifies by the end of the day. Characteristic external signs of aging of this type are pasty, pronounced nasolabial folds, drooping corners of the mouth. This type of aging is typical for people with oily skin. Often there is a violation of the oval face, sagging cheeks, double chin, neck folds. Wrinkles may be almost non-existent, except for facial expressions. Also a characteristic external sign of aging is an excess of skin in the upper and lower eyelids.

The mixed type is characterized by a combination of features of wrinkled and deformation type. As a rule, this type of aging is characterized by thin skin, with hyperkeratosis, pigmentation, pronounced „goose bumps” in the periorbital region, folds in this and perioral area, as well as swelling, pronounced nasolabial folds, oval face disorders.

In the pathogenesis of involutinal-degenerative skin disorders in the above-described morphological types, the general pattern is vascular dysfunction. Thus, with wrinkled skin type, the signs of involution are usually due to impaired microcirculation in the dermis due to insufficient arterioles, which leads to reduced arterial blood flow to the surface layers of the skin and the development of atrophic changes. Disruption of microcirculation in the deformation type is caused by insufficiency of venules, which leads to the development of intercellular edema, stagnation, pastosity, compaction of the epidermis. In turn, with a mixed type of microcirculation disorders in the upper layers of the dermis are mixed: there are signs of insufficiency of both arterioles and venules. For pathogenetically determined correction of involutinal-degenerative disorders of the skin, an important area of rehabilitation measures is the standardization of tactics and criteria for treatment effectiveness, taking into account the morphological features of cell-tissue and vascular components of the skin.

Comparative characteristics of the structural and functional state of facial skin are presented in Table 2. According to the indicators of involutinal-degenerative changes given in the table, no statistical differences between groups were found before treatment ($p > 0,05$).

The decrease in the distribution of echoes in the dermis indicated the dystrophic nature of changes in the skin, in particular, a decrease in the density of the connective tissue component of the dermis. This picture reflects the

Table 1. Distribution of women depending on the morphological type of skin and age

Skin type	Amount (n=287)	Age		
		42-50	50-58	58-65
Wrinkled type	n=72 (25 %)	12 (16,67 %)	22 (30,55 %)	38 (52,78 %)
Deformation type	n=96 (33,5 %)	28 (29,17 %)	32 (33,33 %)	36 (37,5 %)
Mixed type	n=119 (41,5 %)	32 (26,9 %)	34 (28,6 %)	53 (44,5 %)

Table 2. Initial structural and functional characteristics of the facial skin of the studied women before the massage

Structural and functional features of the skin (physiological indicators)	I group	II group	P
The thickness of the epidermis microns	102,4±5,3	101,2±4,6	P≥0,05
Acoustic density of the epidermis, c.u.	89,7±3,5	91,3±4,2	P≥0,05
The thickness of the derma, mcm	1654,3±41,2	1579,5±39,8	P≥0,05
The level of hydration (corneometry method), c.u.	46,21±3,5	45,6±3,8	P≥0,05
The level of transepidermal moisture loss sq.m. p/h	21,6±4,5	19,8±4,7	P≥0,05
The level of seboregulation, ng / cm ²	162±59,6	157,2±49,3	P≥0,05
The level of elasticity, resilience, %	57,7±6,3	59,3±7,2	P≥0,05
IDF, ml per min.	6,5 ± 1,4	6,2 ± 1,7	P≥0,05

involutional changes in the fibrous composition of the dermis: disorganization, compaction and fragmentation of collagen and elastin fibers, loss of skeletal function in the skin. Reduction of the tissue component of the main amorphous substance - the main metabolic link of connective tissue was expressed in a decrease in dermal thickness by 11%, which was not statistically significant, but reflected dystrophic changes in the form of separation of cell-tissue interaction in the nipple and reticular layer of the dermis.

The level of hydration revealed a significant suppression of moisture in the stratum corneum of the epidermis by 22.3% ($p \leq 0.05$) compared with normal. In the epidermis there are quite large hydrophilic pores in the intercellular «lipid cement» of the stratum corneum. Since the water balance of the stratum corneum of the epidermis is under the control of quantitative and qualitative composition of lipids of the epidermis.

Assessment of a clinical sign of aging skin, such as dryness, is associated with changes in hydration and the amount of sebum and transepidermal water loss (TEVV). The complex of disorders that lead to dysfunction of the skin barrier during involutionary changes includes increased TB and dehydration of the skin. The degree of hydrophilicity of keratinocytes is determined mainly by ceramides, in particular glycosphingolipids. Sebaceous glands also play a huge role in the regulation of water balance. The epidermis contains a lot of saturated fatty acids, which do not penetrate well into the epithelial layers and form an occlusive film that delays the evaporation of water. Violation of the lipid barrier is associated with impaired skin permeability and TBI. A significant increase in TEVV by 23.5% compared to normal was evidence of dehydration and dry skin.

Fluid loss by the skin is one of the pathogenetic links of involutional-degenerative disorders: fluid deficiency in the intercellular substance is accompanied by inhibition of the synthesis - glycosaminoglycans - the main biosynthetic material of physiological regeneration of connective tissue.

Measurement of the amount of sebum on the skin surface by sebometry showed a significant reduction in this indicator by 16.5% in women with dry wrinkled skin type compared to normal. Violation of the formation of an oily film on the surface of the epidermis negatively affected the functional characteristics

of the skin: dryness, peeling, redness and susceptibility to microdamage and penetration of infectious agents.

The elastic-elastic properties of the skin were studied by the method of kutometry. Significant reduction of skin elasticity by 25.9% is shown, which is associated with disorganization, defibering and destruction of collagen and elastic fibers of the dermis and clinically manifested by flabby, atonic, sagging skin with reduced turgor and soft tissue ptosis. This pathogenetic mechanism is more characteristic of the deformation type of involutional skin changes.

According to laser Doppler flowmetry (LDF), it was found that the microcirculation of the skin changed significantly with a significant decrease of 20% compared with the physiological norm.

The obtained data indicate the predominant influence of the state of the microcirculatory tract on metabolic processes and structural organization of the skin.

Thus, the pathogenetic validity of the correction and treatment of involutional-degenerative changes of the skin system should be aimed at improving the state of metabolic processes in cells and intercellular substance, improving hemo- and lymphomicrocirculation, the formation of a balance of prooxidant and antioxidant systems.

It is shown that the use of PRP therapy had a very pronounced clinical effect in 1 month after the introduction of autologous plasma (Figure 1).

According to sonography, positive changes in age-related disorders on the background of PRP-therapy were qualitative and quantitative parameters. After 1 month, an increase in the thickness of the epidermis, the thickness of the dermis, the echogenicity of the entire dermis and separately the upper and lower layers.

But after 3 months of follow-up after PRP-therapy revealed even greater significant differences in the structural and functional parameters of the skin compared to baseline. There was an increase in the thickness of the epidermis by 16.7%, the level of hydration increased by 26.9%, the level of TEV by 29.5%, the oiliness of the skin or the level of seboregulation increased by 16.8% ($p \leq 0.05$). Important characteristics of the protective effect of PRP therapy were an increase in the elastic properties of the skin by 31.8% and an increase in the microcirculatory network by 23.1% compared to baseline before the procedure of PRP therapy ($p \leq 0.05$).

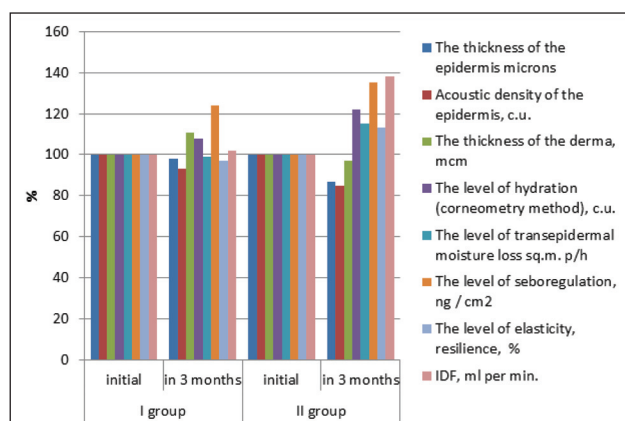


Figure 1. Comparative characteristics of structural and functional indicators of skin before ZTP therapy and in 1 and 3 months after its application

CONCLUSION

In our opinion, a powerful stimulus to restore water balance, mechanical properties of the skin and its metabolism was the influence of growth factors on the vascular component - an increase in vertical capillary loops in the papillary layer, an increase in the number of venules, which is probably due to tissue basophils or mast cells involved in the synthesis of heparin, histamine - powerful angiogenic factors.

The expediency of its use to stimulate skin regeneration with involuntional-dystrophic changes was revealed, which allowed to quickly reduce the number, depth and length of wrinkles, significantly increased turgor, elasticity, relief and general condition of facial skin, improved its general appearance significantly increased turgor, elasticity, regression. , improved the general condition of the skin and its appearance.

The proposed method can be used as a stand-alone complex conservative therapeutic method of treatment and is used after surgery to rejuvenate the skin of the face and neck in people over 40 years. It has been shown that the effectiveness of restoring the functional state of the musculoskeletal corset of the face increases when using PRP at the same time as massage. It is substantiated that the combination of activation massage and regenerative stimulation by the introduction of PRP should be carried out simultaneously during treatment throughout the course.

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Influence of Rehabilitation Measures on the State of Static and Motor Functions in Children with Cerebral Palsy

Wpływ technik rehabilitacyjnych na statykę i motorykę u dzieci z mózgowym porażeniem

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SUMMARY

Aim: The article experimentally tests the influence of rehabilitation measures on the state of static and motor functions in children with cerebral palsy (CP). It was found that medical rehabilitation of children with cerebral palsy requires the development of adequate strategies and tactics, integrated approach, application, if possible, of non-drug methods (physiotherapy, kinesitherapy).

Materials and Methods: During the study, the effectiveness of a set of rehabilitation measures was evaluated in 168 children aged 3 to 7 years, with spastic forms of cerebral palsy. All children were divided into two observation groups: the main group, which conducted the proposed rehabilitation course (n = 98) and the control group, which underwent a course of generally accepted rehabilitation content (n = 70).

Results: As a result of experimental work, the increase in indicators in the experimental group was higher. And although in the blocks "lying on your back", "sitting on the floor", "sideways turns", "lying on your stomach", "on your knees" and "standing and getting up" the difference between the indicators of the groups was insignificant ($P > 0.05$), we observed the best tendency to recovery in children of the study group in the blocks "crawling", "sitting", "walking". The average increase in testing scores using the scale for assessing large motor functions in the study group was much higher than in the control.

Conclusions: A comparative evaluation of the effectiveness of comprehensive rehabilitation of children with spastic forms of cerebral palsy, found that the use of the developed program allows to achieve a clear therapeutic effect to improve the results of rehabilitation.

Key words: cerebral palsy, treatment, medical rehabilitation, methods, muscles, muscle spirals

Słowa kluczowe: porażenie mózgowie, leczenie, rehabilitacja medyczna, metody, mięśnie, spirale mięśniowe

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INTRODUCTION

According to the sectoral statistics of the Ministry of Health of Ukraine, about 20 thousand children are registered, whose disability is associated with cerebral palsy. Cerebral palsy (CP) is one of the most common causes of childhood disability. The prevalence in Europe is from 2 to 3 per 1000 newborns. In Ukraine, the prevalence is 2.56 per 1,000 newborns. Among preterm infants, the number of cases of cerebral palsy increases to 40 - 100 per 1,000 newborns [1]. Treatment of children with cerebral palsy is one of the most difficult problems of medical rehabilitation. In Ukraine, about 16,000 children, or 20 people per 10,000 children,

receive the status of a "disabled child" every year. The total number of socially maladapted children in Ukraine is about 50 thousand [2].

The concept of cerebral palsy covers a group of symptoms that occur as a result of brain damage in the fetal, intranatal and early postnatal periods. The most common causes of CP are: hypoxia of the brain, prematurity, respiratory disorders of the fetus, infectious brain damage, hemorrhage, natal trauma, severe jaundice of newborns and others. Recently, the issue of genetic pathology of children as one of the possible provoking factors of cerebral palsy is a highly discussed topic.

Cerebral palsy as a disease is manifested primarily by the inability of the patient to independently maintain a vertical body position, to perform arbitrary movements. Also, characteristic features of cerebral palsy are a violation of muscle tone, in coordination of movements, pathological postures and movements, disorders of psychomotor development, a defect in the sense of one's own body and space [3].

Medical rehabilitation of children with cerebral palsy requires the development of adequate strategy and tactics of measures, a comprehensive approach, the use, if possible, non-drug methods (physiotherapy, kinesitherapy) [4-6]. At the present stage of development of medicine there are many interesting techniques. The most effective author's complex integrated methods of rehabilitation include: the system of intensive neurophysiological rehabilitation V.I. Kozyavkin [7]; dynamic proprioceptive correction according to K.O. Semenova [8], Bobat – therapy [9], Voita - therapy [10], Aers's sensory integration method, tandem-partnership model [11-13].

Applying the elements of these methods in our own medical practice, we consider anthropologically and physiologically justified and appropriate to use in addition to the existing known methods of their modified, supplemented versions. Our technique is based on the principles of spiral construction of muscular kinematic chains, feature is the complex effect on several muscle spirals (MS) simultaneously during the performance of different rehabilitation procedures, based on the principle that each muscle performs two functions: one is of local significance at the regional level, the second is manifested in the synergy of the general level in the whole spiral. Muscles contract not only in isolation, but also participate in the joint movements of spirals through aponeuroses, fascia and intermuscular membranes. Bilateral symmetry of kinematic muscle spirals provides a variety of movements and human adaptation in the Earth's gravitational field. Spiral muscle construction in the clinical aspect can be used not only to identify the mechanism of congenital and acquired pathology, but also in its correction [13].

Thus, the prevalence of cerebral palsy, the complexity and diversity of clinical manifestations and pathophysiological mechanisms of their development, treatment difficulties and children's disabilities around the world are a serious problem that determines the medical and social significance of treatment and rehabilitation of such children, as well as the task of developing new and improving existing methods of rehabilitation [7, 8, 12, 14].

AIM

The article experimentally tests the influence of rehabilitation measures on the state of static and motor functions in children with cerebral palsy (CP). It was found that medical rehabilitation of children with cerebral palsy requires the development of adequate strategies and tactics, integrated approach, application, if possible, of non-drug methods (physiotherapy, kinesitherapy).

MATERIALS AND METHODS

In order to solve the tasks, the effectiveness of a set of rehabilitation measures in 168 children aged 3 to 7 years was

evaluated. We studied children with with spastic forms of cerebral palsy (spastic diplegia - 68 children, spastic hemiplegia - 63, tetraparesis (spastic form) - 37 patients). All children were divided into two observation groups: the main group, which conducted the proposed rehabilitation course (n = 98) and the control group, which underwent a course of generally accepted rehabilitation content (n = 70).

In the study, all children were divided into two observation groups: the main group (n = 98), which conducted our rehabilitation course on the basis of the Rehabilitation Center for Children with Organic Nervous System Disorders of Poltava Regional Children's Clinical Hospital and control group, who underwent a course of generally accepted rehabilitation content in the neurological department of Poltava Regional Children's Clinical Hospital (n = 70).

Rehabilitation measures were aimed at solving the following tasks: normalization of voluntary movements in the joints of the upper and lower extremities, formation of posture skills close to optimal and correction of foot position, correction of sensory disorders, correction of coordination disorders (fine motor skills of the hand, static and dynamic balance, rhythmic movements, spatial orientation), training of musculoskeletal sensation, prevention and correction of contractures, assimilation of new poses and movements, normalization of respiratory system functions.

The examination was performed three times: before the course of treatment when the child applied to the medical institution, after a course of rehabilitation treatment and three months later in order to study the long-term results of treatment and the effectiveness of independent homework to perform individually selected exercises and knowledge gained by parents at the Parents' School "Spiral".

Methods of research: somatoscopy, anthropometry, clinical and neurological examination, measurement of the volume of movements of the cervical spine (evaluated according to the Menya-Lesage's scheme in the author's modification); large motor functions were measured on the scale Gross Motor Function Measure - GMFM [1], used a modified Ashworth's muscle spasticity scale to assess muscle tone [1] muscle pain in contracted muscles was examined using the Visual Analog Scale (VAS); violation of the statics of the child's posture in the gravitational field was assessed by goniometric method of studying conditionally skeletal plots in the frontal and sagittal planes; methods of mathematical statistics were used to analyze the obtained data.

The Ethics Commission of the Poltava State Medical University has no comments on the methods used in this study.

RESULTS

We used the GMFM scale to objectively assess the level of motor disorders and the effectiveness of the proposed rehabilitation measures [1, 4, 7], which is designed for global assessment of motor functions and consists of 88 standard motor tests, summarized in 5 subgroups in order of complexity of the motor task. Evaluation of each test is graded from 0 to 3, where: 0 - no initiative to perform; 1 - the presence of

Table 1. Comparative analysis of the average level of development of large motor functions of the main and control groups before and after treatment

Study groups	Main group (n=98)		Control group (n=70)
	Before treatment, units	After treatment, units	Before treatment, units
Group A: lying down and turning over	74.66 ± 3.44	80.60 ± 4.4	76.34 ± 4.6
Group B: sitting	68.15 ± 2.57	77.21 ± 6.3*	69.13 ± 4.2
Group C: crawling and moving on the knees	72.15 ± 5.1	79.15 ± 6.0	71.70 ± 5.6
Group D: standing	42.38 ± 4.4	52.40 ± 6.6*	43.26 ± 6.1
Group E: walking, running, jumping	41.62 ± 4.6	47.60 ± 6.1	42.3 ± 4.7
GMFM	59.71 ± 4.25	67.31 ± 3.92*	60.20 ± 4.1

Note: * - $p < 0.05$

Table 2. Indicators for assessing the level of motor disorders and the amount of muscle tone in children of the examined groups at the beginning and after the rehabilitation course

Study groups	GMFM scale	
	At the beginning	After treatment
Main (n=98)	59.71 ± 4.25	67.31 ± 3.92*
Control (n=70)	60.22 ± 3.78	65.33 ± 4.1

Note: * - $p < 0.05$

the initiative to implement; 2 – partial execution; 3 – full implementation.

During the assessment of baseline on the GMFM scale, it was found that the children of the main and control groups did not have a significant difference between the mean groups at the beginning of the study and had an insufficient level of development of motor functions.

The obtained results of the initial assessment of large motor functions in children with cerebral palsy were the lowest in the test blocks in group D (standing) and group E (walking, running, jumping) and were on the test of “standing” $42.38 \pm 4.4\%$ and $43.26 \pm 6.1\%$ for patients of the main and control groups; according to the test “walking, running, jumping” $41.62 \pm 4.6\%$ and $42.3 \pm 4.7\%$, respectively (Table 1).

After the course of rehabilitation intervention, the assessment of motor functions on the GMFM scale proved the advantage of the difference in the growth of total motility from $59.71 \pm 4.25\%$ to $67.31 \pm 3.92\%$ in patients of the main group, and in patients who were engaged in conventional method, the increase was only $5.1 \pm 0.3\%$ (Table 2).

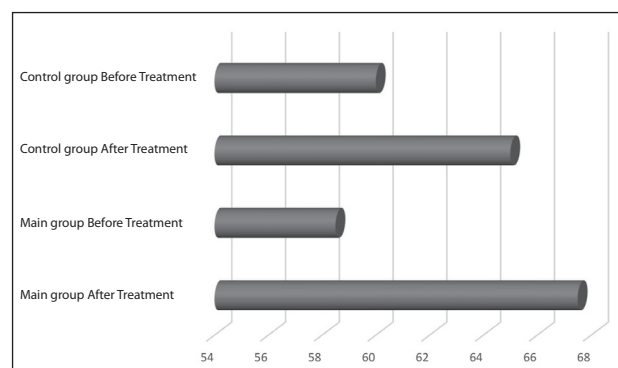
The most significant changes in the indicators were observed in patients of both subgroups by subtests in group B (sitting) and group D (standing).

Motor functions of patients of the main group significantly ($p \leq 0.05$) increased when compared with patients of the control group, whose children also had positive changes (Figure 1).

During the study of large motor functions of children on the GMFM scale, a study was conducted in parallel on the classification system of large motor functions of GMFCS, which is an integral part of the GMFM scale [1].

In order to treat children with spastic forms of cerebral palsy, we used our proposed method aimed at correcting

suboptimal mutual efforts of muscle spirals, which occurred due to a violation of their bilateral symmetry. This allows the prevention of contractures and spastic attitudes in spasmodic areas of MS, which are fixed in a pathological position [7, 12, 13]. Restoration of motor functions of a child with cerebral palsy was carried out due to the complex rehabilitation effect on the muscle spirals. Due to this, motor reactions, stages of verticalization of the child’s head and body were formed, statics and dynamics were optimized, coordination of movements was trained. Correction of the by “Spiral” motor stereotype we used in the studied groups of children with spastic forms of cerebral palsy to restore the balance of the body in the gravitational field, which contributed to the harmonization of bilateral symmetry of muscle spirals, restoration of reciprocal relations of muscular spirals-antagonists and their joint static work for fixing of joints; optimization and awareness of “body diagrams and movements in space” [13]; mastering the skills of multi-vector movements of muscles of different parts of

**Figure 1.** Evaluation of motor functions on the GMFM scale by increasing the total motility (%); ($p \leq 0.05$)

the body in the formation of motor stereotype due to the bilateral symmetry of muscle spiral antagonists.

“Spiral” complexes on an unstable support or balancer contributed to the activation and assimilation of multi-vector movements, optimization of motor stereotype through the work of muscle spirals, development of many motor skills, training of vestibular analyzer functions. Exercises on unstable support in the formation of body awareness in space play an important role, which helped to optimize the support function of the body on different surfaces in different static poses and when moving [7, 13].

Muscle spirals, harmoniously competing bilaterally, participate in the formation of optimal postures and movements of healthy children. Violation of this harmony in sick children with spastic forms of cerebral palsy leads to problems of adaptation to the environment and makes them dependent on outside help [7, 8, 10, 12].

Bringing the motor stereotype to the optimal in patients with spastic forms of cerebral palsy is one of the main tasks of rehabilitation. In developing a comprehensive approach to the correction of movements, we proceeded from the premise that the development of the motor system and its adaptive capabilities occurs in the process of formation of the motor act, based on inverse afferentation.

We have improved the method of rehabilitation of children with spastic forms of cerebral palsy, through a comprehensive impact on all affected MS of torso and extremities, biomechanical muscle stimulation and hardware physiotherapeutic effect on the intersection of MS antagonists, manual therapy and correction of all MS by placing the patient on a special set of soft objects to “re-educate” vicious postures and movements and fix the achieved result, which allowed to deactivate muscle trigger points on the basis of the impact on all pathologically significant MS with simultaneous activation of the MS antagonist. This effect, in turn, will significantly improve the results of rehabilitation not only in children with cerebral palsy, who walk independently, sit, but also in those who are significantly limited in movement, as well as in general to improve the quality of life of children with spastic forms of cerebral palsy.

The proposed technique was performed as follows:

- Biomechanical muscle stimulation (BMS), which consists in enhanced sinusoidal extraneous stimulation of tense muscles, which leads to longitudinal vibration of muscle fibers, acts as the maximum load, was carried out by devices “Grizzly” and “Youth”. The therapeutic effect of BMS lies in optimization of contractile function of muscles, i.e., contraction and stretching at the level of myofibrils, as well as the effect of muscles on the peripheral parts of the circulatory system and nervous system.
- Hardware physiotherapy was performed by devices “Amplipulse” and “Stimulus” with specification of the impact on the affected muscle spirals: cross them on the thigh, waist, on the projection of muscle chains of external or internal rotation of the limbs (individually). Number of procedures was 10-12 in a day;
- Mobilization of shortened, pathologically tense muscles of the extremities and torso is carried out simulta-

neously with the muscles of the entire spiral. The effect on the contracted muscles was performed in the initial position lying on his back on a convex soft support, sitting on top of a stuffed soft log, simulating hippotherapy, with the location of the torso and limbs thus, that the kinematic influence covered at once stretching all spiral in which the contracted muscle enters, at the same time the stimulating effect was carried out on the muscle chain antagonist. Deactivation of trigger points in the muscles was also performed with stretching of the entire MS, in a specific starting position;

- Correction of motor stereotype (CRS) of “Spiral” was carried out in order to fix the achieved corrective effect, optimization of postures and movements, training of balance, relaxation of shortened and activation of flaccid muscles, creation of optimal conditions for formation of “trace image in the CNS on the basis of afferent flow of impulses, self-awareness in space” according to Berstein. CRS is carried out on an unstable support, a trampoline, an inflatable pillow, gymnastic balls with a diameter of 45-65 cm in initial position standing, sitting alone or with the help of a doctor, lying on your stomach, back; stuffed soft deck, placed on the balancer in the starting position sitting “on top” with legs apart (imitation of hippotherapy in the author’s modification). Dynamic exercises are performed actively, actively-passively, passively, in three planes (multi-vector) simultaneously, movements mimic the movements of animals for simplified perception by children. A fundamental feature is the simultaneous inclusion in the work of kinematic circuits of oppositely oriented MS. Mobilization of efforts of dynamic potential of all links of a kinematic chain of a spiral gives the chance to show the maximum power reserves, to balance in a gravitational field;
- According to the indications, we performed a release of soft tissue manual therapy to improve proprioception from the periphery to the centers of the nervous system. Some attention, in the presence of indications, was paid to the unlocking of the ileo-sacral joints by the method of gradual soft mobilization;
- Position treatment method (therapeutic laying) was used using specific corrective poses in certain starting positions with a load for simultaneous relaxation of spasmodic areas of MS; with simultaneous correction of the entire helix and activation of the helix-antagonist was administered daily for 10-30 minutes on a special set of soft items for laying. Laying was used to prevent and gradually correct vicious postures, spastic installations in the joints in the areas of MS. The optimal cognitive background of sick children was important in the application of medical treatments. When using the method of medical treatment, pathologically significant areas of MS must be taken into account to emphasize the rehabilitation effect on them;
- “Parents’ school”. Important in the process of rehabilitation of children with cerebral palsy is the period of preservation and consolidation of the effect in the time between rehabilitation courses. “Homework” was

played on video in the form of three-plane therapeutic gymnastics and CRS "Spiral" with auxiliary items (ball, gymnastic stick, soft toys of different sizes, soft modules of different volume and color), breathing exercises, muscle automation, dynamic prevention of contractures, therapeutic laying, massage, body verticalization, imitation of hippotherapy on unstable support. Classes at home are recommended to perform daily on a video sample in a gentle mode for 15-45 minutes under the control of well-being and pulse.

DISCUSSION

The key to the success and effectiveness of medical rehabilitation of patients with spastic forms of cerebral palsy is to solve the main tasks, such as: correction of motor stereotype and its approximation to the optimal, the formation of skills for optimal posture and position of the feet, training for optimal movement in the joints of the upper and lower extremities, correction of coordination, training of self-awareness of the body in space, prevention and correction of contractures, increase of level of cognitive functions, development of motivation to rehabilitation process. Motor stereotype is a stable individual complex of conditioned-reflex motor reactions, which are realized in a certain sequence in providing pose-tonic functions. At the present stage, there are a large number of techniques that address these issues. Solving these problems requires the development of new methods of rehabilitation, because the prevalence of cerebral palsy is not decreasing in Ukraine or in the world. This disease is accompanied by a high degree of disability and, as a consequence, a low level of quality of life, adaptation in this environment.

The main clinical pattern of cerebral palsy is characterized by the inability of the patient to maintain optimal vertical posture and perform arbitrary movements [7, 8, 9, 10]. An extremely promising approach to rehabilitation in this sense is to consider the human motor stereotype in the context of balanced work of functional associations of skeletal muscles, which are represented by longitudinal muscle groups, muscle pairs and muscle spirals (MS) [7, 11]. Interacting with each other, paired longitudinal joints of muscles maintain symmetry of a body and take part in movements of a backbone and an axial skeleton as a whole. The muscles located ventral to the spine act as flexors; muscles located more dorsally act as extensors, and simultaneous reduction of homolateral ventral and dorsal groups complements action of lateral metamer muscles which provide lateral inclinations of a backbone [11]. Muscle pairs are a combination of muscles that provide stabilization and movement of the kinematic parts of the body around a specific axis of rotation. Muscle spirals are functional associations of muscles that provide rotational movements. The basis of MS is a chain of skeletal muscles, the essence of which is the transfer of force from link to link. In this case, each spiral belongs to a certain set of muscles, some of which can participate in other spirals. When the spiral muscle interactions are disturbed, changes develop that dissect the bilateral symmetry of the body and

reduce the efficiency of the muscles. MS normally run from the head, neck, continue through the upper limb along the muscles of the back, chest to the opposite lower limb. They support the axial skeleton, dynamically fix the position of the head, preserve the physiological curves of the spine, participate in the respiratory movements of the chest, as well as provide stability of body position and movements of the limbs [7].

Purposeful use of medical rehabilitation contributes to some extent to the gradual restoration of the disturbed balance between the main processes of the nervous system, optimization of the bilateral symmetry of the muscle spiral antagonists. Due to the rehabilitation effect on static and dynamic stereotype, statics and locomotion are corrected, which brings them closer to the optimal level. The influence on the pathological motor stereotype was first realized by creating a biodynamic suit of movement correction "Spiral", which for the first time used the effect on the muscular spirals of children with cerebral palsy in the system of intensive neurophysiological rehabilitation by Kozyavkin V.I. [7].

This system is universally recognized. The system of intensive neurophysiological rehabilitation, proposed by prof. V. Kozyavkin [7], reflected in the encyclopedic edition of pediatric orthopedics edited by German prof. Nietard, Kozyavkin's method was included in the four most effective conservative methods of rehabilitation of patients with cerebral palsy [7].

To help children with nervous system disorders in Ukraine, a system of rehabilitation "Tandem Partnership" was introduced under the leadership of V. Martyniuk, which is distinguished by its high efficiency [11].

CONCLUSIONS

At the beginning of the study we found an insufficient level of development of motor functions in the studied children with cerebral palsy and the lack of a significant difference between the mean values of study groups ($P > 0.05$). According to the results of the secondary assessment of motor functions at the end of the experiment, the studied indicators increased in both groups, both in the control and in the experimental groups. But it should be noted that the increase in performance in the experimental group was higher. And although in the blocks "lying on your back", "sitting on the floor", "sideways turns", "lying on your stomach", "on your knees" and "standing and getting up" the difference between the indicators of the groups was insignificant ($P > 0.05$), the best tendency to recovery was observed in children of the study group in the blocks "crawling", "sitting", "walking". The difference between the indicators of the groups at the end of the study was significant, meaning not random ($P < 0.05$). Despite the noted positive effect of medical rehabilitation on the motor functions of patients in the control and in the study group, the rehabilitation process was more successful in children in the main group. The average increase in testing scores using the scale for assessing large motor functions in the study group is much higher than in the control.

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Conflict of interest:

The Authors declare no conflict of interest

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Informacja prasowa

ŁOJOTOKOWE ZAPALENIE SKÓRY

OCTOPIROX® Krem kojący do twarzy SPF 15. Wskazania: Polecany do codziennej pielęgnacji skóry zaczerwienionej, łojotokowej, trądzikowej, ze skłonnością do nadmiernego łuszczenia (szczególnie wokół skrzydełek nosa, między brwiami, na czole i w okolicy ust). Rekomendowany dla osób prowadzących kurację leczniczą z powodu łojotokowego zapalenia skóry oraz jako profilaktyka zapobiegania nawrotom łuszczenia się skóry.

Działanie: Specjalistyczny krem o działaniu kojącym, nawilżającym i natłuszczającym skórę z problemem łojotokowego zapalenia skóry i/lub trądziku. Preparat reguluje gospodarkę hydro-lipidową skóry wzmacniając jej barierę ochronną. Zmniejsza nadmierne łuszczenie się naskórka i skłonność do podrażnień. Octopirox® o silnych właściwościach przeciwbakteryjnych i przeciwgrzybiczych, przywraca równowagę mikroflory naskórka, zapobiegając nawrotom dolegliwości łojotokowego zapalenia skóry. Krem normalizuje wydzielanie sebum zapewniając efekt zmatowienia. Preparat wykazuje wysoki stopień tolerancji. Zawarte filtry SPF 15 chronią przed niekorzystnym działaniem promieniowania słonecznego. Skuteczność potwierdzona w badaniach na skórze trądzikowej.

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Rehabilitation of the Patients with Myasthenia Gravis as an Integral Part of the Patient's Treatment Algorithm in the Postoperative Period

Rehabilitacja pacjentów z miastenią jako integralna część algorytmu leczenia pacjenta w okresie pooperacyjnym

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SUMMARY

Aim: The purpose of this article is to determine the role of rehabilitation in the structure of the treatment algorithm for patients with myasthenia gravis.

Materials and Methods: All patients admitted to the SI «Zaycev V.T. Institute of General and Urgent surgery of National Academy of Medical Sciences of Ukraine», Kharkiv, Ukraine for surgical treatment for thymoma or carcinoma of the thymus gland. 102 people aged 18 to 69 with myasthenia have been comprehensively surveyed and their data have been analyzed and studied. Diagnosis of myasthenia was established according to the tenth edition of the International Classification of Diseases ICD-10 (WHO, 1992).

Results: The severity of the patients' condition corresponded to grade IIIA in 5 patients (16.7%), IIIB grade – 14 patients (46.7%), IVA grade – 7 patients (23.3%), IVB grade – in 4 patients (13.3%). According to the clinical classification of MGFA, the severity of the condition in most patients in this group corresponded to Class IIB (32.4%) and IIIA class (35.2%).

Conclusions: The results of our study suggest that clinical and anamnestic features of myasthenia in absence of structural thymus disorders are debut before the age of 40 years, predominant affection of skeletal muscles, mild course (severity of the disease corresponds to 12.7 ± 1.76 points on the QMGS scale) and characterized by a debut after 40 years regardless of sex, manifestation of generalized muscle weakness and severe course (in 68.4% of cases severity of the disease was 31.68 ± 3.76 points on the QMGS scale).

Key words: rehabilitation, myasthenia gravis, thymic hyperplasia, thymoma, MGFA

Słowa kluczowe: rehabilitacja, miastenia, rozrost grasicy, grasiczak, MGFA

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INTRODUCTION

Myasthenia gravis remains an urgent medical and social problem due to the predominant lesion of the motor system and rapid disability of the patient. Despite current achievements in practical medicine and science in the study of etiopathogenesis, clinical features and approaches to myasthenia treatment, many issues remain unresolved [1, 2]. Even constant expansion of the arsenal of medicines aimed at inhibition of pathological autoimmune processes in myasthenia often does not allow to achieve the appropriate therapeutic control over this severe, life-threatening illness [3-5].

According to various authors, the number of myasthenia cases increases annually and reaches at present 14.2-20.3

cases per 100,000 populations. The disease is observed predominantly in women (3:1), and the start of it is at a young age (90% – up to 40 years) [6, 7]. In women, the debut of the disease occurs earlier and its course is more severe than that of men [8-10].

Development of myasthenia is traditionally associated with thymus pathology. According to the American National Institute of Neurological Disorders and Stroke, 10% of patients with myasthenia are thymoma and 70% have thymic hyperplasia. In this case, thymectomy, as one of the most common methods of treating myasthenia, does not always lead to sustained remission [11-13].

AIM

The purpose of this article is to determine the role of rehabilitation in the structure of the treatment algorithm for patients with myasthenia gravis.

MATERIALS AND METHODS

All patients admitted to the SI «Zaycev V.T. Institute of General and Urgent surgery of National Academy of Medical Sciences of Ukraine», Kharkiv, Ukraine, for surgical treatment for thymoma or carcinoma of the thymus gland underwent standard clinical and laboratory tests. 102 people aged 18 to 69 with myasthenia have been comprehensively surveyed and their data have been analyzed and studied. Diagnosis of myasthenia was established according to the tenth edition of the International Classification of Diseases ICD-10 (WHO, 1992) - G 70.2 (Congenital and acquired myasthenia). All patients independently signed an informed consent to participate in a scientific clinical research.

The exclusion criteria were the age of patients younger than 18; refusal of the patient to participate in the scientific clinical research at any stage and reluctance to sign an informed consent to participate in it; available decompensated cardiovascular pathology and respiratory diseases that were not a result of muscle weakness in myasthenia; Lambert-Eaton syndrome and other myasthenic syndromes against the background of somatic and endocrine pathology.

For diagnostic purposes, a classical pharmacological test with subcutaneous administration of 2 ml 0,05% solution of proserine was conducted. 30 minutes later muscular strength of the patient was evaluated, limited to the gradual assessment of the test.

Structural condition of thymus in patients with myasthenia was evaluated using the apparatus of the spiral computer tomography (SCT) SeleCT SP (Marconi). Neuromuscular transmission was assessed, applying stimulation electromyography, using 4-channel neuromyograph Neuro-MSP of Neurosoft Company based on the amplitude of M-response negative phase analysis and the decrement-test index.

The statistical analysis of the results was carried out by methods of variation statistics, using standard software packages Exel (version 7), Biostat and Statistica (StatSoft Inc., USA). The type of sign distribution in the sample was carried out using the Shapiro-Wilk criterion and the dispersion equality of features distribution in groups - by using the Leuven criterion. The two groups with normal distribution were compared using the parametric classical Student t-criterion for independent samples and the Student t-criterion with separate dispersion estimates. The data are presented in the form of an average arithmetic and standard error average.

A correlation analysis using the Pearson coefficient (r) was used to determine presence and determination of the strength and direction of the probable link between the indices. Differences were considered statistically significant at ($p < 0.05$).

RESULTS

Taking into account the purpose of the study and the data of MSCT of chest organs, patients with myasthenia were divided

into three groups. The first group consisted of 35 patients with myasthenia without structural thymus disorders (group M), the second group consisted of 37 patients with myasthenia against the background of thymic hyperplasia (group MH), the third group included 30 patients with myasthenia against the background of thymomas (MT group).

Analysis of clinical and anamnestic data has shown that in patients with myasthenia without structural thymus disorders the average age of the debut disease was in women - 31.7 ± 8.3 years, in men - 32.1 ± 9.4 and manifested by ocular disorders in 20% patients, in those with bulbar disorders - 11.4%, generalized muscle weakness of 68.6%.

In patients with myasthenia against the background of thymic hyperplasia the disease manifested earlier in women than in men (24.4 ± 7.2 and 33.4 ± 12.1 years, respectively) and was characterized by the appearance of local forms: ocular - 37.8%, pharyngeal -facial - 46%; and only in 16.2% of patients the disease debut manifested as a generalized muscle weakness. In patients with myasthenia against the background of thymomas, there was a late disease debut regardless of sex (men - $48,7 \pm 8,3$, women $52,9 \pm 9,7$). In 70% of patients in this group myasthenia manifested by generalized muscle weakness. The bulbar form was diagnosed at the beginning of the disease in 20% of the patients, the ocular form - in 10%. Subsequently, the disease was slightly unstable and difficult. This was confirmed by the fact that only in this group 17% of patients had urgent states in the form of myasthenic crisis according to anamnesis of the disease given in the medical documentation provided by the patients under study.

Generalized neurological status data showed that oculomotor disorders were found in M group most often in the form of nystagmus - 40.0% of patients, ptosis was observed in 11.4% of cases, and diplopia and obliquity - in 14.3% of patients. In MH group, oculomotor disorder manifested with the following frequency: ptosis in 18 (9.0%) patients, diplopia, nystagmus, and strabismus in 45 (9.0%). In MT group, only 10% of patients had ptosis, but the highest frequency of nystagmus (83.3%), diplopia and strabismus (50.0%) was noted.

In MH and MT groups, respiratory failure was recorded in (5.6% and 36.6% of patients respectively) but was not found in M group. Unlike patients in MH group, 13.3 % of patients in group MT prior to being included into the study, needed artificial ventilation to compensate for respiratory distress (after that they were included in the study). This phenomenon was not observed in other groups.

In all patients we observed a reduced muscle tone and decreased muscle strength in the limbs. Thus, in patients from M and MT groups upper limb muscle lesions (54.3% and 53.4% of patients, respectively) predominated, unlike in MH group patients, where lower extremities were more often affected (54.0% of cases). However, maximum reduction in muscle strength in general was observed in MT group patients. Thus, in 16.6% of patients in this group muscle strength was 1.0-1.5 points, 50.0% - 2.0-2.5 points and 33.4% - it corresponded to 3.0-3.5 points. In MH group, 16.2% of the patients experienced a decrease in muscle strength to 2.0-2.5 points, in 70.2%-3.0-3.5

points and in 13.6% of patients to -4.0-4.5 points. The slightest changes in muscle strength were observed in M patients group, whose indicators were not less than 3.0 points (3.0-3.5 points - 71.4% of the cases, 4.0-4.5 points - 28.6 % of cases).

The fact that 87.0% of patients in these three groups had hyperreflexia may be explained by theories of autoimmune myasthenia gravis and similar pathophysiological mechanisms of other diseases of the nervous system with the autoimmune mechanism's development. According to the data obtained by MGFA classification, the severity of the patients with myasthenia status without structural thymus disorders was in line with grade IIA in 21 patients (60.0%), IIB grade - 9 patients (25.7%), grade IIIB - in 5 patients (14.3 %)

In patients with myasthenia against the background of thymic hyperplasia, the severity of the patients' status corresponded to grade IIA in 5 patients (13.5%), grade IIB - 12 patients (32.4%), grade IIIA - 13 patients (35.2%) IIIB grade - in 5 patients (13.5%), in IVA grade - in 2 patients (5.4%). The most severe course of the disease according to MGFA classification was observed in patients with myasthenia against the background of thymomas.

The severity of the patients' condition corresponded to grade IIIA in 5 patients (16.7%), IIIB grade - 14 patients (46.7%), IVA grade - 7 patients (23.3%), IVB grade - in 4 patients (13.3%)

A quantitative scale of myasthenia clinical manifestations (QMGS) was performed to objectivize the severity of the patients' condition with different forms of myasthenia. The average severity of the disease in patients with myasthenia without structural thymus disorders was 15.4 ± 4.5 points, in patients with myasthenia against the background of thymic hyperplasia 19.4 ± 4.5 points, and in patients with myasthenia against the background of thymomas, maximum index was 29.8 ± 4.36 points, which is 1.9 times higher than that of M group and 1.5 times higher than that of MH group. The data obtained quantitatively confirm the most severe course of myasthenic symptoms in patients with myasthenia against the background of thymomas, and the highest - in patients with myasthenia without structural thymus disorders.

When comparing clinical and electromyographic data, it has been found out that myasthenia without structural changes in the thymus is characterized by a predominant lesion of skeletal muscles, mild course of myasthenia (according to QMGS scale), and less pronounced changes in EMG rates compared with patients in other groups. In the vast majority of patients in this group (60%), the severity of the condition corresponded to grade IIA according to MGFA classification, which indicates a mild course of the disease. Certain clinical-neurophysiological dissociation was observed, too. Skeletal muscle lesion was more prevalent than oropharyngeal in the clinical picture but changes in EMG-values in skeletal muscles were less pronounced compared to those in oropharyngeal muscles.

Myasthenia in combination with thymus hyperplasia is characterized by a direct correlation between the severity of clinical manifestations, severity of patients' condition and deterioration of neurophysiological parameters. Lesions prevalence of bulbar and ocular group of muscles over skeletal muscles is accompanied by a more pronounced decrease in the amplitude

of M-response negative phase in the corresponding muscles. More severe course of the disease according to the QMGS scale score is combined with higher rates of the decrement test. According to the clinical classification of MGFA, the severity of the condition in most patients in this group corresponded to Class IIB (32.4%) and IIIA class (35.2%).

Patients with myasthenia against the background of thymomas differed from the patients of other groups by the most severe course of the disease (severity of the majority of patients' conditions corresponded to IIIB class (46.7%) and IVA class (23.3%), the greatest violations of the parameters of neuromuscular transmission in all subjects, as well as a relatively lower effectiveness of anticholinesterase drugs.

CASE REPORT №1

Patient R., 58 years old, applied to the SI «Zaycev V.T. Institute of General and Urgent surgery of National Academy of Medical Sciences of Ukraine», for surgical treatment. He considers himself ill since February 2016, when he first drew attention to the violation of chewing, dynamic drooping of the left eyelid, double vision, then weakness of the muscles of the neck, proximal extremities, bulbar disorders. Generalized myasthenia gravis was diagnosed at the place of residence. The diagnosis was made: Myasthenia gravis, generalized form, III A class . According to the MSCT data: in the anterior mediastinum, a neoplasm of 7.0x5.0x2.0 cm is determined (Figure 1). The patient was referred to the thorax department, where in March 2016 was performed videothoroscopic removal of the thymus tumor. In the pathomorphological study of the drug: type B1 thymoma with signs of capsule invasion. The postoperative period was uneventful. For decreasing inflammation, symptoms of swelling, lower of production of sputum and improving lung ventilation we prescribe Pulmicort by 1 inhalation 2 times per day. For movement activity the patients needs put on the stilts for 2 days after the thymthymectomy.

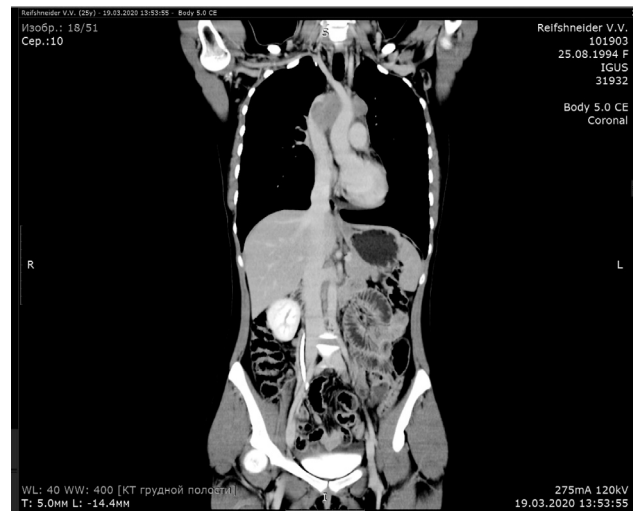


Figure 1. MSCT of the chest organs: in the region of the anterior-superior mediastinum, a tumor of a heterogeneous structure with dimensions of 3.0x2.7x2.5 mm is determined

DISCUSSION

Currently, there are clinical guidelines for the treatment of myasthenia gravis. However, the rehabilitation of patients in the postoperative period, after exacerbations during the period of remission, still remains a big problem [14,15].

Rehabilitation alone or in combination with medical treatment can improve symptoms in MG. A multidisciplinary rehabilitation approach is important to optimize functional abilities. This approach also has the goal of preventing further disease-associated illness (e.g. recurrent pneumonias). Such an approach includes therapy (physical therapy, occupational therapy, speech therapy, respiratory therapy) as well as evaluation for and training with assistive device, other durable medical equipment (DME), and/or orthotics [16].

Physical therapy evaluation includes assessment of strength, flexibility, mobility, balance, safety/fall prevention, gait, endurance/activity tolerance, and transfers. Speech therapy evaluation includes assessment of dysphonia, dysarthria, and dysphagia. Occupational therapy evaluation includes evaluation of ADLs including endurance/activity tolerance and areas of improvement for energy conservation and assistive device use in ADLs (e.g. bathing and grooming, dressing, eating, household management), physical environment modification. The benefit of a rehabilitation program has also been seen pre- and post-thymectomy, with not only significant reduction in operative risk and postoperative morbidity but also significantly faster recovery [17].

Pulmonary function is often improved with treatment. Routine PFTs should be monitored in the setting of acute exacerbation. Chest physical therapy involves respiratory and upper limb rehabilitation, diaphragmatic breathing, postural drainage, chest percussion and vibration, turning, deep breathing exercises, and coughing. In more severe cases, nocturnal non-invasive ventilation may be required.

Though muscle weakness from MG worsens with repeated muscle use, this should not preclude patients from being or staying active in some way. In fact, patients with stable MG should find an optimal balance between physical activity and rest to gain as much function as possible. Maintaining activity limits significant muscle atrophy and physical deconditioning and addresses skeletal as well as respiratory strengthening / cardiovascular health [18].

During an exacerbation, energy conservation is the goal rather than exercise. Mobility should be safe and supervised, utilizing assistive devices if necessary. Use of electric appliances can help with energy conservation. Safety precautions should also be used at home including home modification for fall prevention (e.g. adding grab bars, removing throw rugs).

Patients with stable MG should undergo an aerobic and resistance exercise program as discussed below .

The recommended intensity of physical activity/training is of low to medium intensity, avoiding exercise-related fatigue (including but not limited to worsening of MG symptoms e.g. ptosis or diplopia during exercise). Not only is physical activity tolerated in MG; clear benefit has been seen in these patients from strength training. General exercise programs for patients

with MG should focus on strengthening large muscle groups, particularly of the shoulder and hip girdle. Timing of exercise is also key and should be targeted to the time of day when the patients are not feeling tired (often the morning). If a patient takes pyridostigmine, exercise should be timed with the peak dose effect (1.5-2 hours after taking a dose). In addition to strength testing, aerobic exercise and balance strategy training may be effective and should be supervised [19].

If swimming is part of the exercise program, supervision is important, and patients should only swim in water where they can touch the bottom. Swimming in deeper water may lead to over-exertion which can be dangerous. Care should be taken to control other factors that can worsen MG symptoms e.g. heat. Aerobic exercise may improve respiratory function as well as stamina [20].

Depending on the level of weakness, an assistive device and/or orthotic may be necessary for gait support. Assistive devices range from a cane to a walker to powered mobility. Orthotics such as an ankle foot orthosis (AFO) may be helpful as well to assist with ankle dorsiflexion [21].

Rehabilitation with speech language pathologists is indicated for those with bulbar deficits. Exercises may work on breath control, voice quality, swallowing, and articulation. Postural exercises also assist with breathing, speaking, and swallowing. A formal neuroophthalmological exam is recommended. Corrective surgeries for ptosis often provide relief, however, may lead to dry eyes. Adaptive glasses with ptosis crutch or support can also be used. Ocular may require surgical intervention [22, 23].

CONCLUSIONS

1. Although, rehabilitation of patients with myasthenia gravis is not the main, but a very important part of the patient's treatment algorithm.
2. Clinical and anamnestic features of myasthenia in absence of structural thymus disorders are debut before the age of 40 years, predominant affection of skeletal muscles, mild course (severity of the disease corresponds to 12.7 ± 1.76 points on the QMGS scale) and presence of clinical neurophysiological dissociation (prevalence of skeletal muscles lesions in clinical picture, but-EMG changes are more pronounced in oropharyngeal muscles).
3. Neurophysiological disorders in patients with myasthenia, regardless of structural changes in the thymus, are manifested by a decrease in the amplitude of the negative phase of M-response in m. orbicularis oculi and m. abductor digiti minimi and an increase in the decrement test.

This study contains the results of the treatment and rehabilitation patients with myasthenia gravis after surgical operation. Since using our methods we improve results in the postoperative period and realize the full effect of treatment and rehabilitation in these patients.

Since the usage new ways of surgical treatment, conservative treatment and rehabilitation in patients with myasthenia gravis can notice improving of results. We plan to develop an algorithm that will reduce the number of postoperative complications.

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Conflict of interest:

The Authors declare no conflict of interest

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Increase in Motion Range of the Cervical Spine by Means of Physical Rehabilitation in Children with Cerebral Palsy According to the Severity of Muscle Pain

Zwiększenie zakresu ruchów odcinka szyjnego kręgosłupa za pomocą fizykoterapii u dzieci z mózgowym porażeniem w zależności od nasilenia dolegliwości bólowych mięśni

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SUMMARY

Aim: The article experimentally examines the effect of rehabilitation measures on increasing the volume of movements of the cervical spine, taking into account the severity of muscle pain in children with cerebral palsy.

Materials and Methods: The study involved 168 children with spastic forms of cerebral palsy, they were divided into two observation groups: the main group, which conducted the proposed rehabilitation course (n = 98) and control, who underwent a course of conventional rehabilitation content (n = 70).

Results: During application of the proposed method, the therapeutic effect on pathologically significant areas of bilateral muscle kinematic chains was carried out taking into account their mutual antagonism, bilateral symmetry, taking into account the course of homolateral and heterolateral muscle spirals. Positive dynamics in the clinical status in the vast majority of patients during re-observation was achieved, but the effectiveness of rehabilitation and the stability of the achieved therapeutic effect in the study groups were different. Thus, in patients of the main and control groups, changes in the mobility of the cervical spine were detected, which were recorded using the proposed integrated assessment. Namely, in patients who were engaged in the proposed method, the amount of movement in the cervical spine (passive lateral tilt with an element of rotation) probably increased when compared with the indicators before rehabilitation. Also noteworthy is statistically significant reduction in pain intensity, which allows for more manipulative rehabilitation.

Conclusions: The proposed method of rehabilitation of children with spastic forms of cerebral palsy has a pronounced sanogenetic effect, meaning it stimulates their own health reserves and triggers a cascade of reactions of the body aimed at forming a healthy motor stereotype. It involves influence on organism of the patient by rehabilitation procedures with inclusion in work of all biokinematic muscular chain at the same time, taking into account spiral construction of muscles of a body, which allows to achieve a more pronounced therapeutic effect.

Key words: cerebral palsy, treatment, medical rehabilitation, methods, muscles, muscle spirals

Słowa kluczowe: porażenie mózgowie, leczenie, rehabilitacja medyczna, metody, mięśnie, spirale mięśniowe

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INTRODUCTION

Cerebral palsy is the result of damage to the cortical and subcortical structures of the central nervous system in the early stages of its development. According to the definition of the International Seminar, cerebral palsy is not an etiological diagnosis, but a clinical descriptive term, which means a group of disorders of movement and body position, causing limitations of activity caused by non-progressive brain damage of the fetus or child. Motor disorders in cerebral palsy are often accompanied by sensitivity defects, cognitive and communicative functions, perception and / or behavioral and / or convulsive disorders [1-3].

In Ukraine, there are about 20 thousand children with cerebral palsy and annually registered a number of diagnoses of cerebral palsy, established for the first time. According to medical statistics, in the structure of pediatric neurological pathology, the disease is about 24%, and the incidence rate in Ukraine is 2.59 per 1000 children.

An important point that confirms the need and relevance of this study is that cerebral palsy is in principle an incurable disease, and the possibility of socialization of patients with cerebral palsy depends on the effectiveness of treatment and rehabilitation measures, their frequency, controllability of results and timely correction of the rehabilitation program individually for each child.

Rehabilitation of children with cerebral palsy is a difficult problem due to high disability dictated by the damage to the central nervous system in the early stages of ontogenetic development of the brain. But in this period there is a defeat not only of the nervous system, but also of other organs and systems. Formation of motor disorders due to organic brain damage, the presence of muscle atrophy leads to hypodynamics, chronic muscle weakness and to osteopenia. Muscle activity, muscle tone affects the tension in bone tissue, which forms signals that control the processes of modulation and remodulation, and affects the intensity of these processes.

Cerebral palsy directly affects the daily lives of sick children. It turns out that the development of therapeutic and rehabilitation systems can involve not only the improvement of great motor skills, but also posture and mobility. Restoration of motor activity is of great importance and has a positive effect on the psycho-emotional state of a sick child, improves his socialization. Functional disorders that increase with age, pose a threat to the further development of such children, in addition, there is a risk of spinal deformity, which becomes pathological (kyphosis, lordosis, scoliosis). There may be deterioration of the hip joints, imbalance of antagonist muscles in muscle system (MS) with the simultaneous appearance of muscular dystrophy and instability of certain parts of the skeleton.

AIM

The article experimentally examines the effect of rehabilitation measures on increasing the volume of movements of the cervical spine, taking into account the severity of muscle pain in children with cerebral palsy.

MATERIALS AND METHODS

In order to solve the tasks, the effectiveness of a set of rehabilitation measures was assessed in 168 children aged 3 to 7 years, with spastic forms of cerebral palsy (spastic diplegia - 68 children, spastic hemiplegia - 63, tetraparesis (spastic form) - 37 patients). All children were divided into two groups of observation: the main group, which conducted the proposed course of rehabilitation (n = 98) and control, who underwent a course of generally accepted rehabilitation content (n = 70).

The rehabilitation course developed by us was carried out on the basis of the Center for Rehabilitation of Children with Organic Nervous System Lesions of Poltava Regional Children's Clinical Hospital. The course of the generally accepted rehabilitation took place in neurological department of the Poltava regional children's clinical hospital.

Rehabilitation measures were aimed at solving the following tasks: normalization of voluntary movements in the joints of the upper and lower extremities, the formation of posture skills close to optimal and correction of foot position, correction of sensory disorders, correction of coordination disorders (fine motor skills of the hand, static and dynamic balance, rhythmic movements, spatial orientation), training of musculoskeletal sensation, prevention and correction of contractures, learning new postures and movements and normalization of the respiratory system.

The examination was conducted three times: before the course of treatment when the child applied to the medical institution, after the course of rehabilitation and three months to study the long-term results of treatment and the effectiveness of independent homework to perform individually selected exercises and knowledge obtained by parents at the school for parents the "Spiral".

Methods of the study: somatoscopy, anthropometry, clinical and neurological examination, measurement of the volume of movements of the cervical spine (evaluated according to the scheme Menya-Lesage in the author's modification); large motor functions were measured on the scale Gross Motor Function Measure (GMFM) [4, 5], used a modified Ashworth's muscle spasticity scale to assess muscle tone [4] muscle pain in contracted muscles was examined using the Visual Analog Scale (VAS); violation of the statics of the child's posture in the gravitational field was assessed by goniometric method of studying conditionally skeletal plots in the frontal and sagittal planes; methods of mathematical statistics were used to analyze the obtained data.

The Ethics Commission of the Poltava State Medical University has no comments on the methods used in this study.

RESULTS AND DISCUSSION

Changes in the volume of movements of the cervical spine are quite informative before treatment to assess the initial state, and in the dynamics and at the end of the course as an integral indicator of the state of the muscular kinematic spiral, because the cervical spine is biokinematically connected to other parts of the spine, pelvic joints and tender limbs, and the neck muscles (flexors and extensors) are an integral part

Table 1. Explanations for Figure 1

Pain assessment	No pain	Minimal pain	Average pain	Strong pain	Very strong pain	Strongest pain
Points	0	2	4	6	8	10

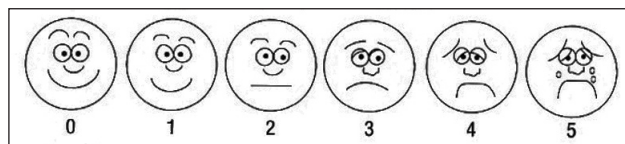


Figure 1. Wong-Baker facial grimace scale for pain intensity assessment

of the main muscle spirals, which entangle the human body from the delicate limbs to the head. Therefore, restrictions on movements in the cervical spine arise as independent pathologically significant functional blocks, and as compensatory sanogenetic in order to maintain body balance, this, as a consequence, is one of the links in the formation of pathological motor stereotype [6] (Figure 1, Table 1).

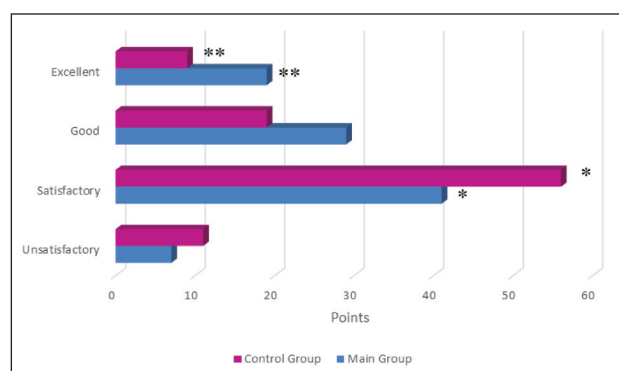
On this scale, pain was assessed by facial expression, motor reactions from the extremities and torso, verbal reactions, or a combination of behavioral and autonomic changes during palpation of shortened muscles. The intensity of pain during the manipulations statistically significantly decreased under the influence of treatment in patients of the main group from 4.4 ± 0.2 to 1.7 ± 0.1 points, and in the control it lowered from 4.2 ± 0.3 to $2, 8 \pm 0.3$ points. This indicates a positive shift not only in the physical condition of patients when using the proposed method, but also to improve the perception of procedures and the overall quality of life of children [7-11].

Thus, when applying the proposed method, the therapeutic effect on pathogenic areas of bilateral muscle kinematic chains was carried out taking into account their mutual antagonism, bilateral symmetry, taking into account the course of both homolateral muscle spirals and heterolateral muscle spirals directly on the affected areas and on the entire muscle spiral, while activating the antagonist of muscle spiral [6, 12, 13].

Under the influence of the proposed course of treatment in patients of the main and control groups, the following changes in the mobility of the cervical spine were detected, which were recorded using the author's proposed integrated assessment (Table 2) [12].

Positive dynamics in the clinical status in the vast majority of patients during re-observation was achieved, but the effectiveness of rehabilitation and the stability of the achieved therapeutic

effect in the study groups were different. Thus, in patients of the main and control groups, changes in the mobility of the cervical spine were detected, which were recorded using the proposed integrated assessment. Namely, in patients who were engaged in the proposed method, the amount of movement in the cervical spine (passive lateral tilt with an element of rotation) probably increased when compared with the indicators before rehabilitation. Also noteworthy is the probable reduction in the intensity of pain, which allows for rehabilitation manipulations in a larger volume (Table 3).



Note: * - $p < 0.05$, ** - $p < 0.01$

Figure 2. The results of an integrated assessment of the effectiveness of the rehabilitation effect on the area of the muscular spiral in the cervical spine in patients of the studied groups

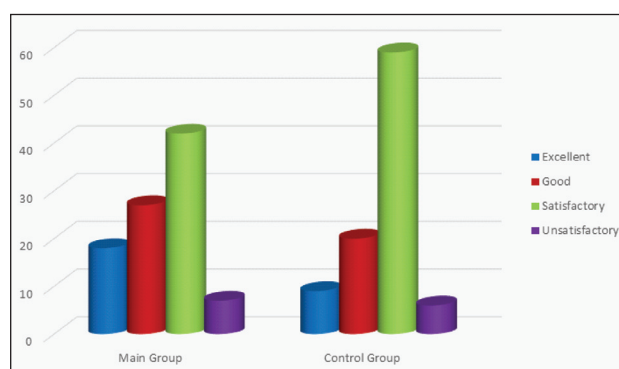


Figure 3. The results of an integrated assessment of the effectiveness of the rehabilitation effect in patients of the studied groups (%)

Table 2. Integral assessment of changes in the mobility of the cervical spine

Result	Parameter
Excellent	the increase in the volume of movements is $\geq 15^\circ$
Good	the increase in the volume of movements is $10^\circ - 14,99^\circ$
Satisfactory	the increase in the volume of movements is $\in 5^\circ - 9,99^\circ$
Unsatisfactory	the increase in the volume of movements is $\leq 5^\circ$

Table 3. The results of the rehabilitation effect on the volume of movements in the cervical spine in patients of the studied groups

Study groups	Main group		Control group	
	Initial parameters	After treatment	Initial parameters	After treatment
Volume of movements in the cervical spine (passive lateral tilt with an element of rotation), (in degrees)	22.4 ± 2.17°	33.2 ± 3.05°*	23.6 ± 2.21°	28.1 ± 4.11°
Pain intensity, points	4.4 ± 0.2	1.7 ± 0.1*	4.2 ± 0.3	2.8 ± 0.3*

* - difference is statistically significant (p<0.05)

Table 4. Indicators for assessing the level of motor disorders and the amount of muscle tone in children of the examined groups at the beginning and after the rehabilitation course

Study groups	The degree of spasticity according to the Ashworth's scale, points GMFM scale (%)			
	Initial parameters	After treatment	Initial parameters	After treatment
Main (n=98)	2.52 ± 0.02	1.75 ± 0.03*	59.71 ± 4.25	67.31 ± 3.92*
Control (n=70)	2.71 ± 0.01	2.20 ± 0.02*	60.22 ± 3.78	65.33 ± 4.1

* - difference is statistically significant (p<0.05)

Changes that occurred in the area of muscle spirals in the cervical spine in patients of the studied groups during the integrated evaluation of the effectiveness of the rehabilitation effect, taking into account the spiral structure of the muscles and with the inclusion in the work of the entire biokinematic muscle chain simultaneously, shown in Figure 2, which clearly demonstrates the vast majority of excellent results of rehabilitation among patients of the main group and the number of satisfactory among the control.

Thus, the increase in the volume of painless movements in the cervical spine is quite informative both before treatment to assess the initial state, and in the dynamics and at the end of the course as an integral indicator of the state of the muscular kinematic spiral. Increasing the volume of movements of the cervical spine, taking into account the intensity of pain, it is advisable to use as a criterion for the effectiveness of the rehabilitation effect on muscle spirals in patients with spastic forms of cerebral palsy.

Given this fact, that a significant reduction in spasticity is not always accompanied by a marked improvement in locomotor functions, we conducted an integrated assessment according to the method of Dekopov A.V. [14] as follows:

1. Excellent result - reduction of tone to 1.5-2 points; improvement of motor functions on one category according to GMFM.
2. Good result - reduction of tone to 1-1.5 points; positive dynamics of motor functions, the patient remains in the same group according to GMFM.
3. Satisfactory result - reduction of tone to 2 points without clear dynamics of motor functions
4. Unsatisfactory result - lack of clear dynamics of spasticity and locomotor functions or negative dynamics.

Evaluation of motor functions on the GMFM scale proved the probability of the difference in the growth of total motility from 59.71 ± 4.25% to 67.31 ± 3.92%

in patients of the main group, and in patients who were engaged in the conventional method, the increase was only 5.1 ± 0.3% in total for the group (Table 3). The most significant changes in indicators were observed in patients of both subgroups by subtests in group B (sitting) and group D (standing) [15].

During the integrated assessment of the effectiveness of the rehabilitation effect according to the method of Dekopov A.V. we got the results, which testified in favor of the proposed technique with the inclusion in the work of the entire biokinematic muscle chain simultaneously taking into account the spiral structure of the muscles of the body and the course of muscle spiral, namely: the number of patients in the main group, who according to the total assessment of spasticity and the level of motor disorders received an excellent and good result was significantly higher, and those who had a satisfactory and unsatisfactory result at the end of the course, respectively, lower (Figure 3).

Thus, the proposed method of rehabilitation of children with spastic forms of cerebral palsy has a pronounced sanogenetic effect, meaning it stimulates their own health reserves and triggers a cascade of reactions of the body aimed at forming a healthy motor stereotype. It involves influence on organism of the patient by rehabilitation procedures with inclusion in work of all biokinematic muscular chain at the same time, taking into account spiral construction of muscles of a body, which allows to achieve a more pronounced therapeutic effect, to improve the results of rehabilitation not only in children who walk independently, sit, but also in those who are bedridden [13].

CONCLUSIONS

Painless increase in the volume of movements in the cervical spine should be used as a new integrated marker for assessing the effectiveness of rehabilitation treatment. The proposed

method of rehabilitation of children with spastic forms of cerebral palsy has a therapeutic sanogenetic effect, that is, stimulates its own health reserves and triggers a cascade of reactions of the body, aimed at bringing the motor stereotype to the optimal. It involves influence on the patient's body by rehabilitation procedures with the inclusion of the entire biokinematic muscle chain simultaneously, taking into account the spiral structure of the muscles of the body, which allows to achieve a more pronounced rehabilitation effect, improve the quality of life, improve the results of rehabilitation not only in those children who walk independently.

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Conflict of interest:

The Authors declare no conflict of interest

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The Use of Magnetic-laser Therapy in the Rehabilitation Period for Patients with Infraorbital Nerve Damage

Wykorzystanie magneto- i laseroterapii w okresie rehabilitacyjnym u pacjentów z uszkodzeniami nerwów podoczodołowych

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SUMMARY

Aim: The aim of the study was to assess the effectiveness of magnetic-laser therapy in complex treatment of patients with zygomatic fractures accompanied by the infraorbital nerve damage.

Materials and Methods: The study included 32 patients with single fractures of the zygomatic bone accompanied by infraorbital nerve injury. Patients were divided into two groups: the main group (n=17) and the control one (n=15). In both groups the complex treatment was used, which included: the fragment reposition operation, broad-spectrum antibiotic, nonsteroidal anti-inflammatory drug, anti-edematous therapy, vitamin B complex. In the main group of patients in the postoperative period the magnetic-laser therapy was applied. Assessment of qualitative and quantitative indices of pain was carried out on the 1st, 7th and 14th days of treatment.

Results: In the main group of patients the magnetic-laser therapy significantly reduced the intensity of nociceptive pain, led to moderate regression of all types of neuropathies associated with infraorbital nerve damage. When comparing 2 groups the best pain relief had patients of the main group. At the end of treatment a significant positive dynamics of improving the electrical sensory of infraorbital nerve has been noted, as indicated by recovery of sensory threshold, pain threshold and pain tolerance almost to the level of intact contralateral side.

Conclusions: The use of magnetic-laser therapy in the combined treatment of infraorbital nerve damage allows to improve the recovery of infraorbital nerve sensory changes following zygomatic fractures, reduce the pain, increase the effectiveness of treatment and provide rapid postoperative rehabilitation of patients.

Key words: zygomatic fracture, infraorbital nerve injury, magnetic-laser therapy, pain and sensory dysfunctions

Słowa kluczowe: złamanie jarzmowe, uszkodzenie nerwu podoczodołowego, magneto- i laseroterapia, ból i zaburzenia czucia

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INTRODUCTION

Among all facial bone fractures, the priority belongs to zygomatic bone fractures, which according to various authors is from 35 to 43% of all cases of facial injuries [1]. The most common fracture occurs within the inferior orbital margin in the zone of the infraorbital canal. The fractures of zygomatic bone are associated with the damage of infraorbital nerve in the canal [2, 3]. In the complex therapy of nerve fiber injuries traditionally use vasoactive drugs, antithrombotic and anti-fibrinolytic drugs, diuretics, psychotropic substances and nootropic agents that indirectly act on the infraorbital nerve through the trophic recovery of surrounding tissues. Low level laser therapy has become very popular in the last decade due to the multifactorial effects, simplicity and atraumatic nature of the technique, the absence of allergic reactions [4]. Magnetic-laser therapy (MLT) is a combined effect on the body with

the therapeutic and prophylactic action with a magnetic field and low-intensity laser therapy. It is known that combined physiotherapeutic methods should be based primarily on the synergism of the biological action of different therapeutic physical factors in one procedure. Both magnetic field and laser therapy have trophic-regenerative, anti-inflammatory, analgesic, anti-edematous, immunomodulatory and other effects [5, 6]. Due to these effects, magnetic therapy is widely used for injuries. Physical methods play an important role in the treatment and rehabilitation of the patient [7, 8]. Their choice depends on the time, passed after the trauma [9]. It is recommended to use MLT in the absence of purulent-inflammatory complications of maxillofacial bone fractures in 3-4 days after injury.

In the literature there is insufficient data about MLT usage for infraorbital nerve injuries. Therefore, we consider

it necessary to study the effect of MLT (permanent magnet + low-intensity laser radiation of the red) on the process of function recovery of the infraorbital nerve injury following zygomatic fractures.

AIM

The aim of the study was to assess the effectiveness of magnetic-laser therapy in complex treatment of patients with zygomatic fractures accompanied by the infraorbital nerve injury in the rehabilitation period.

MATERIALS AND METHODS

Operative and postoperative treatment of 32 patients (28 males and 4 females, aged 18 to 38 years) with single fractures of the zygomatic bone without bone fragment dislocation accompanied by a clinical manifestations of infraorbital nerve damage were carried out. The patients were divided into two clinical groups: the main group (n=17) and the control group (n=15). In both groups a complex treatment was performed, which included: the operation for bone fragment reposition, administration of broad-spectrum antibiotic and nonsteroidal anti-inflammatory drug, anti-edematous therapy, antihistamine, vitamin B complex. Dosages of medicines were prescribed according to the guidelines. All treatment procedures were agreed with the neurologist, who carried out daily monitoring of treatment effectiveness of these patients. The average duration of in-patient treatment and hospital stay was 13.8 days.

In the main group of patients in the postoperative period the physiotherapy treatment was applied using the Uzor-A-2K MLT device. This device includes low-intensity pulse laser with radiation in the red spectrum (630 nm) and magnetic attachments. The following parameters were used for the treatment: wavelength $0.89 \pm 0.02 \mu\text{m}$, impulse radiation mode, pulsed wave frequency 80 Hz, pulse power up to 5 W, magnetic induction is 60 mTl. The patients had 7 procedures lasting 20 min daily.

The study was performed in Maxillofacial Surgery Department of Vinnytsia City Clinical Emergency Hospital. For the possibility of adequate processing of study data, patients with fractures of zygomatic bone (isolated unilateral, without clinical manifestations of nerve damage on the opposite side) were selected. At the same time, there was either no fragments dislocation in the patients or it measured to 0.5 cm.

The severity of pain syndrome and neuropathy symptoms were evaluated using the Leeds Assessment of Neuropathic Symptoms and Signs (LANSS pain scale; M. Bennett, 2001), Douleur Neuropathique 4 (DN4) questionnaire (Bouhassira D. et al., 2005), the Visual Analogue Scale (E.S. Huskisson, 1974) and Neuropathy Total Symptom Scores (NTSS-9). For the quantitative objective assessment of sensory changes, we used the method of determining the threshold of pain sensitivity in the projection zone of the infraorbital nerve using Pulp Tester DY310 device. The sensory threshold, pain threshold and pain tolerance were determined [10].

The complex of studies was carried out three times during the treatment period: at the time of hospitalization (the first

day), on the 7th and 14th days of treatment. The requirement for all patients was to undergo a course of treatment without NSAIDs with analgesic effect, that could confound the study results. This was achieved by the following ways: at the day of hospitalization the examination was performed as soon as possible before the appointment of drugs, on the 7th and 14th days of treatment – in the morning prior to therapeutic manipulations (not less than 6 hours after the previous drug administration). Due to the fact that the antibacterial drug included in complex treatment had no influence on the study results, it was used according to conventional treatment regimen equally in both groups of patients.

Statistical analysis of the study results was carried out using computer programs Microsoft® Excel 2017 for Mac (corporate license, Product ID: 02984-001-000001; Device Code: 86C36D0C-8F15-59CA-A81E-B1D889205F71) and the licensed package “Statistica 6.1” (serial number BXXR901E246022FA). Statistical data processing was performed by method of the Student parametric criterion according to the principle of variation statistics. Values of $p < 0.05$ were considered statistically significant.

The work is a fragment of the research project “Development of methods of surgical treatment of patients with maxillofacial pathology considering correction of concomitant diseases”, state registration № 0118U005403.

The studies were carried out in compliance with the main provisions of the “Rules of ethical principles for performing the scientific medical researches with human participation”, approved by the declaration of Helsinki, ICH GCP, EEC Directive №609, orders of the Ministry of Health of Ukraine №690 dated 23.09.2009, №944 dated 14.12.2009 y., №616 dated 03.08.2012. The study protocol was approved by the biomedical ethics committee of National Pirogov Memorial Medical University, Vinnytsya.

RESULTS

Patients of both groups with zygomatic fractures (not accompanied by displacement of bone fragments) had a mild injury degree. It was an injury of infraorbital nerve, which can be characterized as neuropraxia. Patients complained of numbness and pain in the entire cheek, the ala of nose, and upper lip. During skin electrosensometry in projection of the infraorbital foramen on the side of the trauma the decrease of skin sensitivity was diagnosed – $42.5 \pm 5.4 \mu\text{A}$. In a day after surgery operation in both clinical groups the significant increase of sensory threshold (45.6 ± 1.7 s.u.), pain threshold (57.9 ± 2.1 s.u.) and decrease of pain tolerance level (77.2 ± 1.9 s.u.) were diagnosed, indicating a significant violation of sensory excitability of infraorbital nerve compared to normal values ($p < 0.05$) and insufficient functional activity of the antinociceptive system in these patients (Table 1).

To differentiate nociceptive painful syndrome from neuropathic pain the LANSS scale assessment of neuropathic pain was used. Using the LANSS pain questionnaire, the signs of allodynia, impaired sensitivity in the innervation area as well as the intensity and character of the pain were revealed.

Table 1. Indicators of electrical excitability of the infraorbital nerve in treatment dynamic, s.u.

Terms	Sensory threshold		Pain threshold		Pain tolerance	
	Main group	Control group	Main group	Control group	Main group	Control group
	In norm – 15.76 ± 1.38		In norm – 36.83 ± 1.34		In norm – 52.46 ± 1.56	
1st day	45.83±1.62 p < 0.05	45.41±1.66 p < 0.05 p ₁ > 0.05	58.03±2.19 p < 0.05	57.67±2.11 p < 0.05 p ₁ < 0.05	77.26±1.82 p < 0.001	77.12±1.85 p < 0.001 p ₁ > 0.05
7th day	36.20±1.42 p > 0.05	42.58±1.64 p < 0.05 p ₁ > 0.05	47.43±1.45 p > 0.05	52.90±1.91 p < 0.05 p ₁ < 0.05	66.86±1.73 p < 0.001	73.74±1.81 p < 0.001, p ₁ < 0.05
14th day	20.16±1.42 p > 0.05	37.54±1.55 p > 0.05 p ₁ < 0.05	38.23±1.45 p > 0.05	47.41±1.28 p > 0.05 p ₁ > 0.05	53.30±1.52 p > 0.05	66.16±1.8 p < 0.05, p ₁ < 0.05

Note: p – the significance of the difference between the values in norm and during treatment (1st, 7th, 14th day); p₁ – the significance of the difference between the values of the main and the control groups.

Table 2. Indicators of the pain scales in the patients with zygomatic fractures, accompanied by infraorbital nerve damage, scores (M ± m)

Group of patients	1st day	7th day	14th day
LANSS pain scale			
Main group (n=17)	22.81 ± 3.2	10.05 ± 1.7	9.62 ± 1.2
Control group (n=15)	22.73 ± 3.1 p > 0.05	18.21 ± 2.2 p < 0.01	17.54 ± 2.2 p < 0.01
Douleur Neuropathique 4 questionnaire			
Main group (n=17)	9.54 ± 0.70	7.76 ± 0.61	5.71 ± 0.51
Control group (n=15)	9.52 ± 0.68 p > 0.05	8.54 ± 0.63 p > 0.05	7.36 ± 0.65 p > 0.05
Visual-Analogue scale (VAS)			
Main group (n=17)	7.69 ± 0.83	1.71 ± 0.44	0.28 ± 0.46
Control group (n=15)	7.67 ± 0.49 p > 0.05	5.48 ± 0.50 p < 0.001	3.87 ± 0.69 p < 0.001
General assessment of neuropathic symptoms scale (NTSS-9)			
Main group (n=17)	22.21 ± 2.11	13.66 ± 1.94	6.03 ± 1.59
Control group (n=15)	22.18 ± 2.12 p > 0.05	17.66 ± 2.15 p > 0.05	14.60 ± 1.32 p < 0.001

Note: p – the significance of the difference between the indexes of the main and control groups.

In general, the average indices in the examined patients were 22.77 ± 3.2 scores. Decreased scale indices were determined in both groups, indicating the pain reduction. This is due to the fact that in the absence of inflammatory complications, after the acute period (1-3 days) regeneration occurs in the fracture zone, leading to reduce the pain syndrome. However, the pain reduce was not the same in two groups of patients (Table 2): on the 7th day of treatment the obtained results were 10.05 ± 1.7 scores in the main group and 18.21 ± 2.2 scores in the control group; on the 14th day – 9.62 ± 1.2 and 17.54 ± 2.2 scores, respectively. It is seen that the indices are significantly better in the main group on the 7th and 14th days than in the control group (p < 0.01). Analyze the

data of LANSS pain scale in the main group, it is revealed that a sharp decrease is observed due to the parameters that characterize nociceptive pain. In the future, the indices are almost unchanged, and are preserved due to signs of disesthese manifestations.

A diagnostic DN4 questionnaire for neuropathic pain was used to analyze sensory changes. Thus, when using the DN4 questionnaire 84.4% patients in both groups a neuropathic character of pain was revealed; the average indices were 9.53 ± 0.6 scores. In general, the results confirm the high frequency of neuropathic pain in zygomatic bone fractures and involved neurogenic mechanisms in the formation of pain inherent to the infraorbital nerve damage.

At the beginning of the study, there was almost no difference between the indices, moreover, they were somewhat higher in the main group (Table 2). In 7 days of treatment, the values of indices in the main group were lower by 1.1 times and in 14 days by 1.29 times than in the control group. Since this questionnaire mainly characterizes the signs of disesthetic signs, we can assume that MLT has little effect on the regression of these manifestations in fractures.

When analyzing the indices of Visual-Analogue scale (VAS), the obtained results show the tendency of VAS scores to reduce the pain in both treatment groups. Significantly more rapid pain relief was revealed in the main group. On the 7th day of treatment the indices of VAS in the main group were 1.71 ± 0.44 scores against 5.48 ± 0.50 scores in the control group ($p < 0.001$); on the 14th day – 0.28 ± 0.46 scores against 3.87 ± 0.69 scores ($p < 0.001$), respectively. It means that on the 7th day the VAS scores were lower by 3.2 times, and at the time of discharge from the hospital (14th days) in patients the indices were 13.8 times lower than in the control group. This shows that the pain syndrome (mainly spontaneous pain and pain during exercise) in the main group at the time of discharge from the hospital was almost absent and patients did not need to use any painkillers. Whereas in the control group there was moderate pain that required the use of analgesics.

The results of the study by NTSS-9 scale are as follows (Table 2): in the main group the indices were not differ significantly on the 1st and 7th days of observation compared to the control group ($p > 0.05$), on the 14th day we noted a significant reduction ($p < 0.001$) of neuropathy symptoms in the main group of patients: 6.03 ± 1.59 scores against 14.60 ± 1.32 scores in the control group. There were the clear-cut differences between the groups in the dynamics of improvement of patients' state. At the first day, the indices were similar, being even somewhat higher in the main group of examined patients. In 7 days, the difference was 1.29 times lower and in 14 days – 2.42 times lower in the main group than in the control group.

Thus, as the LANSS, DN4, VAS and NTSS-9 scales characterize pain syndrome from various perspectives, the results were different with existing similar tendency.

Determination of electrical excitability of nerve fibers in patients who used the traditional scheme of postoperative rehabilitation, statistically confirmed a significant violation of the sensory threshold, pain threshold, pain tolerance (Table 1). In the main group, a significant positive dynamics in improving the electrical excitability of the infraorbital nerve was determined. The sensory threshold, pain threshold and the level of pain tolerance were recovered almost to the level of the intact side at the end of observation.

DISCUSSION

Approximately 30% to 80% of patients with zygomaticomaxillary complex fractures experience infraorbital nerve injuries [1]. Infraorbital nerve damage causes symptoms like mild numbness in the sensory dermatome and sensory loss, ranging from complete anesthesia to dysesthesia [11]. This complication leads to psycho-emotional disorders and

significantly impairs the quality of person's life [3]. Gradual nerve function recovery was confirmed to be possible with conservative treatment and rehabilitation alone [6, 8, 12]. That is why, MLT in the rehabilitation period for patients with zygomatic bone fractures has been investigated because of its intimate relationship with tissue recovery processes, such as on infraorbital nerve damage.

After analyzing the dynamics of complaints and objective data in zygomatic bone fractures accompanied by infraorbital nerve injury, it was revealed that the use of MLT with a red laser and a constant magnetic field accelerates the pain reduce during treatment. This physiotherapy procedure significantly reduces the intensity of nociceptive pain, leads to moderate regression of all types of neuropathies associated with damage to the infraorbital nerve, namely: shooting pain, sensations of burning and coldness, aching pain, allodynia, static hyperalgesia, tingling, cramps (twitching).

An analysis of pain scales and questionnaires seen the following patterns: on the 7th day of treatment the indices of VAS scale in the main group were lower by 3.2 times than in the control group ($p < 0.05$), and on the 14th day – 13.8 times ($p < 0.05$), respectively. It was revealed that the indices of spontaneous pain by LANSS scale, on the 7th day of observation in the main group was significantly reduced by half, on the 14th day by 2.37 times ($p < 0.01$). In the control group, the decrease of indices for 14 days of observation occurred 1.3 times. On the 14th day, the indices of pain by NTSS-9 scale in the main group showed a significant decrease to 6.03 ± 1.59 scores (2.42 times) compare to the control group, where the indices were 14.60 ± 1.32 ($p < 0.001$). The clinical effectiveness of MLT for treatment of infraorbital nerve injuries is proved, the use of which provides significant analgesic and anti-inflammatory effects, which reduces the use of analgesics by 6.24 ± 0.71 days.

A significant pain reduction and sensory recovery of the infraorbital nerve on the 7th and 14th days of observations in patients of the main group compared to patients of the control group shows the effectiveness of physical therapy procedures. Effectiveness of MLT on pain relief can be explained by the fact that laser light absorbed by nociceptors, exert an inhibitory effect on A and C pain fibers, which slows conduction velocity, and suppresses neurogenic inflammation [5]. The peripheral nervous system reacts to the magnetic field by reducing the sensitivity of peripheral receptors, which causes an analgesic effect, and improving the function of conductivity, which has a positive effect on restoring the functions of injured peripheral nerve endings by improving axonal growth, myelination and inhibition the connective tissue formation in them [5, 12]. The analgesic effect of magnetic therapy is caused by increased secretion of endogenous opioids, which lead to muscle relaxant, anti-edematous and anti-inflammatory action. The use of MLT allowed to increase the effectiveness of complex treatment, optimizing the use of drugs by reducing the number of drugs and their doses, to reduce postoperative rehabilitation periods for patients with zygomatic bone fractures and can be recommended for wide use in practical medicine.

CONCLUSIONS

Thus, having analyzed the dynamics of patients' complaints as well as the objective data, pain scale indices and electrical excitability of the infraorbital nerve damage following zygomatic fractures, the use of MLT in combined therapy was found to accelerate the reduce of pain, significantly decrease the severity of all neuropathy manifestations, improve the recovery of infraorbital nerve sensory changes, increase the effectiveness of treatment and provide rapid postoperative rehabilitation of patients.

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Informacja prasowa

ATOPOWE ZAPALENIE SKÓRY (AZS)

EMOTOPIC nawilżający balsam w piance do ciała. Wskazania: Do codziennego stosowania w celu zapobiegania objawom i dolegliwościom wywołanym suchością skóry (tj. zaczerwienienie, podrażnienie, świąd) szczególnie w przebiegu atopowego zapalenia skóry (AZS). Wyrób przeznaczony dla osób z uszkodzoną barierą naskórkową, ze zwiększoną skłonnością do wystąpienia reakcji alergicznych oraz nadwrażliwością na czynniki zewnętrzne, w tym substancje drażniące.

Wskazany w celu zapobiegania nasilaniu i nawrotom objawów towarzyszących AZS oraz innym dermatozom, którym towarzyszy nadmierna suchość skóry. Polecany do stosowania profilaktycznie w przypadku skóry z tendencją do przesuszania. *Wyrób przeznaczony do stosowania po ukończeniu 6. miesiąca życia, dla dzieci i dorosłych.

Zawiera kompozycję zapachową.

Działanie: Balsam w formie ultra-delikatnej pianki przywraca odpowiednie nawilżenie skórze, tworzy fizyczną barierę ochronną, przywracając jej prawidłowe funkcje. Wyrób działa profilaktycznie, zmniejszając skłonność do powstawania podrażnień, łagodzi zaczerwienienia oraz zapobiega przesuszeniu skóry. Wspomaga odbudowę oraz wzmacnia ochronny płaszcz lipidowy, zmniejszając w ten sposób podatność na działanie czynników zewnętrznych. Dzięki zawartości lipidów lamelarnych, strukturalnie podobnych do lipidów naturalnie występujących w skórze, wyrób zmniejsza suchość skóry, łagodzi uczucie świądu oraz zapobiega nawrotom i zaostrzeniu objawów AZS. Formuła oparta na naturalnych olejach, przywraca komfort napiętej i szorstkiej skórze. Wyrób zmniejsza łuszczenie, wygładza, pozostawiając skórę miękką w dotyku.

(www.pharmacaris.com)

Prevention of Post-Surgical Complications Following Odontectomy in Patients with Underlying Diabetes Mellitus

Zapobieganie pooperacyjnym powikłaniom po odontektomii u pacjentów ze współistniejącą cukrzycą

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SUMMARY

Aim: Purpose of the study. The study was dedicated to assessment of the effect of photon physiotherapeutic therapy combined with the use of PRF clot on the course of regeneration processes in a socket of extracted tooth in DM patients.

Materials and Methods: Thirty patients with confirmed diabetes mellitus aged 40 - 60 referred to the Pirogov Memorial Clinical Hospital (Vinnytsia) that required tooth extraction were engaged in the study. Patients were assigned into two groups: Group I patients with spontaneously healed post-extraction wounds, and Group II patients subjected to physiotherapy in combination with the PRF. The physiotherapeutic effect was achieved by using a multispectral photon physiological system. Platelet-rich fibrin (PRF) was produced immediately before tooth extraction from the patients' venous blood. The efficacy of the photon physiotherapeutic therapy combined with the use of PRF clot was studied by the morphological methods.

Results: The study of pathomorphological features of the post-extraction wound regeneration revealed differences in patients of Groups I and II. In Group II patients, the treatment was characterized by an anti-inflammatory effect (less abundant inflammatory infiltrate with fewer polymorphonuclear leukocytes in bioptic samples), accelerated regeneration process, as evidenced by a larger number of fibroblasts on Day 3 and Day 7 of follow-up, and faster development of fibrous structures in the granular tissue. Group II patients demonstrated earlier post-extraction wound epithelialization and more active angiogenesis.

Conclusions: The study of pathomorphological features of post-extraction wound regeneration proved the therapeutic efficacy of the photon effect combined with the transport of PRF to the extracted tooth socket in two DM patient groups (Group I patients with spontaneously-healed post-extraction wounds, and Group II patients subjected to physiotherapy in combination with PRF).

Key words: photon effect, growth factors, regeneration, diabetes mellitus

Słowa kluczowe: efekt fotonowy, czynniki wzrostu, regeneracja, cukrzyca

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INTRODUCTION

According to WHO, the number of patients with diabetes mellitus in the world has been increasing exponentially year by year. Diabetic complications, including the most common ones, such as angiopathy and polyneuropathy, pose a significant medical problem. Changes in the microcirculatory vasculature that develop in the course of the disease are considered one of the main pathogenetic factors of poor tissue regeneration in wounds. DM patients also develop slow and unregulated formation of new capillaries (angiogenesis) in damaged tissues. Angiogenesis is one of the physiological processes that play a key role in the response of tissues to damage. Restoration of damaged tissues produces the growing demand in nutrient metabolism. Various cells, biologically active substances, matrix structures, and microelements need to be quickly delivered to all points of the wound. Blood flow

in the newly developed blood vessels contributes greatly to this kind of metabolism. Therefore, the disturbance of the angiogenic response has a negative effect on the course of wound healing.

That's why, simple surgery in DM patients (e.g. tooth extraction) may lead to disproportionately severe consequences.

The topical issue of today is a search for non-invasive techniques that exert positive effect on the processes of tissue regeneration in wounds of DM patients.

AIM

The objective of the study was to assess the photon physiotherapeutic effect in combination with the use of PRF clot on the course of regeneration process in the extracted tooth socket of DM patients.

MATERIALS AND METHODS

Thirty patients with confirmed diabetes mellitus aged 40-60 referred to the Department of Maxillofacial Surgery of the Pirogov Memorial Clinical Hospital (Vinnytsia) that required tooth extraction were engaged in the study. All patients voluntarily gave written consent for surgery. Patients were assigned into two groups: Group I patients with spontaneously-healed post-extraction wounds, and Group II patients subjected to physiotherapy in combination with the use of PRF. Females and males accounted for 57% and 43% of the population, accordingly. The physiotherapeutic effect was achieved by using a multispectral photon physiological system [1] (Figure 1). The post-extraction wounds were irradiated with a 50 mW red light for 5 min; the course consisted of 3 sessions (once a day).

Platelet-enriched fibrin was produced immediately before tooth extraction. To do this, 10 ml of venous blood was taken from the patients' ulnar vein. Venepuncture was performed using a butterfly needle connected by a catheter to a vacuum tube with walls covered with a coagulation activator. The resulting blood was centrifuged for 12 minutes at 3000 rpm. The efficacy of the photon physiotherapeutic effect combined with PRF was assessed by morphological methods. All morphological changes were assessed 5 hours following tooth extraction, then on 3, 7 and 14 post-operation days in the control (without model diabetes) and in the experimental (with model diabetes) patient groups. Mucotome or curettage spoon were used for sampling tissues from a socket of the extracted teeth.

RESULTS

Healing of the post-extraction wound is an important issue for recovery of patients to the normal quality of life, which in case of such concomitant pathology as diabetes mellitus, is a precondition for compensated course of the disease.

The regenerative processes in the alveolar process tissues following tooth extraction can be analyzed by evaluating the results of the morphological examination.

The study of slides revealed a large number of segmental leukocytes, including dead, in samples of the first group of patients



Figure 1. Multispectral photon system

on Day 1 of the follow-up. The damaged area was abnormally large, had no clear boundaries, and contained isolated fibrin threads (Figure 2A). A similar pathomorphological pattern was observed in Group II, but the amount of fibrin in the slides was much higher (Figure 2B).

Three days following tooth extraction, patients of experimental Group I manifested a large number of polymorphonuclear leukocytes between the remaining fibrin threads while studying the histological samples. The damaged zone was abnormally large, yet had clearer boundaries (Figure 3A). On Day 3, patients of the experimental Group II presented a significant amount of fibrin in tested samples, while the inflammatory infiltrate was less pronounced compared to the morphological data of the experimental Group I. In addition, in contrast to the experimental Group I, the inflammatory infiltrate was found containing macrophages, which are stimulators of tissue regeneration (Figure 3B).

The differences of the morphological pattern between Groups I and II were even more significant on Day 7 of the follow-up.

Slides taken in Group I had the inflammatory infiltrate still pronounced, consisting mainly of polymorphonuclear leukocytes, including, among others, mononuclear cells such as blood monocytes, predecessors of young fibroblasts, and tissue macrophages. Immature fibroblasts had a sharply basophilic cytoplasm and swollen, loose nuclei. No signs of epithelialization

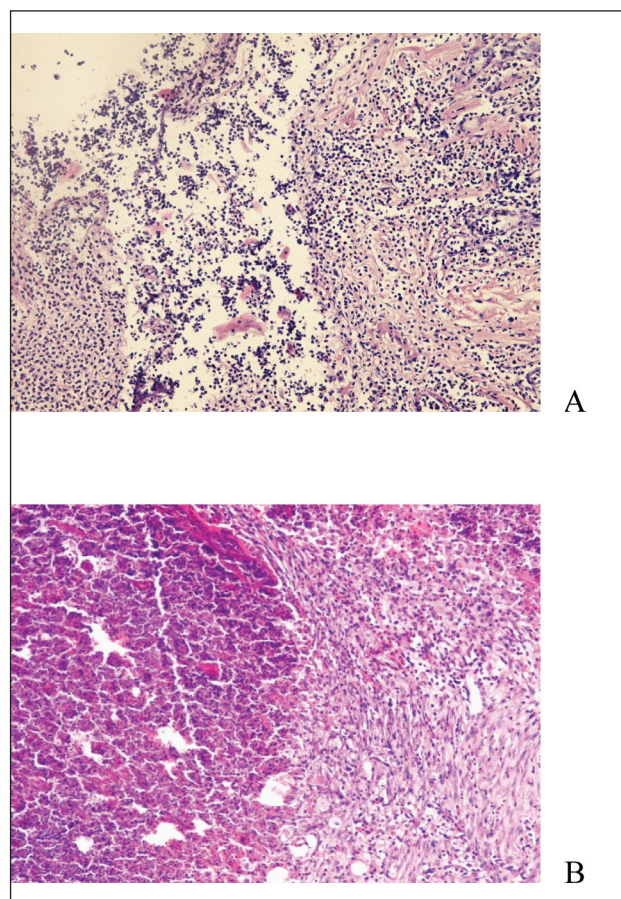


Figure 2. Staining with hematoxylin and eosin. Magnification: objective 20x, eyepiece10x

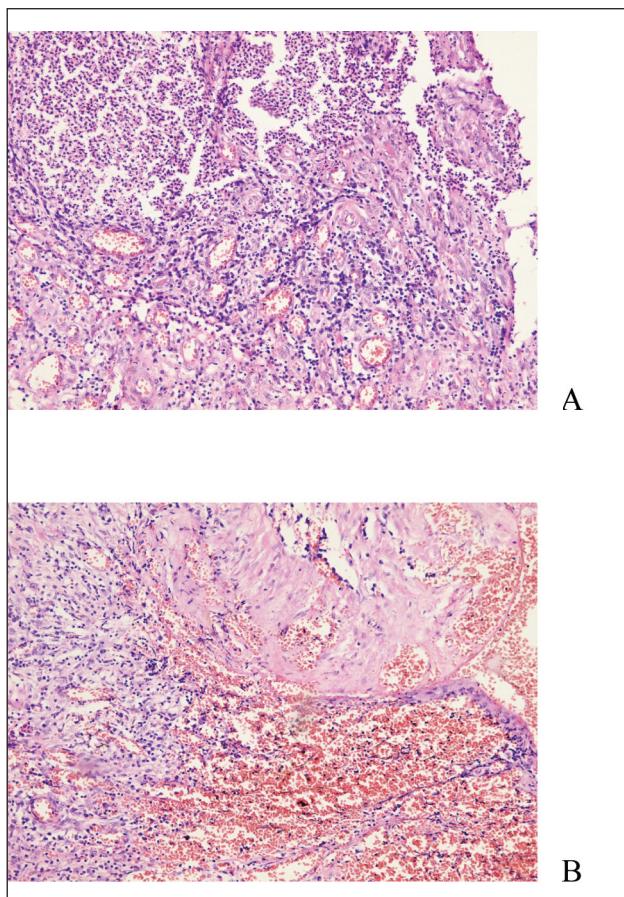


Figure 3. Staining with hematoxylin and eosin. Magnification: objective 20x, eyepiece 10x

were present in this period (Figure 4A). On Day 7 of the experiment, Group II patients had signs of marginal wound epithelialization. The wound was filled with newly formed well-vascularized granulation tissue, which still had a slight polymorphocellular infiltration, mainly with lymphohistiocytic elements inclusive of single segmental leukocytes. The fibrous and cellular components were equally well expressed (Figure 4B).

On Day 14, slides of the experimental Group I were characterized by granulation tissue, weakly infiltrated with neutrophils. Surface layers of the newly formed granulation tissue had cellular component prevailing over the fibrous one. The granulation tissue was poorly vascularized, yet having no signs of thrombosis and capillarostasis. By this time, signs of marginal epithelialization of the wound had been already present (Figure 5A). On Day 14 of the experiment, slides of Group II had the pronounced signs of young scar epithelialization. The wound was almost completely filled with mature newly formed well-vascularized fibrous tissue with a slight scattered polymorphocellular infiltration consisting of mainly lymphohistiocytic elements inclusive of additional segmental leukocytes. The fibrous component significantly prevailed over the cellular one. Newly formed fibrous tissue was well vascularized (Figure 5B).

DISCUSSION

Serious complications of diabetes mellitus include diabetic neuropathy and angiopathy [1, 2]. These complications are

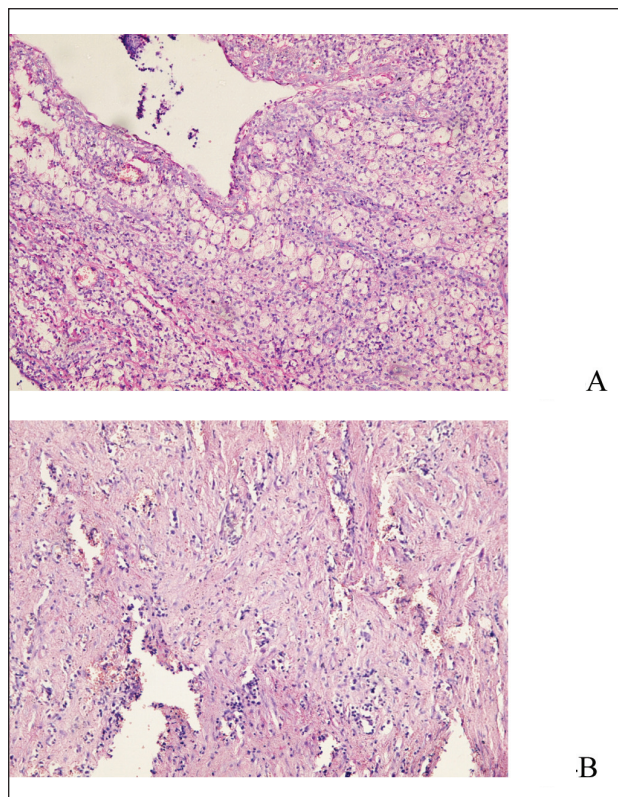


Figure 4. Staining with hematoxylin and eosin. Magnification: objective 20x, eyepiece 10x

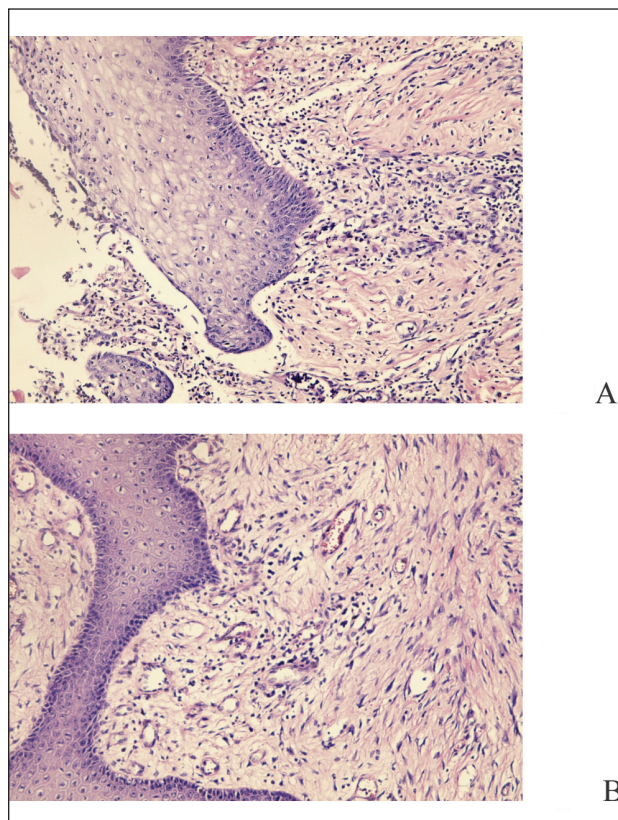


Figure 5. Staining with hematoxylin and eosin. Magnification: objective 20x, eyepiece 10x

characterized by specific manifestations in the oral cavity, inter alia [3]. Diabetes leads to alteration of the microcirculatory vessels of the oral mucosa and periodontal tissues, including a decrease of capillary patency, thickening of the basal membrane, and defected endothelial cells. Abnormally thick basal membrane interferes with a physiological fluid exchange and cell migration, thus leading to a weaker resistance to infections [4]. Altogether, these structural and functional abnormalities lead to delayed healing of even minor injuries in DM patients [5].

Diabetic patients with extracted tooth demonstrated a process of mutual burdening, characterized by slow healing of wound and the course of diabetes mellitus worsened by affected teeth and extraction surgery [6].

Therefore, researchers are in a constant search for opportunities to improve regenerative processes in DM patients [7]. For example, a property of visible light to improve the microcirculation of blood and lymph, increase the elasticity of vascular walls, normalize blood rheology, the immune, endocrine, central and peripheral nervous systems [8].

The research of targeted delivery of growth factors, cells and proteins to a damaged area with a possibility of influencing the angiogenic response is considered quite promising [9]. We studied the photon physiotherapeutic effect in combination with the use of PRF clot as a source of VEGF (vascular endothelial growth factor), PDGF (platelet-derived growth factor), TGF beta (transforming growth factor beta), and proteins. The application of this non-invasive method is promising in terms of preventing post-surgical complications following odontectomy in patients with underlying diabetes mellitus.

CONCLUSIONS

The study of pathomorphological features of post-extraction wound regeneration proved the therapeutic efficacy of the photon effect in combination with the transport of PRF on the extracted tooth socket in two DM patient groups (Group I patients with spontaneously-healed postextraction wounds, and Group II patients subjected to physiotherapy in combination with the use of PRF). In patients of the experimental Group II, the therapy exerted an anti-inflammatory effect (less ample inflammatory infiltrate with fewer polymorphonuclear leukocytes in biopsy samples); the regeneration processes accelerated, as evidenced by a larger number of fibroblasts on Day 3 and Day 7 of the follow-up and faster development of fibrous structures in the granulation tissue.

The Group II patients demonstrated earlier post-extraction wound epithelialization and more active angiogenesis.

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A – Research concept and design, B – Collection and/or assembly of data, C – Data analysis and interpretation, D – Writing the article, E – Critical revision of the article, F – Final approval of article

Prevention of Complications of Removal of the Mandibular Third Molars

Zapobieganie powikłaniom związanym z usuwaniem zębów mądrości z żuchwy

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SUMMARY

Aim: Study of the causes that may contribute to complications during and after tooth extraction to justify treatment and prevention measures.

Materials and Methods: A retrospective analysis of the content of ambulatory cards and protocols of operations of 168 patients for the period from 2016 to 2018 and evaluation of the results of personal work for 2018–2020 related to surgical interventions in 134 patients which removed the third lower molars.

Results: According to the retrospective material, damage to the inferior alveolar nerve was found in 5.9% of cases, lingual nerve – in 3.3% of cases, the prevalence of alveolitis with simple removal was 16.3% of cases, at difficult and surgical removal – 3.9% of cases. The application of our proposed treatment and prevention complex allowed to reduce their rates to 3.1%, 2.3%, 8.0% and 3.8% of cases, respectively. Risk factors for complications have been identified.

Conclusions: when planning the method of surgical removal of third lower molars it is necessary to take into account the probability of its intimate location in relation to inferior alveolar nerve and lingual nerve. The presence of focus of destruction with signs of acute or exacerbation of chronic inflammation in the periodontal bone tissue of the causative tooth is a risk factor for alveolitis and an indication for the appointment of treatment and prevention in the preoperative period, even with simple removal.

Key words: teeth, removal, complications, treatment, prevention, inferior alveolar nerve, lingual nerve

Słowa kluczowe: zęby, usuwanie, powikłania, leczenie, profilaktyka, nerw żębołowy dolny, nerw językowy

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INTRODUCTION

Removal of the mandibular third molars occupies a significant percentage in the structure of daily medical practice of the dentist-surgeon and remains an urgent task today, as it requires an individual approach to the choice of surgery technology, taking into account possible postoperative complications. The complexity of the task is due to a number of objective circumstances and requires the doctor to understand the measures of dental rehabilitation of each patient after surgery. Statistics on sensory disorders of the third branch of the trigeminal nerve in the operation of atypical removal of mandibular third molars presented in modern publications confirm the fact that this problem is of great socio-economic importance, as it mainly affects patients of working age [1].

In our previous publication, it was noted that recently the method of choice is increasingly becoming a surgical procedure such as coronectomy of the tooth, which is considered the most rational way to remove the retained and dystopian mandibular third molars. Its use is primarily shown in cases of their intimate

location directly to the mandibular canal, when there is a high probability of injury to the vascular-nervous bundle with damage to n. inferior alveoli. In this aspect, coronectomy is the operation of choice for the doctor, which prevents its damage [2].

However, during surgery in the area of mandibular third molars there is a risk of damage and the lingual nerve which can lead to prolonged sensory deficit and deterioration of the patient's quality of life in the postoperative period. There is little information in the available literature on the anatomical preconditions and features of surgical techniques that would help prevent injury to the lingual nerve.

Given the above circumstances, we studied this issue regarding the completeness of its coverage in periodicals according to the publications to compare them with their own observations, summarize the results of clinical cases of complications of tooth extraction, starting with preoperative examination, protocol of operation, the postoperative period. This is the basis for the development of precautions in the provision of surgical care.

AIM

The aim study of the causes that may contribute to complications during and after tooth extraction to justify treatment and prevention measures.

MATERIALS AND METHODS

To achieve this goal, a retrospective analysis of the content of ambulatory records (f.№069 / 0) and ambulatory cards of 168 dental patients (f. 3 043 / O) for the period from 2016 to 2018 inclusive, which was removed 3NM and evaluated results of surgical interventions in 134 patients performed by employees of the Department of Propaedeutics of Surgical Dentistry during 2018-2020 on the basis of Poltava Regional Clinical Dental Clinic (KM «Poltava Regional Center of Dentistry - Dental Clinic»).

Examination of patients was performed according to the generally accepted method with X-ray examination (intraoral contact radiography, orthopantomography (OPTG) or cone-beam computed tomography (CCT)) [3]. Statistical processing of the received data is carried out.

RESULTS

In total, a retrospective study of materials related to dystopia, retention, difficult eruption and the presence of complicated forms of caries over a period of time removed 213 mandibular third molars in 168 patients. Of these, 45 patients (26.7%) had both mandibular third molars removed at different time intervals. In 71.4% of cases (152 teeth) the intervention was performed by the method of complex or surgical removal, and in other 28.6% of cases (61 teeth) - by the method of simple removal (Table 1).

Analysis of ambulatory maps of all 302 patients by measuring the retromolar distance on OPTG by the method of Olive-Basford (1981) in 64.2% of cases (253 teeth) revealed a lack of sufficient space for eruption of mandibular third molars, and in other 35.8% (141 teeth) - sufficiency of space for eruption. In 34.8% of cases (137 teeth) they were partially covered with bone tissue, and in another 65.2% (257 teeth) - in a state of

eruption or covered only with the mucous membrane of the gums. According to the classification of G. Pell, B. Gregory (1933), the position of mandibular third molars is shown in (Figure1), and the greatest difficulty of their surgical removal is characteristic of the position of the teeth C2-C3.

According to the classification of G. Winter (1926) according to radiological and clinical data, in 41.2% of cases the mesioangular inclination of mandibular third molars was determined, in 25.5% - horizontal position, 18.6% - vertical, in 9.8% the buccal lingual inclination, and 4.9% accounted for dystoangular inclination. According to these features, retrospective material and data from own observations have identical values.

Archival data on temporary loss of sensitivity in the area of innervation of the inferior alveolar nerve in 9 cases (5.9%) are evidenced by consulting a patient with a neurologist with the appointment of pathogenetic neurotropic treatment. However, they do not contain complete information about the time of treatment after tooth extraction, its duration and effectiveness, but indicate the restoration of tissue sensitivity in the area of innervation within 6-8 months.

During the period of personal research at removal of 131 mandibular third molars in 4 cases (3.1%) in the postoperative period sensory disturbances of temporary character in a zone of innervation of the lower alveolar nerve were noted. Timely consultation with a neurologist immediately after the

Class I	A	B	C	A1	B1	C1
	0,8%(3)	6,7% (24)	3,9%(14)			
Class II	A	B	C	A2	B2	C2
	18,4%(66)	13,7% (49)	7,8%(28)			
Class III	A	B	C	A3	B3	C3
	28,8%(103)	21,2% (76)	8,7%(31)			

Figure 1. The nature of the position of mandibular third molars as a percentage of the total number of removed teeth

Table 1. Structure and frequency of complications after 3-d LM removal

The structure of complications and periodontal destructive changes (abs.%)		Number of examined patients			
		The data are retrospective		Data from own research	
		168		134	
		Number of teeth removed			
		Easy removal	Complex or surgical	Easy removal	Complex or surgical
		61	152	50	131
nerve damage	mandibular alveolar	-	9 (5.9)	-	4 (3.1)
	tongue	-	5 (3.3)	-	3 (2.3)
alveolitis	serous	4 (6.5)	6 (3.9)	3 (6.0)	5 (3.8)
	purulent	6 (9.8)	-	1 (2.0)	-
periodontal destructive changes	periapical	12 (19.7)	3 (2.0)	9 (18.0)	3 (2.3)
	pocket of Wuzhheim	23 (37.7)	15 (9.9)	21 (42.0)	14 (10.7)

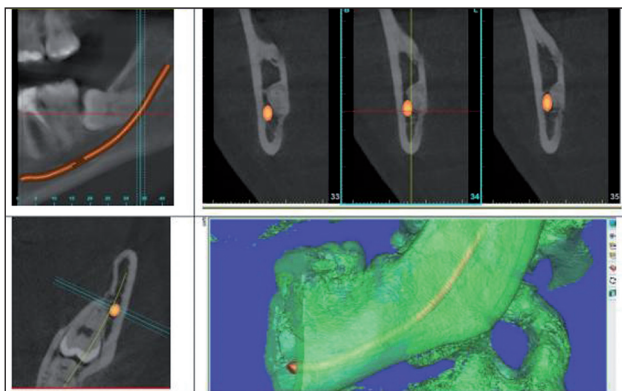


Figure 2. Sections of the OPTG fragment of the mandible at the intimate location of mandibular third molars to the mandibular canal

detection of damage and the appointment of pathogenetic treatment helped to restore sensitivity for 2-4 months.

With the intimate location of the mandibular third molars in relation to the mandibular canal, which is confirmed by the results of cone-beam computed tomography (Figure 2), we chose the technique of coronectomy of the tooth to avoid injury to the inferior alveolar nerve during surgery. Its introduction made it possible to reduce the frequency of nerve damage by almost 2 times, from 5.9% to 3.1% of cases.

According to archival data, in 5 cases (3.3%) of trauma of the lingual nerve there was a loss of tactile, pain and temperature sensitivity of the tongue, the mucosa of the alveolar process from the lingual surface and the soft tissues of the bottom of the oral cavity on the side of the injury. In 4 patients, sensory deficits were observed for 4-8 weeks after with a gradual recovery of sensitivity on the background of treatment prescribed by a neurologist. In one of 5 cases of traumatic neuropathy of the lingual nerve to restore tissue sensitivity took 10 months with long-term use of pathogenetic therapy.

Despite the seemingly low prevalence of injury, its occurrence leads to functional disorders, accompanied by damage to the tongue when closing the dentition, especially chewing. This causes the patient psycho-emotional concern, especially since in this case it is not possible to predict the timing of the restoration of lost sensitivity.

According to the results of own observations, injuries of the lingual nerve are documented 3 times (2.3%). Analysis of surgical protocols shows that in 2 cases there is an osteotomy of tissues adjacent to the distal contact privacy, from the retromolar fossa, as well as in the case of prolonged visual sensitivity, which separates the crown, requiring its lingual tilt (Figure 3).

The most common complication of mandibular third molars removal in the postoperative period according to archival data was alveolitis (alveoloneuritis). Thus, with simple removal of 61 mandibular third molars alveolitis was found in 10 cases (16.3%), of which in 4 cases (6.5%) - serous form, in 6 cases (9.8%) - purulent form. With complex and surgical removal of 152 mandibular third molars serous alveolitis was diagnosed in 6 cases (3.9%). It has been found

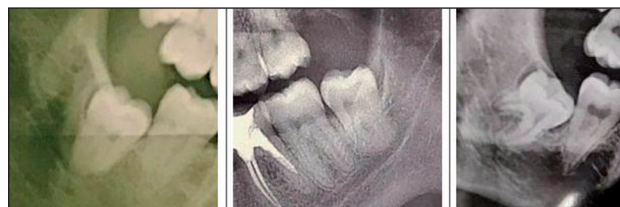


Figure 3. Fragments of the mandible on OPTG of patients with postoperative traumatic neuropathy of the lingual nerve

that in cases of alveolitis with simple removal, patients were preceded by acute inflammatory phenomena in the area of the causative tooth with radiological signs of Vuzhheim's pocket or destruction in the periapical tissues.

Such statistical differences can also be explained by the fact that after complex or surgical removal of mandibular third molars, prophylactic antibacterial therapy was prescribed.

DISCUSSION

The available data on the features of the topographic location of the lingual nerve, obtained in the study of cadaveric material by different researchers [4, 5], have significant statistical differences. This is due to a number of subjective and objective factors - different research methods without regard to race, age, sex, bone atrophy and timing of tooth loss. Figure 4 shows the average results of measurements of the location of the lingual nerve in the horizontal plane (distance to the lingual cortical plate) and vertically from the lingual edge of the alveolar ridge at the level of mandibular third molars, obtained by Kiesselbach and Chamberlian (1984).

According to their data, up to 17% of cases the nerve is located at or above the apex of the alveolar crest, and direct contact with the bone occurred in 62% of cases, which causes a high probability of injury during surgical removal of mandibular third molars.

To determine the role of anatomical preconditions in damage to the lingual nerve, the analysis of the literature indicated the difficulty of visualizing the nerve trunk at the stage of preoperative examination. Data on certain successes in the application of ultrasound diagnostics in determining its horizontal level of the lingual nerve in the area of the

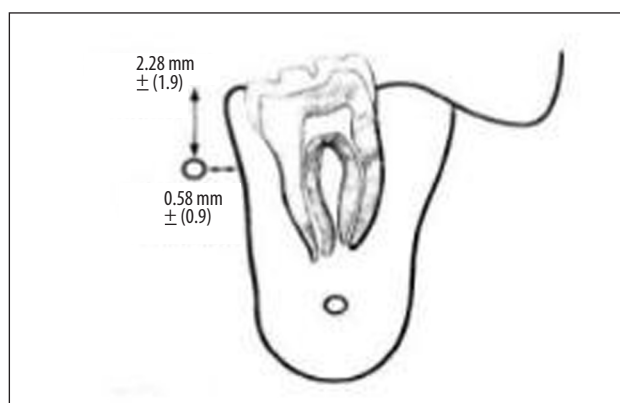


Figure 4. Schematic representation of the location of the lingual nerve in relation to mandibular third molars in the frontal plane

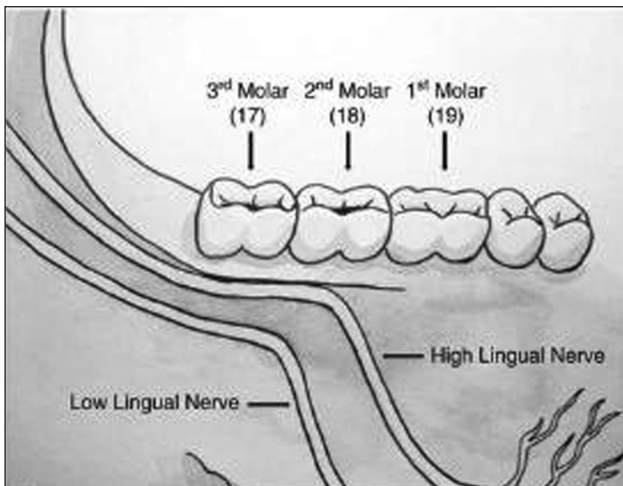


Figure 5. Schematic representation of variants of the topographic location of the lingual nerve in relation to mandibular third molars in the sagittal plane

third molar are given [6]. In particular, the authors propose to distinguish between the upper or lower lingual nerve on the basis of ultrasound (Figure 5).

Therefore, determining the features of the anatomical and topographic location of the lingual nerve is a necessary condition for choosing the method of surgical intervention, which should have minimal risks of intra- and postoperative complications. This is greatly facilitated by the use of magnetic resonance imaging and X-ray examination with visualization of landmarks along the lingual nerve.

In the case of separation crown with lingual inclination significantly hampered visual inspection the rotating instrument and with a thin lingual wall of the alveoli, its perforation is possible with direct mechanical damage to the nerve by burr. Foreign authors in these cases recommend the use of lingual flap retractor, which, although it leads to a temporary loss of sensitivity of the lingual nerve, but prevents its severe injury with rupture of the tissues [8].

The buccal access to the tooth and adjacent bone tissue is generally accepted. Therefore, under such conditions, we constantly perform: separation of the tooth crown (complete or partial), separation of the tooth by bifurcation of the roots, osteoectomy along the perimeter of the tooth crown. Other techniques, such as lingual flap retraction with lingual split technique, are rarely used in our practice due to the possibility of injury to the lingual nerve. R. Pippi, A. Spota and M. Santoro note that osteoectomy are statistically significantly associated with the likelihood of permanent damage to the lingual nerve. Recognized situations of possible trauma to the lingual nerve should also include cases where the buccal inclination of the tooth, there is a thinning of the lingual wall of the alveoli mandibular third molars, and during the dislocation of the tooth may break. Bone fragments should be removed during revision of the surgical wound. It is at this stage that iatrogenic nerve injury is possible [7].

The analysis of statistical data of scientific publications on the prevalence of lingual nerve injury shows its significant variation. Temporary loss of sensitivity in buccal access without

“lingual flap retraction” and “lingual split technique” in most cases did not exceed 5%. With detachment of the lingual flap with osteoectomy, the risks increased to 10% or more [9, 10]. Therefore, in our practice in the case of detachment of the lingual flap and osteoectomy on the lingual side, we must use a tongue retractor to prevent injury to the nerve of the same name.

According to our own observations, the retention of the flap by the tongue retractor allowed to reduce the frequency of injuries of the lingual nerve from 3.3% to 2.3% of cases.

Given the statistics on the frequency of alveolitis presented by other authors [11], we can assume that the prerequisite for the occurrence of alveolitis is acute odontogenic inflammation or exacerbation of a chronic process (periodontitis, pericoronitis, etc.). That is, alveolitis occurs against the background of an existing source of infection in the periodontal tissues. Unfortunately, the primary documentation did not always provide objective data that could lead to complications and negative consequences.

Therefore, we took into account certain shortcomings in the management of such patients in the pre- and postoperative periods and further in their practice in the presence of acute inflammation or exacerbation of chronic odontogenic lesions to prevent alveolitis prescribed treatment and prevention 1-2 days before surgery to remove mandibular third molars, and absence of inflammatory phenomena in the periodontal tissues, this course was performed immediately after surgery, only under conditions of complex or surgical removal:

1. Antibacterial drugs (amoxicillin - 500 mg 2 times, or azithromycin - 500 mg 1 time per day for 7 days).
2. Nonsteroidal anti-inflammatory drugs (nimesulide - 100 mg, or ketorolac - 10 mg 2 times a day) in the presence of intense pain.
3. Antihistamines (levocetirizine 5 mg or loratadine 10 mg once a day for 7 days).
4. Locally recommended antiseptic (chlorhexidine bigluconate 0.05% solution or “Angilex-Health” solution for the oral cavity) in the form of mouth baths before and after eating.

According to the results of our own observations, the appointment of treatment and prevention complex allowed to reduce the frequency of damage to the inferior alveolar nerve by almost 2 times, from 5.9% to 3.1% of cases, the frequency of lingual nerve injury from 3.3% to 2.3% of cases, the frequency development of alveolitis from 16.3% to 8.0% of cases with simple removal of mandibular third molars and avoid the development of purulent forms of the disease in general.

CONCLUSIONS

1. At an intimate arrangement of mandibular third molars to inferior alveolar nerve for the prevention of its damage the method of choice is a coronectomy (partial odontectomy). When planning technological approaches to perform flap detachment surgery and osteoectomy in the area of the alveolar ridge on the lingual side, it is desirable to pre-perform radiological examination or ultrasound to visualize the lingual nerve, which greatly helps prevent its damage.

2. At separation of a crown of mandibular third molars in case of its lingual inclination there is a high probability of perforation of a lingual wall of an alveolus with simultaneous damage of a nerve of the same name. Therefore, it is expedient and reasonable to keep the detached tongue flap with a lingual flap retractor.
3. In case of manifestations of post-traumatic neuropathy of the inferior alveolar or lingual nerves, we recommend an early examination by a neurologist in order to prescribe pathogenetic neurotropic treatment. This allows to reduce by 2 times the recovery time of sensory disturbances in the area of innervation.
4. The presence of foci of destruction with signs of acute or exacerbation of chronic inflammation in the periodontal bone tissues of the causative tooth is a risk factor for alveolitis and an indication for the appointment of therapeutic and prophylactic drug complex in the preoperative period, even with simple removal of mandibular third molars times.

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Conflict of interest:

The Authors declare no conflict of interest

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Masticatory Muscle Activity in Individuals with Temporomandibular Disorder

Aktywność mięśni żwaczy u osób z zaburzeniami stawu skroniowo-żuchwowego

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SUMMARY

Aim: The aim of our study was to investigate features related to EMG-activity of masticatory muscles in subjects with TMD.**Materials and Methods:** The study comprised 22 patients with clinical symptoms of TMD. The average age of the subjects was 29.3 ± 4.4 years. Malocclusion was evaluated according to Angle classification, TMD – according to the Research Diagnostic Criteria (RDC/TMD). Registration of EMG-activity of masseter and anterior temporalis muscles was performed during maximum voluntary clenching, clenching on the right and left sides.**Results:** Normal activity of the masticatory muscles is characterized by symmetrical and EMG-activity of the masticatory muscles on the left and right sides. EMG-activity of masticatory muscles in subjects with TMD are characterized by: 1) increased values of EMG-activity of temporal and masseter muscles; 2) disproportional and asymmetric muscle work of the masticatory muscles on the right and left sides.**Conclusions:** Features of masticatory muscles activity in individuals with Angle Class I malocclusion and TMD were found.**Key words:** EMG-activity, temporomandibular disorders, masseter, temporalis muscles**Słowa kluczowe:** aktywność EMG, zaburzenia skroniowo-żuchwowe, żwacz, mięśnie skroniowe

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INTRODUCTION

The vast majority of authors define temporomandibular disorders (TMD) as a collective term that covers a number of clinical problems related to the masticatory muscles, occlusion, and structural components of the temporomandibular joint (TMJ). Main questions about temporomandibular joint dysfunction (TMD) in relation to malocclusion/orthodontic treatment seem to be of interest. It concerns correlations between TMD and different kinds of functional or morphologic malocclusions [1]. TMDs, as a group, are characterized by regional pain in the facial and preauricular areas or by limitation or interference in jaw movement. Frequent examination findings are hyperalgesia usually revealed via pressure application to the muscles of mastication or temporomandibular joints (TMJs) and noises in the TMJs. The most common subtypes of TMDs include pain-related disorders, such as myofascial pain and arthralgia, and disorders associated with the TMJ, primarily internal derangements and degenerative joint disease [2].

Diagnostic evaluation of the muscles activity is an integral part in the planning and set of measures for rehabilitation of dental patients. Electromyography is one of the methods of

objective, minimally invasive muscle examination instrumental and highly informative method of functional diagnostics of muscles, namely recording of biopotentials of muscle fibers and activity of their motor units [3-5]. EMG has been used to identify different muscle patterns and compare diagnostic data in different individuals [6].

AIM

Therefore, the aim of our study was to investigate features related to EMG-activity of masticatory muscles in subjects with TMD.

MATERIALS AND METHODS

Two groups of individuals were studying: (1) study group: 22 subjects of 20-38 years aged with TMD, (2) control group: 26 age- and sex-matched individuals with normal occlusion and without clinical symptoms of any TMDs. The average age of subjects in study group was 29.3 ± 4.4 years. 8 (36.4%) were men, 14 (63.6%) were women. All subjects were found malocclusion of class I by Angle, that was characterized by neutral relationship on the first permanent molars and anomalies of tooth position in frontal area. Diagnosis of TMD was determined by the first

and second axis by RDC/TMD [7]. In control group 12 (46.2%) subjects were men, 14 (53.8%) were women. The average age of individuals was 28.8 ± 3.8 years. Exclusion criteria of the study for subjects of two groups were: previous orthodontic treatment, general diseases, traumas and clefts in maxillofacial region.

All subjects of both groups were performed come been computed tomography (CBCT) of temporomandibular joint (TMJ) and surface EMG. Surface EMG of anterior temporal, masseter muscles of both sides (left and right) was performed to using the electromyograph Synapsis (Neurotech company, Russia). The myograph is powered via the USB interface of a computer. During the EMG examination, the subjects, seated in an upright position with the head in natural posture, with legs standing on foot on a firm support (floor), hands quietly lie on the hips. Arms and legs were not be crossed [8]. Before the EMG test, the subjects were explained the purpose and features of EMG, to warn about the absence of pain sensations.

To record muscle bioelectrical activity, unipolar electrodes were used, which are connected to the electromyograph by 4 separate wires with separate inputs. Before applying the electrodes, the skin was cleaned and degreased with 70% solution of ethyl alcohol, which reduced the interelectrode resistance. Electrodes placement was very essential. Disposable silver chloride surface electrodes (diameter 10 mm, Neurosoft, Russia) were positioned on the muscular bellies parallel to muscular fibers [5, 9]. These points were identified by palpation in the area with the greatest muscle tension during teeth clenching. To determine the point of placement of the electrode on the masseter muscle, palpation was performed in the area above 3 cm in antero-superior direction of the lower jaw angle parallel to the lower third of the imaginary line connecting the lower jaw angle and the outer angle of the eye of the same side of the face. For the frontal part of the temporal muscle, palpation was performed along the anterior edge of the muscle parallel to the frontotemporal suture.

EMG-activity was recorded in 3 tests, lasted 30s for each one: maximum voluntary clenching, clenching of the standard cotton roll on the left side (left-side clenching), clenching of the standard cotton roll on the right side (right-side clenching). Maximum voluntary clenching was performed in intercuspal position. EMG data were processed using Neurotech's Synapsis software. EMG-activity for each muscle was estimated by maximum amplitude of the muscle contractions (μV).

The procedures received approval from the Bioethics Committee of the Ukrainian Medical Stomatological Academy (Poltava, Ukraine). All patients signed a statement of informed consent.

EMG-activity between sides (right and left/normal and clicking) were statistically analyzed using Student's paired t-test (level of significance $p_1 < 0,05$). Differences in the indicators of EMG-activity between the study (with TMD) and control (with normal occlusion) groups ere evaluated using analyses of Fisher's criterion X2. The hypotheses were verified at the level of significance $p < 0,05$.

RESULTS

All subjects of the study group were diagnosed TMD according to RDC/TMD (group II b of muscle disorders). Clinical symptoms of TMD were identified in all patients of the group, namely pain from the temporomandibular joints (TMJs) or jaw muscles, pain on mandibular movement (63.3%), joint sounds, and locking/luxation of joints (on the right side (40.9%), on the left side (58.9%), deviation of the lower jaw when opening and closing the mouth (86.4%). CBCT confirmed the change in the shape and position of the articular head on the clicking side. Osteoarticular changes were determined flattening (72.7%), sclerosis (18.2%), osteophyte (40.9%), decrease joint space (68.2%).

In subjects without symptoms of TMD, neuromuscular balance was determined, which is recorded as symmetrical EMG-activity of masticatory muscle on right and left sides. At maximum voluntary clenching test EMG-activity of temporal and masseter muscles on the left and right side is registered identical and symmetrical, the maximum amplitude of muscle potentials does not exceed 1000 mW. In subjects of the control group masseter muscles demonstrated a slightly higher EMG-activity than the anterior temporalis muscles ($p > 0.05$).

EMG-activity of masticatory muscles of two groups in maximum voluntary clenching test is represented in Table 1.

Subjects with TMD had a masticatory pattern different from subjects of the control group. First of all, EMG-activity of masticatory muscles was higher in the study group, but the difference between control and study group in maximum clenching test was not statistically approved ($p > 0.05$). To demonstrate asymmetrical muscle work, we analyzed separately EMG-activity of masticatory muscles in subjects of right and left clicking in TMJ in this test. The anterior temporal and masseter muscle EMG-activity differed

Table 1. EMG-activity of masticatory muscles in patients of the study and control groups in maximum voluntary clenching test

Group	Max. amplitude, μV			
	m.temporalis dextra	m.temporalis sinistra	m.masseter dextra	m.masseter sinistra
Study	1017.01 \pm 31.43	986.42 \pm 29.29	860.55 \pm 29.65	886.52 \pm 28.6
right TMJ clicking (n=9)	1432.21 \pm 42.38*	635.33 \pm 31.88	1074.22 \pm 37.61*	764.48 \pm 27.52
left TMJ clicking (n=13)	701.25 \pm 33.65*	1487.23 \pm 40.92	735.39 \pm 37.42	987.22 \pm 44.01
Control	835.29 \pm 31.38	808.54 \pm 34.61	923.28 \pm 38.03	917.32 \pm 37.55
p	>0.05	>0.05	>0.05	>0.05

* $p_1 < 0,05$

Table 2. EMG-activity of masticatory muscles in patients of the study and control groups in left-side clenching test

Group	Max. Amplitude, μ V			
	m.temporalis dextra	m.temporalis sinistra	m.masseter dextra	m.masseter sinistra
Study	985,54 \pm 31.57*	1528,99 \pm 46.69	782.05 \pm 28.44	1296.44 \pm 40.91
right TMJ clicking (n=9)	1234.43 \pm 38.53	1456.76 \pm 53.72	909.56 \pm 35.32	1205.44 \pm 39.27
left TMJ clicking (n=13)	736.29 \pm 24.61*	1601.22 \pm 49.66	654.54 \pm 21.55*	1387.43 \pm 42.54
Control	608,16 \pm 54,53*	928,41 \pm 37.76	685,16 \pm 46,77*	965,68 \pm 43,40
p	>0,05	<0,05	>0,05	>0,05

*p₁<0,05**Table 3.** EMG-activity of masticatory muscles in patients of the study and control groups in right-side clenching test

Group	Max. amplitude, μ V			
	m.temporalis dextra	m.temporalis sinistra	m.masseter dextra	m.masseter sinistra
Study	1286.16 \pm 35.15	1060.22 \pm 36.96	1044.55 \pm 30.38	914.54 \pm 30.43
right TMJ clicking (n=9)	1566.54 \pm 48.23	623.44 \pm 23.14	1245.54 \pm 36.69	596.54 \pm 21.88
left TMJ clicking (n=13)	1005.77 \pm 22.07	1497.21 \pm 46.77	843.55 \pm 24.07	1232.54 \pm 38.98
Control	845.34 \pm 30.34*	651.43 \pm 25.66	943.64 \pm 32.51*	692.24 \pm 26.54
p	>0,05	<0,05	>0,05	<0,05

*p₁<0,05

between the left and right sides, and higher muscle activity was found on the side of TMJ clicking comparatively to the opposite side (right and left anterior temporal muscle in patients with right and left TMJ clicking respectively, right masseter muscle in subjects with right TMJ clicking, $p < 0.05$). We found that EMG-activity of the temporal muscle in the side of TMJ clicking was higher than EMG-activity of masseter muscle on that side.

EMG-activity of the masticatory muscles of the subjects of two groups in tests of clenching teeth on the left and right sides are shown in Table 2 and Table 3 respectively.

On comparing the left and right sides in subjects of the control group with normal occlusion, there was significant statistical difference for EMG-activity of the masticatory muscles. Thus, EMG-activity was statistically higher on the working side (in left-side clenching test working side is left, in right-side clenching test working side is right) than on the balancing side ($p < 0.05$). Such EMG-activity of masticatory muscles in control group in test of one-side clenching with cotton rolls could be considered as physiological and compatible with normal function.

EMG-activity of anterior temporalis and masseter muscles was higher in the study group, than in the control group, but there was no statistical difference ($p > 0.05$), except left anterior temporalis muscle ($p < 0.05$). We have identified certain features of muscle function in the test of the left-side clenching in the study group. In the left-side clenching test EMG-activity of anterior temporalis ($p < 0.05$) and masseter ($p > 0.05$) muscle was higher on the working (left) side comparatively to the balancing (right) side. In subjects with left TMJ clicking there was a significant difference between EMG-activity of anterior temporalis and

masseter muscle on the balancing and working sides ($p < 0.05$). In subjects with right TMJ clicking was not observed a statistically significant difference in indicators on the working and balancing sided. This is due to the increased activity of the muscles on the balancing (right) side ($p > 0.05$).

We found that in right-side clenching test subjects of the study group with left-side TMJ clicking were no statistically significant difference between EMG- activity of masseter and temporal muscles, indicating increased EMG-activity of muscles on the balancing side, that is the side with clinical symptoms in a joint.

DISCUSSION

The term "TMJ dysfunction" (or temporomandibular disorders (TMD) involves all disorders of the masticatory system. TMD is a collective term used for a number of clinical problems that involve the masticatory muscle complex, the temporomandibular joint (TMJ) and associated structures and remains an open challenge for modern dentistry [1, 2, 10]. According to Manfredini and a number of authors, TMJ dysfunction is a combined term that includes a group of conditions characterized by the damage to the TMJ structures or dysfunction of the masticatory muscles [7]. Approximately 33% of the population have at least 1 TMD symptom, and 3.6-7.0% of the population have TMD with sufficient severity to seek treatment [11, 12].

TMD is a polyetiologial disease that is associated with a close and complex relationship in the functioning of all components of the stomatognathic system. Publications present a number of classifications of temporomandibular disorders,

which are mostly based on the clinical manifestations of the characteristic symptoms of the disease. Research diagnostic criteria for temporomandibular disorders (RDC/TMD) are the most commonly applied criteria. The main signs and symptoms involve TMJ pain and clicking, myofascial or oral masticatory muscle pain, and abnormal jaw movement. TMD constitute a major public health problem, as they are a main source of chronic oral facial pain, interfering with daily activities. These disorders are also commonly associated with other symptoms affecting the head and neck region, including headache, ear-related symptoms, cervical spine dysfunction, and altered head and cervical posture [7, 13].

To establish the EMG characteristics of muscles in TMD, we conducted a study involving 22 subjects with clinical manifestations of musculoskeletal TMD without malocclusion. All subjects underwent clinical examination, CBCT of facial region and surface EMG of the masticatory muscles. Based on the study, we identified certain features of muscle activity in TMD cases.

It has been found that increased EMG-activity of masticatory muscles, asymmetric muscles work on the right and left sides was the main characteristic feature of muscle work in subjects with TMD. It should also be noted that in subjects with reciprocal clicking in one of the joints there was a much higher EMG-activity of the temporalis muscle over the masseter muscle on the side of the TMJ clicking. Many studies indicate a violation of muscle function in the cases of clinical symptoms of TMD, but the study of EMG-activity of masticatory muscle in such tests is not mentioned in available sources.

CONCLUSIONS

Electromyography is origin, objective, minimally invasive highly informative method of functional diagnostics of muscles, in particular, of the orofacial region, and registration of biopotentials of muscle fibers and activity of their motor units. Normal activity of the masticatory muscles is characterized by symmetrical and EMG-activity of the masticatory muscles on the left and right sides. Characteristic features of muscle activity in subjects with TMD are high values of EMG-activity of the masticatory muscles, disproportional and asymmetric muscle work of the masticatory muscles on the right and left sides.

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Evaluation of the Effectiveness of Laser Therapy in Complex Treatment of Periodontal Diseases

Ocena skuteczności laseroterapii w kompleksowym leczeniu chorób przyzębia

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SUMMARY

Aim: The object of the study is to increase the efficiency of treatment in patients with generalized periodontitis by using a laser in complex treatment.

Materials and Methods: Eighty patients underwent for instrumental and X-ray examination of the oral cavity, bacteriological studies of the microbiota of periodontal pockets, clinical analysis of peripheral blood that was taken from the ulnar vein and capillary blood that taken from the gums, as a local treatment carried lesion treatment portion of diode laser.

Results: It was determined that opportunistic microflora, dominating before treatment in the contents of periodontal pockets, was not isolated in all patients, but on the 10th day of treatment, the microflora of periodontal pockets had stabilized. Both in the main group and in the comparison group, among neutrophils and monocytes, the populations of phagocytes with a low digesting ability prevailed, however, the proportions of medium- and highly active phagocytes after laser treatment were higher than after treatment with standard conservative therapy.

Conclusions: The use of a laser for the therapeutic stage of the complex treatment of patients with generalized periodontitis of the I-II degree, chronic course contributes to the acceleration of reparative processes, a decrease in the degree of destruction in bone tissue, a decrease in the intensity of pain syndrome, a decrease in collateral edema, has an antibacterial effect and a longer stabilization of the periodontal condition.

Key words: generalized periodontitis, laser, periodontal indices, phagocytes, microflora, periodontal pockets, treatment

Słowa kluczowe: uogólnione zapalenie przyzębia, laser, wskaźniki chorób przyzębia, fagocyty, mikroflora, kieszonki przyzębne, leczenie

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INTRODUCTION

The relevance of studying the issues of diagnosis and treatment of inflammatory and destructive periodontal diseases is explained by the high prevalence of such pathology – more than 85% [1, 2]. Generalized periodontitis, today, is one of the main causes of tooth loss, including young patients [3]. In addition, with periodontitis, the focus of chronic infection located in the periodontal pockets contributes to the general sensitization of the body, which leads to unsatisfactory health and exacerbation of chronic diseases [4, 5]. The given data indicate that inflammatory-destructive periodontal diseases are not only a general medical problem, but also a socio-economic problem that dictates the search for new methods of treatment of this pathology [6].

The modern concept of treatment of generalized periodontitis provides a complex of therapeutic, orthopedic,

surgical and orthodontic measures, the effectiveness of which, as knowns, is not always ultimate. Local treatment usually much considerable and brings scientific interest, that allows to eliminate foci of inflammation, lead to long-term stabilization of the periodontal tissues and, if necessary, create favorable conditions for preoperative preparation [7].

It is known that generalized periodontitis is characterized by dysbiotic disorders, where there are immunosuppression and inflammatory reaction [8, 9]. Thus, an effective medicinal effect in periodontitis should be directed both to the microbiota of the oral cavity and to the correction of immunological changes and dysergic inflammation [10, 11].

AIM

The object of the study is to increase the efficiency of treatment in patients with generalized periodontitis by using a laser in complex treatment.

MATERIALS AND METHODS

An open and randomized study was conducted of 80 patients (women - 49, men - 31) aged 35-44 years (according to the WHO classification - young age) with a diagnosis of generalized periodontitis, I-II degree, chronic course, who applied to the Dental Medical Center of the National Medical University named after O.O. Bogomolets at the Department of Therapeutic Dentistry.

During the examination and instrumental research, the intensity of dental caries was determined using the DMFt index, the hygienic state of the oral cavity - OHI-S, the PMA gingivitis index, the degree of gingival bleeding - PBI, the degree of the inflammatory-destructive process - PI. Further, an X-ray examination was carried out.

All patients were divided into two groups: the main group (40 people) and the comparison group (40 people).

In order to assess local nonspecific resistance in patients, peripheral blood was taken from the ulnar vein and capillary blood from the gums.

Bacteriological studies of the microbiota of periodontal pockets: to obtain isolated colonies of microorganisms, subculture from thioglycolic medium to solid nutrient media was carried out by using the method of sector inoculations according to Gould. Facultative anaerobic microorganisms were cultivated on nutrient media: 5% blood agar, yolk-salt agar, Endo medium. To isolate the fungi was used a Sabouraud's medium surrounding. Isolation and cultivation of anaerobic and microaerophilic bacteria was carried out on 5% blood agar using a GasPak EZ gas generating container system (GasPak 100, Becton Dickinson, USA).

Considering the complexity of isolation and identification of anaerobic microorganisms, as the main etiological agents of the development of chronic generalized periodontitis, were used the methods of "express diagnostics". The contents of the periodontal pockets were used to prepare preparations in Gram stain and native preparations "crushed drop" (dark-field microscopy). The isolated microorganisms were indicated by morphological, tinctorial, and cultural conditions, taking into account pathogenicity factors.

Investigation of the number and functional activity of neutrophils and monocytes in blood taken from the gums - is clinical analysis of peripheral blood taken from the ulnar vein and capillary blood that taken from the gums, as well as determination of the digesting ability and absorption activity of neutrophils and monocytes in the blood of the gums. Blood from the gums, in an amount of 0.5 ml, was taken with a syringe with a blunt cannula after professional hygiene, treatment of the oral cavity with distilled water, drying with sterile gauze napkins and isolation from saliva. Blood sampling was carried out in tubes with heparin. To formulate the reaction of spontaneous and stimulated HCT - tests, as well as phagocytosis with latex, only 0.06 ml of blood was used, the rest was transported to the clinical diagnostic laboratory within an hour.

After the examination, all patients received an individual plan of complex treatment in accordance with the protocol for the management of patients with periodontal diseases.

Local treatment consisted of professional oral hygiene, correction of overhanging edges of fillings, contact points, replacement of restoration, and filling of carious cavities. All patients with orthopedic structures in the oral cavity were referred to a dentist orthopedist to assess the consistency of the structures.

According to indications was recommended the following treatments: orthopedic, surgical, orthodontic treatments. The initial stage of local treatment is professional oral hygiene, which includes, first of all, motivation and training in individual oral hygiene with a demonstration of the technique of brushing teeth, and also the use of interdental agents on models with subsequent control. Much attention has been focused on creation trusting relationship with patient. To remove supra- and subgingival dental deposits, were used a Piezon Master 600™ ultrasound apparatus (EMS, Switzerland), curettes Gracie (Hu - Friedy, USA) performed closed curettage of periodontal pockets with an antiseptic - 0.2% aqueous solution of chlorhexidine bigluconate. Further, were removed the overhanging edges of the fillings, the surfaces of the teeth were polished. Personal hygiene products were recommended. Patients of the main group, as a local treatment had treatment of the affected area with a diode laser 0.400 mm/980 nm for 60 sec at 0.7 W with a continuous wave.

Obtained data were analyzed by using Statistical Package for Social Sciences software for Windows, version 18.0 (SPSS Inc., Chicago, USA). The test for the normality of the distribution of the selected groups was carried out with the definition of the Kolmogorov- Smirnov criterion. Descriptive statistics included the calculation of the arithmetic mean (M), standard deviation (SD), standard error (m), minimum, maximum, mode, median. The indicator of the significance of differences between the compared data was determined using the Student's t-test. The results of the statistical analysis were considered significant if the error probability was not more than 5% ($p < 0.05$).

RESULTS

Analysis results of clinical indicators showed that both groups had reduction or absence of bleeding gums when brushing teeth, hyperemia, pain and discomfort in the gums, as well as the disappearance of bad breath on the 3rd - 4th day from the start of treatment. The values of the simplified hygiene index OHI-S in patients of the main group and the comparison group in the control periods of observation after the treatment had a tendency to positive dynamics, which is manifested in a decrease in the index values after 10 days (Table 1).

Parameters of the PMA index in all patients in the control periods of observation after the treatment also significantly decreased in comparison with the initial data before treatment by two times (Table 2). In the main group, at the control periods of observation, the results did not statistically differ from the comparison group (after treatment, $p = 0.159$; after 10 days, $p = 0.127$).

10 days after treatment, there was a significant decrease in the values of the Russell's Periodontal Index in patients of

Table 1. Dynamics of the OHI-S hygiene index ($M \pm SD$) in patients with generalized periodontitis, grade I-II, chronic course in the control periods of observation before and after treatment

Study groups	Before treatment	After treatment	P_1^*	After 10 days	P_2^*
Main group	2,5±0,05	0,91±0,03	<0,001	0,92±0,04	<0,001
Comparison group	2,44±0,05	0,92±0,04	<0,001	0,93±0,05	<0,001

Note: * - the significance of differences corresponding to the two-tailed Student's test for dependent paired samples with a critical value of 0.05: p_1 - between indicators before and after treatment and, p_2 - between indicators before treatment and after 10 days.

Table 2. Dynamics of the PMA index ($M \pm SD$) in patients of the main group and the comparison group at different periods of observation

Study groups	Before treatment	After treatment	P_1^*	After 10 days	P_2^*
Main group	51,62±0,64	24,82±0,47	<0,001	24,7±0,48	<0,001
Comparison group	50,57±0,88	25,77±0,47	<0,001	25,8±0,52	<0,001

Note: * - the significance of differences corresponding to the two-tailed Student's test for dependent paired samples with a critical value of 0.05: p_1 - between indicators before treatment and after 10 days, p_2 - between indicators before treatment and after 3 months.

Table 3. Dynamics of the Russell's periodontal index ($M \pm SD$) in patients of the main group and the comparison group at different periods of observation

Study groups	Before treatment	After treatment	P_1^*	After 10 days	P_2^*
Main group	3,79±0,08	1,48±0,05	<0,001	1,49±0,04	<0,001
Comparison group	3,82±0,08	1,56±0,05	<0,001	1,59±0,05	<0,001

Note: * - the significance of differences corresponding to the two-tailed Student's test for dependent paired samples with a critical value of 0.05: p_1 - between indicators before and after treatment, p_2 - between indicators before treatment and after 10 days.

Table 4. Dynamics of the PBI index ($M \pm SD$) in patients of the main group and the comparison group at different periods of observation

Study groups	Before treatment	After treatment	P_1^*	After 10 days	P_2^*
Main group	1,95±0,06	0,98±0,08	<0,001	1,0±0,08	<0,001
Comparison group	1,99±0,07	1,04±0,08	<0,001	1,07±0,08	<0,001

Note: * - the significance of differences corresponding to the two-tailed Student's test for dependent paired samples with a critical value of 0.05: p_1 - between indicators before and after treatment, p_2 - between indicators before treatment and after 10 days.

Table 5. Dynamics of isolation of microorganisms from the contents of periodontal pockets of patients with generalized periodontitis, I-II degree, chronic course using laser therapy (abs /%).

Genus of microorganisms	Before treatment		5th day of treatment		7th day of treatment		10 day of treatment	
	abs	%	abs	%	abs	%	abs	%
1. <i>Streptococcus spp. β hemolysis and without hemolysis</i>	10	100	10	100	10	100	10	100
2. <i>Lactobacillus spp.</i>	3	30	3	30	3	30	3	30
3. <i>Propionibacterium spp.</i>	--	--	1	10	2	20	2	20
4. <i>Peptostreptococcus spp.</i>	4	40	1	10	1	10	-	-
5. <i>Enterococcus spp.</i>	3	30	2	20	1	10	-	-
6. <i>Gram-negative bacteria</i>	3	30	2	20	1	10	-	-
7. <i>Micrococcus spp.</i>	2	20	1	10	1	10	-	-
8. <i>Actinomyces spp.</i>	3	30	1	10	-	-	-	-
9. <i>Neisseria spp.</i>	2	20	1	10	-	-	-	-
10. <i>Leptotrichia spp.</i>	2	20	1	10	-	-	-	-
11. <i>Corynebacterium spp.</i>	1	10	1	10	-	-	-	-
12. <i>Staphylococcus spp.</i>	1	10	1	10	-	-	-	-
13. <i>Spirillum spp.</i>	1	10	-	-	-	-	-	-

Table 6. Absorption activity of phagocytes in blood taken from the gums in patients with generalized periodontitis, I-II degree, chronic course before and after treatment

	Before treatment		After treatment			
	Neutrophils	Monocytes	Neutrophils		Monocytes	
			Main group	Comparison group	Main group	Comparison group
The number of phagocytic cells, ·10 ⁹ /l	7,37±2,35	0,57±0,25	0,24 ±0,06*	0,26 ±0,06*	0,054 ±0,027*	0,058 ±0,029*
Number of latex particles per active cell	3,3±0,2	4,4±0,1	2,63±0,07*	2,19±0,05*	3,19±0,13*	3,00±0,11*

Note: * Indicators are marked that significantly differ from those before treatment.

Table 7. Digestion capacity of phagocytes in blood taken from the gums in patients with generalized periodontitis, I-II degree, chronic course before and after treatment

	Before treatment		After treatment			
	Neutrophils	Monocytes	Neutrophils		Monocytes	
			Main group	Comparison group	Main group	Comparison group
Number of HCT positive cells, ·10 ⁹ /l	6,45±2,06	0,50±0,22	0,012 ±0,003*	0,11 ±0,03*	0,012 ±0,06*	0,038 ±0,019*
Number of formazan granules per active cell	3,33±0,65	3,67±0,65	2,13±0,84	2,2±0,13*	1,75±0,85*	2,79±0,16*
The number of HCT positive cells with a stimulated test, ·10 ⁹ /l	6,76±2,15	0,51±0,23	0,037 ±0,00855*	0,13 ±0,03*	0,028 ±0,014*	0,044 ±0,022*
The number of formazan granules per active cell in a stimulated HCT test	3,66±0,17	4,54±0,20	2,6 ±0,28*	2,75 ±0,06*	2,27 ±0,20*	3,35 ±0,27*

Note: * Indicators are marked that significantly differ from those before treatment.

both groups by almost 2.5 times in comparison with the data before treatment (Table 3). In the main group, at the control periods of observation, the results did not statistically differ from the comparison group (after 10 days, $p = 0.285$).

The values of the PBI index in patients with generalized periodontitis, I-II degree, chronic course significantly decreased from the initial data obtained before treatment (Table 4). In the main group, at the control periods of observation, the results did not statistically differ from the comparison group (after treatment, $p = 0.613$; after 10 days, $p = 0.538$).

A decrease in pathological tooth mobility after treatment was clinically determined in both groups, as evidenced by the prevalence of the 1st degree of tooth mobility, while before the treatment, the 2nd degree prevailed.

The analysis of the obtained results of the index assessment in patients with generalized periodontitis, I-II degree, chronic course after treatment in the control periods of observation demonstrates a statistically significant decrease in all indices compared to the initial values before treatment.

Normalization of the physiological state of the biotope of periodontal pockets during treatment and 10 days after treatment with laser therapy in patients with generalized periodontitis manifested itself in the absence, and in some cases, and / or in a sharp decrease in microorganisms isolated before the start of treatment (Table 5).

Starting from the 5th day of laser application, it was revealed that opportunistic microbiota, which predominates in the contents of periodontal pockets before treatment, continued to be secreted not in all patients. On the 10th day of treatment, the microbiota of periodontal pockets stabilized, which was characterized by the dominance in the crops of monocultures represented by bacteria of the genus *Streptococcus* β hemolytic and non-hemolytic (100%) or binomial associations of bacteria of the genus *Lactobacillus* (30%) and *Propionibacterium* (20%) with *Streptococcus*.

After the treatment, compared with the initial level, the absorption activity of neutrophils and monocytes significantly decreased, as evidenced by a decrease in the number of phagocytic cells and a decrease in the phagocytic number (Table 6). At the same time, the number of phagocytic neutrophils and monocytes, as well as latex particles per active cell after treatment, did not statistically differ between the groups.

The digestive activity of neutrophils and monocytes, compared with the baseline values, significantly decreases in both groups after the treatment, as evidenced by the decrease in the number of formazan granules per active cell when a spontaneous and stimulated HCT test is performed. In both groups, the parameters of the HCT-test significantly increased, which indicated an increase in the reserve capacity of the cells (Table 7).

After the treatment, both in the main group and in the comparison group, among neutrophils and monocytes, populations of phagocytes with a low digesting ability prevailed, however, the proportions of medium and highly active phagocytes after laser treatment were higher than after treatment with standard conservative therapy.

DISCUSSION

In recent years, a large number of new technologies have been developed and introduced into practice, contributing to an increase in the effectiveness of treatment of periodontal tissue diseases, in particular, laser technologies [12-14]. It is well known that laser light has a wide range of therapeutic and prophylactic effects. In particular, it has a pronounced anti-inflammatory effect, normalizes microcirculation, lowers the permeability of vascular walls, stimulates tissue regeneration and increases the oxygen content in them, has an analgesic, bactericidal effect, stimulates the immune defense system, accelerates wound healing [15-18].

It was found that in patients with various pathologies of the soft tissues of the oral cavity after a using a diode laser with a wavelength of 970 nm, observed a clear reduction or absence of bleeding of the gums during brushing teeth, hyperemia, pain and discomfort in the gums, as well as the disappearance of bad breath - PMA index indicators have significantly decreased by half (24.7 ± 0.48).

The use of a laser promotes the stimulation of healing processes to a greater extent in comparison with the conventional method, reduces the intensity of postoperative pain and edema formation expressed collateral [19-21]. The use of laser contributes to the stabilization process in parodontite- decreases the mobility of the teeth, the degree of destruction of the alveolar bone, the severity of gingival recession, eliminates bleeding and swelling of the gums normal hemodynamics [22, 23].

E.R. Kusek et al (2012) published a study showing that a diode laser stimulates the immune defense system, reduces the pathogenicity of microflora, increases its sensitivity to antibiotics, and positively regulates the functions of cement plaque in vitro [12].

It is known that during inflammation, laser radiation causes general and local effects. The general effect is expressed in an increase in the content of nonspecific humoral defense factors (such as complement, interferon, lysozyme), general leukocyte reaction, an increase in the phagocytic activity of micro- and macrophage systems. Arises a desensitizing effect that activating immunocompetent system, specific cellular and humoral immune defense, that increasing overall protective adaptive reactions [7, 8, 11]. We found that the digestive activity of neutrophils and monocytes, compared with the baseline values, significantly decreases in both groups after the treatment, as evidenced by a decrease in the number of formazan granules per active cell when a spontaneous and stimulated HCT test is performed. In both groups, the indicators of the HCT test significantly increased.

CONCLUSIONS

1. The use of a laser for the therapeutic stage of complex treatment contributes to the acceleration of reparative

processes, a decrease in the intensity of pain syndrome, a decrease in collateral edema and long-term stabilization of the periodontal state in patients with generalized periodontitis of the I-II degree, chronic course.

2. The use of a laser leads to the elimination of bleeding, a decrease in the degree of tooth mobility, a decrease in recession, it helps to reduce the depth of periodontal pockets and improve oral hygiene to a greater extent than the traditional method.
3. The use of a laser helps to reduce the degree of destruction in bone tissue and leads to long-term stability of the process.
4. The use of a laser has also an antibacterial effect on representatives of periodontal pathogenic microflora, although it does not completely eliminate them.

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Informacja prasowa

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Fundamentals of Improvement of the Physical Qualities of Schoolchildren Via Outdoor Games

Podstawy poprawy wydolności fizycznej u dzieci w wieku szkolnym poprzez zabawy plenerowe

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SUMMARY

Aim: The objective of the research is the elaboration and the scientific justification of the methodology of the development of physical qualities of junior school children via the method of action-oriented games.

Materials and Methods: The methodology of the research is based on the usage of the theoretical, pedagogical, medical and biological methods, the method of monitoring of the steps and chronometry. The research was attended by the students of the 3rd and 4th year at Poltava general education school №22 of 1-3 degrees.

Results: The particularity of the elaborated method of the development of physical qualities is the application of physical exercises and action-oriented games in the course of physical education. The results of the experiment showed that the students from the experimental group had a significantly better level of physical qualities in the course of verification and experience slight fatigue in the course of action-oriented games. 79% out of 100% of the students of the experimental group experienced no difficulties in the course of execution of physical engagement during action-oriented games.

Conclusions: According to the analysis and summarization of the information from literature sources, it was discovered that physical qualities are the show of the motional capabilities of a child. Active motional activity leads to faster, but more importantly – to more harmonic maturing of morphological and functional systems of a student.

Key words: physical qualities, methods of development of physical qualities, moving games

Słowa kluczowe: wydolność fizyczna, metody poprawy wydolności fizycznej, zabawy ruchowe

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INTRODUCTION

The applicability of the research is defined by the fact that in the current conditions of anthropogenic development of society the issue of the formation, preservation and enforcement of the health of junior school children via the ways of the augmentation of the level of their motion activity, the development and enhancement of their physical qualities is the basis in the sphere of physical education. The most effective way to execute the physical education of the children of the junior type is the method of action-oriented games. The explanation is that the action-oriented games are the instrument of the complex enhancement of the physical qualities which are normally showed from the side of the students by motion capabilities and abilities, and

they, subsequently are defined by the sufficient level of their physical development. The formation of the physical qualities of students is enforced within the course of the development of motion abilities. Systematic application of motion games provides the extension of the motion capabilities, which are transformed into indispensable vital abilities and skills.

The formed motion skills and abilities provide the opportunity to economise physical energy and flawlessly execute physical exercises, which positively impacts the development of muscles, ligaments, joints and the skeletal system.

The analysis and systematisation of the scientific literature indicated that the issue of the formation of physical qualities of junior school students was explored by: V. Arefiev, 2020;

K. Bugaevsky, 2019; J. Sageie, 2000; V. Fotynyuk, G. Griban, 2019; V. Kondakov, E. Kopeikina, Usatov A., 2016.

However, the issue of the development of physical qualities of junior school children via the method of action-oriented games requires further elaboration. As it is clearly seen, the junior school age is the most favourable period for the application of action-oriented games in the course of education and formation of motion (physical) qualities of the children [1].

It's worth pointing that age particularities are deeply ingrained in the core of the formation of physical qualities of students. The development of a child takes place in combination with the changes in the organism which have numeral and qualitative indexes and depend on biological as well as on social causes. Each age group of children possess their own particularities of physical development [2].

The main instrument of the development of physical qualities of children is action-oriented games. The usage of action-oriented games in the course of physical education plays a significant role in the life of a child. They encourage the formation of physical qualities, activates the necessity for the action-oriented actions, provides active participation in public events of physical activity [3]. Predominantly, children have a positive attitude towards action-oriented games, which is explained by their need to achieve particular results. These prospects and deep awareness of the adults of the fact that the health of a child depends on their motion activity motivate children to overcome difficulties and be involved in regular classes of physical exercises and games.

The results of the pedagogical experiment showed the fact that action-oriented games as an instrument of physical education can be effectively used for the development of physical qualities of junior school children and also implement them in a pedagogical practice of pre-school institutions [1].

The previously stated conclusions confirm the applicability and advisability of the exploration of the issue of the development of physical qualities of junior school children via the method of action-oriented gaming, which is defined by the elaboration and the research new methodological approaches towards the issue of application of action-oriented games in physical education of students with the objective of the development of physical qualities as the basis of their physical readiness.

AIM

The objective of the research is the elaboration and the scientific justification of the methodology of the development of physical qualities of junior school children via the method of action-oriented games.

In order to get the main objective achieved, the following principal tasks are highlighted:

The analysis of the state of the research of the issue in psychological and pedagogical literature and of the physical education sphere.

The exploration of the development of physical qualities of junior school students and their physical level of preparation.

The elaboration of methods of development of physical qualities of junior school children, which are based on the usage of action-oriented games.

MATERIALS AND METHODS

The methodology of the research is based on the usage of the following methods: theoretical method (the analysis and summarization of scientific and methodological literature and internet references); pedagogical method (the observation, surveys, testing); medical and biological methods (anthropometry, pulsometry, functional approbation, content-analysis of medical cards, method of the estimation of physical health, methodology of the estimation of physical condition), the method of monitoring of the steps and chronometry. The research was attended by the students of the 3rd and 4th year at Poltava general education school №22 of 1-3 degrees.

RESULTS

Physical or motional qualities are to be explained as indications of motional capabilities of a child. Their development happens ceaselessly in the course of growth and development of a child, but not in a simultaneous way. Active motional activity causes more rapid, but more importantly – more harmonic maturing of morphological and functional systems the organism of the pupil.

The process of development of physical qualities of junior school students must be executed according to their morphological particularities, physical development and the level of the functionality of their organism. The method which is vital for this process is the differentiating method, which considers the age, health state, motion provision level and the particularities of the mental state of children from 6 to 10 years old.

Physical qualities of junior school children which can be developed are speed, dexterity, flexibility, endurance and vigour.

Speed is monitored according to the time of running of a pupil within short distances (approximately 10 m). The track for running must be straight with dense soil or asphalted surface, which is not shorter than 20 m. The inrun zone, marked by the line, must be at least 4-5 m with the analogical one behind the finish line. The time of the run is measured by the second meter from the start line to the finish line [4].

The ability of development is necessary for the formation and enhancement of the running process, various types of jumping, the participation in action-oriented games, and also the successful assimilation of competency for performing different kinds of sport exercises.

There is the differentiation of several types of speed, whose main types are: the quick reaction to the signal for the action or the alteration of the type of this action; the speed of individual motion; the ability to accelerate the pace of movements according to signals or in gaming conditions; the frequency of cycled movements (jogging, skishoeing, cycling) [5].

Dexterity is required for the execution of all movements, including the process of action-oriented and sports games. Dexterity reveals the ability of an individual to precisely visualise and execute the motion, considering its dimensional, temporary and powerful particularities. The speed and time of the execution of tasks related to rounded or turned running can be regarded as the level of dexterity of children from 6 to 9 years old [6].

The scientists differentiate two types of the development of dexterity: the augmentation of the dexterity level via the assimilation of various movements; the level of dexterity augments if the complicated motion is successfully executed, the combination of familiar movements is comprehensible, and the alteration of execution of the motion takes place [7].

Dexterity is recorded according to the time of the execution of a physical exercise. Considering the particularity of the development of junior school children, the following task may be suggested: the participant takes the patch, runs to the opposite side and places it in the appropriate place, returns for another one, redoes the actions and stops. The time consumed for the execution of this task may be used as an indication of the level of dexterity. Another type of task is also possible: running around eight small flags, which are situated on the upholders with a distance of 1 m between them. The distance to the first and after the last flag is 1.5 m. The general distance is 10 m.

Flexibility defines the degree of mobility of different sections of the skeletal system of a pupil. It depends on the form and the construction of joints, the elasticity of muscles and ligaments, on the functional state of the central nervous system and skeletal system. The mobility within the joints provides a particular impact on the functional activity of a child. It is also connected with the amplitude, the accuracy, and the swiftness of their movements. For this reason, the development of the flexibility of junior school children must be highly prioritised in the course of the process of their physical education [8].

The development of *endurance* is provided in the process of action-oriented games which involve the reproduction of the actions, as well as in several sport exercises. Their particularity is the ceaselessly changed activity concerning the intensity and the form of movements in the process.

Endurance can be estimated according to the time of the execution of walking or running on the distance of 300 m. One chooses the straight track with the length of 50 m the line of the start (or finish) and the line of turning are marked afterwards. A pupil covers the distance of 50 m interchanging the processes of walking and jogging – they walk from the line of the start to the turning line, run on their way back and reproduce these actions two more times [9].

Vigour is measured by carpal or conditional dynamometer via mutually acceptable methods. Every inspecting exercise must be executed by a child at least twice (with the intervals for a rest). The best result of two attempts is selected and recorded. Junior school children possess better-developed torso muscles, and more badly developed muscles of limbs. Exercises for the development of children must be mainly dynamic and all-inclusive combined with the enhancement of the ability to relax muscles after their engagement. For this very reason, the emphasis in the course of physical development classes must be focused on the development of the speed, which leads to the augmentation of the speed of the execution of simple movements and their frequency [10].

Narrowly-specified elaborated system of methods of development of physical qualities of junior school students can be presented as the system of physical education which

provides for the impact on different aspects of the motional activity of a child, including all-inclusive development of all motional qualities and precisely – the execution of the basic movements, generally developing exercises, participation in action-oriented games. For example long or high jumping at a run enhance speed, vigour, dexterity, whereas running in the course of various action-oriented games enhances the same qualities along with intensive endurance; hurling of the objects at the target improves vigour and dexterity, etc.

Pedagogical influence on the development of particular qualities is provided via the correct selection of physical exercises and methodology of their organization.

Thus, the task for students of 1-2 years of study to jump from a fixed position as far as possible causes their possession of the qualities of rapidity and vigour; meanwhile students of 3-4 years of study it may be suggested to land in a defined place (on blue, yellow or green ribbons, situated at 40, 60, 80 cm from the jump-off point). In this way, the emphasis is focused on the development of dexterity that is the ability to correlate the muscular efforts with the requirements of an educator.

The particularity of the elaborated methodology of the development of physical qualities is the application of physical exercises and action-oriented games in the course of physical education. In the course of application of an all-inclusive approach towards the development of physical qualities of junior school students, it is important to focus on the development of speed, dexterity, endurance, and flexibility, which are the qualities, which are the most actively developing in junior school children.

An action-oriented game is a consciously aware activity of children aimed for the achievement of intellectual gaming objectives. Besides, an action-oriented game is a dynamic motional activity of children [11].

The founder of the theory of physical education Teodora-Mihaela I., Veronica M., Laurentiu-Gabriel T. postulated that a game is an instrument, which is used by children to show their independence during the distribution of the roles and actions in the course of a game [12]. Various motional actions such as walking, running, jumping, and other types, which are parts of the games play a significant role in the gaming activity of a child. Particularly these types of games can be defined as action-oriented ones. They can be organised in any season. The groups from one to several players can participate in them. The gaming process can be held with or without adults.

An action-oriented game is defined as one of the basic instruments and methods of physical education and applied predominantly on the stage of drilling and enhancement of motional skills. Its values lie in the fact that action-oriented games provokes positive emotions, the sense of cheerfulness, activity, positively impacts the mental and physical development of preschoolers, as well as leads to the enrichment of the motional experience of students.

The objective of action-oriented games is the development of physical perfection in a way of development of physical qualities, strengthening of vital capabilities and formation of the personality of students.

Action-oriented games are one of the significant instruments of physical education for junior school children. They lead to the

formation and enhancement of vitally indispensable movements, physical development, strengthening of vital capabilities of a child, fostering of positive moral and volitional qualities.

There is the elaboration of the methodology of development of physical qualities of junior school children, which is based on the usage of action-oriented games.

For the optimization of the flexibility of children aged from 6 to 8, one uses exercises, which lead to the extension of muscles and ligaments of the skeletal system. They are executed with an extended amplitude and provide the maximal impact on the condition of its systematic execution within complexes of morning exercises, physical activity breaks and during physical education classes. The most rational ones are yielding (bending and aligning of a torso, half-crouching) and swinging movements (with superior and inferior limbs) in various initial positions.

In the course of the execution of these physical exercises, students must obtain the task for achievement: to touch the floor with a small flag or a ball, without bending legs in knees; to swing their leg in a way of touching the stretched out hand with their toe. These physical exercises augment the level of engagement of students, encouraging them to show their motional skills. Such elements of motional activity should also be included in action-oriented games.

The basic methodological condition, which must be obeyed in the course of work on the development of mobility of joints of students is the compulsory warm-up before the execution of action-oriented games.

Exercises for stretching must be executed in a combinatory manner in a particular succession: exercises for joints of superior limbs, torso and inferior limbs, exercises for relaxation must take place during the intervals.

A complex may consist of 8-10 exercises of passive or active manner. Pauses between the exercises for the development of flexibility even within the period of 2-3 weeks negatively impact the level of enhancement of flexibility.

The particularity of the methodology of development of speed is the emphasis of the course of physical education classes on the development of swiftness of execution of movements via the usage of the cycle of exercises:

Exercises for the development of swiftness at the beginning of the action-oriented game, which develops the ability of immediate reaction to signals (verbal or phonic one) – this physical quality is indispensable in multiple action-oriented or sports games (such as table tennis, basketball, etc), on the start line on jogging, swimming, and in the course of any contests;

Exercises, which train the maintenance of the high pace of motion, for example outracing a run with a partner, during the rolling of a ball or hula hoop.

The selection of games and exercises for the development of speed is defined via the basic didactic principles (correspondence of height and physical competence of a child, the gradual complication of tasks and their repetition).

The requirements for the organization of action-oriented games are:

1. The principles of the motion must be assimilated by a pupil at a slow pace. Thus, who clumsily catches a ball

and commits the chain of mistakes (presses the ball to his chest or widely stretches his arms) will be unable to catch it swiftly and immediately throw it back. The correction of the flaws about his technique of motion in the course of the swift execution of a task is impossible.

2. Duration of physical exercises for swiftness must not be long, in order to prevent the reduction of swiftness and the appearance of fatigue before the end of the exercise. The length of the targeted distance for running with a high pace must not exceed 10-30 m, the amount of the repetitions of jumps – 10-20 times, the duration of ceaseless intensive running in the course of games involving children aged 2-3 – 10 sec, aged 6-7 – up to 15-20 sec. The intervals for rest are obligatory;
3. Exercises for the development of speed must not bear the monotonous manner of execution. They must be repeated in different conditions, with different intensity, with complications or simplification of requirements and facilitation of tasks;
4. The appropriate state of the central nervous system is achieved only in the case of the absence of fatigue of the students because of their previous activity.

For the development of speed, as a physical quality, it is appropriate to engage exercises for swinging, circling, punching, hurling and pushing of light objects, and turning, which are executed with the most maximal possible frequency.

The experimental research hosted 42 students of the third year of study from general education school №22 of 1-3 degrees from Poltava. In the course of the execution of the experiment, the students were divided into experimental (20 students) and inspecting (22 students) groups. The students of the experimental group were studying according to the methodology of the development of physical qualities in the course of physical education classes, whereas the students of the inspecting group did it without the previously mentioned methodology. Experimental research indicated that the physical competence of junior school children was estimated according to the following criteria: running for 10 m with initial walking (sec), running for 30 m from the start (sec), shuttle run (sec), standing jump (cm), running jump (cm), the number of squats for 30 seconds.

For the estimation of the results of the experiment, the special estimating scale of physical competency was engaged. The results of the experiment showed that the students from the experimental group had a significantly better level of physical qualities in the course of verification and experience slight fatigue in the course of action-oriented games.

Of the 100% of students in the experimental group, 79% had no difficulty performing physical activity during moving games (Figure 1).

For estimation of results of testing there was the application of the estimation scale of physical competence.

22% of the students had high and 57% had a sufficient level of physical competence. As for the students from the inspecting group, 63% of them experienced difficulties executing physical engagement in the course of action-oriented games and showed all external signs of fatigue. 5% of students from

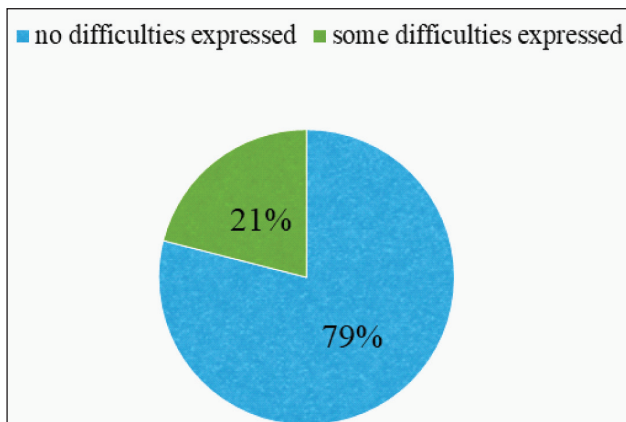


Figure 1. Students of the experimental group expressed no difficulties in the course of execution of physical engagement during action-oriented games

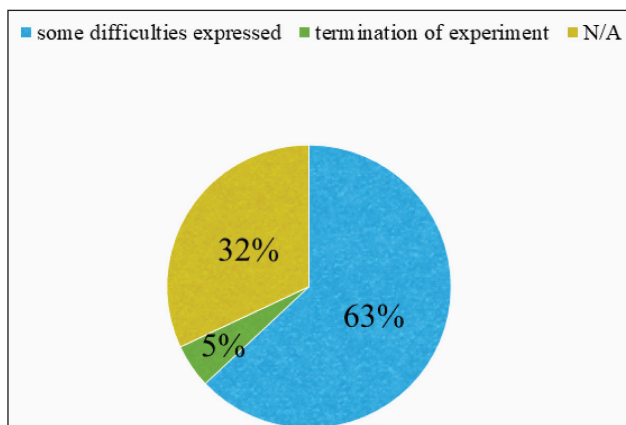


Figure 2. Results of the test of the inspecting group

the inspecting group refused to continue the participation in the classes and asked for a rest (Figure 2).

This data confirms the positive results of experimental research and proves the effectiveness of the elaborated methodology.

DISCUSSION

Method of the development of vigour of junior school children in the course of action-oriented games is focused on the balanced development of the entire muscular system, particularly one that is responsible for the formation of posture. For that, it is vital to strengthen muscles, maintaining the spine in the correct position. It greatly concerns the muscles of the neck, back and belly. Considering the physical capabilities of junior school children, action-oriented games for the development of vigour lead to a strengthening of all groups of muscles of the skeletal system of students; development of the ability of rational usage of force considering various conditions of activities.

Selecting exercises and games for the development of vigour, it is necessary to consider the fact that the methodology of development of physical qualities must be elaborated with the consideration of basic didactic principles: graduality, accessibility, and according to ageing and individual particularities of students.

Exercises for the development of physical abilities are divided into two groups: exercises with external resistance

and weight of hurled or pushed objects and exercises with the burdening by the weight of one's own body, such as crawling, climbing or jumping.

For the development of endurance volitional qualities, desire to show the maximal amount of abilities and persistence in overbearing the fatigue matter significantly. The basic method of development of endurance is the method of ceaseless exercises in the course of a game of great intensity and more active exercises with short pauses. Development of endurance in the course of action-oriented games adapts an organism of students for physical loading. Their speed of running naturally increases along with the augmentation of the level of endurance. In winter ski walking is recommended. In this case development of endurance is combined with the hardening effect of fresh air, increasing the recovering impact of the movements. For the development of a physical quality such as speed, it is possible to organize games, providing for motional actions, which rapidly change and are complicated with additional tasks, as well as games with covering of particular distance for the shortest time possible such as "gotcha game", "who is first, and also games involving the importance of motional coordination "hit the target", "make a manoeuvre", "gotcha game with a ball". The strength of particular muscles of arms and legs can be in the course of games, which involve of brief forceful engagement: "Who throws farther", "Who jumps farther". Endurance is developed in the course of games with intensive motional activity, but appropriate in a temporal aspect for age group such as "Catch up to your partner" or "Fishing rod" games.

CONCLUSIONS

According to the analysis and summarization of the information from literature sources, it was discovered that physical qualities are the show of the motional capabilities of a child. Their development happens ceaselessly, but not equally in the course of the growth and development of an organism. Active motional activity leads to faster, but more importantly – to more harmonic maturing of morphological and functional systems of a pupil. With the help of physical exercises and action-oriented games, it is possible to actively impact the process of development of physical qualities of students and manage their development. Applying an all-inclusive approach towards the formation of physical qualities of junior school children, it is necessary to focus on the development of swiftness, dexterity, endurance, and flexibility that are the qualities, which the most actively progress in junior school students. The concept of an action-oriented game is defined as one of the basic instruments and methods of physical education and is applied predominantly on the stage of assimilation and enhancement of motional skills.

The organised research does not deplete the number of aspects of such multi-sided issues as the development of physical qualities of students by educational institutions. The issue of elaboration of didactic conditions for effective development of not solely physical qualities of junior school children and their harmonic personal development preserves its applicability.

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Informacja prasowa

MAGNETOSTYMULACJA VIOFOR JPS W REHABILITACJI PACJENTÓW PO PRZEBYCIU COVID-19

Skuteczność i bezpieczeństwo metody magnetostymulacji Viofor JPS, zostało potwierdzone klinicznie, a korzystne efekty biologiczne mają bezpośredni wpływ na skuteczność rekonwalescencji i rehabilitacji po przejściu chorób infekcyjnych, w tym COVID-19.

Jest to terapia nieinwazyjna i szczególnie korzystna u osób z chorobami współistniejącymi (np. sercowo-naczyniowymi, po udarze mózgu, po przebytych zapaleniu płuc), obarczonych największym ryzykiem powikłań.

Udokumentowane na przestrzeni 20 lat działanie przeciwzapalne, przeciwbólowe, wzmacniające układ odpornościowy, poprawiające krążenie obwodowe i mikrokrążenie, regeneracyjne, relaksacyjne itd. mogą być skutecznym narzędziem dla lekarza, a pacjentowi umożliwić szybki powrót do zdrowia.

Magnetostymulacja Viofor JPS ma zastosowanie w leczeniu i rehabilitacji schorzeń infekcyjnych dróg oddechowych,

w tym COVID-19, w zakresie występujących powikłań takich jak: – niedobory odporności

- niewydolność układu oddechowego – bóle różnego pochodzenia, w tym bóle głowy, mięśni i stawów
- powikłania układu sercowo-naczyniowego – problemy ze snem, problemy z koncentracją, objawy depresji oraz tzw. „mgły mózgowej” po przejściu COVID-19 – dysfunkcji układu nerwowego – udar mózgu, uszkodzenia nerwów skutkujące neuropatią – bólem neuropatycznym lub neuralgię

(www.medandlife.com)

Results of Anti-Recurrent Measures in the Active Course of Chronic Parenchymatic Parotitis in Children

Metody zapobiegania nawrotom w trakcie zaostrzenia przewlekłego śródmiąższowego zapalenia przyusznic u dzieci

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SUMMARY

Aim: To establish the effectiveness of anti-relapse measures in the active phase of chronic parenchymal mumps in children in time of remission.

Materials and Methods: The material for writing this work was the results of a survey in remission for 5 years of 38 children with active chronic parenchymal mumps. General clinical, special and additional research methods were used to establish the effectiveness of anti-relapse measures.

Results: According to the generalization of scientific information, it was found that for dynamic monitoring of the course of mumps are quite informative ultrasound diagnosis and sialography, cytological and microbiological study of parotid liquid. Preventive measures, which were carried out twice a year, allowed for a five-year period in 24% of children to achieve recovery, in 76% to improve the condition, and the number of exacerbations decreased by 14 times compared to the first year of observation.

Conclusions: To monitor the effectiveness of anti-relapse measures in the active course of chronic parenchymal mumps in remission, it is necessary to study the qualitative properties of the secretion of glands, its cellular composition and the nature of the microbial composition. Quite valuable information is ultrasound diagnostic and sialography, which together allows to establish the severity of violations of their anatomical structures, the quality of specialized care and timely measures to prevent exacerbations, which has a positive effect on the functional activity of the parotid salivary glands.

Key words: children, chronic mumps, anti-relapse measures

Słowa kluczowe: dzieci, przewlekła świnka, metody zapobiegania nawrotom

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INTRODUCTION

Despite the significant scientific achievements of domestic and foreign authors, which are covered in periodical scientific literature, the number of different nosological forms of sialadenitis is constantly growing. Active long-term study of its etiology, the establishment of leading chains of pathogenesis, the use of modern diagnostic technologies and modern pharmacological drugs do not always allow to effectively influence on its clinical course and some consequences. This is due to the complex anatomical structure of the large salivary glands and their multifaceted functional activity, as well as its variable structure and specific reactions to external and internal irritants [1-4].

At the same time, chronic parenchymal mumps occupies a prominent place among all chronic forms of sialadenitis. It

is not possible to establish the cause of its occurrence despite the existence of a significant number of evidentiary views, theories and concepts regarding its origin, because quite often in-depth examination of children with special methods of examination reveals signs of latent chronic inflammation in the parotid salivary gland [5-7].

Currently, the prevailing opinion is that all changes in it can be realized only under conditions of reduction of its functional activity. Reducing the normal level of salivation leads to disruption of the digestive process, as well as deterioration of self-cleaning of the oral cavity, which, in turn, leads to the formation of a favorable situation for the impact of hard tissues of the tooth, periodontium and mucous membranes. The amount of oral fluid varies in a fairly wide range and largely

depends on age, seasonality, the presence of concomitant somatic diseases, the nature of the regulatory effects of the central and autonomic nervous system, which also occurs in the presence of chronic pathological process in the parotid salivary glands [8-10].

Due to the peculiarity of the etiology and pathogenesis of chronic parenchymal perotitis, its treatment is quite long, practically have a significant difficulty and mainly depends on the form, stage, phase of the disease. Great importance is attached to local drug treatment, but, unfortunately, anti-relapse measures in relation to such patients do not receive adequate attention from doctors, which negatively affects the frequency of exacerbations and contributes to the progression of morphological disorders directly in the glandular tissues [11-13]. This scientific work is devoted to the partial solution of this question.

AIM

To establish the effectiveness of anti-relapse measures in the active phase of chronic parenchymal mumps in children in time of remission.

MATERIALS AND METHODS

In scientific development were involved of 38 children aged between of 2 to 16 years with active chronic parenchymal mumps in remission. In this group of patients the frequency of exacerbations ranged from 3 to 11 times a year, and was accompanied by deterioration of the general condition, fever from 37.5°C to 38.0°C, significant swelling of soft tissues in the anatomical projection of the parotid gland, a decrease in the volume and by changing the qualitative properties of the secret.

At the initial examination after the abatement of acute inflammation to establish the severity of anatomical changes in the structural elements of the salivary glands were performed its ultrasound examination and sialography with contrast of the inflow system and acinuses with 76% solution of triombrast according to classical methods. X-ray examination was performed on both dental and stationary devices in direct and lateral projections.

In order to study the cellular composition of the secretion, it was collected, smears were made with subsequent staining according to Romanovsky-Gimse. Qualitative and quantitative parameters of cytograms were studied in 10 fields of view with the conversion of the number of cellular elements per 1 field of view [8].

To establish the species composition of microorganisms in the parotid secretion used the order of the Ministry of Health of Ukraine for №236 from 04.04.2012, taking into account the recommendations of the European Association of Clinical Microbiology and Infectious Diseases. Visually and palpably determined the condition of the parotid glands, the mouth of the excretory ducts, the volume and nature of the secretion. All types of research were conducted before and after treatment and prevention measures and on the basis of comparison determined their effectiveness and made a forecast for the future for each patient.

RESULTS

The clinical characteristics of the remission period are presented on the basis of generalization of anamnestic data and examination of patients a month after the elimination of exacerbation of the disease, before each treatment and prevention measures.

At this time, out of 38 patients, 30 (79%) had no complaints. On visual inspection, the parotid glands were within the anatomical location, palpably soft, painless. In 8 children (21%) who had complaints of recurrent pain in the parotid and masticatory area, there was a weak swelling and single foci of compacted glandular tissue were identified. The mucous membrane of the oral cavity in all had a pale pink color and was well moisturized. The reaction of regional lymph nodes was detected in 16 children (42%).

On examination of the oral cavity, a slight swelling of the mucosa around the orifice of the excretory duct of the affected gland was noticeable in 19 people (50%), and in 12 of them it gaped and a hyperemic border of the mucosa was observed around it. When massaging the glands, only in 7 patients (18%) from the main duct were secreted a sufficient amount of clear secretion with single, small whitish inclusions, and in the other 31 - (82%) it was of high viscosity and contained a significant number of flakes. inclusions

Diagnostic ultrasound examination, which was performed on 29 children (74%) in all cases found a seal of the parotid gland, and the parenchyma had a heterogeneous structure due to the presence of sialectases of different sizes, shapes and quantities. In addition, hypoechoic inclusions alternated with echo-compacted areas (Figure1).

The study of the cellular composition of the mumps fluid in 31 patients (82%) found that the cercket had a significant number of inclusions against the background of a protein substrate of moderate density - accumulations of leukocytes both with the kept form, and destroyed, lymphocytes, macrophages, coccal microorganisms were defined (Figure 2).

In the cytograms of 7 children who had small and single inclusions in the secretion, on the background of limited areas

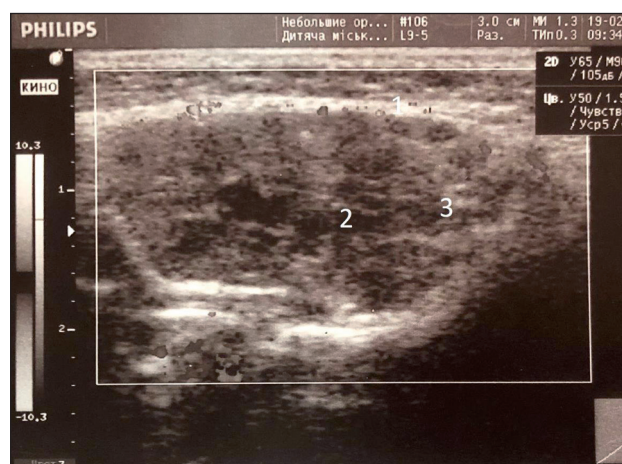


Figure 1. Ultrasound image of the left parotid gland. The echo-compacted capsule (1) is defined, in parenchyma existence of moderate quantity of sialectases of various form in the sizes from 3 to 4 mm (2) is traced, among them single hyperechogenic sites (3)

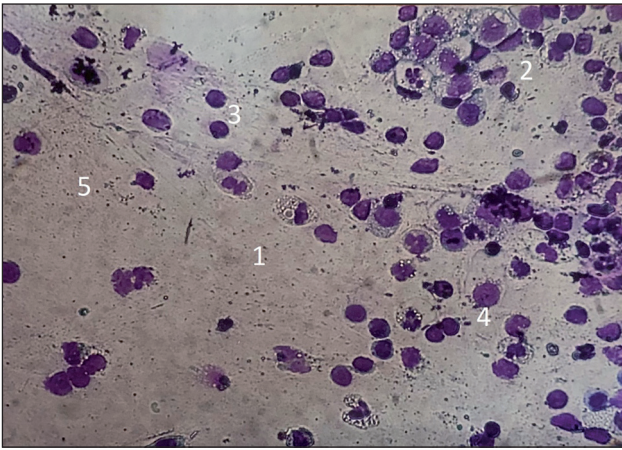


Figure 2. Micrograph of a smear of mumps secret. Against the background of a protein substrate of moderate density (1) is determined by the accumulation of leukocytes (1), lymphocytes (2), macrophages (3) and coccal microorganisms (4)

of protein substrate, the presence of only single neutrophilic leukocytes and lymphocytes.

Bacteriological study of mumps secretion, which was conducted in 21 patients (55%) allowed to establish the presence of coccal microflora in all, and it was represented by a monoculture: in 15 patients (71%) hemolytic and non-hemolytic streptococci and in 6 patients (29%) coagulonegative staphylococci. Hemolytic streptococci (11 observations 73%) had hemolytic and fibrinolytic activity. Non-hemolytic streptococci and coagulonegative staphylococci had no pathogenic factors. It was found that during this period of the disease microorganisms were determined in concentration of $5 \cdot 10^6$ - $5 \cdot 10^5$.

Given the fact that in 14 patients (37%) during the first year there were 7-11 exacerbations of the disease, they underwent sialography to specify the severity of structural changes in the duct system and gland parenchyma. The sialograms of 8 patients revealed the presence of diffuse and separate sialectases, which were combined with uneven expansion of the main duct of the parotid gland (Figure 3).

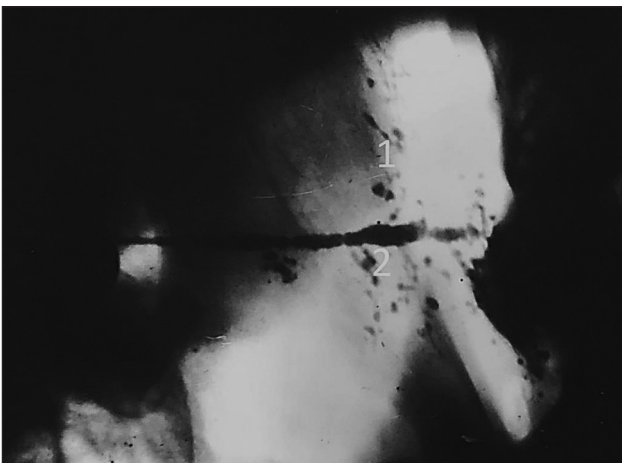


Figure 3. Sialogram of the right parotid gland in lateral projection. The uneven distribution in a parenchyma of a gland of sialectases in the size from 1 to 2 mm (1) and insignificant expansion of the main output channel (2) is defined

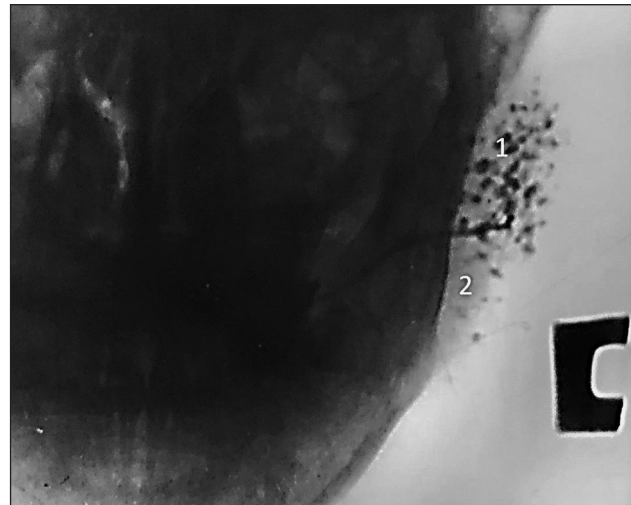


Figure 4. Sialogram of the right parotid gland in direct projection. In the upper pole of the parotid gland is determined by the accumulation of sialectases, ranging in size from 1 to 3 mm (1), and in the lower lobe they are single (2)

Sialography, which was performed on 3 children revealed a significant number of evenly accumulated sialectases of different sizes in the parenchyma of the whole gland, or in its single lobes (Figure 4).

X-ray examination of parotid glands with artificial contrast, which was also performed in 3 patients with clinical manifestations of unilateral lesions, revealed that they had the presence of sialectases in symmetrical glands, but their number and location were individual (Figure 5). It should be noted that more frequent and active exacerbation of the disease occurred with a significant number of them.

Taking into account our personal long-term experience and data given in scientific periodicals and dedicated to measures aimed at preventing exacerbation of chronic parenchymal mumps, we have chosen the best option for the scope of treatment and prevention measures aimed at creating conditions that reduce the number of exacerbations and prolong the remission period. [6, 11, 12]:

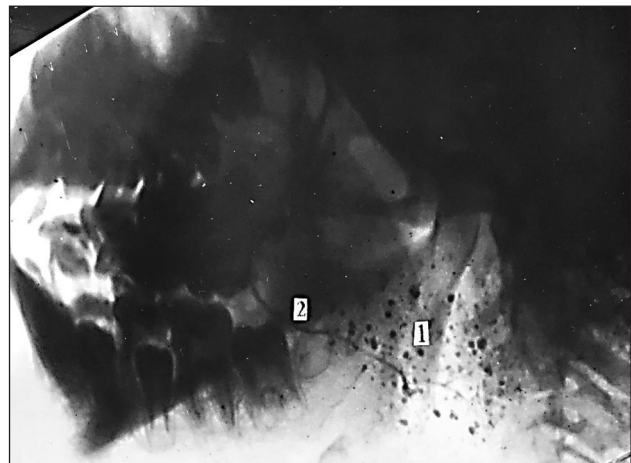


Figure 5. Sialogram of the left parotid gland without clinical manifestations of chronic inflammation in lateral projection. A moderate number of sialectases with a size of 1 to 2 mm, located throughout the parenchyma (1), the main excretory duct has a bend (2)

- At each of 4 visits per month, three instillations of 1% lysozyme solution into the ductal system of the glands were performed with an interval of 5 minutes and their subsequent massage to dilute the secretion, improve its rheological properties and increase the level of immunological potential.
- After this procedure, the introduction of sea buckthorn oil once a week, only 4 times a month, to create favorable conditions for the regeneration of the epithelial lining of the structural components of the gland and improve their functional activity.
- Electrophoresis with 3% KJ solution according to the standard method №15 to prevent the progression of dystrophic changes in the gland and hyperplastic processes in the intraglandular lymph nodes.
- Conducted sanitary and educational work with children and their relatives, provided the necessary recommendations for the care of the oral cavity and involved, if necessary, specialists of related profiles.

After the initial treatment and prevention course, all children had no complaints. On palpation, the glands were within their anatomical location, were soft in 35 people (92%) and 3 people (8%) identified limited single tuberous areas in separate lobes of the gland. The oral mucosa is sufficiently moist, of normal color in all subjects, including around the orifice of the excretory ducts, which gaped only in 4 of 12 cases, and single flaky inclusions in the mumps were found in only 6 patients out of 31 who had these manifestations before carrying out a complex of procedures.

When studying the cellular composition of cytograms of mumps secretion at this time of observation found a significant decrease in the formed elements of the blood of the inflammatory series and in all smears were seen in small numbers separately located neutrophils, lymphocytes, macrophages and coccal microorganisms on a background of loose protein substrate (Figure 6).

Microbiological examination of secretion in 21 patients who underwent this at the beginning of preventive measures, only in 4 observations were sown with non-hemolytic streptococcus and in 2 cases – coagulonegative strains of staphylococcus.

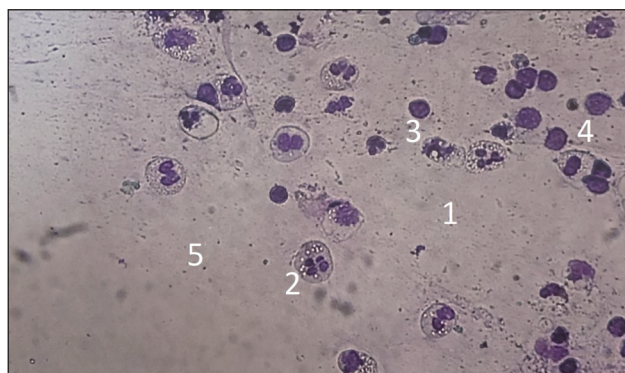


Figure 6. Micrograph of a smear of mumps secret at the end of the anti-relapse course. Against the background of a loose protein substrate (1) are determined in small numbers scattered neutrophils (2), lymphocytes (3), macrophages (4), single cocci (5)

In all cases, their quantitative parameters did not exceed the level of $5 \cdot 10^5$.

These measures were performed twice a year – in spring and autumn, and the assessment of their effectiveness was determined because of generalization of the results of anamnestic data, clinical manifestations, study of the cellular composition of mumps and its microbiota. To control the nature of the disease in atypical cases, additional ultrasound and sialography were performed repeatedly and upon completion of preventive measures.

It should be noted that during the first year of patient care the number of exacerbations decreased by 8 times, and during the 5-year period by 14 times. Due to the positive clinical dynamics under conditions of normalization of the functional activity of the parotid salivary glands 9 children (24%) were deregistered during this time due to the recovery, and significant improvement was observed in 29 children (76%).

DISCUSSION

In acute forms of sialadenitis of viral and bacterial origin there is almost no doubt about the list of diagnostic tests that allow you to determine the scope of treatment, the choice of pharmacological drugs, and, accordingly, to complete their treatment within the term of 7-10 days. In the presence of chronic inflammation in the parotid glands, it is necessary to conduct a comprehensive differential diagnosis with the involvement of modern technologies [4, 6, 7]. If in clinical practice the treatment measures used in the exacerbation of the chronic process in the gland are presented in periodicals thoroughly and carefully [11-13], then regarding the implementation of rehabilitation measures, a significant number of issues remain unresolved. Therefore, children with chronic parenchymal mumps, which often recur, especially in the active course, in the duct system and acinar apparatus there are pronounced functional and morphological disorders [4, 6]. This requires a clear tactical approach to the formation of an algorithm for accompanying these patients in remission, which would significantly improve their quality of life. Due to the comprehensive solution of urgent needs to provide appropriate specialized care for these children and the long-term positive results, we strongly recommend more widespread use of the presented developments directly in outpatient settings and consider this approach quite promising.

CONCLUSIONS

The use of pathogenetically directed anti-relapse measures in children with active chronic parenchymal mumps during remission twice a year can achieve a prolongation of remission and a reduction in the number of exacerbations during the first year by 8 times and in five years term by 14 times. The study of the cellular composition of mumps and its microbial composition as diagnostic and prognostic tests allows to determine with a high degree of probability the possibility of manifestations of the disease and the prospect of remission. Involvement of ultrasound diagnostics and sialography for dynamic monitoring of the course of chronic inflammation in

the parotid glands at all stages of observation allows to obtain a high quality image of the duct system and parenchyma. These non-invasive research methods provide comprehensive information that contributes to the rational planning of the scope of conservative therapy and, accordingly, to improve the quality of specialized medical care, which allows to prolong the remission of the disease.

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A – Research concept and design, B – Collection and/or assembly of data, C – Data analysis and interpretation, D – Writing the article, E – Critical revision of the article, F – Final approval of article

Bruxism as a Marker of Violation of Psychological Adaptation in Computer Game Players

Bruksizm jako marker zaburzenia adaptacji psychologicznej u graczy komputerowych

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SUMMARY

Aim: To study the relationship between the psycho-emotional state of computer game players with the development of bruxism, its early diagnosis in people at risk, increasing the effectiveness of preventive measures in people with this pathology.

Materials and methods: At the first stage of the study, a survey of 120 people (85 - men, 35 - women) aged 18 - 30 years was conducted. The computer club was chosen as the place of the poll. The questionnaire is represented by questions that were aimed at identifying clinical manifestations of bruxism. Also, the subjects were asked to take an automated FPI test to assess the psycho-emotional state. In the second stage of the study, according to the results, the main group of patients with bruxism was identified. It consisted of 68 people aged 18-30 years (50 - men, 18 - women). The control group of people consisted of 20 volunteers (10 - women, 10 - men), who did not show clinical manifestations of bruxism and temporomandibular joint dysfunction and who do not play computer games.

Results: According to a survey of 120 people aged 19-29, who often play computer games, it was found that 48.33% had bruxism. In 96.55% of the analysis of the FPI test revealed signs of mental distress. In the control group, the results of FPI in most indicators were average.

Conclusions: The prevalence of bruxism among young people who play computer games was 48.33%, which is associated with psycho-emotional distress of this category of people: increased neuroticism, sudden aggression, depression, irritability and emotional lability. Diagnosis by questionnaire allows to detect manifestations of the disease in the early stages of development.

Key words: bruxism, masticatory muscles, computer games, addiction

Słowa kluczowe: bruksizm, mięśnie żwacze, gry komputerowe, uzależnienie

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INTRODUCTION

The word bruxism is translated from the ancient Greek language as „gnashing of teeth”. The more common nocturnal form of the disease, when gnashing occurs during sleep, but there is also a daytime form of the disease [1]. As a rule, a person may not even guess for a long time that he will gnash his teeth at night until his family members tell him about it. The diurnal form of the disease is often noticed by the patient himself.

Any form of bruxism has a negative effect not only on tooth enamel, but also on the work of the jaw joints.

According to statistics, about 10% of the population complain of gnashing of teeth during sleep. However, the final cause of the disease has not been established. It is believed that the main cause of bruxism is nervous tension and frequent stressful situations [2-4]. However, there is no consensus on what influences the emergence of bruxism. Nervous tension can cause nocturnal

bruxism, because during sleep a person can not control the muscles of the face, and they can involuntarily contract, causing the gnashing of teeth [1, 5]. Therefore, bruxism is more common at night than during the day, because when we do not sleep, it is much easier to control the facial muscles.

Today's pace of computerization exceeds the pace of development of all other industries. Modern man begins to interact with the computer constantly - at work, at home, in the car and even on the plane. Computers are rapidly being introduced into human life, taking their place in our minds, and we often do not realize that what we start will depend on their performance. With the advent of computers, computer games appeared, which immediately found a lot of fans. With the improvement of computers, games have improved, attracting more and more people. According to forecasts, in the coming years the market of electronic games will steadily expand. A whole class of people who are fans of computer

games is being formed in society; the game becomes their main activity. The range of social contacts they have is very narrow, all other activities are aimed only at survival, to meet physiological needs; the main thing is to satisfy the need to play on the computer. Experience shows that many of them do not benefit from this hobby at all, and some seriously need help. Most of them are people with well-known psychological problems: poor personal life, dissatisfaction with themselves, and as a consequence, loss of meaning in life and normal human values. The only value for them is the computer and everything connected with it.

For mental health, the greatest danger of computer games is addiction [6, 7]. Dependence on computer games a person is most exposed, because the events in computer games are not repeated and occur quite dynamically, and the gameplay itself is continuous. Before the end of any game, there are some logical stages, which, for the most part, are quite tightly tied together, which forces the subject not to be distracted, but to perceive the passage of the whole game from beginning to end as a single process. Young people are especially prone to them [8].

AIM

The aim was to study the relationship between the psycho-emotional state of computer game players with the development of bruxism, its early diagnosis in people at risk, increasing the effectiveness of preventive measures in people with this pathology.

MATERIALS AND METHODS

Methods: at the first stage of the study sociological (questionnaire, FPI test), at the second stage - general clinical and special clinical (objective examination, history taking, general examination, palpation of the TMJ and masticatory muscles, diagnosis of static occlusion and dynamic), medical and statistical.

Materials: 1) results of the questionnaire (the questionnaire contains 10 questions related to the presence and clinical manifestations of bruxism in respondents), the number of respondents - 120 people,

2) the results of an automated FPI test to assess the psycho-emotional state. The questionnaire includes 12 diagnostic scales, the results of psychodiagnostic research are evaluated on a 10-point standard scale (from 1 to 10 points), the number of respondents - 120 people.

3) the main group of patients with bruxism (68 people aged 18 to 30 years, including 50 - men, 18 - women) and the control group - volunteers of 20 people (10 - women, 10 - men), who did not show clinical manifestations of bruxism and TMJ dysfunction and who do not play computer games.

RESULTS

At the first stage of the study, a survey of 120 people (85 - men, 35 - women) aged 18 to 30 years was conducted. The computer club was chosen as the place of the poll. The questionnaire is represented by ten questions, which were aimed at identifying clinical manifestations of bruxism.

1. Do you gnash your teeth while sleeping?

2. Has anyone heard that you gnash your teeth while sleeping?
3. Have you noticed that you wake up with clenched teeth?
4. Do you feel pain or fatigue in your jaws when you wake up?
5. Do you have a feeling of loosening your teeth when you wake up?
6. Do you have a feeling of pain in your teeth or gums when you wake up?
7. Do you have a headache in the temples during awakening?
8. Do you feel a jaw „jamming” / heaviness when opening the mouth on waking?
9. Have you ever noticed that you grit your teeth during the day?
10. Have you ever noticed that you gnash your teeth during the day?

The subjects were also asked to take an automated FPI test to assess the psycho-emotional state [9, 10]. The questionnaire includes 12 scales that diagnose neuroticism, spontaneous aggression, depression, irritability, excitability, sociability, poise, reactive aggression, shyness, openness, extraversion-introversion, emotional lability, masculinity-femininity. The results of psychodiagnostic research are evaluated on a 10-point standard scale (from 1 to 10 points). The following intervals of indicators are distinguished: from 1 to 3 - low level, from 3.1 to 4 - below average, 4.1-6.9 - average, 7-7.9 - above average, 8-10 - high level.

In the second stage of the study, according to the results, the main group of patients with bruxism was identified. It consisted of 68 people aged 18 to 30 (50 - men, 18 - women). The control group of people consisted of 20 volunteers (10 - women, 10 - men), who did not show clinical manifestations of bruxism and TMJ dysfunction and who do not play computer games. Further clinical examination consisted of history taking, general examination, palpation of the TMJ and masticatory muscles. Additionally, static and dynamic occlusion was diagnosed, and vertical occlusion distance was assessed.

According to the results of the survey, 120 people aged 19-29, who often play computer games, found that 48.33% had bruxism. In 96.55%, the analysis of the FPI test revealed signs of mental distress: increased levels of neuroticism, sudden aggression, depression, emotional lability, irritability, decreased level of balance and self-criticism. In the control group, the results of FPI in most indicators were average. At clinical examination of patients of the first group the nature of the closure of the teeth - planar, control - point. On palpation of the masticatory muscles in the first group, painful sensations in the areas of the lateral pterygoid and actually masticatory muscles, on palpation of the TMJ, a crunch was detected.

DISCUSSION

Psychological research has found a strong link between nocturnal bruxism in young people playing computer games with the level of situational anxiety. Anxiety as a personality trait was also slightly higher in players with nocturnal bruxism, which gives reason to talk about personal anxiety as a factor that leads to bruxism. The prevalence of bruxism among young people who play computer games was 48.33%, which is associated with psycho-emotional distress of this category of people: increased

neuroticism, sudden aggression, depression, irritability and emotional lability.

According to various authors, the prevalence of bruxism is from 5 to 90% in adults and from 10 to 50% in children; its decrease is observed in persons older than 60 years (Montagna P., 2013; Safari A., 2013; Lobbezoo F., 2014; Varalakshmi S., 2014; Vertrugo R., 2015). Significant discrepancies are due to imperfect diagnosis, as the verification of the diagnosis is still based on subjective data of questionnaires during sleep as the first symptoms of the disease (Macaluso G., 1998; Yoshida K., 1998; Bleicher V.M., 2002; Brokar D., 2009; Montagna P., 2013; Lobbezoo F., 2014; Kostenko E.Ya., 2016). Bruxism is a frequent manifestation of a generalized process, which is characterized by various somatic disorders and is caused by psychological stress. As a rule, the first to diagnose this pathology is a dentist.

At the local level, bruxism leads to a violation of the natural occlusion of the teeth, which significantly complicates the restoration of the correct ratio of the dentition (Klitinsky Yu. V., 2006; Slavychek R., 2008; Montagna P., 2013; Lobbezoo F., 2014; Varalakshmi S., 2014; De Meyer M., 2015; Jeffrey S., 2015; Vertrugo R., 2015).

Diagnosis by questionnaire allows you to detect manifestations of the disease in the early stages of development. As a prevention of bruxism and psycho-emotional disorders, the time of playing video and computer games should be limited. The use of a computerized psychodiagnostic system helps in the early stages of bruxism to determine the behavioral and personal characteristics of the patient, which can initiate the disease, knowledge of the psychological status of the patient helps to build an effective professional model of "doctor-patient" relationship. Further study of the etiology and central pathophysiological mechanisms of bruxism is needed. Requires a multidisciplinary approach of neurologists, psychiatrists, somnologists and dentists in the treatment of this disease. The treatment of anxiety and depressive disorders with drugs should be approached consciously, as it is often possible to induce bruxism in a patient.

CONCLUSIONS

1. The manifestation of nocturnal bruxism is significantly influenced by the level of anxiety, both situational and personal.
2. People with nocturnal bruxism have pronounced signs of psychological maladaptation on the FPI questionnaire scales: vitality, emotional functioning and mental health and need correction of psychological state and level of stress.
3. Nocturnal bruxism in computer game players is a marker of impaired psychological adaptation.

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Somatometric Method to Assess the Level of High Schoolers' Physical Development

Somatometryczna metoda oceny poziomu rozwoju fizycznego uczniów szkół średnich

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SUMMARY

Aim: To develop tables to assess the physical development of high schoolers based on the interaction of total physical dimensions.

Materials and Methods: To achieve this goal, we studied the indicators of body length, body weight and chest circumference of 7-17 years old boys (n=1111) and girls (n=1133) of secondary schools in Kyiv (Ukraine). Multiple correlation was used to calculate the interaction of indicators of total physical dimensions, and multiple regression was used to develop gender and age standards of physical development of high schoolers.

Results: The tables to assess physical development of high schoolers of a certain gender and age have been developed. The tables contain body length in vertical direction and body weight or chest circumference in horizontal direction, depending on what is needed for determination: the proper values of CC or body weight. The quantitative characteristics of high schoolers with good, excessive, below average and low levels of physical development are presented.

Conclusions: Rational organization of physical training of high schoolers is impossible without objective testing of the level of their physical development. Timely corresponding testing is a guarantee in preventing physical strains and health problems.

Key words: physical development, health, high schoolers

Słowa kluczowe: rozwój fizyczny, zdrowie, uczniowie szkół średnich

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INTRODUCTION

The study of physical well-being of high schoolers, and even more so, the methods of its optimization is of great theoretical and practical importance. Along with the level of functioning of body systems, the physical development of a human being is one of the main indicators of physical well-being, which is characterized by a complex of somatometric and somatoscopic features [1-3].

The level of physical development plays a special role in determining the health status of high schoolers, whose body is in the process of formation and due to its plasticity is extremely prone to both positive and negative influences of environmental factors. Therefore, the indicators of physical development reflect not only the health status of children

and adolescents, but also the socio-economic and socio-hygienic conditions of their lives, the level and quality of organization and methods of teaching physical education in secondary school [4, 5].

The physical development of high schoolers was studied from 1925, in stages: 1925-1927, 1937-1938, 1947-1949, 1955, 1959-1960, 1966-1967, 1970-1971 and, finally, in 1969-1973 [6]. Forasmuch as, the tables for assessing the physical development of high schoolers, developed in 1974 on the basis of research of 1969-1973, are outdated not only in time but also for calculation methods, there is an urgent need to develop new tables for assessing the physical development of high schoolers, which could be recommended as criteria for individual and group assessment.

AIM

The aim of this article is to develop tables to assess the physical development of high schoolers based on the interaction of total physical dimensions.

MATERIALS AND METHODS

A special difference of our method is the development of tables for assessing the proper values of body weight not only in relation to body length (as it was used previously), but also taking into account the actual values of chest circumference (CC). Accordingly, assessment tables of proper CC indicators were developed taking into account the combined effect of body length and weight indicators. Multiple correlation and regression were used for this purpose.

The comparative data of pair and multiple correlation coefficients became the basis for changing the traditional approach. In the first case, they are mainly low and medium in value, in the second case they are mostly high, which cannot but affect the accuracy of the forecast assessment of the proper values of body weight and CC (using regression equations). In addition, the use of multiple correlation and regression does not contradict the method of determining the level of physical development by the ratio of total physical dimensions.

The research involved 7-17 years old boys ($n=1111$) and girls ($n=1133$) from secondary schools in Kyiv (Ukraine).

The research methods included the analysis and generalization of data from special literature (21 sources on the topic of the article from the scientometric databases PubMed, Scopus, Web of Science Core Collection and others were used), anthropometry, correlation and regression analyses.

RESULTS

Since the tables are developed according to age and gender features, it is first necessary to establish the age of a high schooler on the day of the study in order to assess his physical development. It is determined by subtracting the date of the high schooler birth from the date of the study.

Indicators of height are limited by sigma deviations within $X \pm 0.67\sigma$ (average values), from $X + 0.68\sigma$ to $X + 1.5\sigma$ (above average), from $X + 1.6\sigma$ and above (high), from $X - 0.68\sigma$ to $X - 1.5\sigma$ (below average), from $X - 1.6\sigma$ and below (low). Knowing the gender and age of the high schooler, it is determined according to the proper table to which group he belongs (by height): average, above average, below average, high, low.

The horizontal column includes the indicators of CC (or weight) of the subject of interest and the intersection of the actual data of his height and CC (or weight) determines the proper value of weight (or CC). Then the obtained weight (CC) is compared with the actual one and the less value is subtracted from the larger value of weight (CC) with assigning a sign of the greater value (therefore, if the high schooler has a weight (CC) greater than he should have according to the data of his height and CC (weight), the sign “+” is assigned, if less, then the sign “-” is assigned. The resulting difference is divided by the partial sigma: for weight - σ_{R-1} , for CC - σ_{R-2}

(Tables 1, 2) and it is determined on how many partial sigma the weight (CC) of the high schooler of interest is greater or less (depending on the sign of the difference found) compared to the one he should have for a given height and CC (weight). If the value obtained is within $\pm 0.67\sigma_R$, then the weight (CC) is average, from $0.68\sigma_R$ to $1.5\sigma_R$ - above average, from $-0.68\sigma_R$ to $-1.5\sigma_R$ - below average, from $1.6\sigma_R$ and above - high, from $-1.6\sigma_R$ and below - low.

Here is an example: a 10 years old boy has a height of 143 cm, weight - 35.6 kg, CC during the pause - 69.2 cm. The table shows that the height of a 10 years old boy of 143 cm is within $X \pm 0.67\sigma$, i. e. it is average. The proper weight for a height of 143 cm and CC of 69.2 cm should make 35.3 kg, and the proper value of CC at this height and weight of 35.6 kg - 69.0 cm. The partial sigma (σ_R) for the weight is 2.12, and for CC - 1.95. $35.6 - 35.3 = 0.3$ (kg); $69.2 - 69.0 = 0.2$ (cm). Both obtained numbers are within one partial sigma ($\pm 2.12 \times 0.67 = \pm 3.54$ for weight and $\pm 1.95 \times 0.67 = \pm 1.31$ for CC), therefore, the weight and CC of the boy, as well as his height, are average, i.e. his physical development is harmonious (good).

However, there are other options in which, for example, the high schooler's height will be higher or lower than average one, and the weight or CC may be of a different value. Taking this into account and based on the recommendations [6], the high schoolers can be divided into 4 groups according to the level of their physical development:

1. High schoolers with good physical development, i. e. with average, above average, high and below average indicators of height at average and above average indicators of weight and CC.
2. High schoolers with excessive physical development, i. e. with the same indicators of height as in the first group, but with high indicators of weight and CC or only one of them.
3. High schoolers with lower than average physical development, i. e. with average, above average and high indicators of height at below average indicators of body weight and CC (or one of them).
4. High schoolers with low level of physical development, i. e.:
 - a) with high, above average and average indicators of height at low indicators of weight and CC or one of them;
 - b) with indicators of height below average at below average and low indicators of weight and CC (or one of them);
 - c) with low indicators of height.

To perform group assessment of physical development of different children's groups you need to determine the proportion of children with one or another level of physical development (good, excessive, below average and low) in each group (team). Individual assessment of physical development allows distinguishing children with disharmonious physical development among all of the high schoolers.

The assessment tables for children of a certain gender and age show the length of the body (height) in vertical direction and the weight of the body or chest circumference (CC) in horizontal direction on the left, depending on what is needed for determination: the proper values of CC or body weight (Table 3).

Table 1. Table of statistical data on the indicators of physical development of male high schoolers

Feature	Age	X	σ	R_1	R_2	b_1	b_2	b_3	b_4	a_1	a_2	σ_{R-1}	σ_{R-2}
Body length (cm)	7	130.4	6.57	-	-	0.1864	0.0671	-	-	-	-	-	-
	8	131.6	5.23	-	-	0.2716	0.0365	-	-	-	-	-	-
	9	137.7	4.39	-	-	0.3442	-0.1329	-	-	-	-	-	-
	10	141.9	7.11	-	-	0.4352	-0.1480	-	-	-	-	-	-
	11	146.4	5.72	-	-	0.2593	0.0051	-	-	-	-	-	-
	12	151.2	7.04	-	-	0.2190	0.0060	-	-	-	-	-	-
	13	157.7	8.07	-	-	0.3385	0.0500	-	-	-	-	-	-
	14	166.0	8.75	-	-	0.2901	0.0359	-	-	-	-	-	-
	15	171.6	7.44	-	-	0.4487	-0.1148	-	-	-	-	-	-
	16	177.3	7.77	-	-	0.5278	-0.1926	-	-	-	-	-	-
17	179.0	5.68	-	-	0.1727	0.0828	-	-	-	-	-	-	
Body weight (kg)	7	28.0	2.93	0.852	-	-	-	-	0.5403	-57.33	-	1.53	-
	8	28.0	3.12	0.820	-	-	-	-	0.6248	-58.60	-	1.79	-
	9	31.6	4.57	0.916	-	-	-	-	0.7084	-88.69	-	1.83	-
	10	33.7	4.42	0.877	-	-	-	-	0.6351	-86.42	-	2.12	-
	11	38.4	4.63	0.871	-	-	-	-	0.6273	-71.30	-	2.27	-
	12	39.1	4.24	0.888	-	-	-	-	0.6708	-61.91	-	1.94	-
	13	45.8	6.53	0.891	-	-	-	-	0.5229	-90.07	-	2.99	-
	14	53.8	6.43	0.882	-	-	-	-	0.5196	-83.83	-	3.01	-
	15	57.7	5.09	0.887	-	-	-	-	0.6429	-91.93	-	2.33	-
	16	64.7	6.36	0.801	-	-	-	-	0.6137	112.14	-	3.12	-
17	65.6	5.06	0.716	-	-	-	-	0.3631	-74.43	-	3.54	-	
Chest circumference (cm)	7	64.7	2.07	-	0.835	-	0.9330	-	-	-	41.17	-	1.13
	8	65.1	2.73	-	0.784	-	0.7811	-	-	-	42.80	-	1.70
	9	67.2	3.58	-	0.900	-	1.0849	-	-	-	63.10	-	1.56
	10	67.6	3.20	-	0.795	-	0.8626	-	-	-	67.34	-	1.95
	11	70.8	3.76	-	0.852	-	1.0122	-	-	-	45.99	-	1.95
	12	71.5	3.74	-	0.868	-	0.9495	-	-	-	44.36	-	1.87
	13	74.6	5.17	-	0.871	-	1.1004	-	-	-	42.69	-	2.53
	14	78.7	5.04	-	0.862	-	1.1364	-	-	-	44.81	-	2.60
	15	81.3	4.49	-	0.827	-	0.8936	-	-	-	63.87	-	2.54
	16	85.6	5.36	-	0.807	-	0.9717	-	-	-	80.11	-	3.17
17	86.7	3.36	-	0.714	-	1.2574	-	-	-	48.11	-	2.35	

Table 2. Table of statistical data on the indicators of physical development of female high schoolers

Feature	Age	X	σ	R_1	R_2	b_1	b_2	b_3	b_4	a_1	a_2	σ_{R-1}	σ_{R-2}
Body length (cm)	7	126.9	4.21	-	-	0.4082	-	-0.2596	-	-	-	-	-
	8	129.6	5.20	-	-	0.4502	-	-0.0999	-	-	-	-	-
	9	134.2	5.45	-	-	0.2480	-	0.0015	-	-	-	-	-
	10	143.2	7.60	-	-	0.4006	-	-0.1314	-	-	-	-	-
	11	147.3	7.76	-	-	0.4353	-	-0.1507	-	-	-	-	-
	12	153.9	6.00	-	-	0.6094	-	-0.0920	-	-	-	-	-
	13	160.2	6.62	-	-	0.4660	-	-0.1710	-	-	-	-	-
	14	162.4	6.12	-	-	0.3923	-	-0.0309	-	-	-	-	-
	15	165.3	5.11	-	-	0.5525	-	-0.0282	-	-	-	-	-
	16	165.6	5.31	-	-	0.3451	-	-0.1434	-	-	-	-	-
17	166.6	5.81	-	-	0.3783	-	0.0170	-	-	-	-	-	
Body weight (kg)	7	22.9	2.29	0.796	-	-	-	-	0.7899	-61.94	-	1.40	-
	8	25.4	3.30	0.798	-	-	-	-	0.7801	-60.24	-	1.98	-
	9	28.8	3.64	0.857	-	-	-	-	0.7223	-55.14	-	1.89	-
	10	34.2	4.87	0.868	-	-	-	-	0.6318	-83.74	-	2.43	-
	11	37.1	6.19	0.912	-	-	-	-	0.7199	-88.53	-	2.55	-
	12	42.9	7.39	0.857	-	-	-	-	0.6372	-110.09	-	3.83	-
	13	47.6	6.33	0.895	-	-	-	-	0.5346	-121.50	-	2.83	-
	14	52.4	6.49	0.811	-	-	-	-	0.4759	-89.77	-	3.78	-
	15	55.7	5.76	0.732	-	-	-	-	0.4399	-99.47	-	3.91	-
	16	56.6	3.32	0.684	-	-	-	-	0.4590	-67.35	-	2.42	-
17	59.3	5.83	0.767	-	-	-	-	0.3368	-105.96	-	3.73	-	
Chest circumference (cm)	7	61.0	2.22	-	0.663	-	0.5417	-	-	-	75.85	-	1.66
	8	62.2	3.65	-	0.664	-	0.4393	-	-	-	55.31	-	2.73
	9	64.1	3.00	-	0.827	-	0.7910	-	-	-	43.07	-	1.69
	10	66.0	3.97	-	0.805	-	0.9179	-	-	-	63.21	-	2.34
	11	68.1	5.23	-	0.886	-	0.9023	-	-	-	63.63	-	2.61
	12	71.2	6.28	-	0.801	-	0.8313	-	-	-	58.02	-	3.76
	13	71.9	3.67	-	0.858	-	1.3134	-	-	-	73.85	-	1.87
	14	73.9	4.43	-	0.779	-	1.0625	-	-	-	43.93	-	2.76
	15	73.5	4.19	-	0.665	-	0.8682	-	-	-	53.63	-	3.13
	16	74.8	2.80	-	0.642	-	0.8956	-	-	-	72.51	-	2.15
17	75.0	2.63	-	0.732	-	1.3637	-	-	-	52.18	-	1.78	

Conventional signs:

 R_1 – coefficient of multiple correlation between the indicators of body weight and body length and CC; R_2 – the same, but between the indicators of CC and body length and body weight; $b_1 - b_4$ – regression coefficients between the indicators of body length and body weight, body weight and CC, body length and CC and CC and body weight, respectively; a_1, a_2 – intercept terms of regression equations for body weight and CC, respectively; σ_{R-1} – partial sigma of body weight indicators; σ_{R-2} – partial sigma of CC indicators

Table 3. Fragment of assessment of proper body weight and chest circumference in 10 years old boys (average height)

Body length (cm)	Chest circumference (cm)														
	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71
138	22.8	23.7	24.5	25.4	26.3	27.1	28.0	28.8	29.7	30.6	31.4	32.3	33.2	34.0	34.9
139	23.2	24.1	25.0	25.8	26.7	27.6	28.4	29.3	30.1	31.0	31.9	32.7	33.6	34.5	35.3
140	23.7	24.5	25.4	26.3	27.1	28.0	28.9	29.7	30.6	31.4	32.3	33.2	34.0	34.9	35.8
141	24.1	25.0	25.8	26.7	27.6	28.4	29.3	30.2	31.0	31.9	32.7	33.6	34.5	35.3	36.2
142	24.5	25.4	26.3	27.1	28.0	28.9	29.7	30.6	31.4	32.3	33.2	34.0	34.9	35.8	36.6
143	25.0	25.8	26.7	27.6	28.4	29.3	30.3	31.0	31.9	32.7	33.6	34.5	35.3	36.2	37.1
144	25.4	26.3	27.1	28.0	28.9	29.7	30.6	31.5	32.3	33.2	34.0	34.9	35.8	36.6	37.5
145	25.9	26.7	27.6	28.4	29.3	30.3	31.0	31.9	32.8	33.6	34.5	35.3	36.2	37.1	37.9
146	26.3	27.2	28.0	28.9	29.7	30.6	31.5	32.3	33.2	34.1	34.9	35.8	36.6	37.5	38.4
Body length (cm)	Chest circumference (cm)														
	72	73	74	75	76	77	78	79	80	81	82	83	84	85	
138	35.7	36.6	37.5	38.3	39.2	40.1	40.9	41.8	42.6	43.5	44.4	45.2	46.1	47.0	
139	36.2	37.0	37.9	38.8	39.6	40.5	41.4	42.2	43.1	43.9	44.8	45.7	46.5	47.4	
140	36.6	37.5	38.3	39.2	40.1	40.9	41.8	42.7	43.5	44.4	45.2	46.1	47.0	47.8	
141	37.1	37.9	38.8	39.6	40.5	41.4	42.2	43.1	44.0	44.8	45.7	46.5	47.4	48.3	
142	37.5	38.3	39.2	40.1	40.9	41.8	42.7	43.5	44.4	45.3	46.1	47.0	47.8	48.7	
143	37.9	38.8	39.6	40.5	41.4	42.2	43.1	44.0	44.8	45.7	46.5	47.4	48.3	49.1	
144	38.4	39.2	40.1	40.9	41.8	42.7	43.5	44.4	45.3	46.1	47.0	47.8	48.7	49.6	
145	38.8	39.7	40.5	41.4	42.2	43.1	44.0	44.8	45.7	46.6	47.4	48.3	49.1	50.0	
146	39.2	40.1	41.0	41.8	42.7	43.5	44.4	45.3	46.1	47.0	47.9	48.7	49.6	50.4	
Body length (cm)	Body weight (kg)														
	22	23	24	25	26	27	28	29	30	31	32	33	34	35	
138	60.9	61.5	62.2	62.8	63.4	64.1	64.7	65.3	66.0	66.6	67.2	67.9	68.5	69.1	
139	60.7	61.4	62.0	62.6	63.3	63.9	64.6	65.2	65.8	66.5	67.1	67.7	68.4	69.0	
140	60.6	61.2	61.9	62.5	63.1	63.8	64.4	65.0	65.7	66.3	66.9	67.6	68.2	68.9	
141	60.4	61.1	61.7	62.4	63.0	63.6	64.3	64.9	65.5	66.2	66.8	67.4	68.1	68.7	
142	60.3	60.9	61.6	62.2	62.8	63.5	64.1	64.7	65.4	66.0	66.6	67.3	67.9	68.6	
143	60.2	60.8	61.4	62.4	62.7	63.3	64.0	64.6	65.2	65.9	66.5	67.1	67.8	68.4	
144	60.0	60.6	61.3	61.9	62.5	63.2	63.8	64.4	65.1	65.7	66.4	67.0	67.6	68.3	
145	59.9	60.5	61.1	61.8	62.4	63.0	63.7	64.3	64.9	65.6	66.2	66.8	67.5	68.1	
146	59.7	60.3	61.0	61.6	62.2	62.9	63.5	64.2	64.8	65.4	66.1	66.7	67.3	68.0	
Body length (cm)	Body weight (kg)														
	36	37	38	39	40	41	42	43	44	45	46	47	51	52	53
138	69.8	70.4	71.1	71.7	72.3	73.0	73.6	74.2	74.9	75.5	76.1	76.8	79.3	79.9	80.6
139	69.6	70.3	70.9	71.5	72.2	72.8	73.4	74.1	74.7	75.3	76.0	76.6	79.2	80.0	80.4
140	69.5	70.1	70.8	71.4	72.0	72.7	73.3	73.9	74.6	75.2	75.8	76.5	79.0	79.6	80.3
141	69.3	70.0	70.6	71.2	71.9	72.5	73.1	73.8	74.4	75.1	75.7	76.3	78.9	79.5	80.1
142	69.2	69.8	70.5	71.1	71.7	72.4	73.0	73.6	74.3	74.9	75.5	76.2	78.7	79.4	80.0
143	69.0	69.7	70.3	70.9	71.6	72.2	72.9	73.5	74.1	74.8	75.4	76.0	78.6	79.2	79.8
144	68.9	69.5	70.2	70.8	71.4	72.1	72.7	73.3	74.0	74.6	75.2	75.9	78.4	79.1	79.7
145	68.7	69.4	70.0	70.7	71.3	71.9	72.6	73.2	73.8	74.5	75.1	75.7	78.3	78.9	79.5
146	68.6	69.2	69.9	70.5	71.1	71.8	72.4	73.0	73.7	74.3	74.9	75.6	78.1	78.8	79.4

DISCUSSION

The analysis of the studied sources [7, 8] shows that individual organs and systems of a high schooler's body are developed and reach a mature type of functioning during all school years. All these processes happen according to clearly defined biological laws of organism's development. Only being aware of these laws, the parents and teachers will be able to help high schoolers improve physically. According to the experts [9, 10], the assessment of the level of development according to morphofunctional indicators is an important criterion of school maturity (correspondence between calendar and biological age), a prerequisite for scientifically sound dosing of mental and physical activities.

The study of the physical development issues is associated with many scientific problems: it is a study of peculiarities of physical development of high schoolers in different regions of the country; search for the reasons causing acceleration of rates of physical development of children and teenagers; differentiated approach in the process of physical education taking into account the peculiarities of physical development of high schoolers of one form and gender [11-13].

Rational organization of physical training of high schoolers is impossible today without objective testing of the level of their physical development [14]. Timely testing is a guarantee in preventing possible disorders in the high schoolers' health [15]. Scientists pay a lot of attention to methods of studying physical development. Somatometry is considered to be the main method among them, which includes determining the indicators of body weight and chest circumference [16, 17].

The difference between the author's method of assessing the level of physical development of high schoolers is the development of tables of proper values of body weight not only taking into account body length (as was the case with predecessors), but also considering the actual values of chest circumference. Accordingly, the assessment tables of proper chest circumference indicators were developed taking into account the combined effect of body length and body weight. Multiple correlation and regression were used for this purpose. The results of our research expand the conclusions of the works of many scientists [18-21] and complement them.

CONCLUSIONS

1. Rational organization of high schoolers' physical education is impossible without objective assessment of their physical development. Proper testing in a timely manner is the key to preventing physical strain and health problems.
2. The use of multiple correlation and regression in the development of standards for physical development of 7-17 years old high schoolers, in contrast to the traditional approach, on the basis of pair correlation, significantly increases the accuracy of assessing the proper values of body weight and chest circumference, and with the rest the high schooler physical development.
3. Statistical data of summary tables are the basis for drawing up standards of physical development of high schoolers. The availability of standards of physical development of high

schoolers is essential for assessing the socio-economic and hygienic living conditions of citizens. The level of physical development, together with such indicators as fertility and morbidity, are key indicators of social health.

Prospects for further research are to develop tables to assess the physical development of university students based on the interaction of total physical dimensions.

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Conflict of interest:

The Authors declare no conflict of interest

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Informacja prasowa

VIOFOR JPS - DZIAŁANIE REGENERACYJNE I WZMACNIAJĄCE UKŁAD ODPORNOŚCIOWY – W DYSFUNKCJACH UKŁADU ODDECHOWEGO

Magnetostymulacja Viofor JPS ma działanie przeciwzapalne i wzmacniające układ odpornościowy.

Viofor jest pierwszym wyrobem medycznym do fizykoterapii impulsowym polem magnetycznym o udokumentowanym klinicznie wpływie na skuteczność leczenia infekcji dróg oddechowych. Przebyte infekcje, szczególnie w połączeniu z antybiotykoterapią, mają niekorzystny wpływ na system odpornościowy, upośledzają mechanizmy regeneracyjne organizmu i tym samym opóźniają proces rekonwalescencji zwiększając ryzyko nawrotu choroby. Korzystne zmiany immunokorekcyjne w zakresie układu odpornościowego po zastosowaniu zabiegów Viofor JPS, przyczyniają się w znacznym stopniu do poprawy stanu klinicznego, zapobiegają powikłaniom i nawrotom choroby.

Skuteczność zastosowania magnetostymulacji Viofor JPS w leczeniu wtórnych niedoborów odpornościowych jest rezultatem pobudzenia grasiczozależnego procesu dojrzewania limfocytów T i ich kompetencji w rozpoznawaniu patogenów chorobotwórczych. Uzupełnienie niedoborów tej populacji w układzie odpornościowym i pamięć komórkowa w nich zawarta może zapewnić nam ochronę przez wiele lat, mimo spadku przeciwciał, zapobiegając tym samym nawrotom infekcji.

Badania *in vitro* potwierdzają immunokorekcyjne działanie magnetostymulacji Viofor JPS System obserwowane w postaci zmniejszenia stężenia prozapalnych cytokin TNF- α oraz IL-8.

(www.medandlife.com)

Influence of Small Doses of Electromagnetic Oscillations on the Features of Coronavirus Reproduction

Wpływ małych dawek oscylacji elektromagnetycznych na cechy reprodukcji koronawirusa

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SUMMARY

Aim: To study the influence of small doses of electromagnetic oscillations on the molecular-biological state and features of coronavirus reproduction.

Materials and Methods: The study was conducted at the Laboratory of Experimental Chemotherapy of viral infections of the State Institution "L.V. Gromashevsky Institute of Epidemiology and Infectious Diseases of the National Academy of Medical Sciences of Ukraine" and was based on the materials of the educational institution "Ukrainian Resource Center of Educational Innovations". During 90 days, with the use of hardware and software complex "Vim Vitae" (from Latin – life force), an experimental study on the registration and analysis of antiviral activity of small doses of electromagnetic oscillations on a biological object (coronavirus pathogens) was organized based on the author's methodology "Life without medicines".

Results: A study of the antiviral effect of low doses of electromagnetic oscillations on an experimental model of coronavirus – virus of transmitted swine gastroenteritis – showed that small doses of electromagnetic oscillations inhibited coronavirus reproduction by 1.25-2.4 lg TCD50 (tissue cytopathogenic dose 50).

Conclusions: We believe that in the near future, traditional diagnostic methods will be replaced by new, information-metric, widely available technologies based on smartphones and tablets, which allow not only very quickly and accurately to detect disease, but also learn a lot of other information important for effective therapy. In perspective, these technologies will become a convenient method for self-monitoring and remote interaction with the doctor, for maintaining own health and the health of loved ones.

Key words: quantum technologies, information impact, pathogens, innovations, coronavirus

Słowa kluczowe: technologie kwantowe, wpływ informacji, patogeny, innowacje, koronawirus

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INTRODUCTION

Currently, scientists around the world are actively working to find effective treatments and rehabilitation after a complicated course of the disease of COVID-19. The recovery process does not end after discharge from the hospital. Doctors and researchers from different countries claim that after recovery, people can still feel the effects of the disease for a long time

– on the lungs, heart, kidneys, or mental health. People often have high rates of depression and anxiety, experience post-traumatic stress. Other long-term effects of coronavirus include viral fatigue syndrome, muscle dysfunction – decreased muscle tone, digestive disorders and a number of mental health problems, including insomnia and various changes in cognitive function [1-3].

The transition to the information society has marked a priority need to review the challenges addressed by the health care system and the introduction of available technologies that help change people's minds from the search for disease in the direction of maintaining health. This requires a holistic approach that combines the positive experience of previous generations, creating conditions for the initiative of citizens themselves and the actualization of publicly available scientific advances in information, nano- and femtotechnologies with a leading imperative – identifying potential functional disorders in humans preceding the development of the disease, their monitoring, correction and systemic prevention.

Among the achievements of recent decades, the most interesting are the practical aspects of nonlinear evaluation of ultra-weak electromagnetic signals, functionally significant for living biological systems, and methods of systematic software analysis of the information encoded in them. Over the past century, fundamental research has been conducted that has opened up fundamentally new approaches to assessing the information component of biological objects of the material world and inanimate nature [4-8].

However, for some time the sensitivity and power of hardware and software systems and analyzers did not allow to register and separate nonlinear electromagnetic radiation of living organisms. It has only become possible in the last decade to increase the sensitivity of existing detectors. With the development of information technology, fundamentally new methods of recording the response of living organisms under the influence of wave oscillations in the ranges of biological frequencies were proposed, which opened up great opportunities for informationometry and such an important area as diagnosis of functional status at an early stage of pathological process, analysis of results of therapy and prevention in real time [9-11].

Considering a living organism in its interaction with the environment, it should be borne in mind that for the normal functioning of the organism not only structural and metabolic characteristics of homeostasis are important, but also energy homeostasis and information homeostasis [4, 6, 12, 13].

AIM

The aim of this article is to study the influence of small doses of electromagnetic oscillations on the molecular-biological state and features of coronavirus reproduction.

MATERIALS AND METHODS

The study was conducted under an agreement on cooperation, partnership and cooperation between the State Institution “L.V. Gromashevsky Institute of Epidemiology and Infectious Diseases of the National Academy of Medical Sciences of Ukraine” and Education Institution “Ukrainian Resource Center of Educational Innovations” at the laboratory of experimental chemotherapy for viral infections. For 90 days, using a hardware-software complex “Vim Vitae” (lat. – *life force*), an experimental study on the registration and analysis of antiviral activity of small doses of electromagnetic oscillations was organized based on the author's method

“Life without medicines” (its informational impact on the biological object (coronavirus).

The project “Vim Vitae” was made possible through the use of established Scientific Research and Production Complex (SRPC) “Life without medicines” (hardware-software system), comprising: an electronic device for the reception and transmission of electric bio-potentials; electronic module for conversion of electromagnetic oscillations; special computer program for smartphone, personal computer (PC), laptop, tablet, and etc.; servers with algorithms for automatic processing of personalized data, databases of electronic markers, recommendations, etc. placed on the servers.

The “Vim Vitae” complex uses the principle of spectral-dynamic analysis of the electrets field strength of a living organism (E. Menefi, USA), as well as all biological processes occurring in it. It allows us to record the dynamic spectrum of a biological object, to perform spectral analysis of the information obtained, comparing it with the author's database of health markers, as well as to ensure the implementation of the correction of indicators.

These research methods are based on the properties of bio-tissues to be both a conductor and a dielectric. We have created a unique database of markers that characterize the electrets' state of biological objects. A significant part of this database of markers is comprised by information models of the parasitic forms (viruses, bacteria, and etc.).

Thanks to innovative methods, stable work with dynamic signals is reached that allows to analyze volume characteristics of these signals and to provide a high level of accuracy of the analysis and its validity. The non-invasive method of using “Vim Vitae” programs ensures the comfort of research for the consumer and the provider of correctional and rehabilitation services.

To implement the proposed method used with the necessary additions of hardware and software of the Medical Spectral-Dynamic Complex (MSDC) according to the patent of the Russian Federation of the utility model No. 88932. Information about MSDC is available on the manufacturers' websites (www.kmsd.bv and www.kmsd.su).

The following laboratory materials and methods were used during the experiment:

1. Viruses: transmissible swine gastroenteritis virus (TGEV) – etiological agent of transmissible gastroenteritis of pigs (TGS) – highly contagious intestinal disease of pigs.
2. Virus strain: D_{52.5}(BRE₇₉) – is a highly adaptogenic virus for pigs of all ages at the level of 5 passages in transplanted monolayer culture of testicular cells of piglets ST. Tropism of the virus of the gastrointestinal tract and respiratory tract is shown. The strain was provided by Dr. Hubert Laude from the Laboratory of Molecular Virology and Immunology of the INRA Center for Biotechnology in Jouy-en-Josas (France).
3. Titration of infectivity of viral materials on cell cultures was performed by two methods – final dilutions by Cytopathic Action (Figure 1), and the titer of infectivity determined by the method of Kerber-Ashmarin and expressed in TCD (tissue cytopathic dose) 50/ml, by the method

of negative colonies (S-sign) under 1.35% agar coating (Difco-Bacto) (Figure 2), and the titer of infectivity was expressed in BFU (bacteriophage-forming units)/ml. The results were calculated after 120 hours of cultivation at 38°C.

4. Virus – swine transmission gastroenteritis virus (STGV) – coronavirus.
5. Cell culture: SHEB – transplanted culture of pig embryonic kidney cells.
6. NSP is a transplanted culture of piglet kidney cells.
7. ST – transplanted culture of testicular cells of piglets.
8. CTC – transplanted culture of pig thyroid cells.

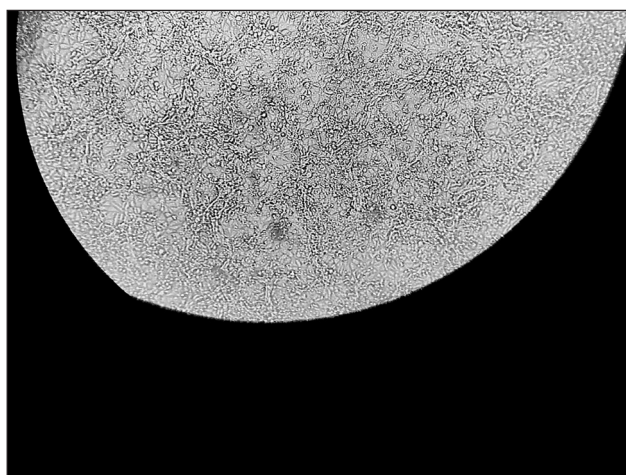


Figure 1. Control of SHEB culture (transplanted culture of pig kidney cells)

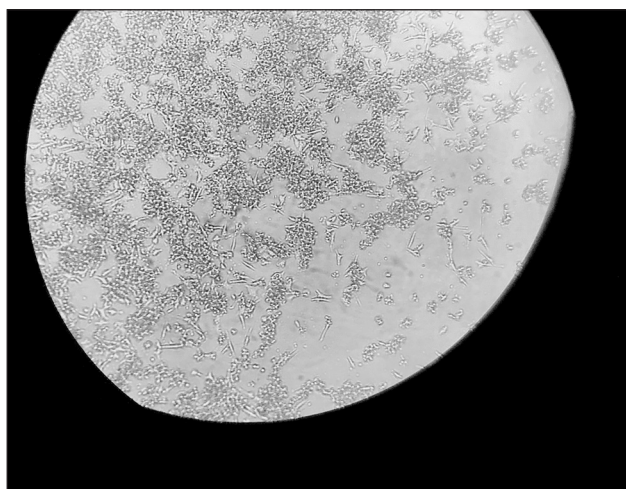


Figure 2. Control of the virus on SHEB (transplanted culture of pig kidney cells)

9. Determination of cytotoxic concentration of drugs (CC_{50}). To determine the CC_{50} cell cultures SHEB were used. The experiments used at least ten rows of wells in dishes with cell culture for each dilution of the drug in the culture environment. Cell culture dishes were incubated at 37°C with 5% CO_2 for 5 days. Experimental and control samples of cultures were observed daily to establish the presence or absence of cytopathogenic action (CPA). The degree of CPA was determined by changes in cell mor-

phology (rounding, cell shrinkage, rejection from the surface of the holes of degeneratively altered cells on the 4+ plus system from + to ++++: “-” – complete absence of cell degeneration; “+” – affected no more than 25 % (protection of monolayer cells from antiviral drugs by 75 %); “++” – affected no more than 50 % of the cells of the leg layer; “+++” – no more than 75 % of the cells of the monolayer are affected; “++++” – complete degeneration of monolayer cells. As CC_{50} of the preparation the largest amount which did not cause cell degeneration was considered.

10. MTT is a method of studying of cells viability. This method is based on the functioning of the dehydrogenase system of mitochondria of intact cells, which under normal conditions convert 3, (4,5-dimethyltriazol-2-yl) -2,5-diphenyltetrazolium bromide (MTT) into formazan. The reaction product can be determined quantitatively by spectrophotometric method. The conversion of MTT into formazan decreases with cell death under the action of toxic for the cells substances. A cell suspension with a density of 5×10^5 cells/ml was cultured in growth medium with 10 % ETS containing test substances in various concentrations in 96-well plates. In the control group, there were cells not treated with drugs. Each concentration of the substance was checked in 3-4 repetitions. Cell dishes were incubated in thermostats at 37°C in 5 % CO_2 atmosphere for 48 hours.

The MTT substrate (Sigma, USA) was dissolved in FSB at room temperature to a concentration of 5 mg/ml. The filtered MTT solution in a volume of 25 μ l was added to wells containing 100 μ l of cell suspension and incubated for 3 hours at 37°C in 5 % CO_2 . After incubation, to precipitate the cells, the plates were centrifuged at 1500 rpm for 10 min and the supernatant was removed. 100 μ l of 96 % ethanol was added to the cell pellet in the wells, in which there was a dissolution of crystalline formazan. After 10 minutes of careful shaking at 37°C, the optical density of solutions at a wavelength of 540 nm on a spectrophotometer for tablets Multiskan FC (Thermo-scientific) was measured. The percentage of inhibition of cell viability under the action of drugs was determined by the amount of formazan formed in the test samples compared to the control, which was taken as 100 %.

11. Determination of effective dose of (EC_{50}). EC_{50} is the minimum concentration of the drug that inhibits the development of virus-specific TCD by 50 %. To determine the EC_{50} test virus at a dose of 100 TCD₅₀/0.1 ml was introduced into cell culture and incubated for 60 min at 37°C. After adsorption of the virus on the cells, its residues were removed, the cells were washed with nutrient medium, and then in a supportive medium (RPMI-1640 + 2 % fetal serum) drugs were made in different concentrations. The absence of TCD in the studied (in treated cultures), in the presence of it in the control group, as well as the reduction of infectious titer in treated cultures, in the presence of control group and the difference in infectious titers in the experiment group compared with virus control allowed to establish EC_{50} of a drug.

12. Criterion for assessing the antiviral activity of compounds in *in vitro* systems. Cytotoxic concentration (CC_{50}) – the concentration of the drug, which reduces the viability of cell culture by 50 % – was determined by analysis of cytotoxic effects of test compounds in accordance with regulatory guidelines for research on antiviral drugs *in vitro*. To determine the antiviral activity of the test substances, the effective concentration (EC_{50}) was determined, i.e., the concentration of the test substance at which the level of virus replication in infected cell culture is suppressed by 50 %. After determining the indicators of cytotoxic and antiviral activity, the selectivity index (IS) was calculated as the ratio of CC_{50} to EC_{50} . Test substances with an $IS \geq 16$ in the *in vitro* system were considered more active and promising for further study in animals.

13. Detection of RNA of transmissible swine gastroenteritis virus pcs. D52 by reverse polymerase chain reaction (RT-PCR). RNA isolation was performed using a set of “Rhibo-sorb” in accordance with the manufacturer’s instructions (AmpliSens, RF).

The reverse transcription reaction was performed using the “RevertAid™ H MinusFirstStrandcDNASynthesisKit” kit according to the manufacturer’s instructions (Thermo Scientific, Lithuania). Gene-specific nucleoprotein oligonucleotide primers of the following sequence were used for PCR: direct Uni_1 (5’-TGCACGTGATCAATGTGCTAG-3’) and reverse Uni_2 (5’-TGAAAACACTGTGGCACCCTT-3’). A fragment of 309 P.M. M-marker “100 bpPlus DNA Ladder” (“Thermo Fisher Scientific”, Lithuania).

The digital material presented in the work is processed variationally and statistically. Statistical evaluation of the levels of significance of differences in the obtained figures was performed using Student’s t-test using Microsoft Excel and Microcal Origin. Differences at $p < 0.05$ were considered significant.

RESULTS

Transmissible porcine gastroenteritis (TPG) coronaviruses matched on different cultures were characterized by infectious titer. The results are presented in Table 1.

The virus neutralization reaction was performed in 96-well plates “Costar” (USA), according to the method of H. Laude, using as a positive control the reference hyperimmune serum N6926, of the same producer (Figure 3).

In determining the cytotoxicity of small doses of electromagnetic oscillations of the test substances by visual evaluation and MTT-observation in all wells, the cells were

Table 1. Infectious titer of CBT virus in cell cultures

Cell culture	Infectious titer of BOE
ST ₅	3.9×10^7 BOE/ml;
CHEB ₁₀₀	3.1×10^7 BOE/ml;
NSP ₁₀₀	4.3×10^7 BOE/ml;
CTC ₁₀₀	1.4×10^8 BOE/ml.



Figure 3. Negative colonies of transmissible swine gastroenteritis virus pcs. D₅₂₋₁₀₀ CTC

viable. Based on the obtained results of the toxic effects of small doses of electromagnetic oscillations with an exposure of 12 minutes was not determined.

The cytopathogenic effect of the coronavirus TGS on cells is morphologically manifested in the formation of small cell degeneration. According to the obtained results, it was found that small doses of electromagnetic oscillations inhibit the reproduction of coronavirus CBT. The criterion for assessing the inhibitory activity of antiviral drugs in the “*in vitro*” systems is a decrease in infectious titer by 1.5-2.0 lgTCD₅₀. Therefore, Table 2 presents the summarized results of studies to determine the difference in infectious titers of coronavirus CBT under the influence of small doses of electromagnetic oscillations.

Table 2. Indicators of inhibition of infectious titers of three experiments to study the effect of small doses of electromagnetic oscillations on the reproduction of coronavirus CBT

The name of the drug	Inhibition of infectious titer in lgID50
Experiment 1	1.3
Experiment 2	1.25
Experiment 3	2.4

DISCUSSION

In 2002, cases of severe acute respiratory disease were reported in the western provinces of China, Hong Kong, Vietnam, and Singapore. It was identified that the causative agent in these cases was coronavirus SARS (Severe Acute Respiratory Syndrome (SARS)) – a term proposed by the World Health Organization (WHO) on March 17, 2003, instead of the previously adopted – “atypical”. Its resonant frequencies were determined: 9918; 9740; 4959; 4870; 2479.5; 2435; 1394.7; 1369.6; 1239.7; 1217.5; 774.8; 760.9; 619.9; 608.7; 464.9; 456.5; 309.9; 304.4; 155; 152.2 Hz [2, 9].

In January 2020, cases of coronavirus infection were again detected in Wuhan Province (China). It is currently

found in different parts of our planet. On March 11, 2020, the WHO declared an outbreak of a new coronavirus pandemic. The threat of spreading this type of coronavirus should not be underestimated because humans do not have a natural immunity to it, and due to the rapid defeat of the human body, the immune response simply does not have time to form, which often leads to death.

In the modern world, there are two global medical schools: European and Eastern. The foundation of modern European one was created in the XIX century, with the rapid development of chemical science. Materialist Western physicians believed that the human body consists exclusively of matter. If a person is ill, the content of chemicals in his/her organs has changed, so it can be cured by introducing other chemicals into the body. The Eastern school recognizes the existence of etheric, astral, mental states of humans in addition to the material. It is scientifically proven that each organ of a living being, each of its cells constantly vibrates with its inherent frequency, creating its own electromagnetic fields [5, 14]. In our opinion, there is no contradiction between the schools. Physicists said the body has two components: one is substance, which the European physicianstry to influence and the second one is a field, which is more elaborated in the East [10, 12].

Modern science has described about 100,000 microorganisms, but only 100-150 of them are pathogenic. Immunologists claim that the human body produces antibodies against the pathogens. But antibodies to the pathogens of some diseases have not been detected in humans, and they, getting inside us, have no effect [15]. It can be argued that pathogenic are only those microorganisms that have oscillation frequencies close to the resonant frequencies of cells of specific human organs.

Considering a living organism in its interaction with the environment, it should be borne in mind that for the normal functioning of the organism not only structural and metabolic characteristics of homeostasis are important, but also energy homeostasis and information homeostasis [5].

We have outlined some aspects of information exchange in living systems, the most common errors related to information processes in living organisms, ways to solve some information problems based on theoretical developments, experimental data, and the results of many years of practical application of the proposed methods.

Introduction of biological feedback technologies, modern software-diagnostic information-metric systems and devices based on wireless communication, 3D-technologies, modern TV, audio, and video communications, quantum nonlinear methods of homeostasis assessment into the health care system, as well as biomedical devices and devices for functional diagnostics, screening and remote health monitoring will allow to put into practice the idea of pre-nosological diagnosis of diseases in the future.

The results obtained by us confirmed and significantly expanded the conclusions of the works of many scientists [16-20].

CONCLUSIONS

Due to the spread of coronavirus, in addition to the measures proposed by the governments of different countries

to maintain hygiene, mask regimes, restrictions on attending public events, crowded places, traveling, and quarantining there are other effective methods to prevent and deter the spread of viral infections.

Such tools include methods of simulating the frequency of vibration of pathogens – methods of using small doses of electromagnetic oscillations that effectively affect the mobilization of the human body, form an immune response, production of antibodies to this type of virus, which is equivalent to non-invasive vaccination without dangerous vaccines.

The results of research on the antiviral effect of low doses of electromagnetic oscillations on an experimental model of coronavirus – transmissible pig gastroenteritis virus in SNEV cell culture showed that small doses of electromagnetic oscillations inhibit coronavirus reproduction by 1.25-2.4 lg TCD50.

In the near future, traditional diagnostic methods will replace new, information-based, widely available, technologies based on smartphones and tablets, which allow not only very quickly and accurately to detect disease, but also learn a lot of other information important for effective therapy. In the future, these technologies will become a convenient method for self-monitoring and remote interaction with the doctor, maintaining own health and the health of loved ones.

It is planned to investigate the effectiveness of innovative technologies for protection and restoration of health.

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Informacja prasowa

DZIAŁANIE W SCHORZENIACH NEUROLOGICZNYCH – REHABILITACJA PO UDARZE MÓZGU

Do częstych skutków neurologicznych spowodowanych COVID-19 zalicza się udar mózgu. Magnetostymulacja pomaga przywrócić sprawność niedowładnych kończyn, przyspiesza powrót funkcji psycho-motorycznych i poprawę czucia. Stosowanie impulsowego pola magnetycznego i światła LED działa wyjątkowo korzystnie w aspekcie leczenia analgetycznego, wazodilatacyjnego i spazmolitycznego, działanie stabilizujące na błony komórkowe neuronów i pobudzające procesy plastyczności mózgu, jest szczególnie istotne w terapii osób po udarze.

Neuralgie i neuropatie należą do powikłań często odroczonej, pojawiające się nawet parę tygodni po ustąpieniu objawów choroby COVID-19. Zabiegi Viofor JPS System są wyjątkowo korzystne w aspekcie leczenia analgetycznego i regeneracyjnego w leczeniu neuralgii i neuropatii, przyspieszają powrót czucia, wpływają na polepszenie funkcji neurologicznych oraz przewodnictwa nerwowego. Zastosowania impulsowego pola magnetycznego i światła LED w obwodowych porażeniach nerwu skraca czas leczenia i rehabilitacji ruchowej.

(www.medandlife.com)

The Impact of Radiation Pollution of Environment on Students' Physical Development and Health

Wpływ zanieczyszczenia środowiska promieniowaniem na rozwój fizyczny i zdrowie studentów

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SUMMARY

Aim: To study the impact of small doses of radiation pollution of environment on the physical development and health of students from different areas of residence.

Materials and Methods: The study was conducted at Polissya National University (Zhytomyr, Ukraine) during 2012-2020. 647 students of different specialties in the age of 17-23 were interviewed about the use of preventive measures to eliminate the consequences of the Chernobyl Nuclear Power Plant (CNPP) accident in 1986 and other factors of radiation pollution of environment. In addition, 127 students who were born, lived for some time or periodically lived in the area of low doses of radioactive contamination (58 males and 69 females) and 238 students who lived in the clean area from radioactive contamination (113 males and 125 females) were interviewed to compare the samples.

Results: The comparative analysis of the students' physical development from different areas of residence showed that the students from the clean area have better indicators of average body height, body weight, Erisman index with no significant differences ($P > 0.05$). Significant differences were revealed in the indicators of the circumference of the chest and the dynamometry of the hand ($P < 0.05-0.01$).

Conclusions: It was established that long-term residence in the area with low doses of radioactive contamination has a negative impact on the physical development and health of the students. The students who have lived for a long time in the area of radioactive contamination more often suffer from a disease, miss classes and get tired faster during physical education sessions. It was clarified that the majority of the students are not involved in health preservation activities, but only in cases when they face significant health problems associated with the need to see a doctor, disability, etc.

Key words: radiation pollution, physical development, health, students

Słowa kluczowe: zanieczyszczenie radiacyjne, rozwój fizyczny, zdrowie, studenci

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INTRODUCTION

The life-sustaining activities of the human body is in a continuous dynamic relationship with environmental factors. Such interaction should not disrupt the adaptive mechanisms of the human body. Inborn and acquired reflexes are created in the human's body under the influence of various stimuli of the internal and external environment, which determine the maintenance of dynamic balance based on metabolism and energy exchange between the body and the environment.

Environmental factors must effectively influence health and ensure the normal flow of all human life processes.

As a result of the Chernobyl Nuclear Power Plant (CNPP) disaster and other sources of radioactive impact, the environment of certain areas of Ukraine is contaminated with radionuclides such as strontium-90, iodine-129, radium-226, cesium-137, plutonium-239. The accident was unique worldwide in terms of the number of radionuclides released into the atmosphere, the area of contaminated territories, the collective human

radiation exposure, and the large “iodine shock”, millions of people affected by small doses of radiation. In this situation, a significant part of the population of Ukraine is forced to consume water and food products with a certain content of radioactive substances, which leads to the accumulation of radionuclides and causes chronic internal exposure of the body [1-3].

The scientists have identified a number of features of the biological action of small doses of radiation, namely: 1) small doses of radiation actively affect human metabolism; 2) low-intensity radiation is more effective than acute one within certain dose intervals; 3) the dependence of the effect on the radiation dose may be nonlinear, non-monotonic, polymodal in nature; 4) the doses with observed extreme values depend on the power (intensity) of radiation and decrease with its reduction; 5) radiation in small doses leads to changes (in most cases to the increase) in the sensitivity to the action of damaging factors [4, 5].

Air, soil, vegetation, water in open reservoirs, agricultural products, etc. are polluted as a result of the fallout of radioactive substances. Radioactive particles are partially dissolved in water, and some of them gravitate to the bottom, infecting water bodies to the full depth. The greatest radioactive contamination is experienced by lakes, ponds, slow-flowing rivers, rainwater and melt water. Radionuclides get into food raw materials of plant origin through root systems and leaves and into the human body – through air, water and through the consumption of fruits, vegetables and grain varieties, meat of animals, poultry, fish grown on contaminated lands [6, 7]. The shortest ways for radionuclides to enter the human body are the use of radioactively contaminated drinking water and the inhalation of atmospheric air with radioactive dust. The analysis of scientific research [8, 9] shows that more than 90% of all radioactive substances that enter the human body from the environment are contained in food, 5-9% – in drinking water, less than 1% – in air. The gastrointestinal tract is the main route of radionuclides entry into the human body. Radioactive elements behave as corresponding stable ones. The principle of selective absorption is justified in such a way that when the body is provided with the necessary substances, the probability of absorption of radioactive substances by cells decreases. Depending on this, there are isotopes that: 1) are accumulated in the bones: strontium, barium, radium, calcium; 2) are concentrated in the liver and skeleton: lanthanum, cerium, promethium; 3) are evenly distributed: tritium, carbon, iron, polonium; 4) are accumulated in the muscles: potassium, cesium, rubidium; 5) are concentrated in the spleen and lymph nodes: ruthenium, niobium; 6) are accumulated in the thyroid gland: iodine [10, 11].

The degree of danger of radionuclide contamination depends on the frequency of consumption of products contaminated with radioactive substances, as well as on the rate of their excretion from the body. If the radionuclides that enter the body are the same as the elements consumed by humans with food (sodium, potassium, chlorine, calcium, iron, manganese, iodine and others), they are quickly excreted with them. Radioactive isotopes are accumulated in the tissues of various

organs and become a source of long-term radiation. The concentration of radionuclides in an organ can be many times higher than in the human body as a whole. Therefore, the absorbed doses accumulated in one of the organs can cause adverse effects, although the total isotope content in the body is small [12].

According to the scientific research [13], the vast majority of schoolchildren and students living in the areas of radioactive contamination is characterised by a decrease in mental and physical performance, psychomotor tone, the level of psychosocial activity, as well by a tendency to proneness to conflict and deterioration of their emotional state. Therefore, it is necessary to modify the content, methods and organizational forms of teaching and education in terms of working with high schoolers and students living in the contaminated area.

Therefore, it is necessary to take into account the degree of influence of environmental factors on the body of students, especially the effects of radiation pollution during the training sessions on physical education and physical culture as well as fitness and health recreation events. In particular, high-risk areas should be identified, the level of mutagenic background and mutational variability should be assessed, and the sources of mutagens entering the environment should be clarified in order to avoid pathology of a genetic nature.

AIM

The aim of this article is to study the impact of small doses of radiation pollution of environment on the physical development and health of students from different areas of residence.

MATERIALS AND METHODS

The study was conducted at Polissya National University (Zhytomyr, Ukraine) during 2012-2020. 647 students of different specialties in the age of 17-23 were interviewed about the use of preventive measures to eliminate the consequences of the CNPP accident and other factors of radiation pollution of environment. In addition, 127 students who were born, lived for some time or periodically lived in the area of low doses of radioactive contamination (58 males and 69 females) and 238 students who lived in the clean area from radioactive contamination (113 males and 125 females) were interviewed to compare the samples. The survey was conducted using the author's questionnaires. A questionnaire was used for the survey in accordance with the requirements of the Codes of Ethics of Polissya National University. The questionnaire was assessed by the experts in this field (6 professors and 8 associate professors) and was approved by the Academic Council of Polissya National University (Protocol No. 2 dated 15.09.2012). Consent to voluntary participation in the survey was obtained from all the students involved in the study.

The research methods: theoretical (analysis and generalization of literature sources (26 sources on the topic of the article from the scientometric databases PubMed, Scopus, Web of Science Core Collection and others were analyzed), study and analysis of clinical records of the students); empirical

(pedagogical observations, questionnaires, surveys, testing); methods of mathematical statistics.

This study complies with the ethical standards of the Act of Ukraine "On Higher Education" No. 1556-VII dated 01.07.2014 and the Letter from the Ministry of Education and Science of Ukraine "On the Academic Plagiarism Prevention" No. 1/11-8681 dated 15.08.2018. Also, this study followed the regulations of the World Medical Association Declaration of Helsinki – ethical principles for medical research involving human subjects. Informed consent was received from all individuals who took part in this research.

RESULTS

The impact of negative environmental factors on the body of students during their intense physical activities is even more harmful because it is associated with greater consumption of polluted air, food products, water and the intensity of all functional systems and the body as a whole. Therefore, the construction of sports facilities, the choice of grounds for training and conditioning exercises, leisure-time activities and outdoor recreation, swimming in open water should take into account the impact of radioactive contamination of the environment on the health of students. Each student must understand the ways in which radionuclides enter the body and predict the consequences they may lead to.

We have studied the ways in which radionuclides enter the human body. Included in the cycle of substances, radionuclides enter the human body with food products, water and air, moving through the food chain. The first chain is air – man. The second chain is soil – plant food – man. The third chain is soil – vegetation – cows, goats, sheep – milk – man. The fourth chain is soil – vegetation – graminivorous domestic and wild animals, poultry and wild birds – man. The fifth chain is 1) water – man; 2) sea and river water – phytoplankton – fish – man; 3) sea and river water – zooplankton – crayfish, crabs, mollusks, algae (seaweed) – man; 4) sea and river water – waterfowl and wild birds – man.

The state of health of students depends on the social, economic and spiritual development of society, the state of the environment, waste disposal, the availability of sufficient amount of wholesome and safe food, clean water, fresh air and certain scientific and educational knowledge about environmental behaviour and the use of its natural resources. At the same time, morbidity reflects the degree of students' adaptation to environmental conditions, and the structure of morbidity i.e. the proportion of each disease in their total number. The analysis of the causes of morbidity and environmental conditions, in which students live, provides grounds for the protection of each individual from the influence of negative environmental factors.

The study of measures to preserve students' own health in connection with environment pollution due to the CNNP accident and other natural factors showed that 57.9% of the students do not pay attention to this situation and do not take any preventive measures. Only a small proportion of students – 15.3% (usually those who already have health problems) undertake examination in diagnostic centres, 7.6% – additionally

engage in exercise to improve health, 11.1% – visitsauna, 8.9% – consume pure products of radioprotective action, 5.1% – use chemicals of radioprotective action prescribed by a doctor (Table 1). In general, the surveys have shown that the majority of the students are not involved in health preservation activities, but only in cases when they face significant health problems associated with the need to see a doctor, disability and sick leave.

Our in-depth surveys of the students who were born and lived for a long time in the areas of high radionuclide contamination showed that 63.8% of those surveyed complained of general weakness, frequent headaches, rapid fatigue, increased irritability, sweating, sleep disorders, dizziness, memory impairment, frequent respiratory diseases, pains in joints, muscles, bones during physical activity and without it (Table 2). The students often sought medical help (2-5 times a year) for respiratory diseases, sore throats, tooth decay, osteochondrosis, etc. The comparison of the indicators of the students' subjective assessment of their own health status living in the area of radioactive contamination and clean area of residence indicates a significant difference between the comparison groups (34.5-9.3%). The data confirm the statistics that the area with low doses of radioactive radiation has a negative impact on the health of young people.

It is established that inflammatory processes, pneumosclerosis, and tumours develop due to the biological activity of alpha radiation when radionuclides are inhaled into the lungs. Active radicals are formed in the body, which have high biological activity and quickly damage molecules in the process of ionizing radiation. The analysis of the survey results of the students from different areas of residence confirms the trend that the long-term effects of radiation have a negative impact on the students' health (Table 3). The results of the analysis of the causes of complaints about the disease of students from different areas of residence showed that from 1.7 to 15.4% of the students from the area of radioactive contamination seek more help from a doctor. Thus, 24.7% of the students visited the doctor with respiratory diseases, 22.1% – with sore throat, 11.0% – with thyroid gland, 14.2% – with joint pain, 24.4% – with tooth decay, 20.5% – with cardiovascular system. At the same time, the students from the clean area visited the doctor not that often with similar diseases, in particular with respiratory diseases – 10.5%, sore throat – 6.7%, thyroid gland – 0.8%, joint pain – 2.9%, tooth decay – 8.8%, cardiovascular system – 7.6%. Accordingly, the students who have lived for a long time in the area of radioactive contamination more often suffer from a disease, miss classes and get tired faster during physical education sessions.

Our surveys of the students of Polissya National University showed that their height is in the range of 160.7-191.2 cm, weight – 54.3-97.8 kg, respectively, chest circumference – 78.7-105.6 cm, Erismann index – 3.21-6.2 cm, hand dynamometry – 28.7-56.8 kg, which indicates large individual differences in the students' physical development. The comparative analysis of the students' physical development from different areas of residence showed that the students from the clean area have better indicators of average body height, body weight, chest circumference, Erismann index with no significant differences

Table 1. Preventive activities undertaken by the students to preserve their own health in connection with the consequences of the Chernobyl accident (% , n=647)

Activities	Gender	Study year				Total percent
		1 st	2 nd	3 ^d	4 th	
No activities undertaken	male	70.5	70.3	54.3	47.1	64.7
	female	65.9	47.1	64.7	51.8	54.0
	total	68.4	52.9	60.5	50.4	57.9
Students undertake the following activities and other	male	29.6	29.7	45.7	52.9	35.3
	female	34.1	52.9	35.3	48.2	46.0
	total	31.6	47.1	39.5	49.6	42.1
General medical examination in the clinic	male	25.7	7.8	37.1	38.2	28.6
	female	28.0	30.4	17.6	24.7	27.1
	total	26.7	28.6	25.6	28.6	27.7
Examination in diagnostic centres	male	15.2	10.9	14.3	14.7	13.9
	female	9.8	15.2	17.6	23.5	16.1
	total	12.8	14.1	16.3	21.0	15.3
Additional physical exercises	male	6.7	6.3	14.3	14.7	8.8
	female	7.3	5.2	2.0	12.9	6.8
	total	7.0	5.5	7.0	13.4	7.6
Visiting bath-house or sauna	male	10.5	14.1	17.1	23.5	14.3
	female	9.8	7.3	15.7	9.4	9.3
	total	10.2	9.0	16.3	13.4	11.1
Consumption of pure radioprotective products	male	5.7	12.5	5.7	8.8	8.0
	female	9.8	10.5	13.7	4.7	9.5
	total	7.5	11.0	10.5	5.9	8.9
Consumption of radioprotective chemicals	male	3.8	1.6	5.7	5.9	3.8
	female	6.1	4.7	5.9	8.2	5.9
	total	4.8	3.9	5.8	7.6	5.1

Table 2. Indicators of long-term impact of small doses of radioactive contamination on the health of students from different areas of residence (%)

Students' subjective assessment of their own health	Students from the area of radioactive contamination (n=127)	Students from the clean residence area (n=238)	Difference
General weakness	48.0	13.5	34.5
Rapid fatigue	41.7	24.0	17.7
Frequent headache	21.3	7.6	13.7
Dizziness	26.0	13.5	12.5
Frequent respiratory diseases	40.2	28.9	11.3
Pain in joints, muscles, bones during exercise	32.3	12.2	20.1
Increased irritability	18.1	8.8	9.3
Sweating	50.4	26.5	23.9
Sleep disorders	26.0	11.3	14.7
Memory impairment	14.2	3.8	10.4

– $P > 0.05$ (Table 4). Significant differences were revealed only in the indicators of the circumference of the chest – 2.2 cm and the dynamometry of the hand – 3.6 kg ($P < 0.05$).

The indicators of height in female students are in the range of 150.4-182.8 cm, weight – 41.9-80.3kg, respectively, chest circumference – 62.5-90.2 cm, Erismann index – 2.4-4.9 cm, hand dynamometry – 23.8-39.6 kg, which indicates large individual differences in the physical development of female students of the same age. The comparative analysis of the female students' indicators from different areas of

residence also has no significantly better indicators of body height, body weight, Erismann index ($P > 0.05$) in the female students from the clean areas of residence. At the same time, the female students from the clean areas of residence showed significantly better indicators in the circumference of the chest – 2.7 cm ($P < 0.05$) and dynamometry – 5.4 kg ($P < 0.01$) (Table 5).

Based on the above, it can be stated that long-term residence in the area with low doses of radioactive contamination has a negative impact on the students' physical development.

Table 3. Seeking medical advice by the students from different areas of residence during the academic year

Reason for treatment (complaints of illness)	Students from the area of radioactive contamination (n=127)		Students from the clean r esidence area (n=238)		Difference, %
	n	%	n	%	
Respiratory diseases	31	24.4	25	10.5	13.9
Angina	28	22.1	16	6.7	15.4
Thyroid gland	14	11.0	2	0.8	10.2
Headache	13	10.2	6	2.5	7.7
Joint pain	18	14.2	7	2.9	11.3
Tooth decay	31	24.4	21	8.8	15.6
Osteochondrosis	11	8.7	7	2.9	5.8
Sense of vision	12	9.5	13	5.5	4.0
Cardiovascular system	26	20.5	18	7.6	12.9
Gastrointestinal tract	8	6.3	4	1.7	4.6
Genitourinary and endocrine systems	11	8.7	13	5.5	3.2
Respiratory system	8	6.3	11	4.6	1.7
Nervous system and sense organs	7	5.5	6	2.5	2.5
Congenital anomalies	1	0.8	3	1.3	0.5
Other causes of diseases	16	12.6	23	9.7	2.9
Total	15.7	12.4	11.7	4.9	7.5

Table 4. The level of physical development of the students from different areas of residence (males, $X \pm m$)

Indicators of physical development	Students from the area of radioactive contamination (n=58)	Students from the clean residen- ce area (n=113)	The level of significance	
			t	P
Body length, cm	174.6±1.12	176.3±1.09	1.09	>0.05
Body weight, kg	69.3±0.94	71.6±0.88	1.79	>0.05
Chest circumference, cm	90.2±0.73	92.4±0.65	2.25	<0.05
Erismann index, cm	4.47±0.51	5.58±0.57	1.45	>0.05
Hand dynamometry, kg	36.2±1.04	39.8±0.96	2.54	<0.05

Table 5. The level of physical development of the students from different areas of residence (females, $X \pm m$)

Indicators of physical development	Students from the area of radioactive contamination (n=69)	Students from the clean residence area (n=125)	The level of significance	
			t	P
Body length, cm	164.7±1.14	165.8±1.18	0.67	>0.05
Body weight, kg	56.8±1.91	57.7±1.48	0.37	>0.05
Chest circumference, cm	80.2±0.57	82.9±1.03	2.29	<0.05
Erismann index, cm	2.8±0.49	3.2±0.53	0.55	>0.05
Hand dynamometry, kg	28.2±1.13	33.6±0.97	3.63	<0.01

DISCUSSION

It is established that the radiological situation in the inhabited localities of the north of Zhytomyr oblast has changed for the better in the remote period after the Chernobyl accident, but there are still some critical areas that are radiation-hazardous to the population. The radionuclides of cesium and strontium, having similar chemical properties, respectively, to potassium and calcium, are often easily included in biogenic migration through the trophic chain and are accumulated in food products [6, 8]. Consumption of products contaminated with cesium and strontium by the population leads to additional internal exposure of the human body.

The studies of the researchers [10, 13] have shown that children living in the areas with the same contamination density differed significantly in the level of incorporated cesium-137. The examined children revealed direct dependence of the state of arterial blood pressure (hypertension) on the level of incorporated radionuclides, which indicates a certain role of ionizing radiation in the pathogenesis of the detected changes in terms of cardiovascular disorders. The radiation factor indirectly affects the tissues, organs and systems of the body through the central nervous system in people living in the area contaminated with radionuclides. Incorporated radiocaesium is one of the important ethiological factors of the syndrome of

vegetative-vascular dystonia, which is quite common among children and adults living in contaminated areas.

The following peculiarities have been identified when studying the effect of radiation on the human body: 1) even a small amount of absorbed radiation energy causes profound biological changes in the body; 2) the presence of a latent (incubation) period of ionizing irradiation; 3) radiation has a genetic effect; 4) the organs of a living organism have different sensitivity to radiation; 5) individual organisms react differently to radiation; 6) radiation depends on the frequency. Occasional radiation in a large dose causes deeper changes than small doses of radiation [14, 15].

It has been experimentally proven that there is no safe dose of radiation. A wide range of minimum doses of radionuclides, when there are various pathological disorders in the human body (general weakness, drowsiness, apathy, etc.), confirms the unequal sensitivity of organs and tissues to ionizing radiation [16]. It is also recognized that the relationship between low doses of radiation and disease in the population is linear, as it is most fully consistent with existing experimental data and clinical observations [17].

The ecological approach to physical education classes as well as physical culture and sports activities in the environment contaminated with radioactive substances takes a different perspective and brings the student's worldview from a narrow subject area to the field of universal human sphere i. e. health saving one. As a result, the students develop global thinking, an important element of which is the ecological and humanistic understanding of the world, the restructuring of their thinking and certain premonitions about maintaining their own health.

The organization and conduct of the educational process on physical education, fitness and health recreation events as well as sports activities with students who were born, live or lived a certain period of their lives in the environment contaminated with radioactive substances, require special attention to the formation of environmental and physical education. The reason for this is: 1) lack of environmental knowledge of teachers of physical education; 2) inadequate material and technical resources for conducting recreational and health-improving as well as preventive physical exercises; 3) inadequate medical examination, control over the students' health and the environment; 4) no control over physical development, mental and physical performance; 5) lack of scientific recommendations for physical activities in conditions of small doses of ionizing radiation; 6) violation of food rules in the conditions of radionuclide contamination; 7) violation of sanitary and hygienic conditions for sports as well as physical culture and health activities, leisure and recreation events, etc. Our research is confirmed by the work of other scientists [18-26].

CONCLUSIONS

1. A high frequency of diseases of the respiratory system, musculoskeletal system, cardiovascular system, endocrine, nervous systems, vision in modern students who have lived for a long time in the areas affected by small doses of radionuclide contamination has been determined.

2. Physical development of students is one of the important integral indicators of their health, adaptation to environmental factors, living conditions, learning and at the same time an indicator of the state of the living environment. The physical development of the students of Polissya National University corresponds to the general laws of its formation, but also has its own peculiarities, which are primarily related to the contamination of the environment with radionuclides, in which the students have lived or live for a long time. The comparative analysis of the students' physical development from different areas of residence showed that the students from the clean area have better indicators of average body height, body weight, and Erisman index with no significant differences ($P > 0.05$). Significant differences were revealed in the indicators of the circumference of the chest and the dynamometry of the hand ($P < 0.05-0.01$).

3. It has been established that long-term residence in the area with low doses of radioactive contamination has a negative impact on the physical development and health of students. The students who have lived for a long time in the area of radioactive contamination more often suffer from a disease, miss classes and get tired faster during physical education sessions. At the same time, the majority of the students are not involved in health preservation activities, but only in cases when they face significant health problems associated with the need to see a doctor, disability, etc.

Prospects for further research are to analyse the functional state and physical fitness of students who lived in the area of radiation pollution.

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Conflict of interest:

The Authors declare no conflict of interest

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Rehabilitacja lecznicza realizowana przez Zakład Ubezpieczeń Społecznych w ramach prewencji rentowej

Medical Rehabilitation Carried out by the Social Insurance Institution as Part of Disability to Work Prevention

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STRESZCZENIE

Zakład Ubezpieczeń Społecznych (ZUS) realizuje program rehabilitacji leczniczej w ramach prewencji rentowej od 1996 roku. Celem rehabilitacji leczniczej jest poprawa stanu zdrowia ubezpieczonych w aspekcie odzyskania lub utrzymania zdolności do pracy. Rehabilitacja lecznicza jest prowadzona w tych schorzeniach, które najczęściej wywołują niezdolność do pracy, a tym samym generują największe koszty dla systemu ubezpieczeń społecznych. Aktualnie ZUS kieruje na rehabilitację leczniczą w: chorobach narządu ruchu, chorobach układu krążenia, chorobach układu oddechowego, chorobach psychosomatycznych, osoby po leczeniu nowotworu gruczołu piersiowego, chorobach narządu głosu, osoby, które podczas wypadku, w szczególności wypadku przy pracy, doznały urazu narządu ruchu, chorobach ośrodkowego układu nerwowego. Jej rola ogranicza się do uzupełnienia procesu terapeutycznego o działania medyczne nastawione na poprawę sprawności organizmu umożliwiającą osobie ubezpieczonej lub renciście powrót do zatrudnienia. Stąd też zakres podmiotowy jej działania obejmuje ubezpieczonych zagrożonych całkowitą lub częściową niezdolnością do pracy i rokujących podjęcie pracy zarobkowej w następstwie jej odbycia. Pojęcie niezdolności do pracy oznacza, że niezdolną do pracy jest osoba, która całkowicie lub częściowo utraciła zdolność do pracy zarobkowej z powodu naruszenia sprawności organizmu i nie rokuje odzyskania zdolności do pracy po przekwalifikowaniu. Całkowicie niezdolną do pracy jest osoba, która utraciła zdolność do wykonywania jakiegokolwiek pracy. Częściowo niezdolną do pracy jest osoba, która w znacznym stopniu utraciła zdolność do pracy zgodnej z poziomem posiadanych kwalifikacji.

Słowa kluczowe: rehabilitacja lecznicza, prewencja rentowa, Zakład Ubezpieczeń Społecznych

SUMMARY

The Social Insurance Institution (ZUS) has been implementing a medical rehabilitation program as part of disability prevention since 1996. The purpose of medical rehabilitation is to improve the health condition of the insured in terms of regaining or maintaining the ability to work. Medical rehabilitation is carried out in those diseases that most often cause inability to work, and thus generate the greatest costs for the social insurance system. Currently, ZUS is referring to medical rehabilitation in: diseases of the musculoskeletal system, cardiovascular diseases, respiratory system diseases, psychosomatic diseases, people after treatment of breast cancer, voice organ diseases, people who, during an accident, in particular an accident at work, suffered an injury to the musculoskeletal system, diseases of the central nervous system. Its role is limited to supplementing the therapeutic process with medical measures aimed at improving the body's efficiency, enabling the insured person or pensioner to return to employment. Hence, the subjective scope of its activities covers the insured at risk of total or partial incapacity for work and who are promising to start gainful employment as a result of its completion. The concept of incapacity for work means that a person who has lost the ability to work completely or partially due to a violation of the body's efficiency is incapable of work and does not expect to regain the ability to work after retraining. A person who has lost the ability to perform any work is completely incapable of work. A person partially incapable of work is a person who has largely lost the ability to work in accordance with the level of their qualifications.

Key words: medical rehabilitation, disability to work prevention, Social Insurance Institution

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WSTĘP

Do zakresu działania Zakładu Ubezpieczeń Społecznych (ZUS) należy m.in. prowadzenie prewencji rentowej [1]. Działanie to jest skierowane do osób podlegających ubezpieczeniu społecznemu w ZUS, osób zagrożonych ryzykiem ubezpieczeniowym, jakim jest niezdolność do pracy lub osób już pobierających świadczenia z Funduszu Ubezpieczeń Społecznych (FUS), takie jak: zasiłek chorobowy, świadczenie rehabilitacyjne, renta z tytułu niezdolności do pracy.

Przeprowadzenie rehabilitacji leczniczej w ramach prewencji rentowej ZUS ma dać tym osobom realną szansę na odzyskanie zdolności do pracy i zminimalizować wydatki na świadczenia z tytułu niezdolności do pracy ponoszone przez ubezpieczyciela jakim jest ZUS. Wskazać należy, że jest to działalność restytucyjna. Celem bowiem rehabilitacji leczniczej realizowanej w ramach systemu ubezpieczeń społecznych jest zapobieganie (przez działania medyczne zmierzające do maksymalnego usprawnienia organizmu oraz niedopuszczenia do pogłębienia się powstałych defektów) zagrażającemu osobom ubezpieczonym obniżeniu ich zdolności do zarabkowania, poprawa tej zdolności lub jej przywrócenie. Jak podkreśla się w literaturze przedmiotu, efektywność procesu przedmiotowej rehabilitacji wymaga, aby działania rehabilitacyjne były podejmowane jak najwcześniej z medycznego punktu widzenia, albowiem wcześniej rozpoczęta rehabilitacja lecznicza skraca okres leczenia oraz zapobiega powstaniu lub utrwaleniu kalectwa [2]. Rehabilitacja ta stanowi niezbędny warunek późniejszego przygotowania osoby ubezpieczonej do pracy i odpowiedniego jej zatrudnienia, przy czym im lepsze jest usprawnienie funkcjonalne, tym łatwiejsze jest przywrócenie zdolności do pracy [3]. Niedocenienie tej formy rehabilitacji w procesie leczenia skutkuje wzrostem liczby osób pobierających świadczenia rentowe, a co za tym idzie wzrostem wydatków instytucji ubezpieczeniowej.

Zakład Ubezpieczeń Społecznych realizuje program rehabilitacji leczniczej w ramach prewencji rentowej od 1996 roku. Wdrożenie tego programu do zadań realizowanych przez Zakład pokazuje nowe podejście do roli i zadań instytucji ubezpieczenia społecznego, która nie tylko wypłaca świadczenia, ale przede wszystkim stara się w aktywny sposób wpływać na sytuację ubezpieczonych poprzez poprawę stanu ich zdrowia oraz przywrócenie zdolności do pracy zarobkowej. Mając na względzie główny cel rehabilitacji leczniczej, jakim jest poprawa stanu zdrowia ubezpieczonych w aspekcie odzyskania lub utrzymania zdolności do pracy, przyjęto założenie, że rehabilitacja lecznicza powinna być prowadzona w tych schorzeniach, które najczęściej wywołują niezdolność do pracy, a tym samym generują największe koszty dla systemu ubezpieczeń społecznych. Zakład Ubezpieczeń Społecznych monitorując strukturę przyczyn niezdolności do pracy, w kolejnych latach sukcesywnie wprowadzał nowe programy rehabilitacji leczniczej, mając na uwadze te grupy pacjentów dla których rehabilitacja stanowi niezwykle ważny, często kluczowy, element terapii, decydujący o końcowym efekcie całego procesu leczenia, zarówno zachowawczego jak i operacyjnego.

Aktualnie najczęstszymi przyczynami niezdolności do pracy są następujące grupy schorzeń: nowotwory, choroby układu krążenia, choroby układu kostno-stawowego, mięśniowego i tkanki łącznej oraz zaburzenia psychiczne. W 2021r. Zakład kieruje na rehabilitację leczniczą:

1.) w systemie stacjonarnym:

- w chorobach narządu ruchu,
- w chorobach układu krążenia,
- w chorobach układu oddechowego,
- w chorobach psychosomatycznych,
- osoby po leczeniu nowotworu gruczołu piersiowego,
- w chorobach narządu głosu,
- osoby, które podczas wypadku, w szczególności wypadku przy pracy, doznały urazu narządu ruchu,
- w chorobach ośrodkowego układu nerwowego,

2.) w systemie ambulatoryjnym:

- w chorobach narządu ruchu,
- w chorobach układu krążenia, w tym rehabilitacja kardiologiczna monitorowana telemedycznie.

Definiując cel rehabilitacji leczniczej, ustawodawca określił jednocześnie grupę uprawnionych do tego świadczenia oraz zasady jego przyznawania. Rehabilitacja lecznicza prowadzona przez ZUS przeznaczona jest dla osób:

- ubezpieczonych zagrożonych całkowitą lub częściową niezdolnością do pracy,
- uprawnionych do zasiłku chorobowego lub świadczenia rehabilitacyjnego po ustaniu tytułu do ubezpieczenia chorobowego lub wypadkowego,
- pobierających rentę okresową z tytułu niezdolności do pracy rokujących jednocześnie odzyskanie zdolności do pracy po przeprowadzeniu rehabilitacji.

Pojęcie niezdolności do pracy, w rozumieniu przepisów prawa oznacza, że niezdolną do pracy jest osoba, która całkowicie lub częściowo utraciła zdolność do pracy zarobkowej z powodu naruszenia sprawności organizmu i nie rokuje odzyskania zdolności do pracy po przekwalifikowaniu. Całkowicie niezdolną do pracy jest osoba, która utraciła zdolność do wykonywania jakiegokolwiek pracy. Częściowo niezdolną do pracy jest osoba, która w znacznym stopniu utraciła zdolność do pracy zgodnej z poziomem posiadanych kwalifikacji [4].

Rehabilitacja w ośrodkach rehabilitacyjnych współpracujących z ZUS prowadzona jest według ściśle określonych kryteriów opracowanych dla każdego profilu schorzeń, których podstawą jest kompleksowe oddziaływanie procedurami diagnostyczno-leczniczo-rehabilitacyjnymi i psychologicznymi oraz edukacja zdrowotna. Dla każdego ubezpieczonego ustalony jest indywidualny program przebiegu rehabilitacji, ukierunkowany na leczenie schorzenia będącego przyczyną skierowania na rehabilitację oraz na schorzenia współistniejące. Program rehabilitacji uwzględnia przede wszystkim:

- 1) różne formy rehabilitacji fizycznej, tzn. kinezyterapię indywidualną, zbiorową i ćwiczenia w wodzie oraz zabiegi fizykoterapeutyczne z zakresu ciepłolecznictwa, krioterapii, hydroterapii, leczenie polem elektromagnetycznym wysokiej i niskiej częstotliwości, leczenie ultradźwiękami, laseroterapię, masaż klasyczny i wibracyjny;

- 2) rehabilitację psychologiczną, w tym m.in. psychoedukację i treningi relaksacyjne;
- 3) edukację zdrowotną, ukierunkowaną na przekazanie informacji w zakresie:
 - zasad prawidłowego żywienia,
 - czynników ryzyka w chorobach cywilizacyjnych,
 - podstawowej wiedzy o procesie chorobowym danego profilu schorzenia,
 - czynników zagrożenia dla zdrowia w miejscu pracy,
 - instruktażu sposobu kontynuacji rehabilitacji w warunkach domowych po zakończeniu turnusu rehabilitacyjnego;
- 4) podstawowe informacje o prawach i obowiązkach pracodawcy oraz pracownika.

PROFILE REHABILITACJI LECZNICZEJ REALIZOWANE W ZAKŁADZIE UBEZPIECZEŃ SPOŁECZNYCH

Rehabilitacja w chorobach narządu ruchu

Profil wprowadzony w 1996 r. i jako jeden z pierwszych program rehabilitacji leczniczej w ramach prewencji rentowej w chorobach narządu ruchu był opracowany z uwzględnieniem głównych założeń „Polskiej Szkoły Rehabilitacji” prof. Wiktora Degi. Rehabilitacja według koncepcji Degi polegała na możliwie jak najwcześniejszym zapoczątkowaniu, równoległe z leczeniem operacyjnym, postępowania ukierunkowanego na maksymalne odtworzenie czynności narządu ruchu oraz szeregu innych bardzo istotnych działań uwzględniających m.in. rehabilitację zawodową, społeczną i psychologiczną, mających na celu nie tylko umożliwienie powrotu pacjenta do pracy, lecz również do samodzielnej egzystencji w społeczeństwie. Choroby układu ruchu stanowią poważny problem społeczno-ekonomiczny, a ich rozpowszechnienie sprawia, że są zaliczane do chorób społecznych. Należą także do najczęstszych przyczyn orzekania o czasowej niezdolności do pracy oraz powtórnych orzeczeń rentowych generując bardzo wysokie wydatki ponoszone przez ZUS z ubezpieczeń społecznych z tytułu niezdolności do pracy - dla przykładu w 2019 r. wynosiły w tej grupie schorzeń ponad 5,5 mld zł.

Rehabilitacja w chorobach układu krążenia

Pierwszy program rehabilitacji leczniczej w chorobach układu krążenia w ramach prewencji rentowej ZUS wdrożono w oparciu o Model Rehabilitacji Kardiologicznej opracowany przez kardiologów: prof. Zdzisława Askanasa i prof. Stanisława Rudnickiego - główne założenia tego modelu rehabilitacji obowiązują do dziś. Program rehabilitacji leczniczej prowadzony w ramach prewencji rentowej ZUS na przestrzeni lat był modyfikowany zgodnie z rekomendacjami w zakresie realizacji kompleksowej rehabilitacji kardiologicznej zawartych w stanowisku ekspertów Sekcji Rehabilitacji Kardiologicznej i Fizjologii Wysiłku Polskiego Towarzystwa Kardiologicznego. Należy podkreślić, że programy kompleksowej rehabilitacji kardiologicznej są rekomendowane przez europejskie i amerykańskie towarzystwa kardiologiczne jako standard obowiązujący w postępowaniu m.in. z pacjentami z chorobą niedokrwienną serca, niewydolnością serca, po ostrym zespolech wieńcowych i/lub rewaskularyzacji mięśnia

sercowego. Liczne publikacje naukowe wskazują, że uczestnictwo pacjentów w programach kompleksowej rehabilitacji kardiologicznej zmniejsza ryzyko zgonu z wszystkich przyczyn o 13% oraz ryzyko zgonu z przyczyn sercowo-naczyniowych aż o 26%-31%.

W 2006 r. w ramach Programu Profilaktyki i Leczenia Chorób Układu Sercowo-Naczyniowego POLKARD realizowanego przez Ministerstwo Zdrowia zespół specjalistów Instytutu Kardiologii im. Kardynała Stefana Wyszyńskiego opracował i wdrożył metodykę innowacyjnego programu rehabilitacji kardiologicznej z wykorzystaniem systemów telemedycznych, otwierającego nowe możliwości rehabilitacji dla osób po incydentach sercowo-naczyniowych. W 2007 r. opracowano, w ramach umowy z Instytutem Kardiologii w Warszawie, na potrzeby prewencji rentowej ZUS, program monitorowanej telemedycznie rehabilitacji kardiologicznej w warunkach domowych. Autorami tego programu byli specjaliści w dziedzinie rehabilitacji kardiologicznej: prof. dr hab. n. med. Ryszard Piotrowicz oraz dr hab. n. med. Rafał Baranowski z Instytutu Kardiologii w Warszawie. W latach 2009-2010 Zakład Ubezpieczeń Społecznych wdrożył pilotażowy program monitorowanej telemedycznie rehabilitacji kardiologicznej w warunkach domowych. Pozytywna ocena merytoryczna wyników pilotażu stanowiła podstawę do włączenia na stałe do pakietu programów realizowanych przez Zakład Ubezpieczeń Społecznych w ramach prewencji rentowej rehabilitacji kardiologicznej monitorowanej telemedycznie.

Rehabilitacja w chorobach układu oddechowego

Z analiz przyczyn niezdolności do pracy prowadzonych przez ZUS w kolejnych latach wynikało, że istotnym czynnikiem powodującym niezdolność do pracy były także schorzenia układu oddechowego. Dlatego w 2001 r. ZUS wprowadził nowy profil rehabilitacji leczniczej w systemie stacjonarnym dla osób ze schorzeniami układu oddechowego. Najliczniejszą grupą osób korzystających z tego programu są pacjenci z astmą oskrzelową i/lub przewlekłą obturacyjną chorobą płuc. Przewlekła obturacyjna choroba płuc (POChP) stanowi niezwykle poważny problem w aspekcie zdrowia publicznego z uwagi na postępujący, wieloletni przebieg tej choroby prowadzący często do nieodwracalnych zmian w płucach skutkujących niewydolnością oddechową. W Polsce liczbę chorych na POChP szacuje się na ok. 2 mln osób, z czego nawet u 80% pozostaje ona nierozpoznana. W perspektywie kolejnych lat szacuje się, że liczba osób z chorobami układu oddechowego będzie stale rosła z uwagi na nieustanną ekspozycję na czynniki ryzyka rozwoju tych chorób, z których najważniejsze to palenie tytoniu i oddychanie zanieczyszczonym powietrzem. W leczeniu POChP, poza terapią farmakologiczną, kluczowe znaczenie w opóźnieniu progresji zmian w płucach prowadzących do trwałego inwalidztwa oddechowego ma także postępowanie niefarmakologiczne, a w szczególności rehabilitacja lecznicza, edukacja zdrowotna, promocja zdrowego stylu życia. Rehabilitacja schorzeń układu oddechowego prowadzona w ramach prewencji rentowej ZUS uwzględnia specyfikę tych chorób i potrzeby pacjen-

tów. Ten profil rehabilitacji jest szczególnie istotny w dobie pandemii COVID-19.

Rehabilitacja w chorobach psychosomatycznych

Wobec odnotowywanego stałego wzrostu liczby osób niezdolnych do pracy z powodu zaburzeń psychicznych i zaburzeń zachowania od 2005 r. ZUS poszerzył ofertę rehabilitacji leczniczej o schorzenia psychosomatyczne. Należy podkreślić, że choroby ze spektrum zaburzeń psychicznych i zaburzeń zachowania generują najwyższe ze wszystkich grup chorobowych wydatki ponoszone przez ZUS na świadczenia związane z niezdolnością do pracy - w 2019 r. wyniosły ponad 6,25 mld zł.

Program rehabilitacji w tych schorzeniach skierowany jest do osób z zaburzeniami nerwicowymi, związanymi ze stresem i pod postacią somatyczną oraz z zespołami behawioralnymi związanymi z zaburzeniami fizjologicznymi i czynnikami fizycznymi. Choroby zaklasyfikowane do tych zespołów naruszają w istotny sposób nie tylko sferę emocjonalną, ale także zaburzą funkcjonowanie tych osób w aspekcie społecznym i zawodowym. Wymienione choroby dotyczą coraz młodszych wiekowo grup pacjentów wpływając istotnie na pogorszenie jakości ich życia oraz często powodują ich wykluczenie z życia społecznego i zawodowego. Raporty z badań epidemiologicznych, m.in. badania EZOP, wskazywały na rosnącą w Polsce liczbę osób zmagających się z zaburzeniami psychicznymi i zaburzeniami zachowania. Tendencja ta jest również zauważana w całej Europie - ponad 27% dorosłych Europejczyków doświadcza przynajmniej jednego z przejawów złego stanu zdrowia psychicznego w ciągu roku. W ramach polityki zdrowotnej prowadzonej przez państwo w marcu 2017 r. w Rozporządzeniu Rady Ministrów ustanowiono „Narodowy Program Ochrony Zdrowia Psychicznego” na lata 2017-2022, określający strategię działań zapewniających osobom z zaburzeniami psychicznymi kompleksową, wielostronną i powszechnie dostępną opiekę zdrowotną oraz inne formy opieki i pomocy niezbędne do życia w środowisku rodzinnym i społecznym.

Celem terapeutycznym rehabilitacji leczniczej w chorobach psychosomatycznych jest uzyskanie poprawy objawowej, zmiana stosunku do choroby (wyjście z roli chorego), zwiększenie aktywności i poczucia sprawczości, wypracowanie sposobów radzenia sobie w sytuacjach stresowych, nabycie umiejętności rozwiązywania problemów oraz poszerzenie umiejętności adaptacyjnych w życiu społecznym i zawodowym. Autorką programu rehabilitacji leczniczej w ramach prewencji rentowej w schorzeniach psychosomatycznych była Pani prof. dr hab. med. Maria M. Siwiak-Kobayashi, wówczas kierownik Kliniki Nerwic Instytutu Psychiatrii i Neurologii w Warszawie.

Rehabilitacja po leczeniu nowotworu gruczołu piersiowego

Wprowadzenie w 2009 r. kolejnego, nowego profilu rehabilitacji dla osób po leczeniu nowotworu gruczołu piersiowego to konsekwencja istotnego problemu społecznego, jakim jest wzrost zachorowań na choroby nowotworowe. Choroby te stanowią drugą, najczęstszą przyczynę niezdolności do pracy w orzeczeniach dla celów rentowych. Nowotwory złośliwe są

drugą przyczyną zgonów (około 25% wszystkich zgonów), a w przedziale wiekowym 45-64 lat stanowią ich główną przyczynę (34%). Rozpoznanie choroby w jej początkowym stadium i wdrożenie, odpowiednio wcześniej, intensywnego leczenia uwzględniającego także rehabilitację leczniczą poprawia rokowanie co do uzyskania poprawy stanu zdrowia, a u znacznej części chorych pełnego wyleczenia i powrotu do aktywności społecznej i zawodowej. Należy podkreślić, że upowszechnianie i wdrażanie współczesnych metod rehabilitacji leczniczej w tej grupie chorych jest jednym z podstawowych celów wieloletniego „Narodowego Programu Zwalczania Chorób Nowotworowych” (ustawa z dnia 1 lipca 2005 r. o ustanowieniu programu wieloletniego „Narodowy program zwalczania chorób nowotworowych”). Jednym z najczęstszych i najgroźniejszych nowotworów złośliwych u kobiet jest rak gruczołu piersiowego. W 2009 r. przeprowadzono pilotażowy program rehabilitacji adresowany do osób po operacji nowotworu gruczołu piersiowego, którego wyniki wskazały na zasadność wprowadzenia na stałe tego profilu do rehabilitacji leczniczej prowadzonej przez Zakład Ubezpieczeń Społecznych. Autorem programu rehabilitacji leczniczej dla osób po leczeniu nowotworu gruczołu piersiowego był dr n.med. Andrzej Gabryel.

Wczesna rehabilitacja powypadkowa

Od września 2016 r. do marca 2018 r. prowadzony był pilotażowy program wczesnej rehabilitacji powypadkowej dla osób, które podczas wypadku, w szczególności wypadku przy pracy, doznały urazu narządu ruchu. Celem programu jest jak najszybsze rozpoczęcie rehabilitacji u osób z często ciężkimi urazami narządu ruchu, które zakończyły leczenie szpitalne w oddziale urazowo-ortopedycznym i wymagają kontynuacji leczenia usprawniającego. W takich przypadkach, wczesne rozpoczęcie rehabilitacji jest kluczowe, nie tylko z powodu uzyskania lepszego efektu funkcjonalnego, ale co równie ważne zapobiega także powstaniu i utrwaleniu tych dysfunkcji w obrębie narządu ruchu, które mogą prowadzić do trwałej niepełnosprawności. Autorką programu wczesnej rehabilitacji pourazowej była Pani prof. dr hab. med. Krystyna Książkowska-Orłowska - krajowy konsultant w dziedzinie rehabilitacji medycznej, Kierownik Kliniki Rehabilitacji Narodowego Instytutu Geriatrii, Reumatologii i Rehabilitacji im. prof. dr hab. med. Eleonory Reicher w Warszawie. Po uzyskaniu pozytywnych wyników pilotażu Zakład wprowadził na stałe nowy profil do programu rehabilitacji prowadzonej w ramach prewencji rentowej ZUS.

Rehabilitacja w chorobach ośrodkowego układu nerwowego

Osoby ubezpieczone z chorobami ośrodkowego układu nerwowego korzystały dotychczas z rehabilitacji leczniczej o profilu narząd ruchu, jednak ze względu na to, że przyczyną deficytów neurologicznych i niepełnosprawności jest u nich ogniskowe uszkodzenie ośrodkowego układu nerwowego, rehabilitacja ukierunkowana wyłącznie na dysfunkcję narządu ruchu nie zaspokajała różnorodnych i specyficznych potrzeb i oczekiwań tych osób. Dlatego też w wyniku wielu postulatów przedstawicieli PTSR (Polskiego Towarzystwa Stwardnienia Rozsianego), a także zespołu parlamentarnego

ds. SM (sclerosis multiplex - stwardnienie rozsiane), doszło do utworzenia nowego profilu rehabilitacji dla osób z uszkodzeniem ośrodkowego układu nerwowego i została podjęta decyzja o opracowaniu programu pilotażowego rehabilitacji dla tej grupy pacjentów.

W 2018 r. Pani prof. Gertruda Uścińska - Prezes ZUS powołała zespół konsultacyjny ds. opracowania pilotażowego programu rehabilitacji leczniczej osób z uszkodzeniem ośrodkowego układu nerwowego. Przewodniczącą tego zespołu była Pani dr hab. n. med. Iwona Sarzyńska-Długosz z Instytutu Psychiatrii i Neurologii w Warszawie, specjalista w dziedzinie rehabilitacji neurologicznej. W 2019 r. w oparciu o wytyczne ekspertów wchodzących w skład ww. zespołu konsultacyjnego opracowano wymagania dla ośrodków rehabilitacyjnych i wdrożono program do realizacji.

Należy podkreślić, że choroby układu nerwowego, zgodnie z danymi Światowej Organizacji Zdrowia (WHO), stanowią najczęstszą przyczynę utraty lat życia w pełnej sprawności (ang. Disability Adjusted Life Years Lost - DALYs), wyprzedzając inne schorzenia takie jak: nowotwory złośliwe, HIV/AIDS, chorobę niedokrwinną serca czy choroby układu oddechowego. W związku z tym stanowią poważny problem zarówno medyczny, jak społeczny oraz ekonomiczny. Rehabilitacja jest obecnie najskuteczniejszą metodą przywracania sprawności pacjentów - zwiększa znamienne odsetek osób wracających do stanu względnej lub bezwzględnej sprawności, np. po udarze mózgu czy w przebiegu stwardnienia rozsianego.

Prowadzenie systematycznej i kompleksowej rehabilitacji w tej grupie pacjentów, jako jednego z elementów terapii, pomaga niewątpliwie wydłużyć okres ich aktywności zawodowej. Powrót do pracy osób po przebytej chorobie ośrodkowego układu nerwowego lub cierpiących na przewlekłą chorobę OUN, będących w wieku aktywności zawodowej, przyczynia się do wzrostu jakości ich życia, a możliwość podjęcia pracy stanowi optymalne zwieńczenie efektów rehabilitacji. Rehabilitacja neurologiczna jest zalecana przez wiele towarzystw naukowych - m.in. Zespół Ekspertów Sekcji Chorób Naczyniowych Polskiego Towarzystwa Neurologicznego, American Heart Association oraz American Stroke Association.

Rehabilitacja w chorobach narządu głosu (ngl)

Choroby narządu głosu stanowią blisko 25% ogółu chorób zawodowych orzekanych rocznie w Polsce, a brak działań profilaktycznych i powszechnych programów rehabilitacyjnych skierowanych do osób zawodowo posługujących się głosem może tylko pogłębić ten niekorzystny stan rzeczy.

Z tego powodu w 2013 r. został uruchomiony program pilotażowy dla osób ze schorzeniami narządu głosu. Z tej formy rehabilitacji mogą skorzystać osoby ubezpieczone, czynne zawodowo, dla których głos jest narzędziem pracy i które cierpią na zaburzenia jego funkcji. Głos i jego właściwe brzmienie łączy się zwykle z takimi zawodami jak śpiewacy, aktorzy, spikerzy, nauczyciele, prawnicy, dziennikarze czy politycy. Grupą najczęściej zgłaszającą się do foniatry z powodu problemów głosowych są nauczyciele. W Polsce liczebność tej grupy zawodowej ocenia się na ponad 600 tys. osób, co pokazuje skalę problemu. Zgodnie z wytycznymi Światowej

Organizacji Zdrowia (WHO) celem prowadzonych działań terapeutyczno-rehabilitacyjnych powinno być przywrócenie takiego stanu narządu głosu, aby spełniał zawodowe, społeczne i emocjonalne potrzeby pacjenta. Wśród metod terapii zaburzeń głosu niewątpliwie największą rolę, a nierzadko jedyną, odgrywa właśnie rehabilitacja głosu. Ten unikatowy w skali Polski program rehabilitacji narządu głosu zyskał duże uznanie społeczne, zwłaszcza wśród nauczycieli, którzy stanowią najbardziej liczną grupę zawodową uczestniczącą w tym programie.

Autorką programu rehabilitacji leczniczej w schorzeniach narządu głosu była Pani prof. nadzw. dr hab. n. med. Agata Szkiełkowska z Instytutu Fizjologii i Patologii Słuchu, konsultant wojewódzki w dziedzinie audiologii i foniatry.

TRYB KIEROWANIA I ZASADY WYDAWANIA ORZECZEŃ O POTRZEBIE REHABILITACJI LECZNICZEJ W RAMACH PREWENCJI RENTOWEJ ZUS

W polskim powszechnym systemie ubezpieczeń społecznych działania w zakresie restytucji zdolności do pracy od początku jej wprowadzenia, tj. w 1996 r., koncentrowały się na rehabilitacji leczniczej. W ciągu tego czasu zwiększała się liczba osób kierowanych do ośrodków rehabilitacji, powstawały nowe profile rehabilitacji. Istotna mobilizacja działań ZUS w powyższym zakresie miała miejsce w momencie wejścia w życie 1 stycznia 1997 r. ustawy z 28 czerwca 1996 r. o zmianie niektórych ustaw o zaopatrzeniu emerytalnym i ubezpieczeniu społecznym oraz rozporządzenia Ministra Pracy i Polityki Socjalnej z 8 sierpnia 1997 r. w sprawie orzekania o niezdolności do pracy dla celów rentowych. Te akty prawne, jako element reformy systemu ubezpieczeń społecznych, wprowadziły zasadnicze zmiany w zakresie ujmowania ryzyka określanego do 1997 r. jako inwalidztwo, a nazwanego w nich niezdolnością do pracy. Określiły także nowy tryb orzekania o niezdolności do pracy dla celów rentowych [5, 6, 7, 8]. Przyjęte w nich rozwiązania miały realizować ideę, zgodnie z którą orzeczenie o niezdolności do pracy powinno nastąpić dopiero wówczas, gdy nie ma możliwości odzyskania przez ubezpieczonego zdolności do pracy, w drodze procedur rehabilitacyjnych lub przekwalifikowania zawodowego [9].

Orzecznictwo lekarskie w Zakładzie Ubezpieczeń Społecznych w obecnej formie funkcjonuje od 1 września 1997 r., kiedy to została przeprowadzona reforma systemu orzecznictwa. Celem reformy orzekania o niezdolności do pracy w Zakładzie Ubezpieczeń Społecznych była racjonalizacja systemu, tak aby renty z tytułu niezdolności do pracy były przyznawane osobom, które rzeczywiście utraciły zdolność do pracy i nie rokują odzyskania jej przez rehabilitację leczniczą czy przekwalifikowanie zawodowe. W ramach tej reformy:

- rozdzielono orzekanie o niezdolności do pracy dla celów świadczeń z ubezpieczenia społecznego od orzekania o niepełnosprawności dla celów pozaubezpieczeniowych;
- orzecznictwo o niepełnosprawności zostało objęte nadzorem Pełnomocnika Rządu ds. Osób Niepełnosprawnych i funkcjonuje poza ZUS;

- zmieniono zasady orzekania dla celów ubezpieczeniowych (niezdolność do pracy) i pozaubezpieczeniowych (niepełnosprawność);
- wprowadzono jednoosobowe i jednoinstancyjne orzekanie o niezdolności do pracy i jej stopniu przez lekarzy orzeczników w oddziałach ZUS.

W 2005 r. zmieniono organizację systemu w taki sposób, że wprowadzono II instancję w postaci komisji lekarskich ZUS (składających się z trzech lekarzy), które rozpatrują sprzeczności i zarzuty wadliwości wobec orzeczeń lekarzy orzeczników.

Szczegółowe zasady i tryb kierowania przez Zakład Ubezpieczeń Społecznych na rehabilitację leczniczą oraz udzielania zamówień na świadczenia i usługi rehabilitacyjne określa rozporządzenie Rady Ministrów z 12 października 2001 r. Zgodnie ze wskazaną regulacją to lekarz orzecznik Zakładu Ubezpieczeń Społecznych orzeka o potrzebie rehabilitacji leczniczej wydając orzeczenie o celowości jej przeprowadzenia wskazując jej profil. Lekarz orzecznik ZUS może wydać orzeczenie o potrzebie rehabilitacji leczniczej na wniosek lekarza prowadzącego leczenie. Trzeba podkreślić, że w zakresie obowiązków lekarza prowadzącego leczenie, należy dokonanie oceny, czy stan zdrowia ubezpieczonego uzasadnia potrzebę przeprowadzenia rehabilitacji leczniczej. Jeśli tak, to lekarz leczący powinien wystawić wniosek o rehabilitację leczniczą, który następnie osoba ubezpieczona powinna złożyć w jednostce organizacyjnej ZUS właściwej ze względu na swoje miejsce zamieszkania [10]. Lekarze orzecznicy ZUS wykonując kontrolę orzekania o czasowej niezdolności do pracy z powodu choroby mogą również z „urzędu” nawet bez wniosku lekarza leczącego wydać orzeczenie o potrzebie rehabilitacji leczniczej w ramach prewencji rentowej, jeżeli

stwierdzą, że istnieją wskazania do takiej rehabilitacji. Podobna zasada obowiązuje przy wydawaniu orzeczeń o okolicznościach uzasadniających przyznanie uprawnień do świadczenia rehabilitacyjnego, czy o niezdolności do pracy.

Zasadniczym celem rehabilitacji w ramach prewencji rentowej jest przywrócenie zdolności do pracy zarobkowej, a więc lekarz orzecznik ustali tę potrzebę jedynie w przypadku, kiedy istnieje rokowanie odzyskania zdolności do pracy zarobkowej po przeprowadzeniu rehabilitacji. Lekarz orzecznik ZUS wydaje orzeczenie o potrzebie rehabilitacji leczniczej przy czym, przy ocenie rokowania, bierze się pod uwagę w szczególności:

- charakter i przebieg procesów chorobowych oraz ich wpływ na stan czynnościowy organizmu,
- stopień przystosowania organizmu do ubytków anatomicznych, kalectwa, skutków choroby,
- wiek, zawód, wykonywane czynności i warunki pracy [11].

Osoby ubezpieczone kieruje się na rehabilitację leczniczą do ośrodków rehabilitacyjnych prowadzących rehabilitację w odpowiednim profilu schorzeń i położonych możliwie najbliżej miejsca ich zamieszkania, z uwzględnieniem przeciwwskazań dotyczących miejsca rehabilitacji (np. klimatycznych) zgłoszonych przez lekarza orzecznika ZUS. Jeżeli lekarz orzecznik ZUS wyda orzeczenie o potrzebie przeprowadzenia rehabilitacji leczniczej w ramach prewencji rentowej, osoba zainteresowana otrzymuje zawiadomienie o skierowaniu do ośrodka rehabilitacyjnego. Zaznaczyć przy tym należy, że Zakład Ubezpieczeń Społecznych ponosi całkowity koszt rehabilitacji leczniczej ubezpieczonego lub rencisty (jest to więc świadczenie rzeczowe), łącznie z kosztami zakwaterowania, wyżywienia oraz przejazdu z miejsca zamieszkania do ośrodka

Tabela 1. Liczba orzeczeń o potrzebie rehabilitacji leczniczej oraz jej koszty w latach 1999-2020

Lata	Liczba orzeczeń lekarzy orzeczników o potrzebie rehabilitacji leczniczej	Koszty ZUS poniesione na rehabilitację leczniczą wraz z refundacją kosztów dojazdu (w mln PLN)
1999	42 071	51,5
2000	53 471	81,9
2001	71 402	101,0
2003	73 906	109,0
2003	71 649	99,5
2004	61 103	79,7
2005	69 644	76,9
2006	80 833	99,0
2007	78 713	108,7
2008	83 420	115,8
2009	87 616	170,2
2010	85 348	168,0
2011	90 130	170,0
2012	84 720	169,6
2013	85 165	173,7
2014	87 990	174,5
2015	94 773	175,0
2016	99 909	182,0
2017	101 084	189,0
2018	102 305	190,2
2019	97 430	201,8

rehabilitacyjnego i z powrotem, do wysokości kosztu przejazdu najtańszym środkiem komunikacji publicznej, z uwzględnieniem przysługującej ubezpieczonemu albo renciście ulgi na przejazd danym środkiem transportu, bez względu na to, z jakiego tytułu ulga ta przysługuje [12]. Innym świadczeniem rzeczowym realizowanym w ZUS jest pokrywanie kosztów leczenia z zakresu stomatologii i szczepień ochronnych oraz zaopatrzenia w przedmioty ortopedyczne związanych z wypadkiem przy pracy lub chorobą zawodową.

Od ustaleń orzeczniczych dokonanych przez lekarza orzecznika ZUS, które powinny być zgodne z powyższymi zasadami orzekania o potrzebie rehabilitacji leczniczej zależy więc, czy wydatki z Funduszu Ubezpieczeń Społecznych zostaną poniesione w sposób w pełni uzasadniony, a ubezpieczeni odniosą wymierną korzyść w postaci odzyskania zdolności do pracy po odbyciu tej rehabilitacji. Aby zachować wysoką jakość wydawanych orzeczeń i jednolitość zasad orzekania w ZUS zarówno lekarze orzecznicy, członkowie komisji lekarskich, lekarze nadzorujący pracę lekarzy orzeczników oraz lekarze konsultanci ZUS są lekarzami specjalistami w danej dziedzinie medycyny, co stanowi gwarancję wysokich umiejętności, dużej wiedzy i odpowiedniego doświadczenia w pracy z pacjentami.

Rosnące znaczenie rehabilitacji leczniczej jako świadczenia z powszechnego ubezpieczenia społecznego potwierdzają dane przedstawiające kształtowanie się w latach 1999-2015 liczby orzeczeń o potrzebie rehabilitacji leczniczej w ramach prewencji rentowej ZUS (Tabela 1).

Należy zaznaczyć, że rehabilitacja lecznicza realizowana w ramach prewencji rentowej w powszechnym systemie ubezpieczeń społecznych nie jest alternatywą dla leczenia podstawowego, prowadzonego przez powołane w tym celu instytucje publicznego systemu opieki zdrowotnej i finansowanego ze środków Narodowego Funduszu Zdrowia. Jej rola ogranicza się do uzupełnienia procesu terapeutycznego o działania medyczne nastawione na poprawę sprawności organizmu umożliwiającą osobie ubezpieczonej lub renciście powrót do zatrudnienia. Stąd też zakres podmiotowy jej działania obejmuje ubezpieczonych zagrożonych całkowitą lub częściową niezdolnością do pracy i rokujących podjęcie pracy zarobkowej w następstwie jej odbycia [13].

Piśmiennictwo

1. Art. 69 ustawy z dnia 13 października 1998 r. o systemie ubezpieczeń społecznych (Dz.U. z 2021 r., poz. 423) – „Do zakresu działania Zakładu należy także prowadzenie prewencji rentowej obejmującej:
 - rehabilitację leczniczą ubezpieczonych zagrożonych całkowitą lub częściową niezdolnością do pracy, osób uprawnionych do zasiłku chorobowego lub świadczenia rehabilitacyjnego po ustaniu tytułu do ubezpieczenia chorobowego lub wypadkowego, a także osób pobierających rentę okresową z tytułu niezdolności do pracy;
 - badania i analizy przyczyn niezdolności do pracy;
 - inne działania prewencyjne.”
2. Wilmowska-Pietruszyńska A. Rola orzecznictwa lekarskiego i rehabilitacji w ramach prewencji rentowej w pozarolniczym ubezpieczeniu społecznym, „Zabezpieczenie społeczne osób niepełnosprawnych”, red. L. Frąckiewicz i W. Koczur. Katowice. 2010:71.

3. Wilmowska-Pietruszyńska A. Znaczenie rehabilitacji w ubezpieczeniu społecznym, „Aktywizacja zawodowa osób niepełnosprawnych”. 2005;4:46.
4. Art. 12 ustawy z dnia 17 grudnia 1998 r. o emeryturach i rentach z Funduszu Ubezpieczeń Społecznych (Dz.U. z 2021 r., poz. 291).
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9. Koczur W. Restytucja zdolności do pracy w powszechnym systemie ubezpieczeń społecznych – zarys problematyki, materiały pokonferencyjne z konferencji: Niezdolność do pracy jako ryzyko w społecznym ubezpieczeniu rentowym. Chorzów 19-20 września 2013 r.
10. Rozporządzenie Ministra Pracy i Polityki Społecznej z dnia 10 listopada 2015 r. w sprawie trybu i sposobu orzekania o czasowej niezdolności do pracy, wystawiania zaświadczenia lekarskiego oraz trybu i sposobu sprostowania błędów w zaświadczeniu lekarskim.
11. Standardy orzecznictwa lekarskiego ZUS, wyd. III uzupełnione, Warszawa 2020, dostęp na stronie: www.zus.pl.
12. H. Muszewska H. Program rehabilitacji leczniczej w ramach prewencji rentowej ZUS. Prew Rehab. 2009;2:14.
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Obesity During a Pandemic as a Public Health Problem

Otyłość podczas pandemii jako problem zdrowia publicznego

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SUMMARY

Aim: Identify the problem of obesity during a pandemic and ways to solve the problem in modern circumstances.

Materials and Methods: Materials of state statistics of Ukraine were used in the work. Sociological, epidemiological methods, as well as the method were used to solve problems.

Conclusions: According to research, people with a BMI of up to 30 die about nine years earlier than their slimmer peers. If the BMI is more than 45, life expectancy is reduced by an average of 13 years. Given that the average age of the population of Ukraine, according to official statistics, is 68 years, being overweight can take a sixth of a person's life. Obesity increases the risk of various diseases, including diabetes, cancer and heart disease. Foreign experts say that the "obesity epidemic" is not so much due to incontinence and low activity, but to global changes in the way of life of mankind. However, while Ukrainian doctors are not very active in raising this issue. In our country, this problem has not become national, as, for example, in the United States. BMI is used to verify obesity. An indicator of the clinical risk of metabolic complications of obesity is also the size of the waist circumference. Expert opinions provided by the WHO and the National Institutes of Health suggest that with a low-calorie diet and increased physical activity, overweight people can lose no more than 10% of their initial weight. The approach to lifestyle change is a cornerstone for all people who are overweight and obese.

Key words: obesity, pandemic, public health

Słowa kluczowe: otyłość, pandemia, zdrowie publiczne

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INTRODUCTION

Obesity is a chronic recurrent disease characterized by excessive accumulation of adipose tissue in the body [1]. According to the WHO, almost 1.5 billion adults in the world suffer from overweight, another 350 million are prone to obesity. In economically developed countries, almost 50% of the population is overweight, with 30% of them obese. Among the adult population in the United States, the number of obese people is growing by 8% every 10 years [1].

In Ukraine, according to medical statistics, every fourth woman and every sixth man suffers from obesity. About 20 million children under the age of 8 have problems with being overweight. Women are more prone to obesity than men - doctors attribute this to the peculiarities of the female body. Overall, over 30% of women and about 15% of men are overweight, and obesity is found in 20% of women and 11% of men [1]. When it comes to the extreme degree of

obesity, neither diet, nor starvation, nor sports, nor a course of medication can help to solve the situation [2].

The WHO considers obesity to be an epidemic that has affected millions of people: according to the 10th International Congress on Obesity (Sydney, September 2011), there are more than 300 million obese people in the world. Today in most Western European countries, 5 to 23% of men and 7-30% of women are obese (BMI > 30 kg/m²). in the USA - from 20 to 25%. Overweight (BMI > 25 kg/m²) in industrialized countries, except Japan and China, has about half the population [2].

AIM

Identify the problem of obesity during a pandemic and ways to solve the problem in modern circumstances.

MATERIALS AND METHODS

Materials of state statistics of Ukraine were used in the work. Sociological, epidemiological methods, as well as the method were used to solve problems.

REVIEW AND DISCUSSION

In 2012, the State Statistics Service determined in which regions of Ukraine the largest number of very thin and very fat people live. It turned out that slender people whose BMI (body mass index is less than 18.5) live in Western Ukraine, overweight people whose BMI exceeds 30, mostly live in Poltava, Donetsk, Zaporizhia, Kherson and Mykolaiv regions. Most thin among young people aged 18-19 years, extreme obesity is most common in 50-59 years [3].

According to nutritionists, excess body weight is associated with poor nutrition and lack of energy expenditure: Ukrainians eat a lot of saturated fats – fatty meat, lard, butter, few vegetables and little exercise. It is believed that BMI above 30 is a disease, obesity. But the BMI below 18.5 – this is considered a standard of beauty, this weight is achieved through diets.

According to research, people with a BMI of up to 30 die about nine years earlier than their slimmer peers. If the BMI is more than 45, life expectancy is reduced by an average of 13 years. Given that the average age of the population of Ukraine, according to official statistics, is 68 years, being overweight can take a sixth of a person's life [2]. Obesity increases the risk of various diseases, including diabetes, cancer and heart disease. Foreign experts say that the “obesity epidemic” is not so much due to incontinence and low activity, but to global changes in the way of life of mankind. However, while Ukrainian doctors are not very active in raising this issue. In our country, this problem has not become national, as, for example, in the United States [4].

Obesity is part of the metabolic syndrome - a symptom complex of combined pathological conditions (insulin resistance, disorders of carbohydrate and lipid metabolism, hypertension). The syndrome is not considered a separate diagnosis or nosological form, but is important for the prognosis and treatment of the underlying disease [5, 6].

The importance of obesity is determined by the risk of disability in young patients and the reduction in overall life expectancy due to the development of severe comorbidities. Diseases that accompany obesity include type 2 diabetes, hypertension, dyslipidemia, atherosclerosis and related diseases, sleep apnea, hyperuricemia, gout, reproductive dysfunction, gallstones, osteoarthritis, cancer (women – cancer endometrium, cervix, ovaries, mammary glands, in men – prostate cancer; rectal cancer in both sexes), varicose veins of the lower extremities.

Concomitant diseases, especially cardiovascular, usually develop in obese patients at a young age. The probability of their development increases with weight gain.

The risk of concomitant diseases is also determined by the peculiarities of adipose tissue deposition. Abdominal obesity, which is combined with a complex of hormonal and metabolic disorders, is considered to be the most unfavorable for health.

Obesity is a multifactorial, heterogeneous disease. Factors that determine the development of obesity include: genetic; demographic (age, gender, ethnicity); socio-economic (education, profession, marital status); psychological; behavioral (nutrition, physical activity, alcohol, smoking, stress) [6].

Determinants among these factors are overeating, excessive consumption of fatty foods in combination with low physical activity in people with a hereditary predisposition to obesity.

BMI is used to verify obesity. The nature of adipose tissue distribution is determined by the ratio of waist circumference/hip circumference (OT/OS). The value of OT/OS for men > 1.0 and women > 0.85 indicates the abdominal type of obesity. An indicator of the clinical risk of metabolic complications of obesity is also the size of the waist circumference [6].

Today use the following classifications of obesity:

1. By etiological principle: alimentary-constitutional; hypothalamic; endocrine; iatrogenic.
2. By type of adipose tissue deposition: abdominal (android, central); gynoid (buttock-femoral); mixed.
3. According to the body mass index (WHO, 1997)

BMI classification is used to diagnose obesity, determine the risk of comorbidities and tactics of treatment of obese patients. Obesity as a chronic disease requires effective and adequate treatment.

Providing medical care to obese patients is to prevent weight gain, treat comorbidities, eliminate interacting risk factors, reduce body weight, maintain weight. The purpose of obesity prevention is to prevent the development of obesity in people with normal and overweight, reduce the risk or prevent the development of severe comorbidities [7].

Indications for prevention: familial hereditary predisposition to obesity and its accompanying diseases (type 2 diabetes, hypertension, coronary heart disease, etc.), the presence of early risk factors for metabolic syndrome (hyperlipidemia, impaired carbohydrate tolerance, etc.), BMI > 25 kg/m² in women who have not given birth.

For the purpose of primary prevention of the most widespread complications apply 2 approaches: population and cohort. However, achieving ideal values of blood lipids in the population is not a realistic task, even in the most economically developed countries. Therefore, the cohort approach is used, ie examination and treatment of only patients from high-risk groups.

Treatment of obesity should be aimed not only at weight loss, but also at preventing the development of the disease, significantly improving the health of the patient or eliminating existing comorbidities.

The purpose of treatment: moderate weight loss with the obligatory reduction of risk factors or improvement of concomitant diseases; weight stabilization; adequate control of associated violations; improving the quality and increasing the life expectancy of patients.

For successfully implement a program to reduce and maintain the achieved body weight requires the presence of: qualified professionals of various profiles; weight loss programs that contain clear recommendations for nutrition, physical activity and long-term lifestyle changes; methods of calculating the daily caloric content of food and compiling an individual diet; regular monitoring with mandatory registration of indicators that reflect the effectiveness of treatment [8].

To date, the method of moderate gradual weight loss, taking into account the BMI and associated risk factors. It is proved that weight loss by 5-15% of the initial value is accompanied by a significant improvement in comorbidities. Achieving such weight loss is actually and physically realistic, but intense weight loss is dangerous because there is a risk of recurrence and complications.

Before prescribing treatment, patients are carefully screened and examined. For the treatment of obesity, non-drug methods are used (patient education, rational low-calorie diet, increased physical activity, lifestyle changes), drugs, as well as surgery. The basis of treatment is a rational low-calorie diet, taking into account the individual eating habits of the patient, his lifestyle, age, gender, economic opportunities, combined with increased physical activity [4].

Obesity is the result of the long existence of a positive energy balance, which occurs when the energy intake prevails over its consumption. As a result, it leads to the accumulation of adipose tissue and weight gain. To lose weight, it is necessary to create a negative energy balance, which is achieved by reducing energy intake and increasing its consumption by increasing physical activity.

Total energy consumption consists of three parts: basic metabolism – energy spent on maintaining metabolism at rest (60%); thermogenesis (specific dynamic action of food) – increase in heat production after eating (10%); physical activity - energy expenditure depends on the level of physical activity (20-40%) [6].

An important component of a weight loss program is increased physical activity. Physical training contributes to weight loss through direct energy expenditure, but at the same time other mechanisms are considered, according to which increased physical activity can achieve weight loss, and most importantly – maintaining body weight. The most effective are aerobic exercises: walking, running, swimming, cycling, skiing, jumping rope. The main conditions for an individual exercise program to lose weight are regular aerobic exercise (at least 3-4 times a week), a gradual increase in the intensity and duration of classes, the selection of individual options, taking into account the associated complications. The combination of a balanced diet with increased physical activity will reduce body weight, and lifestyle changes - maintaining the achieved result [3, 5].

In general, a weight loss program can be considered effective if it is possible to: at the stage of weight loss reduce the figure by 5-10 kg with a reduction in risk factors; at the stage of maintaining body weight to maintain the achieved indicators or to prevent their increase by more than 3 kg during the next two years of observation; achieve a steady reduction in waist circumference by 4 cm.

The main goal of the weight control program is to prevent the development or significantly improve the course of obesity-related diseases, improve the quality and duration of life.

The duration of non-drug measures is 12-16 weeks, in the absence of effect it is advisable to prescribe pharmacotherapy.

Weight loss of 5-10% in 4-6 months is considered clinically significant to bring real health benefits to patients. According to research, such weight loss reduces the risk of cardiovascular

disease by 9%, type 2 diabetes – by 44%, overall mortality – by 20%, mortality from cancer associated with obesity – by 40%.

The main feature of the treatment of obesity as a chronic disease is long-term therapy, which must be carried out in an atmosphere of mutual understanding and trust between doctor and patient. To achieve a positive effect of obesity treatment, the patient must first understand the features of his disease and learn to control body weight. How and when a patient seeks medical help depends on many external and internal factors. According to the theory of self-knowledge of Prochaska and DiClemente, behavior change is a process of 5 stages:

1. Stage of indifference: the patient is not worried about his own health, and he does not really assess the situation.

2. Stage of reflection: at this stage the possible consequences of behavior change are assessed.

3. Stage of preparation: the patient makes decisions for certain actions. At transition from a stage of preparation to a stage of action the role of the doctor comes to the fore. The success of treatment largely depends on how the doctor will behave in this situation, whether he will find contact with the patient.

4. Stage of action: the patient is involved in the process of changing his lifestyle, behavior modification.

5. The final stage – maintenance – is successful only if the patient is confident in their actions and really evaluates the results achieved.

The treatment process actually begins at the stage of preparation, when the patient draws up an action plan.

Formation and consolidation of motivation for long-term treatment are first of all necessary for the maximum prevention of relapses. Of great importance is the influence of external motivations. At each stage of treatment, they have a different nature and should be selected and monitored by a physician according to the individual characteristics of the patient. It is important that the treatment of obesity takes place in an interactive atmosphere, so the medical staff involved in the treatment of the patient must be motivated and in relation to him as a person, and in relation to the treatment of the disease itself.

CONCLUSIONS

Therefore, we can say that obesity is a global problem, so the efforts of scientists around the world are now focused on finding effective methods of weight control and treatment of obesity. Unfortunately, the treatments available today are not always effective. Expert opinions provided by the WHO and the National Institutes of Health suggest that with a low-calorie diet and increased physical activity, overweight people can lose no more than 10% of their initial weight. The approach to lifestyle change is a cornerstone for all people who are overweight and obese.

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Informacja prasowa

LIRENE ACID POWER to nowatorskie formuły zawierające unikalne połączenie specjalistycznych kwasów kosmetycznych w wysokim – 7% stężeniu oraz łagodzących hydrolatów. Odpowiednio dobrane pH minimalizuje ryzyko podrażnień i nieestetycznego łuszczenia się skóry, pozwalając na regularną, nieagresywną stymulację komórek do regeneracji. Dzięki temu struktura i koloryt skóry stopniowo wyrównują się, a twarz odzyskuje młodzieńczą świeżość i blask.

Kwasy AHA/PHA: redukują niedoskonałości i przebarwienia, regulują odnowę komórkową, spływając zmarszczki, odblokowują pory i wyrównują strukturę skóry, nawilżają. **Polecane:**

Serum wygładzające z hydrolatem z róży stulistnej; Serum złuszczące z hydrolatem grejpfrutowym;

Serum nawilżające z kwasem hialuronowym i hydrolatem z bławatka (20%)

Kompleks kwasów glikolowego, bursztynowego oraz mlekowego (7%) stymuluje w skórze naturalne procesy odnowy, w których zrogowaciałe komórki naskórka zostają zastąpione przez nowe, młodsze. W efekcie cera staje się gładsza w dotyku, bardziej elastyczna i mniej podatna na powstawanie i utrwalanie się zmarszczek.

Kwas bursztynowy poprawia metabolizm komórkowy oraz działa silnie antyoksydacyjnie, pozwalając zachować młodość skóry na dłużej.

Kwas mlekowy wiąże wodę w strukturach naskórka, długotrwale podnosząc poziom nawilżenia.

20% hydrolatu z róży stulistnej działa wygładzająco, przeciwstarzeniowo oraz kojąco.

Kompleks kwasów glikolowego, migdałowego oraz fitowego (7%) wnika do naskórka, silnie stymulując złuszczenie zrogowaciałych komórek oraz powstawanie nowych. Następuje przyspieszona odnowa naskórka, przez co skóra stopniowo oczyszcza się, a liczba przebarwień i zaskórników zostaje zmniejszona.

Kwas glikolowy pobudza wytwarzanie białek podporowych skóry, dzięki czemu drobne zmarszczki zostają wypełnione od środka, a pory stają się mniej widoczne. Kwas migdałowy redukuje ilość niedoskonałości i skłonność do ich powstawania.

Kwas fitowy hamuje aktywność tyrozynazy (enzymu odpowiadającego za powstawanie melaniny), redukując przebarwienia oraz ujednolicając koloryt skóry.

Hydrolat z grejfruta redukuje skłonność do przetłuszczania, oczyszcza i odblokowuje pory.

Kompleks kwasu mlekowego i laktobionowego (7%) wnika do naskórka, stymulując jego odnowę. Dzięki temu nowo powstałe komórki wypierają starsze (zrogowaciałe) na powierzchnię, gdzie te ulegają złuszczeniu. W efekcie cera regeneruje się, odzyskuje elastyczność i blask, a drobne linie i zmarszczki widocznie spływają się.

Kwas laktobionowy redukuje widoczność zaczerwienień oraz teleangiektazji.

Wysokocząsteczkowy kwas hialuronowy zapobiega utracie nawilżenia oraz wygładza skórę.

20% hydrolatu z bławatka koi podrażnienia i zaczerwienienia, a wysoka zawartość antyoksydantów chroni przed działaniem wolnych rodników odpowiedzialnych za zewnętrzne starzenie się skóry.

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Financial and Legal Support of Military Rehabilitation. The Experience of Ukraine

Wsparcie finansowe i prawne rehabilitacji wojskowej. Doświadczenia Ukrainy

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SUMMARY

Aim: To analyze the experience of Ukraine in providing financial and legal support for the rehabilitation of servicemen.**Materials and Methods:** We analyzed the experience of Ukraine and some EU countries. In addition, we used statistical data of relevant organizations, expert opinions, and international law. The statistical method was used in the analysis of statistical data and reports. The method of comparison made it possible to conduct a study of domestic and international law.**Conclusions:** Ukraine's state of military conflict necessitates the creation of servicemen and members of their families' rehabilitation system. Such rehabilitation should be comprehensive and include the rehabilitation of victims, which would allow individuals to return to normal life as soon as possible to restore their mental and physical condition. In Ukraine, financial support for the rehabilitation of servicemen is provided at several levels, covered by various sources (state budget, local budgets, as well as funds from international organizations through the implementation of international technical support projects).**Key words:** rehabilitation of servicemen, financial provision of rehabilitation of servicemen, tax benefits for servicemen**Słowa kluczowe:** rehabilitacja wojskowych, finansowe zapewnienie rehabilitacji wojskowych, ulgi podatkowe dla żołnierzy

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INTRODUCTION

Ukraine has been in a state of military conflict since 2014. When there is a military conflict, people die and are injured, and their health is gradually destroyed, the state faces the problem of creating a victims rehabilitation system that would allow individuals to return to normal life as soon as possible, to restore their mental and physical condition. Nowadays, such challenges face Ukraine and other countries, such as Israel, Croatia, and others. At the same time, the existence of a rehabilitation system in a military conflict testifies to the state's fulfillment of its social function, as well as the fact that the state takes care of its own defenders. That is why rehabilitation is primarily of national importance. It is evident that the success and effectiveness of such a process depends on the financial capacity of the state, as insufficient funds for such rehabilitation or the establishment of ineffective tax preferences for servicemen could nullify any attempts to implement rehabilitation measures.

AIM

The aim was to analyze the experience of Ukraine in providing financial and legal support for the rehabilitation of servicemen.

MATERIALS AND METHODS

We analyzed the experience of Ukraine and some EU countries. In addition, we used statistical data of relevant organizations, expert opinions, and international law. In general, the theoretical basis of our study were the researches of Bakalyuk T.G., Brindikov Y.L., Kondratenko O.O., Mysula I.R., Noha P.P., Ovchinnikov B.V., Olefir A.O., Pashkov V.M., and others. The study is based on such empirical and general methods and techniques as analysis, synthesis, induction, deduction, description, generalization. Their combined application provided a comprehensive consideration of the problems of financial support for the rehabilitation of

servicemen. The results of scientific researches on the chosen subject are processed by means of integrated analysis. The application of the formal-legal method made it possible to conduct a thorough analysis of regulations that introduce rehabilitation measures, and to develop recommendations and proposals for improving the practice of their implementation. The statistical method was used in the analysis of statistical data and reports. The method of comparison made it possible to conduct a study of domestic and international law.

REVIEW AND DISCUSSION

Usually, scientists consider social rehabilitation as a system of measures to improve the level and quality of life of the rehabilitated, creating equal opportunities for them to participate in social life fully. Social rehabilitation is focused on teaching the rehabilitator the skills of self-care and independence through occupational therapy, pedagogical, psychological, technical means, including financial assistance, creating a barrier-free environment, funding, etc. [1-3]. Indeed, it is a comprehensive approach to rehabilitation that can maximize the recovery of health, functional status, ability to work, and psychological or mental state. In addition, it should be noted that rehabilitation is needed not only by the military servicemen themselves but also by the families of those involved in armed conflict. In practice, such activities require constant attention to communication with families, provide them with comprehensive assistance in addressing a wide range of social issues; cooperation with the families of servicemen, military veterans, constantly and at all levels of their living conditions; analysis of the moral atmosphere and the establishment of a healthy lifestyle in their families; consideration of housing, financial support, material assistance issues, taking into account the needs of young and large families, families of servicemen who died in the line of duty; assisting large and young families, families of deceased servicemen; employment of women, development home-based work approach [4].

Analysis of foreign countries' experience demonstrates that the financial support for servicemen rehabilitation is executed at several national, local, and international levels. This approach is the most optimal and allows to maximally cover the various spheres of life of such persons in need of rehabilitation, with multiple funding sources. The state-level provides for the development of targeted programs to provide comprehensive assistance to servicemen, represented at the legislative level (in resolutions, decrees, laws, orders, directives, etc.); introduction of tax benefits for servicemen; various kinds of promotion of involvement in ordinary life (through assistance in starting own business, etc.). Usually, such programs and practical measures are long-term and have a prolonged nature. At the state level, the main rehabilitation tasks are the formation of a strategy of comprehensive rehabilitation, its goals, objectives, priority areas, and mechanisms; legal support of the rehabilitation process; financing of rehabilitation programs for servicemen. As for the regional level, local authorities, given their awareness of the specific problems of servicemen, actively act as subjects of social policy in the context of comprehensive rehabilitation of this category of the population [5].

Analysis of the laws on the state budget of Ukraine for 2014-2020 [6-12] allows us to conclude that in order to implement social protection programs for servicemen, funds were allocated in the form of subventions from the state budget to the local budgets for about 13 billion hryvnias, excluding private, donor funds, the amount of charitable, volunteer financial targeted assistance to a particular participant of the anti-terrorist operation, his family or a public association of participants of the anti-terrorist operation. According to statistics, on average, up to UAH 11,000 per year is allocated for the social protection of one ATO participant [13]. In addition, the State Budget provides for expenditures to compensate for self-purchased housing for members of the ATO, persons with disabilities of groups I and II, the families of the victims; participants of anti-terrorist operation with disability of the III group from among IDPs; persons with disabilities of the I and II groups among the members of hostilities on the territory of other states and families of the deceased (including Afghan soldiers) [14]. With regard to specific programs, the mechanism of state regulation of social protection of ATO participants and their families is presented through "Leadership and management in the field of social protection of war veterans and the anti-terrorist operation participants"; "Measures for psychological rehabilitation, social and professional adaptation of anti-terrorist operation participants and providing the injured participants of the anti-terrorist operation with sanatorium treatment"; "Subvention from the state budget to local budgets for the payment of monetary compensation for housing for the families of the deceased, as well as for persons with disabilities of groups I-II, persons who have lost the functionality of the lower extremities, disability due to injury, contusion, injuries or diseases received during direct participation in the anti-terrorist operation, and need to improve living conditions "and others [14].

The Fund for Social Protection of the Disabled, which is part of the special fund of the State Budget of Ukraine, provides persons with disabilities from among the participants of the anti-terrorist operation and other categories of persons with technical and other means of rehabilitation. Therefore, we can admit that such a Fund provides social benefits, implementation of measures for social protection of persons with disabilities from among the participants of the anti-terrorist operation, employment of persons with disabilities, job creation. The State Centers for Vocational Rehabilitation of the Disabled, in turn, are responsible for restoring the ability to work and preparing persons for work not only for ATO participants with disabilities but also for other categories of persons [15].

Financial and legal support for the rehabilitation of servicemen is embodied through tax preferences [16]. For example, the Tax Code of Ukraine introduces a number of tax benefits for servicemen regarding personal income tax, military tax, and land tax. First, a participant's income in hostilities during the anti-terrorist operation received as charitable assistance in accordance with the requirements of the Law of Ukraine "On Charitable Activities and Charitable Organizations" is not subject to personal income tax (Article

165). Secondly, the income tax in the form of charitable assistance provided by international charitable organizations to persons residing in the territory of the anti-terrorist operation or to persons who were forced to leave is not taxed (Article 165). Third, the income in the form of pensions of persons who became disabled during the ATO, as well as pensions provided to family members of those killed in the ATO, is also not taxable. Fourth, charitable assistance in any amount (value) provided to taxpayers for the purchase or in the form of special personal protective equipment (helmets, bulletproof vests made following military standards), technical means of surveillance is not included in the taxable income, medicines, personal hygiene products, food, supplies or other goods (works, services) according to the list determined by the Cabinet of Ministers of Ukraine, or to pay (compensate) for the cost of medicines, donor components, medical devices, technical and other means of rehabilitation, paid treatment services, provision of medical devices, technical and other means of rehabilitation, medical rehabilitation services, sanatorium rehabilitation (Article 165). With regard to benefits for the payment of military duty, the income that is a cash benefit for the time of direct participation of a person in an anti-terrorist operation is untaxed (Article 164) [17].

Local authorities can also provide tax benefits. In particular, war veterans and persons covered by the Law of Ukraine "On the Status of War Veterans, Guarantees of Their Social Protection" are exempt from paying land tax. According to the provisions of the Law, participants in an anti-terrorist operation are persons recognized as participants in hostilities who are exempt from paying land tax. In this case, the exemption from land tax provided for this category of individuals applies to one land plot for each type of use within limits, in particular: 1) for personal farming - in the amount of not more than 2 hectares; 2) for the construction and maintenance of a dwelling house, outbuildings, and structures (homestead plot): in villages - not more than 0.25 hectares, in settlements - not more than 0.15 hectares, in cities - not more than 0.10 hectares; 3) for individual country house construction - not more than 0.10 hectares; 4) for the construction of individual garages - not more than 0.01 hectares; 5) for horticulture - not more than 0.12 hectares (art. 281) [17].

As we noted, the implementation of rehabilitation measures and their financing in Ukraine is carried out at several levels and covered by different sources (state budget, local budgets, as well as funds from various international organizations through the implementation of international technical support projects). It is noteworthy that one of the documents based on which the rehabilitation of servicemen and their families was the Action Plan for medical, psychological, professional rehabilitation, and social adaptation of participants in the anti-terrorist operation, approved on March 31, 2015, by the Cabinet of Ministers № 359-r [18]. Now it has exhausted its action but has become a solid foundation for measures aimed at restoring health, psychological rehabilitation of released servicemen, providing social support and adaptation of participants in the Russian-Ukrainian war, members of the families of the dead (deceased); building a system of

vocational adaptation and employment, as well as attracting international assistance. At the same time, according to fair statements of scientists, in general, the analysis by parameters (amount of funding, main directions, measures, features) covers about 40 programs of social protection of ATO participants and their families in the regions of Ukraine. Among the peculiarities are the financing of social taxis, the proper functioning of communal rehabilitation institutions, the expansion of veteran pharmacies' network, particularly the establishment of additional benefits to those provided by law. [19]. Therefore, it can be argued that social protection programs in Ukraine are an instrument of state regulation of ATO participants their families' social protection and provided that the allocated funds are used in full, and they are developed on the principle of diversification (funding from various sources). That allows to cover a more significant number of families of ATO participants in the region and solve more problems [14].

At the international level, the following can be considered as powerful programs: (a) "Support for the reintegration of conflict veterans in eastern Ukraine and their families", implemented during 2018-2020 jointly with the European Union and with total funding of 3,000,000.00 euro; Rehabilitation under this project provided for the implementation of targeted measures to improve the psychosocial situation, expand access to economic opportunities for servicemen, provide assistance for effective reintegration into civilian life; (b) "Social and psychological rehabilitation of the conflict-affected population", which was implemented in 2020 together with the OSCE Project Coordinator in Ukraine with a total funding of € 850,000. It has strengthened the capacity of the Ministry of Veterans' Affairs of Ukraine to develop a national system for the rehabilitation of the population affected by the conflict through the development of rehabilitation mechanisms; (c) The Veterans Reintegration Program, which has been implemented since 2019 in conjunction with the US Government through the Office of the US, European, Eurasian and Central Asian Aid Coordinator of the United States Department of State with total funding of \$ 5,037,031.25 USD. It strengthens the capacity of governmental and non-governmental veterans support structures to improve the resilience of veterans to destabilizing forces by increasing the institutional capacity of the Ministry of Veterans of Ukraine and its relations with non-governmental partners, expanding veterans' access to mental health services and significant economic opportunities; (d) "Socio-economic support for the reintegration of conflict veterans in eastern Ukraine and their families", implemented in 2021-2022 jointly with the European Union with total funding of € 2,000,000.00. Its purpose is to promote the efforts of the Government of Ukraine to ensure the sustainable reintegration of veterans of the conflict in eastern Ukraine [13].

CONCLUSIONS

Ukraine's state of military conflict necessitates the creation of servicemen and members of their families' rehabilitation system. Such rehabilitation should be comprehensive and include the rehabilitation of victims, which would allow

individuals to return to normal life as soon as possible to restore their mental and physical condition. Considering the experience of other states, Ukraine managed to develop and implement numerous measures for the rehabilitation of servicemen. At the same time, the success and effectiveness of such a process depends on the state's financial capacity, as insufficient funds for such rehabilitation or the establishment of ineffective tax preferences for servicemen could nullify any attempts to implement rehabilitation measures. In Ukraine, financial support for the rehabilitation of servicemen is provided at several levels, covered by various sources (state budget, local budgets, as well as funds from international organizations through the implementation of international technical support projects).

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Psychological Rehabilitation During a Coronavirus Pandemic. Legal Aspects

Rehabilitacja psychologiczna podczas pandemii koronawirusa. Aspekty prawne

DOI: 10.36740/ABAL202103120

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SUMMARY

Aim: To analyse the legal regulation of the provision of psychological assistance during the coronavirus pandemic.**Materials and Methods:** The research methods were chosen with the aim of the study in mind. In order to establish objectivity and validity of scientific provisions, conclusions, during the research, a set of general scientific and special scientific methods was used, in particular such as: (1) the formal legal method was used to analyse the legal and ethical foundations for providing psychological assistance during the coronavirus pandemic; (2) using the comparative legal method, the approaches of national legislation and international standards to the provision of psychological assistance during the COVID-19 pandemic were clarified; (3) the forecasting and modeling method was used to develop practical recommendations regarding the importance of analyzing the legal regulation of the provision of psychological assistance during the coronavirus pandemic and others in the future; (4) the method of systems analysis made it possible to study the legal regulation of the provision of psychological assistance during the coronavirus pandemic; (5) the historical and legal method made it possible to identify the features of the evolution of legal regulation of the provision of psychological assistance during pandemics.**Conclusions:** The COVID-19 pandemic has exacerbated existing health deficiencies, including a shortage of psychologists. States should initiate medical training programs, including for psychologists and psychotherapists. It should be noted that psychological assistance during a coronavirus pandemic should be based on the following principles: accessibility; continuity; focus; interdisciplinary; educational nature of interventions.**Key words:** COVID-19 pandemic, psychological assistance, public health, World Health Organization, medical law**Słowa kluczowe:** pandemia COVID-19, pomoc psychologiczna, zdrowie publiczne, Światowa Organizacja Zdrowia, prawo medyczne

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INTRODUCTION

The current COVID-19 pandemic has created an unprecedented situation around the world. The accompanying health threats, quarantine regimes, economic problems and self-isolation have a serious impact on the mental health of the population. The World Health Organization (WHO) and health authorities around the world are taking action to slow the spread of COVID-19 and reduce the incidence. The COVID-19 pandemic has disrupted or interrupted mental health services in 93% of states, according to a WHO study [1]. The coronavirus pandemic has demonstrated the importance of mental health. Psychological assistance is an important component in recovering from this illness. Responding to the global challenges of the COVID-19 pandemic, psychologists and psychotherapists are actively

working to find the most effective means of psychological assistance to overcome the effects of traumatic events during a pandemic. The COVID-19 pandemic can have a wide range of psychological consequences, including the emergence of new psychiatric symptoms in people without mental illness, as well as the deterioration of those who already suffer from such diseases. An outbreak of coronavirus disease causes social psychological reactions such as stress, anxiety and fear, loss of landmarks and plans for the future, and can also lead to post-traumatic stress disorder, depression, exacerbation of psychopathological symptoms and psychological difficulties. Such an unstable time and with constantly changing living conditions, people can experience psychological difficulties, in turn, the majority of the population, worried about the threat of coronavirus infection, avoids visiting psychologists

in medical institutions. Mental disorders are one of the main groups of diseases that cause suffering and disability, according to WHO, their number has increased dramatically during the COVID-19 pandemic [2]. Mental health is already a priority for the WHO Regional Office for Europe in the European work program 2020–2025 “United Action for Better Health”. WHO and other international organizations focus attention on the need to provide psychological assistance during the coronavirus pandemic with the aim of more rapid restoration of society.

AIM

The aim of the article is to analyse the legal regulation of the provision of psychological assistance during the coronavirus pandemic.

MATERIALS AND METHODS

The research methods were chosen with the aim of the study in mind. In order to establish objectivity and validity of scientific provisions, conclusions, during the research, a set of general scientific and special scientific methods was used, in particular such as: (1) the formal legal method was used to analyse the legal and ethical foundations for providing psychological assistance during the coronavirus pandemic; (2) using the comparative legal method, the approaches of national legislation and international standards to the provision of psychological assistance during the COVID-19 pandemic were clarified; (3) the forecasting and modeling method was used to develop practical recommendations regarding the importance of analyzing the legal regulation of the provision of psychological assistance during the coronavirus pandemic and others in the future; (4) the method of systems analysis made it possible to study the legal regulation of the provision of psychological assistance during the coronavirus pandemic; (5) the historical and legal method made it possible to identify the features of the evolution of legal regulation of the provision of psychological assistance during pandemics.

The WHO and the ICRC have prepared a “Basic emergency care” document that covers the provision and access to psychological assistance during emergencies, which also include the coronavirus pandemic [3]. The document “Basic emergency care” contains a recommendation on the dissemination of information necessary to educate the population and ensure safe access to medical care, including psychological [3]. International Labor Organization standards indicate that wherever an employee works, the employer is responsible for his health and safety, as well as psychological well-being. The International Labor Organization emphasizes the importance of psychological health and the need for the state to provide access to psychological assistance given the negative impact of the coronavirus pandemic.

Psychological assistance is essential for both patients and doctors. Patients are faced with post-coronavirus syndrome, and doctors are faced with grueling working conditions and the inability of health systems to deal with pandemics of this magnitude. The Office of the United Nations High

Commissioner for Human Rights is concerned about the lack of healthy and safe working conditions for health workers who are at the forefront of the fight against COVID-19, in particular due to the shortage of personal protective equipment and lack of mental health services and psychosocial support. To effectively tackle the coronavirus, states must develop a range of strategies, including recruiting, re-profiling within training and skills, reallocating roles among health workers in ensuring their safety and providing psychological and psychosocial support.

Luca Steardo Jr., Luca Steardo and Alexei Verkhatsky prepared the study “Psychiatric face of COVID-19”. The study “Psychiatric face of COVID-19” examines (1) Infectious Pandemics as a Risk Factor for Mental Illness, (2) Neurotropism of coronaviruses, (3) Neuroinflammation in COVID-19, (4) COVID-19 and major depressive disorder; (5) COVID-19 and bipolar disorder; (6) COVID-19 and reactive psychosis, (7) COVID-19 and obsessive-compulsive disorder, (8) COVID-19 and epilepsy, (9) COVID-19 and post-traumatic stress disorder, (10) Schizophrenia and viral infection [4].

REVIEW AND DISCUSSION

The coronavirus pandemic has demonstrated not only the importance of psychological assistance, but also its comprehensive nature as part of the right to health. For example, it is important to promote mental health and prevent and treat mental health disorders in schools, community services, government agencies, health systems, transportation services and other negatively impacted coronavirus-related restrictive measures. With a focus on mental health care for school closures, states should develop contingency plans to provide mental health services during school closures to students who rely primarily on school services. The pandemic has demonstrated the importance of psychological assistance for the elderly. A separate issue is the COVID-19 crisis, which has exacerbated the existing institutional, psychological and environmental barriers faced by persons with disabilities in exercising their rights and accessing basic services.

The COVID-19 pandemic has exacerbated existing health deficiencies, including a shortage of psychologists. States should initiate medical training programs, including for psychologists and psychotherapists.

A WHO advisory group to analyse the evidence, identify gaps and seek solutions, advise and support countries’ efforts to meet the mental health needs of their populations during and after the COVID-19 pandemic [2].

WHO conducted a survey on the impact of COVID-19 on mental health services from June to August 2020 in 130 states in six WHO regions. WHO identified the following challenges in providing psychological care in the context of the COVID-19 pandemic as a result of the survey: (1) over 60% reported disruptions to mental health services for vulnerable people, including children and adolescents (72%), older adults (70%), and women requiring antenatal or postnatal services (61%); (2) 67% saw disruptions to counseling and psychotherapy; 65% to critical harm reduction

services; and 45% to opioid agonist maintenance treatment for opioid dependence; (3) more than a third (35%) reported disruptions to emergency interventions, including those for people experiencing prolonged seizures; severe substance use withdrawal syndromes; and delirium, often a sign of a serious underlying medical condition; (4) 30% reported disruptions to access for medications for mental, neurological and substance use disorders; (5) around three-quarters reported at least partial disruptions to school and workplace mental health services (78% and 75% respectively) [1]. The coronavirus pandemic has highlighted weaknesses and gaps in services providing psychological assistance, support and rehabilitation.

WHO has produced “Basic Psychosocial Skills: A Guide for COVID-19 Responders” to help people involved in the COVID-19 response integrate psychosocial support skills into their daily work, thereby improving the well-being of the people with whom they work. contact during a pandemic [5].

WHO has prepared guidelines for maintaining mental health and psychosocial wellbeing during the COVID-19 outbreak, which include guidelines for the general public, guidelines for health workers, guidelines for department managers and chief physicians of healthcare facilities, guidelines for caregivers, guidelines for those caring for the elderly, guidelines for those in isolation. While the WHO guidelines are a source of soft law, they are an important source of medical law.

Given these value-based principles, practical advice to mental health workers on how to protect and enforce the rights of patients with severe mental illness in a pandemic may include: as legal entities) who provide psychiatric care to patients; (1) constant contact with external agents to ensure that no unilateral decisions are made without prior consultation with mental health experts, patient representatives and their relatives; (2) expert information on the medical (and not just psychiatric) history of patients transmitted to these external agents, with particular emphasis on the presence of infectious diseases and possible preventive measures; (3) the use of electronic means of communication, which are used as a possible way to guarantee patients’ access to their basic rights, while protecting the health of their legal representatives, relatives; and (4) raising awareness of the special needs of vulnerable populations (such as psychiatric patients) by mental health professionals in collaboration with decision-makers in social services and political and legal institutions [6]. By following this algorithm, mental health professionals working in psychiatric clinics can make a significant contribution to ensuring the highest ethical and clinical standards for their patients [6], thereby realizing patients’ rights.

During the spread of the coronavirus pandemic, people begin to experience heightened fear, anxiety and anxiety. This applies to both the general population and specific groups of citizens, such as older people, health care providers, people with disabilities and people with underlying health problems. Ensuring uninterrupted access to services for people with developing or pre-existing mental health problems,

along with maintaining the mental health and well-being of health workers who are fighting the pandemic, is now a major concern in States.

A technical advisory group at the WHO Regional Office for Europe reviews and synthesizes available data not only on populations, policies and services, but also on specific groups of people, and identifies needs and possible implications for mental health services in the WHO European Region. The recommendations of the WHO Advisory Group will be incorporated into a mental health action framework that will be presented to the WHO Regional Office for Europe in September 2021 [2]. The creation of the Coalition on Mental Health in the WHO Regional Office for Europe, scheduled for 2021, will bring together European Region countries, as well as service users, health professionals and innovators in the field attract investment in mental health and help raise awareness of the need for reform.

CONCLUSIONS

It should be noted that psychological assistance during a coronavirus pandemic should be based on the following principles: accessibility (in conditions of quarantine or isolation due to illness, remote work via mobile phone or special Internet applications comes to the fore, provided by psychologists, psychiatrists, volunteers on behalf of certain organizations, including primarily health care facilities that provide this service also available financially); continuity (for those who have already been in the process of receiving psychological, social, psychotherapeutic, psychiatric care, provide the maximum opportunity to continue receiving it, with adaptation to new conditions that may change); focus (new appeals are seen as requiring rapid intervention, focused on specific experiences and possible solutions, given the consequences of the coronavirus pandemic); interdisciplinary (pronounced emphasis on joint work of different departments and spheres of services to the population, which allows to refer the patient by a doctor to a psychologist, psychologist to a psychiatrist or social service, a social worker to a doctor or psychologist, etc.); educational nature of interventions (many interventions consist in psychological education of the population and offers of concrete actions, decisions, ways to master a situation which the person will be able to use independently).

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Informacja prasowa

KĄPIELE W SOLANCE SIARCZKOWEJ

Młodszy wygląd, dobre samopoczucie, większa sprawność fizyczna i lepsza kondycja, to pragnienie wielu z nas. Obecnie przeżywamy renesans lecznictwa uzdrowiskowego, powstają liczne nowe obiekty SPA i Wellness.

Coraz większym uznaniem cieszą się zabiegi oparte na naturalnych surowcach leczniczych, takich jak wody termalne, peloidy, algii itp.

Malinowe Hotele wychodząc naprzeciw tym oczekiwaniom stworzyły system profilaktyki i leczenia, oparty na kąpielach w solance siarczkowej. Hotele położone są w uzdrowiskowych miejscowościach, które dysponują warunkami naturalnymi, niezbędnymi do prowadzenia lecznictwa.

Sieć hoteli tworzą Malinowy Zdrój Hotel****Medical SPA, który niezmiennie od 10 lat posiada tytuł Najlepszego Medical Spa w Polsce oraz Malinowy Raj Mineral Hotel****, który połączony jest z jedynymi w Polsce Basenami Mineralnymi.

Wszystkie trzy obiekty zlokalizowane są w malowniczej miejscowości uzdrowiskowej Solec – Zdrój w województwie świętokrzyskim. To tereny idealne do wypoczynku, rehabilitacji i relaksu. W Świeradowie-Zdroju, w samym sercu Gór Izerskich zlokalizowany jest czwarty obiekt sieci - Malinowy Dwór Hotel****Medical SPA.

Ze względu na swoje położenie to urokliwe miejsce zachwyci swoimi walorami również wielbicieli jazdy na rowerze, a zimą na nartach.

Podstawę oferty Malinowych Hotelii stanowi czerpana z własnego źródła „Malina” najlepsza i najsilniejsza na świecie mineralna woda siarczkowa. Najwyższa zawartość aktywnych związków siarki (ok. 800 mg na litr) sprawia, iż ta "woda życia", zgodnie z łacińską sentencją SPA - *Sanus Per Aquam* - zdrowy przez wodę, jest naturalnym źródłem zdrowia i długowieczności.

Woda siarczkowa wykorzystywana jest do leczenia m.in. zwyrodnień stawów i kręgosłupa, dyskopatii, reumatoidalnych zapaleń stawów, stanów pourazowych i przeciążeniowych narządu ruchu, przewlekłych chorób skóry, zaburzeń tętniczego krążenia obwodowego, cukrzycy oraz chorób pochodzenia neurologicznego.

To właśnie dla tego surowca tak licznie do Malinowych Hotelii przybywają Goście.

Centra Medyczne znajdujące się, przy obiektach oferują także pełną gamę zabiegów z dziedziny balneologii, hydroterapii, fizykoterapii oraz różnych form masażu, a także kinezyterapii. Poza kąpielami siarkowymi, to właśnie kinezyterapia i terapia manualna sprawiają, że Goście wybierają właśnie Malinowe Hotele do odbycia kuracji.

Zabiegi te cieszą się ogromną popularnością wśród Gości. Ale nic nie dzieje się bez przyczyny. Wszyscy terapeuci, poza gruntowną wiedzą i przeszkoleniem, posiadają umiejętności potwierdzone wieloletnią praktyką w zawodzie.

Rehabilitacja prowadzona w ośrodkach jest oparta o kompleksową, indywidualną i funkcjonalną rehabilitację. Zadaniem terapeutów jest przywrócenie jak najlepszej sprawności fizycznej. Przeprowadzenie wstępnego badania opartego o szczegółowy wywiad i testy funkcjonalne pozwala na zastosowanie odpowiednich metod oraz dostosowanie indywidualnego planu terapii. Takie podejście daje najlepsze efekty wykonanej pracy, a tym samym przyspiesza powrót do sprawności.

W Malinowych Hotelach prowadzona jest rehabilitacja ortopedyczna i neurologiczna. Poprzez odpowiednio dobrany zestaw ćwiczeń, indywidualnie dopasowany do wymagań i potrzeb pacjenta oraz zaangażowanie terapeutów leczone są schorzenia kręgosłupa oraz narządu ruchu.

(www.malinowehotele.pl)

Application of Magnetoledtherapy and Magnetostimulation in the Treatment of Chronic Finger Wound After Injury. Case Report

Zastosowanie magnetoledoterapii oraz magnetostymulacji w leczeniu przewlekłej rany palca po urazie. Opis przypadku

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SUMMARY

Physical medicine and its wide therapeutic potential shows that this methods can be used in many fields of medicine. It pertains also the wide application of the low-frequency magnetic fields and low-energy optical light emitted by diodes LED. The aim of the study is to present the beneficial results of the treatment a 92-year-old female patient in whom in addition typical pharmacological treatment magnetoledtherapy and magnetostimulation treatments were used, lead to complete healing of the chronic wound.

Together with a surgical cleansing of the wound, its daily hygiene comprising of change dressings and pharmacotherapy, additional treatments supporting wound healing such as magnetoledtherapy and magnetostimulation were implemented. A series of 40 daily treatments were carried out, except Saturday and Sunday, with a positive effect.

Key words: magnetoledtherapy, magnetostimulation, variable magnetic fields, supportive therapy, physical procedures

Słowa kluczowe: magnetoledoterapia, magnetostymulacja, pola magnetyczne niskiej częstotliwości, terapia wspomagająca, zabiegi fizykalne

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INTRODUCTION

Chronic wounds are still a serious medical problem both for doctors and patients, as a result of which the quality of life deteriorates significantly. The problem of difficult chronic wounds concerns about 20 million patients around the world. In Poland, according to the statistical data, the problem of chronic wounds concerns about 500.000 patients. Statistics show that the number of patients will grow due to the prevalence of civilization diseases such as obesity, atherosclerosis and diabetes. It is much more common for chronic wounds to affect the elderly, whose regeneration of damaged tissues can be slower, this does not mean that the chronic wounds do not occur in people in younger age [1, 2].

Chronic wounds can arise for various reasons. The most often they are a complication of chronic venous insufficiency which affects about 80% of patients, diabetes, atherosclerosis and staying in a supine position for a long time (decubitus ulcer), chronic arterial failure, lymphatic diseases, metabolic, hematological, cancerous or postoperative and post-traumatic complications [3, 4].

According to the latest guidelines provided by the European Wound Management Association and the Polish Wound Management Association, the treatment of chronic wounds requires the interdisciplinary actions taken by the qualified medical teams. Therapy should concern activities such as determining the cause and risk factors of the problem, correct wound cleansing, selection of appropriate dressings, pharmacological measures and the use of complementary therapies (e.g. physical procedures, compression therapy or vacuum therapy). Physical medicine treatments, which offer a wide range methods, often allow to accelerate the healing process and significantly reduce the treatment time [1, 4-6].

Pseudomonas aeruginosa is one of the most dangerous microorganisms. It is an opportunistic pathogen which causes infections of blood, soft tissues and skin. Thanks to the pharmacological means and adjunctive treatments, it is possible to counter *Pseudomonas aeruginosa* much quicker. It is responsible for causing complicated and treatment-resistant infections. The most commonly antibiotics

used in its treatment are: polymyxins, fluoroquinolones, cephalosporins of III and IV gen., carboxypenicillins and ureidopenicillins [7].

AIM

The aim of the study is to present the beneficial results of the treatment a 92-year-old female patient in whom in addition typical pharmacological treatment magnetoledtherapy and magnetostimulation treatments were used, lead to complete healing of the chronic wound.

CASE REPORT

A 92-year-old female patient was pricked with a rose thorn, the tip of which was stuck in her finger, while working in the garden. As a result of this trauma after a few days, local inflammation, swelling, purulent coating, significant reddening of the affected area and severe, increasing pain appeared. After a few days on the injection a wound was formed (Figure 1).

The patient reported to the primary medical care. In the treatment room, the driven spike was removed, and then the wound was cleaned to the maximum extent available. The patient was given an anti-tetanus injection. The antibiotic Timentin was also ordered and a flexible Granuflex Extra Thin dressing applied. Basic laboratory tests (blood count, urine test) were also performed. A swab was taken from the wound which showed: „*Infection of the wound with the Pseudomonas aeruginosa ...*”. The patient reported severe pain in the finger (pain ailments on the VAS scale – 8/9). This assessment concerned the initial pain ailments experienced over the last dozen or so days.

The interview conducted earlier showed that the patient had suffered from heart failure and hypercholesterolemia for several years. She also reported pain associated with advanced degenerative changes in the peripheral joints of the lower extremities. She denied stimulants.

After completing the antibiotic treatment, the patient reported to the primary medical care for a follow-up visit. The consulting doctor stated reduced inflammation and less



Figure 1. Photo taken nine days after injection
Fot. 1. Zdjęcie wykonane po dziewięciu dniach od zaktucia

redness, although the wound was not fully healing. Due to the lack of fully satisfactory treatment results, the patient was additionally ordered to perform 40 physical magnetoledtherapy and magnetostimulation outpatient treatments [8, 9].

Treatments were performed with Viofor JPS Standard devices twice a day, 5 days a week (excluding Saturdays and Sundays) for a period of 4 weeks in two series of 20 procedures. The interval between series was 3 weeks. Magnetoledtherapy was performed locally with the use of two-section magnetic-light applicators for 10 minutes, and magnetostimulation with a ring applicator for 10 minutes.

Magnetoledtherapy treatments were performed in the MAGNETIC & LIGHT mode with the M1P2 program with the intensity of the alternating magnetic field 7, frequency 181.88Hz and magnetic induction in the range of 100 μ T, including light radiation with a wavelength of 850 nm. Magnetostimulation treatments were performed using the same magnetic field parameters (M1P2 magnetic field intensity 7).

M1 – application with constant intensity for the entire duration of the treatment for 10 minutes.

P2 – an option of the JPS system with two types of pulses, using the phenomenon of ion cyclotron resonance.

During the physical therapy, the patient continued the current pharmacological treatment (for comorbidities), and after each treatment the wound was continued with a protective Granuflex Extra Thin dressing.

After the completion of physical therapy (40 procedures in total), the wound on the patient's finger was fully healing. The follow-up examination showed no scars, and the swelling and inflammation decreased. The repeated swab did not reveal the presence of *Pseudomonas aeruginosa* bacteria. Pain ailments in the VAS scale – 0 points. The final treatment result is shown on Figure 2.

After the therapy, the functional efficiency of the fingers was assessed by performing simple movement exercises (holding the cup in the hand, clenching the fist, opposing the fingers), during which the full efficiency of the treated finger was demonstrated.

DISCUSSION

The healing wound is a complex and structured biological process that follows an injury in every living organism. Healing of damaged tissues should take place through granulation. Unfortunately, in many cases the healing process does not run properly, because excessive exudate in the wound, insufficient blood supply to the wound area, its extent, weakened immunity, vitamin deficiencies, infection, comorbidities, e.g. diabetes, atherosclerosis disrupt this process [10, 11].

For many years, the TIME system (tissue debridement – tissue preparation, infection control – wound infection control, moisture balance – maintaining optimal wound moisture, epidermization – stimulation of the epidermis) system has been used in the treatment of chronic wounds in accordance with the recommendations of the International Advisory Board and the Polish Wound Treatment Society. The current approach of wound healing experts indicates the fundamental importance of the TIMERS system (repair and



Figure 2. Photo taken after the physical therapy (total 40 treatments / 11 weeks from the beginning of physical treatment)

Fot. 2. Zdjęcie wykonane po zakończeniu terapii (łącznie 40 zabiegów/11 tygodni od rozpoczęcia leczenia fizykalnego).

regeneration) and (social and individual – related factors), according to which such an approach should be used in all wounds, both acute and chronic [1, 12].

In the local treatment of wounds, it is very important to choose the right treatment method, adapted to the specific stage of healing, the stage of the wound and the amount of exudate. Until now, medicine does not have a single golden mean that can be used in the treatment of difficult chronic wounds. Properly conducted wound treatment requires a comprehensive, interdisciplinary approach, and in the course of the entire treatment process – according to the current state of knowledge – it should be indispensable to implement treatments in the field of physical medicine (physical therapy) [2, 3, 6, 8]. In recent years, significant progress has been made in understanding the processes involved in wound healing. This gave the basis for the introduction of many innovative therapeutic methods that accelerate the healing process. Treatments in the field of physical medicine, implemented at the right time, with appropriately selected parameters, may constitute a valuable complementary treatment method, as in the case report presented above [11, 13-16].

Undoubtedly, one of such treatments are low-frequency magnetic fields and low-energy light, the therapeutic mechanism of which includes, among others, improving the blood supply to tissues, increasing the elasticity of oxygen supplied to them, promoting the regeneration processes of damaged tissues and intensifying the epithelial processes, and thus accelerating the

healing process. In addition, variable magnetic fields and optical radiation intensify the regeneration and repair processes, e.g. by stimulating collagen synthesis, they stimulate epidermal processes and inhibit infectious processes, and also show a strong analgesic effect in the case of coexisting pain [8, 15, 16].

The presented case confirms that the implementation of physical treatments was purposeful and effective even at a later stage of wound healing. It should be emphasized that the discussed physical treatments are painless, non-invasive and do not require special preparation of the treatment area. These methods can be a valuable supplement to the classic pharmacological treatment of wounds, and in many complicated cases they can prevent the need to amputate the damaged part of the limb [4, 6].

In the work of Sztander and Zbyradowski the authors analyze the literature of using physical therapy such as the high voltage therapy, the magnetotherapy and the magnetostimulation in the chronic wound healing process. All clinical studies showed that different kinds of physical therapy such as the magnetostimulation, the magnetotherapy, and the high voltage therapy accelerate the process of healing wound. Unfortunately, the application of physical therapy in order to improve the wound healing process is still limited [17].

Confirmation of the obtained results is also the work of Pasek J. et al. in which the authors discusses the positive results of the treatment of a 63-year-old woman with a persisting chronic wound of her right lower extremity after knee joint endoprosthesis surgery. The physical medicine method applied, in the form of magnetoletherapy, contributed to complete wound healing and alleviation of pain suffered, as well as improvement of the quality of life of the treated patient [18].

In another work, the authors Pasek et al. presents the beneficial results of treatment of a 67-year-old woman patient with a diagnosis of crural vein ulceration in the right limb. The applied physiotherapeutic method, in the form of magnetostimulation, contributed to complete healing of the lesion, subsidence of symptoms, as well as improved life quality of the treated patient [19].

CONCLUSIONS

Magnetoletherapy and magnetostimulation supported the process of complete healing wound after a sting with a rose thorn. The therapeutic results achieved with the use of these methods can be highly satisfactory and worth considering when planning the treatment process in similar cases of patients.

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*Informacja prasowa***ZASTOSOWANIE TERAPII MITOCHONDRIALNEJ**

Mitochondria znajdują się w komórce każdej naszej tkanki. Są to nasze “wewnętrzne elektrownie” zaopatrujące organizm w niezbędną do funkcjonowania energię. Dobra forma mitochondriów sprzyja zdrowiu i dobremu samopoczuciu. Osłabione mitochondria mogą być przyczyną wielu schorzeń i chorób przewlekłych.

Terapia mitochondrialna (terapia IHHT) to trening komórek organizmu poprzez podawanie pacjentowi naprzemiennie powietrza z niskim i wysokim stężeniem tlenu.

Terapia jest dobrym wyborem przy ciężkich przewlekłych chorobach.

Dlaczego mitochondria są tak ważne? Mitochondria to centra energetyczne naszego organizmu.

Znajdują się w każdej komórce i to właśnie one zaopatrują organizm w energię niezbędną do życia i funkcjonowania każdego organu. Pełnią również szereg innych istotnych funkcji, chociażby odtruwają nasz organizm.

Komórki mają zdolność do regeneracji i są w stanie odtwarzać niewielkie ubytki mitochondriów.

Jednak, gdy utrata mitochondriów jest zbyt duża (ok. 40%), energii wystarczy już tylko do funkcjonowania organizmu w ograniczonym zakresie. Człowiek traci odporność, zaczyna łapać infekcje, jest chronicznie przemęczony.

Im większa liczba mitochondriów jest uszkodzona, tym organizm jest coraz słabszy,

bo energii wystarczy już na funkcjonowanie tylko najważniejszych organów.

Pojawiają się różne schorzenia i dysfunkcje organizmu, które zazwyczaj medycyna leczy objawowo.

Terapia mitochondrialna polega na oddychaniu przy pomocy powietrza o naprzemiennie niskim i wysokim stężeniu tlenu.

Wiadomo, że ostra hipoksja, czyli niedotlenienie organizmu wiąże się ze szkodliwymi dla naszego organizmu skutkami.

Terapia mitochondrialna stymuluje własne endogeniczne mechanizmy obrony na wszystkich poziomach

– od genu do całego organu lub tkanki. W wyniku hipoksji stare uszkodzone mitochondria obumierają,

a odbudowują się nowe zdrowe, w znacznie szybszym tempie.

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