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CLINICAL EFFICACY OF PHYSICAL THERAPY METHODS IN VERTEBROGENIC CERVICOCRANIALGIA

Abstract. The goal of the study was to investigate the effects of kinesiотaping, PRP-therapy (platelet-rich plasma injection) and therapeutic exercises on the clinical condition and quality of life (HRQoL) of young people with vertebrogenic cervicocranialgia (CCA) syndrome.

Materials and methods. The clinical efficacy of these methods of physical therapy (PT) was evaluated in patients of the main group (MG) – 38 young people with vertebrogenic CCA. The control group (CG) included 30 patients with vertebrogenic CCA of the appropriate age and sex who had drug therapy (NSAIDs and muscle relaxants). Computed tomography and X-ray of cervical spine with functional tests were performed in addition to the routine examination. HRQoL was evaluated by the MOS-SF-36 questionnaire. Pain intensity was assessed by the VAS scale.

Research results. In the CG in 5–7 days of observation (after PRP-therapy), a 9.2 mm reduction in pain was found. In the MG, the pain gradation decreased by 5.72 mm, and exceeded the degree of pain in the group with anti-inflammatory drugs ($p > 0.05$). A month later, in the MG, after the addition of kinesiотaping and TE, pain decreased by 32.9 mm ($p < 0.05$), and in the CG, while taking medications, a significant pain reduction by 21.5 mm was noted compared to the initial pain ($p < 0.05$). But the clinical effectiveness of drug therapy was less pronounced than after PT. In 3 months a statistically significant improvement of PT methods effectiveness was found (difference of 11.7 mm ($p < 0.05$) between MG and CG).

Conclusions. So, the study found that the applied PT methods can stably reduce the manifestation of cervical pain. The use of PT can improve HRQoL in patients with vertebrogenic CCA by reducing pain, restoring spinal mobility, expanding the movement regimen and active lifestyle. The combined use of KTP, PRP-therapy and therapeutic gymnastics is relevant in optimising the treatment of cervical osteochondrosis manifestations and dysplastic instability of the spine. This can increase the effectiveness and safety of treatment and can be recommended for widespread usage.

Key words: cervicocranialgia, cervical osteochondrosis, physical therapy, platelet-rich plasma injection, kinesiотaping.

Бадьїн І. Ю., Горша О. В., Горша В. І. Клінічна ефективність методів фізичної терапії при цервікокраніалгії вертеброгенного характеру

Анотація. Мета роботи – дослідження результатів впливу кінезіотейпінгу, PRP-терапії (введення збагаченої тромбоцитами аутоплазми) та лікувальної гімнастики на клінічний стан та якість життя (ЯЖ) осіб молодого віку з синдромом цервікокраніалгії (ЦКА) вертеброгенного характеру.

Матеріали та методи. Було проведено оцінку клінічної ефективності даних методів фізичної терапії (ФТ) у пацієнтів основної групи (ОГ) – 38 осіб молодого віку, які мали ЦКА вертеброгенного характеру. До контрольної групи (КГ) увійшли 30 пацієнтів із ЦКА зрілого віку та статі, які отримували медикаментозну терапію (НПЗП та м'якорелаксанти). Окрім рутинного обстеження, була проведена комп'ютерна томографія, рентгенографія ШВХ з функціональними пробами. Визначення якості життя проводили за допомогою опитувальника MOS-SF-36. Інтенсивність болю оцінювали за шкалою ВАШ.

Результати дослідження. У КГ через 5–7 днів спостереження (після проведення PRP) встановлено зниження болю на 9,2 мм, в ОГ градація болю зменшилася на 5,72 мм, що перевищувало інтенсивність больових відчут-

тів пацієнтів в КГ, які приймали протизапальні препарати ($p > 0,05$). Через місяць у пацієнтів ОГ після долучення КТП і ЛГ больові відчуття зменшилися на 32,9 мм ($p < 0,05$), а в КГ на тлі прийому ліків зазначено достовірне зниження болю на 21,5 мм порівняно з початковим болем ($p < 0,05$), але клінічна ефективність медикаментозної терапії була менш виражена, ніж після ФТ. Через 3 місяці виявлено статистично значуще переважання ефективності методів ФТ (різниця 11,7 мм ($p < 0,05$) між ОГ та КГ).

Висновки. Отже, дослідження встановило, що застосовані методи ФТ дозволяють стабільно зменшити прояв болю при ЦКА вертеброгенного характеру. Застосування ФТ дозволяє поліпшити ЯЖ у хворих на ЦКА шляхом зменшення болю, відновлення рухливості хребта, розширення рухового режиму і активного способу життя. Комплексне застосування кінезіотейпінгу, PRP-терапії та ЛГ актуальне при оптимізації лікування проявів ОХ та диспластичної нестабільності структур хребта. Це може підвищити ефективність і безпеку лікування та дозволяє рекомендувати розроблену методику ФТ до широкого впровадження.

Ключові слова: цервікокраніалгія, шийний остеохондроз, фізична терапія, введення збагаченої тромбоцитами плазми, кінезіотейпування.

Introduction. According to the International Classification of Diseases, 10th Revision (ICD-10), the diagnosis of cervicgia is classified as “Dorsalgia” with the ICD code M 54.2. The problem of dorsalgia in combination with cranio- and/or cervicogenic cephalgia have been widely studied. Medical experts consider that osteochondrosis (OC) and/or osteoarthritis of the cervical vertebrae is the most common cause of cervical pain [1–5]. However, the features of the etiology and the clinical course of this pathology in young people and children are not studied enough.

The active introduction of electronic gadgets into our daily life and work leads to a catastrophic increase in the number of patients (even children and young people) suffering from vertebral pain (according to various data, from 20 to 80%).

Vertebrogenic cervicocranialgia (CCA) syndrome, especially in young patients and children (up to 18 years old), is often caused by dysplastic cervical spine instability (CSI) [2–6]. With pathological changes in the connective tissue, a combination of degenerative-dystrophic processes of discs and intervertebral anatomical formations and a secondary inflammatory process often occurs. Among other things, cervical spine pathology in the form of the craniovertebral motor segment instability and the lower cervical vertebrae against the background of the weakness of the ligamentous apparatus in children and young people is considered one of the main causes of the vertebrobasilar insufficiency syndrome development [3; 4].

The analysis of the publications of most researchers about the problem of vertebrogenic syndrome showed that they should be treated by a combination of drug and non-drug therapy [1; 2; 6; 7–10]. But the main thesis is that the symptomatic approach to drug analgesia often fails to solve this problem. Methods of physical therapy (PT) is a priority choice at a young age because it causes no adverse effects and mostly has a complex patho- and sanogenetic effect

[3; 4; 6; 7; 9; 11; 12–14]. Non-medication methods are mainly based on a combination of three blocks: kinesitherapy; biomechanical correction of the spine; reflexotherapy and physiotherapy [2; 4; 5; 7; 10]. Among the factors affecting inflammatory and regenerative processes, along with preformed physical factors and kinesitherapy, massage and other manual techniques are also widely used (Kim DH, Kim SY, 2019). However, CSI and therapy on the background of pain syndrome severely limit the possibility of influencing the vertebrogenic CCA syndrome.

In recent years, biotechnologies of regenerative medicine have been introduced into the practice of physical therapy, one of which is platelet-rich plasma (PRP), a new therapeutic tool of an autologous nature. It has become widely used in sports medicine (chronic tendinopathies and enthesopathy), pathology of intervertebral discs, facet joints, ligaments and radiculopathy (Suja M, 2018). Since the autologous PRP is obtained from the patient’s own blood, the PRP-therapy has a low risk of complications and demonstrates significant pain relief in vertebrogenic dorsalgia (Desai M, et al., 2019; Liao JC, 2019; Mohammed S, Yu J, 2018) [1; 15; 17].

Today, there are significant changes in the former principles of treatment – the refusal of strict immobilization of patients and change to rapid activation using methods of kinesitherapy and manual correction due to relaxing, analgesic and anti-dystrophic effects. An alternative approach to management of CCA and/or vertebral cephalgia, the effectiveness of which we studied in our previous studies, is the method of kinesiотaping (KTP). The domestic and foreign scientists’ publications prove scientifically that KTP can be used for PT of patients suffering from vertebrobasilar dysfunction against the background of the undifferentiated connective tissue disease (UCTD) syndrome [3; 4; 7; 9; 16]. Also, an absolute advantage of this method is maintaining an active lifestyle for patients with soft fixation of the musculofascial segment (which is important in case

of CSI) against the background of reflexogenic stimulation with tapes of certain segments of the spine or limbs.

Therefore, the relevance of studying the pathogenetically determined aspects of cervicocranialgia therapy in young people is determined by the prevalence, complexity of etiopathogenetic mechanisms, and undefined algorithms and methodical approaches to the physical therapy of this pathology.

The purpose of the work was to study efficacy of kinesiотaping, PRP-therapy and therapeutic exercises on the clinical condition and quality of life of young people with the vertebrogenic cervicocranialgia syndrome.

Material and methods. The study was conducted in the outpatient setting of the Odesa Regional Clinical Medical Center of the Ministry of Health of Ukraine and the Rehabilitation Clinic in Odesa (license of the Ministry of Health of Ukraine – No. 866(13), dated July 27, 2017). The clinical efficacy of KTP, PRP-therapy, and therapeutic exercises (TE) was evaluated in 38 young patients (18 men and 20 women) aged 20–35 years with osteochondrosis (OC) and/or CSI who had vertebrogenic CCA. The control group (CG) included 30 patients of comparable age and gender who received drug anti-inflammatory therapy. The informed consent was obtained from all participants. Exclusion criteria were as follows: a different or unclear etiology of vertebrogenic CCA; concomitant decompensated diseases; individual sensitivity in the form of allergic reactions; mental disorders.

All patients were examined according to the examination standards of the Ministry of Health of Ukraine, including general clinical and neurological examination, general blood and urine test, computed tomography (CT) on the Toshiba Aquilion ONE/GENESIS apparatus (Japan), X-ray of the cervical spine with functional tests for CSI (SG Healthcare Jumong M apparatus, Korea). For quantitative assessment of pain, the Visual Analogue Scale (VAS) was used, which is a straight line 10 cm (100 mm) long, on which patients marked the level of pain intensity (Fig. 1).

A mark within the range of 10 to 30 mm indicated “mild” pain, from 40 to 60 mm – “moderate” pain, and from 70 to 100 mm indicated that the patient considered the pain to be “severe”. The evaluation of the HRQoL was conducted using an alternative Ukrainian version of the MOS-SF-36 questionnaire (Medical Outcomes Study Short Form-36). The questionnaire items formed the following scales: physical functioning, role functioning, pain intensity, general health, life activity, social functioning, influence of emotional state on role functioning, mental health assessment. The results were presented in the form of scores on the eight scales ranging from 0 to 100 points.

In the treatment of patients with dorsalgia caused by vertebrogenic CCA, according to current clinical protocols approved by the Ministry of Health of Ukraine on August 17, 2007, No. 487 “On approval of clinical protocols for medical care in the specialty of Neurology,” the CG patients received non-steroidal anti-inflammatory drugs (NSAIDs) (diclofenac 75 mg per day, intramuscularly) and muscle relaxants (midocalm 150 mg twice a day or muscomed 4 mg once a day).

In the treatment of patients of the main group (MG) (n=38), a comprehensive PT method was applied. PRP-therapy (by locally injecting plasma enriched with platelets) was performed as the first step for analgesia, reducing inflammation, and initiating the regeneration of dystrophic tissues. Using the injection method, intramuscularly and paravertebrally into soft tissues near the area of established instability and/or osteochondrosis of intervertebral discs, up to 2.5 ml of platelet rich plasma was injected into trigger points and zones according to the developed methodology. After PRP-therapy, within 3–5 days (after reducing the pain syndrome), patients of the main group (MG) received PT on an outpatient basis for a month, which involved a comprehensive application of KTP and TE. KTP of the cervical-collar zone was performed according to the developed and patented methodology (a method for treating cervi-

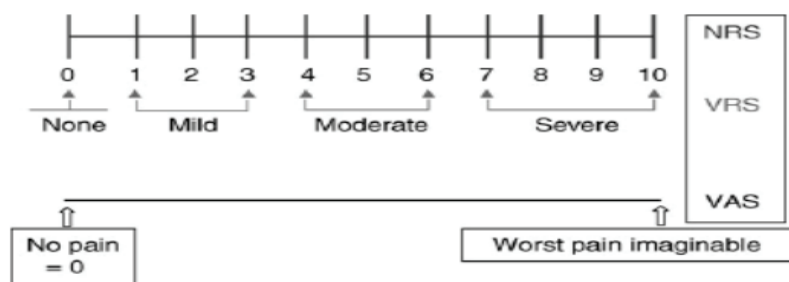


Fig. 1. Visual Analogue Scale

cogenic headache: pat. 112871 Ukraine, 2016) [16]. The procedure for applying tapes was performed every 5 days with a 2-day break, repeated for a course of 4 procedures during the month. Kinesiotherapy was prescribed after reducing the pain syndrome (5–10 days after PRP injection) to strengthen weakened muscles, increase their strength endurance, create a “general muscle corset” of the spine, and form a correct posture: developing joint-muscle sensation, restoring dynamic stereotypes. The complex mainly consisted of isometric exercises supplemented with dynamic ones, which patients learned under the supervision of an instructor and subsequently made them independently for 30 minutes daily. The main part of the complex ended with post-isometric exercises.

Duration of the disease ranged from several days to 7–10 years. Examinations were carried out dynamically: before the PT course, at the short-term perspective (5–7 days later), after the completion of the PT course and medication therapy (about 1 month later), and remotely (3 months after the PRP injection stage).

Methods of analysis: Research results were processed using variation statistics. Before testing hypotheses, normality of the distribution of quantitative features was checked using the Lilliefors criterion and the equality of variances using Fisher’s criterion. After confirming the normality of the distribution of features and the equality of variances, the unpaired Student’s t-test was used to compare groups and test the hypothesis of equality of distribution centres in samples representing quantitative data of the ratio scale obtained for different clinical groups (control and experimental). In case of non-compliance of the analyzed samples with homoscedasticity criteria, a non-parametric χ^2 test with Yates’ correction for continuity was used. The null hypothesis was accepted at $p > 0.05$. The relative error magnitude was calculated using the alternative variation method. Data processing was done using the STATISTICA for WINDOWS 6.0 software. The study was clinical, open, prospective, and controlled. The research methodology complied with the principles of biomedical ethics consensus and was conducted following evidence-based medicine principles.

Results of the study. The main complaint of patients was cervical and occipital pain attack (or persistent pain). The pain occurred episodically, lasting from several minutes to several days. It could be unilateral or generalized, increasing or appearing during head tilts or turns, or during other physical loads. The average pain intensity score by the

VAS scale approached “severe”, averaging 67.1 mm in the control group (CG) and 65.6 mm in the MG. The other complaints were rapid fatigue, emotional lability, sleep disturbances, weather sensitivity, and several complaints simultaneously. The physical examination revealed tension in the cervico-occipital muscles, myogenic trigger points and zones (pericranial and cervical muscles). The clinical signs of connective tissue dysplasia were more often detected: scoliotic posture or scoliosis, increased lumbar lordosis with joint curvature, signs of joint hypermobility. All patients had reduced active range of motion in the cervical spine. In addition, standard and functional (flexion and extension) X-rays showed typical changes characteristic of OC and CSI with lesions of 1st to 3rd spinal segments, the presence of bone osteophytes of the uncovertebral joints, and staircase instability. CT scans of patients in the 1st and 2nd groups revealed vertebral body reduction, decreased intervertebral space height, signs of spondyloarthritis, scoliosis, and OC with circular protrusions. No significant changes indicating inflammation were found in blood and urine analyses. HRQoL indicators revealed a decrease in daily physical activity scores to an average of 60 points in the presence of pain symptoms and exacerbation of chronic disease, and a deterioration in general health to an average of 49 points. Emotional status and mental health values were also reduced.

Examination in the dynamics of treatment. The results of short-term studies (5–7 days after PRP administration) showed that the CG patients had a decrease in the VAS pain intensity by 9.2 mm, the MG patients had the pain intensity decreased by 5.72 mm, but exceeded the intensity of pain in CG patients taking anti-inflammatory drugs. The studied indicators did not have statistical significance ($p > 0.05$), but reflected a general positive trend in the therapeutic effect. A month later, patients in the MG (after the addition of KTP and TE) reported a decrease in pain by 32.9 mm ($p < 0.05$), and patients of the CG (taking medications) showed a significant decrease in pain by 21.5 mm compared to the initial pain ($p < 0.05$).

Clinical efficacy of medication therapy after one month therapy was less pronounced than with PT, although it did not reach statistical significance ($p > 0.05$). A 3-month follow-up period showed that PT application led to a reduction in VAS pain scores by 22.1 mm, almost two-thirds less (by 43.5 mm) compared to the baseline ($p < 0.05$). Medication therapy in CG patients was associated with a significant pain reduction to 33.8 mm (a decrease of 33.3 mm) compared to the baseline ($p < 0.05$). Comparison of remote pain dynamics by the VAS after 3 months of

treatment showed a statistically significant difference of 11.7 mm ($p < 0.05$) in favor of PT application.

Evaluation of HRQoL in patients with vertebrogenic CCA using the SF-36 questionnaire showed significant improvement in all scales in patients of both groups.

Comparing the values of HRQoL according to the SF-36 questionnaire scales in patients with CCA after 3 months of observation, significant differences were noted between the group receiving medical treatment (CG) and the group treated with PT (MG). The mean values of HRQoL indicators significantly differed from a 100 per cent level of "ideal" health. But, at the same time, a significant improvement ($p < 0.05$) occurred in most HRQoL indicators after PT (1.36–1.44 times as much as compared to baseline values before treatment). The indicators of GH (general health) and MH (mental health) improved but without statistical significance ($p > 0.05$). In patients of CG, only the MA (motor activity) indicator achieved statistically significant changes ($p < 0.05$) during the remote observation period.

Discussion. The catastrophic increase in the adverse effects of civilization, the forced position of the head and neck when using phones and other gadgets provoke degenerative-dystrophic changes in spine tissues even in young individuals [11]. At the same time, a lot of young people have dysplastic changes in the connective tissue, which exacerbates and accelerates the phenomena of OC and secondary inflammation of spine structures. Therefore, we justified the use of the PT complex in the form of KTP, PRP-therapy, and TE. Our own previous studies and data of other authors have demonstrated the efficacy of these individually applied methods in pain syndrome of different locations and fixed relief in manifestations OC and vertebrogenic CCA [1; 3; 4; 5; 6; 7; 8; 13; 14; 16; 17].

It is worth noting that immediate results after the start of treatment (from 5–7 days) showed more significant improvement in the condition of CG patients. Thus, in the control group, a decrease in pain by 9.2 mm was noted, while in the main group, the intensity of pain decreased by 5.7 mm but exceeded the degree of pain sensations of patients taking anti-inflammatory drugs. The short term intake of anti-inflammatory therapy caused a more rapid analgesic therapeutic effect. In the PT group patients, the VAS indicators decreased, but less pronounced, indicating the initiation of the anti-inflammatory mechanisms cascade but with less speed and intensity. However, even minimal progress proves the involvement of endogenous growth factor stimulators of nonspecific and specific defense in OC. This was manifested in pain relief syndrome. The obtained data prove the existing concepts about the clinical course of vertebrogenic pain syndrome [5; 6; 7; 8; 11; 18]. Comparing the pain dynamics (according to the VAS) in 3 months of treatment, a statistically significant difference ($p < 0.05$) in pain reduction was found between MG and CG data, indicating the advantage of long-term positive effects of PT over only medication treatment.

Remote examination of HRQoL indicators according to the SF-36 questionnaire scales in patients with vertebrogenic CCA against the background of the applied PT complex showed that they increased during treatment and reached maximum values in 3 months, significantly differing from CG data, who received only medication therapy. This indicated the activation of long-term tissue regeneration mechanisms of degenerative cartilage under the influence of biological cell factor stimulators, kinesiotopeing of cervical muscles and TE. The intake of NSAIDs caused a more rapid analgesic therapeutic effect but was accompanied by the process of pain

Table 1

Dynamics of indicators of the HRQoL of patients with vertebrogenic CCA according to the SF-36 questionnaire

Quality of life indicators	MG (n=38)		CG (n=30)	
	Before PT	In 3 months	Before drug therapy	In 3 months
PF (physical functioning)	64.4 ± 3.63	75.4 ± 3.18*	56.47 ± 3.22	60.88 ± 3.04
MA (motor activity)	38.0 ± 5.63	54.0 ± 5.83*	27.94 ± 5.45	41.91 ± 4.27*
BP (body pain)	51.28 ± 5.65	73.89 ± 6.78*	48.11 ± 5.94	54.88 ± 6.3
GH (general health)	50.6 ± 2.9	55.96 ± 2.39	47.26 ± 2.07	50.09 ± 2.03
V (viability)	52.2 ± 3.4	63.5 ± 2.1*	51.4 ± 2.7	53.6 ± 3.6
SF (social functioning)	64.0 ± 4.08	88.52 ± 3.19*	61.29 ± 3.16	65.66 ± 3.2
ES (emotional state)	49.5 ± 2.75	67.4 ± 4.44*	47.37 ± 2.6	51.18 ± 2.84
MH (mental health)	43.0 ± 3.54	48.4 ± 3.37	41.91 ± 2.29	44.41 ± 2.24

Note: * – significant differences in indicators initially and after 3 months, $p < 0.05$.

and inflammation chronicity. Also, according to many authors, prolonging the course of anti-inflammatory therapy or repeated courses increase the probability of adverse side effects provoked by NSAIDs [15; 12; 13].

Therefore, the analysis of own data and their comparison with other studies shows that the use of the PT complex (kinesiotaping, PRP-therapy, and therapeutic exercises) significantly improves HRQoL in patients with vertebrogenic CCA by reducing pain, restoring spinal mobility, expanding the range of motion, and an active lifestyle, correlating with data of other researchers [2; 5; 6; 7; 8; 14; 18]. However, there are no studies in the available literature that are completely analogous to our research, which confirms its scientific novelty.

Conclusions

1. Physical therapy methods using kinesiotaping, PRP-therapy and exercise therapy can sta-

bly and in the long term reduce the manifestation of pain in CCA against the background of CSI and OC.

2. The application of the developed PT complex significantly and long-term improves HRQoL in patients with vertebrogenic CCA by reducing pain, restoring spinal mobility, expanding the range of motion, and an active lifestyle. This may increase the efficacy and safety of treatment.

3. The study showed that during the PT onset it is expedient to additionally prescribe a short-term course of anti-inflammatory medication therapy in order to reduce the pain syndrome.

4. The improvement in the condition of the examined patients under the influence of the developed PT complex proves the prospects of applying these methods in practice and further research of their effectiveness in OC and manifestations of dysplastic changes in the connective tissue.

BIBLIOGRAPHY:

1. Бадьїн І.Ю. Ефективність застосування плазми, збагаченої тромбоцитами, у лікуванні хворих на остеохондроз хребта. *Український журнал медицини, біології та спорту*. 2019. Т. 4, № 6. С. 271–278. DOI: 10.26693/jmbs04.06.271
2. Балашова І.В. Комплексна оцінка стану пацієнтів з нестабільністю шийного відділу хребта. *Медична реабілітація, курортологія, фізіотерапія*. 2013. № 4. С. 13–15.
3. Горша О.В., Короленко Н.В. Клініко-функціональні аспекти відновного лікування дітей молодшого шкільного віку з цервікогенним головним болем на тлі нестабільності в шийному відділі хребта. *Здобутки клінічної та експериментальної медицини*. 2018. № 3. С. 69–74. DOI: 10.11603/1811-2471.2018.v0.i3.9383
4. Короленко Н.В., Горша О.В. Вплив методики кінезіотейпування на стан гемодинаміки вертебробазиллярного басейну дітей з цервікогенним головним болем. *Relevant issues of modern medicine: the experience of Poland and Ukraine: International research and practice conference, Lublin, October 20–21, 2017: Conference proceedings*. Lublin: Izdavnictvo "Baltija Publishing", 2017. С. 22–25
5. Olson K.A. *Manual Physical Therapy of the Spine*. Elsevier Health Sciences, 2015. 384 p.
6. Gorsha O.V., Korolenko N.V., Shkolna M.V., Strashko Y.Yu. Physical therapy of cephalgia in dysplastic instability of the cervical spine in children. *Світ медицини та біології*. 2021. Vol. 75, N 1. P. 36–41. DOI: 10.26724/2079-8334-2021-1-75-36-41.
7. Лазарев І.А., Сташкевич А.Т., Максимішин О.М., Скуратовський Р.В. Обґрунтування кінезотерапевтичних заходів у хворих з протрузіями та грижами міжхребцевих дисків у поєднанні з нестабільністю поперекового відділу хребта на підставі аналізу біомеханічних досліджень. *Вісник ортопедії, травматології та протезування*. 2014. № 2. С. 32–36. Режим доступу: http://nbuv.gov.ua/UJRN/Votip_2014_2_9
8. Мисула І.Р., Голяченко А.О., Мисула Ю.І., та ін. Сучасні аспекти відновного лікування остеохондрозу хребта, поєданого з остеопорозом. *Україна. Здоров'я нації*. 2017. № 4(1). С. 126–129. Режим доступу: [http://nbuv.gov.ua/UJRN/Uzn_2017_4\(1\)_21](http://nbuv.gov.ua/UJRN/Uzn_2017_4(1)_21).
9. Navani A., Li G., Chrystal J. Platelet Rich Plasma in Musculoskeletal Pathology: A Necessary Rescue or a Lost Cause? *Pain Physician*. 2017. Vol. 20, N 3. P. E345–E356.
10. Shkolna M., Gorsha O. Physical therapy of tension headache in high school children. *Journal of Physical Education and Sport*. 2021. Vol. 21 (iss. 5). P. 2970 – 2974. DOI: 10.7752/jpes.2021.s5394
11. Дудар Л.В., Мельниченко Л.К., Готаренко Л. Фізична підготовленість і спосіб життя студентів – медиків та наявність у них фізичного болю, який заважав займатися нормальною роботою. *Науковий вісник Національного медичного університету імені О.О. Богомольця*. 2012. № 2. С. 56–60.
12. Gozhenko E.A., Badyin I.Yu., Gozhenko A.I. Theoretical Foundations of Medical Rehabilitation. *Актуальні проблеми транспортної медицини*. 2015. № 2 (40). С. 7–14. Режим доступу: http://nbuv.gov.ua/UJRN/aptm_2015_2_3.
13. Mohammed S., Yu J. Platelet-rich plasma injections: an emerging therapy for chronic discogenic low back pain. *Journal of Spine Surgery*. 2018, Vol. 4, N 1. P. 115–122. DOI: 10.21037/jss.2018.03.04.
14. Navani A., Li G., Chrystal J. Platelet Rich Plasma in Musculoskeletal Pathology: A Necessary Rescue or a Lost Cause? *Pain Physician*. 2017. Vol. 20, N 3. P. E345–E356.
15. Куліш С.О., Смирнов О.Б., Ситнік П.О., Залевський Д.М. Використання PRP терапії у комплексному лікуванні пацієнтів із критичною ішемією нижніх кінцівок. *Галицький лікарський вісник*. 2016. Т. 23, № 3 (ч.2). С. 48–50. Режим доступу: http://nbuv.gov.ua/UJRN/glv_2016_23_3%282%29_18.

16. Спосіб лікування цервікогенного головного болю : пат. 112871 Україна : МПК (2016.01), А61F13/06(2006/01) А61F5/00. № u 201608661 ; заявл. ; опубл. 26.12.2016, Бюл. № 24. 3 с.
17. Вернигородський С.В., Фіщенко В.О., Рибінський М.В. Регенерація повношарових дефектів хряща в експериментальній моделі під впливом збагаченої тромбоцитами плазми. *Ортопедія, травматологія та протезування*. 2017. № 4. С. 73–79. DOI: 10.15674/0030-59872017473-79.
18. Randomized, Double-blind, Placebo-controlled Phase III Trial of Duloxetine Monotherapy in Japanese Patients With Chronic Low Back Pain / S. Konno, N. Oda, T. Ochiai, L. Alev. *Spine*. 2016. Vol. 41, N 22. P. 1709–1717. DOI: 10.1097/BRS.0000000000001707

REFERENCES:

1. Badyin, I.Yu. (2019). Efektyvnist zastosuvannya plazmy, zbahachenoyi trombotsytamy, u likuvanni khvorykh na osteokhondroz khrebta [Effectiveness of platelet-rich plasma usage in the treatment of spinal osteochondrosis patients]. *Ukrayn'skyi zhurnal medytsyny, biolohii ta sporta*, Vol. 4, No. 6, pp. 271–278. DOI: 10.26693/jmbs04.06.271 [in Ukrainian].
2. Balashova, I.V. (2013). Kompleksna otsinka stanu patsiientiv z nestabilnistiu shynoho viddilu khrebta [Comprehensive assessment of the condition of patients with cervical spine instability]. *Medychna reabilitatsiia, kurortolohiia, fizioterapiia*, 4, pp. 13–15 [in Ukrainian].
3. Gorsha, O.V., & Korolenko, N.V. (2018). Kliniko-funktsionalni aspekty vidnovnoho likuvannya ditey molodshoho shkilnoho viku z tservikohennym holovnym bolem na tli nestabilnosti v shynomu viddili khrebta [Clinical and functional aspects of rehabilitative treatment of primary school children with cervicogenic headache against the background of cervical spine instability]. *Zdobutky klinichnoi ta eksperymentalnoi medytsyny*, No. 3, pp. 69–74. DOI: 10.11603/1811-2471.2018.v0.i3.9383 [in Ukrainian].
4. Korolenko, N.V., & Gorsha, O.V. (2017). Vplyv metodyky kineziolepyuvannya na stan hemodynamiky vertebrobasilarnoho baseinu ditei z tservikohennym holovnym bolem [Influence of kinesiotaping technique on the state of hemodynamics of the vertebrobasilar basin in children with cervicogenic headache]. *Relevant issues of modern medicine: the experience of Poland and Ukraine: International research and practice conference, Lublin, October 20–21, 2017: Conference proceedings*, pp. 22–25 [in Ukrainian].
5. Olson, K.A. (2015). *Manual Physical Therapy of the Spine*. Elsevier Health Sciences, 384 p. [in English].
6. Gorsha, O.V., Korolenko, N.V., Shkolna, M., & Strashko, Y.Yu. (2021). Physical therapy of cephalgia in dysplastic instability of the cervical spine in children. *Svit medytsyny ta biolohii*, Vol. 75, No. 1, pp. 36–41. DOI: 10.26724/2079-8334-2021-1-75-36-41 [in English].
7. Lazarev, I.A., Stashkevych, A.T., Maksymyshyn, O.M., & Skuratovskyi, R.V. (2014). Obgruntuvannya kinezoterapevtychnykh zakhodiv u khvorykh z protruziiami ta hryzhamy mizhkhrebtsevykh dyskiv u poiednanni z nestabilnistiu poperekovoho viddilu khrebta na pidstavi analizu biomekhanichnykh doslidzhen [Justification of kinesiotherapeutic measures in patients with protrusions and hernias of intervertebral discs in combination with lumbar spine instability based on biomechanical research analysis]. *Visnyk ortopedii, travmatolohii ta protezuvannya*, No. 2, pp. 32–36. Retrieved from http://nbuv.gov.ua/UJRN/Votip_2014_2_9 [in Ukrainian].
8. Mysula, I.R., Goliachenko, A.O., & Mysula, Yu.I., et al. (2017). Suchasni aspekty vidnovnoho likuvannya osteokhondrozu khrebta, poiednanoho z osteoporozom [Modern aspects of rehabilitative treatment of spinal osteochondrosis combined with osteoporosis]. *Ukraina. Zdorovia natsii*. No. 4(1), pp. 126–129. Retrieved from [http://nbuv.gov.ua/UJRN/Uzn_2017_4\(1\)_21](http://nbuv.gov.ua/UJRN/Uzn_2017_4(1)_21) [in Ukrainian].
9. Gorsha, O.V., & Korolenko, N.V. (2018). Psykhofiziologichni stan ditei pry zastosuvanni riznykh metodyk vidnovnoho likuvannya tservikohennoho holovnoho bolu [Psychophysiological state of children during various methods of rehabilitative treatment of cervicogenic headache]. *Visnyk mors'koi medytsyny*, No. 1 (79), pp. 66–74 [in Ukrainian].
10. Shkolna, M., & Gorsha, O. (2021). Physical therapy of tension headache in high school children. *Journal of Physical Education and Sport*, Vol. 21 (iss. 5), pp. 2970–2974. DOI: 10.7752/jpes.2021.s5394 [in English].
11. Dudar, L.V., Melnychenko, L.K., & Hotarenko, L. (2012). Fizychna pidhotovenist i sposib zhyttia studentiv-medykiv ta naiavnist u nykh fizychnoho bolu, iakyi zavazhav zaimatysia normalnoiu robotoiu [Physical abilities and lifestyle of medical students and the presence of physical pain hindering normal work]. *Naukovyi visnyk Natsionalnoho medychnoho universytetu imeni O.O. Bohomoltsia*, No. 2, pp. 56–60 [in Ukrainian].
12. Gozhenko, E.A., Badyin, I.Yu., & Gozhenko, A.I. (2015). Theoretical Foundations of Medical Rehabilitation. *Aktualni problemy transportnoy medytsyny*, No. 2 (40), pp. 7–14. Retrieved from http://nbuv.gov.ua/UJRN/aptm_2015_2_3 [in English].
13. Mohammed, S., & Yu, J. (2018). Platelet-rich plasma injections: an emerging therapy for chronic discogenic low back pain. *Journal of Spine Surgery*, Vol. 4, No. 1, pp. 115–122. DOI: 10.21037/jss.2018.03.04 [in English].
14. Navani, A., Li, G., & Chrystal, J. (2017). Platelet Rich Plasma in Musculoskeletal Pathology: A Necessary Rescue or a Lost Cause? *Pain Physician*, Vol. 20, No. 3, pp. E345–E356 [in English].
15. Kulish, S.O., Smyrnov, O.B., Sytnik, P.O., & Zalevskyi, D.M. (2016). Vykorystannia PRP terapii u kompleksnomu likuvanni patsiientiv iz krytychnoiu ishemiieiu nyzhnikh kintsivok [Use of PRP-therapy in the complex treatment of patients with critical lower limb ischemia]. *Halyskyi likarskyi visnyk*, Vol. 23, No. 3 (part 2), pp. 48–50. Retrieved from http://nbuv.gov.ua/UJRN/glv_2016_23_3%282%29_18 [in Ukrainian].
16. Sposib likuvannya tservikohennoho holovnoho bolu [Method of treatment of cervicogenic headache]: пат. 112871 Україна: IPC (2016.01), А61F13/06(2006/01) А61F5/00. No. u 201608661; statement ; published 26.12.2016, Bull. No. 24. 3 p. [in Ukrainian].

17. Vernyhorodskyi, S.V., Fishchenko, V.O., & Rybinskyi, M.V. (2017). Reheneratsiia povnosharovykh defektiv khriashcha v eksperymentalniy modeli pid vplyvom zbahanoyi trombotsytamy plazmy [Regeneration of full-layer cartilage defects in an experimental model under the influence of platelet-rich plasma]. *Ortopediia, travmatolohiia ta protezuvannia*, 4, pp. 73–79. DOI: 10.15674/0030-59872017473-79 [in Ukrainian].
18. Konno, S., Oda, N., Ochiai, T., & Alev, L. (2016). Randomized, Double-blind, Placebo-controlled Phase III Trial of Duloxetine Monotherapy in Japanese Patients With Chronic Low Back Pain. *Spine*, Vol. 41, No. 22, pp. 1709–1717. DOI: 10.1097/BRS.0000000000001707 [in English].