

I.M. Grygus^{1*}, A.O. Nogas¹, V.V. Zdanyuk² **DYNAMICS OF MOVEMENT AMPLITUDE INDICATORS IN JOINTS OF PATIENTS WITH RHEUMATOID ARTHRITIS***National University of Water and Environmental Engineering, Institute of Health¹**Soborna st., 11, Rivne, 33028, Ukraine**Kamianets-Podilskyi National Ivan Ohienko University²**Ohienko st., 61, Kamianets-Podilskyi, 32300, Ukraine**Національний університет водного господарства та природокористування,**навчально-науковий інститут охорони здоров'я¹**вул. Соборна, 11, Рівне, 33028, Україна**Кам'янець-Подільський національний університет імені Івана Огієнка²**вул. Огієнка, 61, 32300, Україна***e-mail: grigus03@gmail.com***Цитування:** *Медичні перспективи. 2023. Т. 28, № 4. С. 166-173***Cited:** *Medicni perspektivi. 2023;28(4):166-173***Key words:** *rheumatoid arthritis, physical therapy, joints, goniometry, movement amplitude***Ключові слова:** *ревматоїдний артрит, фізична терапія, суглоби, гоніометрія, амплітуда рухів*

Abstract. Dynamics of movement amplitude indicators in joints of patients with rheumatoid arthritis. Grygus I.M., Nogas A.O., Zdanyuk V.V. The purpose of the paper is to evaluate the effectiveness of the technology of rehabilitation measures in patients with rheumatoid arthritis according to the dynamics of movements amplitude indicators. Theoretical (analysis and generalization of literary and Internet data), survey, collection of anamnesis, objective examination, anthropometric (goniometry) methods of mathematical statistics. 188 patients with rheumatoid arthritis were examined, of which 156 (83%) were women, 32 (17%) were men, average age was 44.9±7.6 years. The analysis of the goniometric indicators of the joints of hands affected by rheumatoid arthritis after six months of conducted rehabilitation measures showed a significant improvement in the mobility of the radiocarpal joint and hand fingers in the examined patients. In particular, active flexion in the radiocarpal joint significantly increased in patients of the experimental group and was 72.5±6.0°, while in the patients of the control group this indicator was 5.3° less (67.2±5.0°) ($p<0.05$). A significant result was achieved in restoring flexion of the hand fingers in patients of the experimental group: mobility of the fingers in the metacarpal phalangeal joints was 83.2±3.6°, and in the control group it was 73.4±5.0°, in the proximal interphalangeal joints in patients of the experimental group it was 84.1±3.3°, and in the control group – 67.8±4.8° ($p<0.05$). Positive dynamics of active movements in the foot and finger joints was also observed in patients of both groups at the end of the study. In the patients of the experimental group, the active dorsiflexion in the ankle joint was 27.7±1.4°, the plantar flexion was 41.3±1.8°, which was significantly better than in patients of the control group in which the observed dorsiflexion was 23.4±1.7°, and plantar flexion – 41.3±1.8° ($p<0.05$). Accordingly, there was a significant increase in the motor function indicators in the metatarsal phalangeal joints of patients in the experimental group: flexion was up to 37.1±1.4°, extension – up to 39.2±1.0°, compared with the indicators in the control group: flexion – up to 33.5±1.2°, extension – up to 36.2±1.1° ($p<0.05$). The effectiveness of the developed technology is confirmed by improvement of the results of goniometric indicators in patients of the experimental group compared with the control group.

Реферат. Динаміка показників амплітуди рухів у суглобах пацієнтів з ревматоїдним артритом. Григус І.М., Ногас А.О., Зданюк В.В. Мета роботи – оцінка ефективності застосування технології реабілітаційних заходів у пацієнтів з ревматоїдним артритом за динамікою показників амплітуди рухів у суглобах. Теоретичні (аналіз та узагальнення літературних даних та мережі «Інтернет»), опитування, збір анамнезу, об'єктивне обстеження, антропометричні (гоніометрія) методи математичної статистики. Обстежено 188 пацієнтів з ревматоїдним артритом, із них жінок – 156 (83%), чоловіків – 32 (17%), середній вік яких становив 44,9±7,6 року. Аналіз показників гоніометрії уражених суглобів кисті при ревматоїдному артриті після 6 місяців проведених реабілітаційних заходів свідчив про значне покращення рухливості променево-зап'ястного суглоба та пальців кисті в обстежених пацієнтів. Зокрема, у пацієнтів основної групи достовірно збільшилися активні згинання в променево-зап'ястному суглобі: 72,5±6,0°, у пацієнтів контрольної групи цей показник був на 5,3° меншим (67,2±5,0°) ($p<0,05$). Значного результату було досягнуто у відновленні згинання пальців кисті в пацієнтів основної групи: рухливість пальців у п'ястно-фалангових суглобах – 83,2±3,6°, у контрольній групі – 73,4±5,0°, у проксимально-міжфалангових суглобах в основній групі – 84,1±3,3°, відповідно в контрольній – 67,8±4,8° ($p<0,05$). У пацієнтів обох груп наприкінці дослідження також спостерігалась позитивна динаміка

активних рухів у суглобах стопи та пальців. У пацієнтів основної групи активне тильне згинання в гомілковостопному суглобі становило $27,7 \pm 1,4^\circ$, підшовне згинання – $41,3 \pm 1,8^\circ$, що достовірно краще, ніж у пацієнтів контрольної групи: тильне – $23,4 \pm 1,7^\circ$, підшовне згинання – $41,3 \pm 1,8^\circ$ ($p < 0,05$). Відповідно спостерігалось достовірне збільшення показників рухової функції в плесно-фалангових суглобах пацієнтів основної групи: згинання – до $37,1 \pm 1,4^\circ$, розгинання – до $39,2 \pm 1,0^\circ$ ніж у контрольної групи: згинання – до $33,5 \pm 1,2^\circ$, розгинання – до $36,2 \pm 1,1^\circ$ ($p < 0,05$). Ефективність розробленої технології підтверджується покращенням результатів гоніометричних показників у пацієнтів основної групи порівняно з контрольною групою.

Rheumatoid arthritis (RA) is a chronic systemic condition affecting connective tissues, with an immune origin and an unidentified cause. The disease is characterized by non-specific symmetric arthritis, extra-articular changes and systemic symptoms [1, 2]. The data from the recent Global Burden of Disease study indicate that approximately 1.71 billion people worldwide suffer from musculoskeletal disorders and diseases. In particular, 14 million people are affected by rheumatoid arthritis [3].

In Ukraine, rheumatoid arthritis has a prevalence of 340 cases per 100,000 adults. Women are affected by this condition three to four times more frequently than men. Moreover, the disease predominantly impacts individuals in their working years, typically between the age of 30 and 50, resulting in frequent and prolonged hospitalizations, reduced work capacity, disabilities, and substantial economic costs. [4, 5, 6]. Disability can occur even at an early stage of the disease, with symptoms appearing within the first three years after the onset of rheumatoid arthritis in 27% of patients, and after 8-10 years – in approximately 85% of patients. The mortality rate among individuals with rheumatoid arthritis is twice as high as in the general population. This statistic deteriorates with each passing year [4, 7].

The joint process and the associated chronic pain syndrome exhibit a consistently progressive nature. This progression results in the deterioration of articular cartilage, leading to erosions and bone destruction within the joint. Over time, deformity develops, impairing the function of the joints [8, 9].

In particular, the following typical deformations of the joints appear: “walrus fins” – deviation of the 2nd – 4th fingers in the direction of the elbow (to the little finger); “swan neck” – flexion contracture in the metacarpal-phalangeal joints, hyperextension in the proximal interphalangeal joints and bending of the nail phalanges; “boutonniere” – persistent bending of the proximal interphalangeal joints [6, 10].

In the cyclic course of rheumatoid arthritis, it is generally recognized that the joints are affected and excluded. Predominantly, there is persistent symmetrical damage to the small joints of hands and feet: metacarpal phalangeal, proximal interphalangeal, radial carpal, tibial foot, and metatarsal phalangeal. Other joints are rarely affected. Excluded joints include distal interphalangeal joints; first metacarpal

phalangeal joint of the little finger, first metatarsal phalangeal joints [8, 11].

Steady symmetrical pain and stiffness in the small joints of hands and feet increase gradually. The initial symptoms of the disease appear acutely or covertly, the pain is localized in one or two joints, mainly in the upper limb. Limitation of active movements in the joints is observed. They become swollen, the skin over them is changed and hyperemic [10]. In patients with rheumatoid arthritis, the disease is accompanied by an increase in temperature, general weakness, apathy, and poor sleep. Morning stiffness syndrome appears gradually, and occurs in 93% of patients. The normal volume of movements is restored only after 30-60 minutes of motor activity after waking up. The longer the stiffness lasts, the more pronounced the activity of the process is. Patients note muscle weakness, gradual loss of the ability to move freely [1, 12, 13].

Currently, the conservative therapy, which includes basic and symptomatic therapy to eliminate autoimmune inflammation and relieve pain syndrome is the unchanged basis of treatment for patients with rheumatoid arthritis [6, 14, 15].

In recent years, treatment with immunobiological drugs (anti-cytokine therapy, janus-kinase inhibitors) has been introduced, characterized by point-blocking of the factors of the immune system that trigger the autoimmune inflammatory process in the joints [2, 6, 16].

According to a number of authors, to enhance the efficacy of drug treatment, special emphasis is placed on the inclusion of physical therapy as an integral component of the comprehensive rehabilitative care for individuals with rheumatoid arthritis [4, 5, 7, 12, 17].

Currently, there is a pressing need for the development and implementation of an efficient rehabilitation system. This system should encompass individualized rehabilitation techniques that incorporate innovative physical therapy methods, along with objective approaches for evaluating the effectiveness of these measures and forecasting rehabilitation outcomes [2, 13, 17].

Abundant clinical data highlight a significant decrease in the physical activity of patients with rheumatoid arthritis due to impaired mobility and the functional insufficiency of the affected joints [7, 10, 12].

That is why great importance is attached to an early implementation of rehabilitation measures, which are extremely important for patients with rheumatoid

arthritis to achieve long-term remission, stop the progression of the disease, restore joint mobility and improve patients' quality of life [2, 13, 19, 20].

The purpose of the research is to evaluate the effectiveness of the technology of rehabilitation measures in patients with rheumatoid arthritis according to the dynamics of the amplitude of movements in the joints.

MATERIALS AND METHODS OF RESEARCH

The research was carried out at the rheumatology department and the department of restorative treatment with traditional and non-traditional methods of the Municipal Enterprise "Rivne Regional Clinical Hospital named after Yuriy Semeniuk". The accumulation of research findings was carried out during the admission of patients for inpatient treatment. A total of 188 patients with rheumatoid arthritis – 156 (83%) women and 32 (17%) men, their average age was 44.9 ± 7.6 years. All patients were randomly divided into two groups: the control group ($n=92$, including 16 men and 76 women) and the experimental group ($n=96$, including 16 men and 80 women). The duration of the disease among the participants ranged from 6 months to 10 years [21].

The inclusion criteria were the following: the presence of an established diagnosis of rheumatoid arthritis based on ACR/EULAR 2010 criteria and in accordance with the Order of the Ministry of Health of Ukraine dated 04.11.2014 No. 263 "Unified Clinical Protocol of Primary, Secondary, Tertiary Medical Care and Medical Rehabilitation of Patients with Rheumatoid Arthritis" [6, 16, 19], as well as the presence of patients' informed consent to participate in the study.

The exclusion criteria were the following: age over 60 years, radiological stage IV of joint damage, third degree of inflammatory nature, patient's refusal to participate in the study. Distal interphalangeal, first carpometacarpal, first metatarsophalangeal joints belonged to the excluded ones.

The research was conducted in accordance with the fundamental principles outlined in the "Rules of Ethical Principles of Conducting Scientific Medical Research with Human Participation" approved by the Declaration of Helsinki (1964-2013), ICH GCP (1996 p.), EU Directive No. 609 (of November 24, 1986), orders of the Ministry of Health of Ukraine No. 690 of September 23, 2009, No 944 of August 14, 2009, No. 616 of August 3, 2012. Patients voluntarily participated in the study, as indicated by their respective informed consent to participate in the research [21].

Research methods: theoretical (analysis and generalization of literary and Internet data), survey, collection of anamnesis, objective examination, anthropometric (goniometry, dynamometry), methods of mathematical statistics.

The statistical description of the samples involved calculating the arithmetic mean (M) and its errors (m). The criterion of reliability of the estimates was the level of significance with an indication of probability of a false estimate (p). The difference in means was considered significant at $p < 0.05$ [21]. The obtained numerical data were processed statistically using a statistical analysis package Statistica 10 (Serial Number: STA999K347150-W) and MEDCALC® (<https://www.medcalc.org/calc/>).

RESULTS AND DISCUSSION

Before the start of the rehabilitation course, we conducted analysis of case histories, medical records, patient surveys and thorough familiarization with their drug treatment.

Goniometry was used to assess motor activity indicators of small joints of hands and feet in patients with rheumatoid arthritis. Goniometry is an objective assessment of the motor function of the joints, which is carried out by measuring the angles of different directions of movements in the examined joint.

The active functioning of both the upper and lower limbs largely depends on the the range of motion in the joints. In patients with rheumatoid arthritis, there is a limitation of both passive and active movements in the affected joints as a manifestation of protective reaction, in connection with the pain syndrome, as well as a result of developing muscle contractures. The ongoing inflammatory process in the joints results in a significant reduction in their mobility, the development of joint deviations, deformations and ultimately, ankylosis [8, 10, 12].

During initial examination, we found that most patients had a reduced range of motion in the joints of the upper and lower limbs. Mobility impairment was observed in the carpal joint, joints of hands and fingers, as well as in the ankle joint and metatarsophalangeal foot joints. In particular, a decrease in the amplitude of movements was observed in the carpal joint: flexion was up to $45.2 \pm 5.4^\circ$, extension – up to $37.2 \pm 3.8^\circ$, which occurred due to pain syndrome and weakness of the extensor hand muscles.

The radiocarpal joint is the main tool for hand functioning. Affected by the inflammatory process, a painful, deformed radio carpal joint prevents the motor function of the fingers and causes their deformation. Accordingly, insufficiency of movement activity was also observed in the carpal-phalangeal joints: flexion – up to $64.9 \pm 5.4^\circ$, extension – up to $72.1 \pm 6.7^\circ$; in proximal interphalangeal joints, flexion was up to $61.2 \pm 3.64^\circ$, extension – up to $67.2 \pm 5.9^\circ$ (Table 1).

Foot as well as hand joints are involved in the pathological process quite early, which is manifested by the clinical picture of the disease, early changes on the x-ray of the feet. The most characteristic is the damage

to the metatarsal-phalangeal joints of the 2nd–4th toes. Damage of the ankle joint is manifested by its soreness, reduced mobility and swelling in the area of bones.

Initial examination of patients with rheumatoid arthritis revealed a reduced range of movements in

the ankle joint: dorsiflexion – up to 15.8±1.4, plantar flexion – up to 29.8±1.8°. Movement disorders of the toes were also observed in the metatarsal-phalangeal joints: flexion – up to 22.7±1.4°, extension – up to 27.4±1.5° (Table 1).

Table 1

**Goniometric indicators in examined patients
with rheumatoid arthritis before the course of physical therapy (n=188, M±m)**

Joints	Test movement (in degrees)	
	active flexion	active extension
	M±m	M±m
Hand joints		
Radiocarpal (norm 90/70)*	45.2±5.4	37.2±3.8
Carpal phalangeal (norm 90/90)*	64.9±5.4	72.1±6.7
Proximal phalangeal (90/90)*	61.2±3.6	67.2±5.9
Foot joints		
Ankle dorsiflexion/plantar flexion (norm 20/50)*	15.8±1.4 29.8±1.8	-
Metatarsal phalangeal (norm 40/40)*	22.7±1.4	27.4±1.5

Notes: norm in degrees; * p<0.05 between the indicators of the experimental and control groups.

The conducted initial examination confirmed the presence of movement disorders in patients and deviation of indicators from the norm. After the initial examination, all patients were randomly assigned to control (92 patients) and experimental (96 patients) groups, proportionally as they were admitted to the hospital.

All patients underwent a standard clinical, laboratory and functional examination. The patients were treated according to the normative protocol of the Ministry of Health of Ukraine and were under the supervision of doctors [6]. Along with the drug therapy, rehabilitation measures were carried out according to the severity of the disease.

The patients of the control group underwent rehabilitation in accordance with the recommendations of the regulatory document of the Ministry of Health of Ukraine [6] (Appendix 1), according to which the standard rehabilitation measures (exercises, massage, hardware physiotherapy) were applied.

The patients of the experimental group were engaged in rehabilitation activities according to the proposed

technology. A program of physical therapy was developed for each patient for a long-term period of six months, and included inpatient and outpatient stages.

For better effectiveness of the restorative treatment of patients of the experimental group, achievement of clinical remission, reduction of pain syndrome, improvement of motor function of the joints, prevention of deformations and contractures, preservation and improvement of quality of life, we have developed the technology of rehabilitation measures.

The developed rehabilitation technology provided for a personalized approach to each patient taking into account age characteristics, the severity of the course of the disease, the degree of activity of the rheumatoid process and the clinical picture of the disease, the radiological stage and functional insufficiency of the joints, existing contraindications and warnings, specific physiological and psychological disorders, and assessment of the functional condition of patients.

The rehabilitation interventions included therapeutic exercises tailored to the disease period and joint functional limitations (positioning treatment,

static exercises, as well as passive and active exercises both assisted and unassisted, integrating resistance training); exercises utilizing various objects, specific routines to improve the range of motion in the affected joints and increase muscle strength. Special emphasis was placed on aerobic exercises, as they are characterized by lower intensity and longer duration and, considered the most appropriate form of physical activity for individuals with rheumatoid arthritis, according to our assessment. The recommended exercises focused on extension and abduction of the extremities to increase muscle tone in the muscles responsible for flexion and adduction, while simultaneously reducing the tone in the muscles responsible for extending and abducting the limbs [22].

Therapeutic massage was administered and the patients were instructed on how to perform self-massage. Additionally, the physiotherapeutic treatment, hydrotherapy, orthotic devices, mechano-

therapy, kinesiotaping and psychological support were provided as part of the intervention. Hydrotherapy was employed to improve blood circulation, alleviate joint pain and reduce muscle spasms. The approach to mechanotherapy was adapted to the specific clinical forms of joint damage in order to improve the range of motion, stretch and improve the flexibility of muscles and ligaments, and restore muscle strength and joint motor function [22].

The obtained results were examined, compared with the initial data, and assessed three times: prior to the beginning of the physical therapy course, three months after, and six months after during the implementation of rehabilitation measures.

Both standard treatment and physical therapy after three months contributed to the improvement of the goniometric indicators of all patients, as evidenced by the data in Table 2.

Table 2

Dynamics of goniometric indicators in patients of both groups three months after the course of physical therapy (M±m)

Test movement (in degrees)	Before the course of physical therapy		Three months after	
	EG (n=96)	CG (n=92)	EG (n=96)	CG (n=92)
	M±m	M±m	M±m	M±m
Hand joints				
Radiocarpal joint				
Active flexion/extension	43.9±4.0	46.5±4.7	64.9±6.1	54.2±4.8
	36.1±3.5	38.3±4.1	44.9±3.6	43.4±4.5
Carpal phalangeal (2nd – 5th fingers)				
Active flexion	65.1±6.1	64.7±4.7	72.7±6.2	67.5±4.7
Proximal interphalangeal (2nd – 5th fingers)				
Active extension	62.3±2.6	60.2±4.7	70.5±6.0	63.9±4.8
Foot joints				
Ankle joint				
Active dorsiflexion/ plantarflexion	16.3±1.3	15.4±1.6	23.1±1.7	19.2±1.7
	30.4±1.9	29.3±1.7	36.7±1.5	34.1±1.8
Metatarsal phalangeal joints				
Active flexion / extension	22.8±1.5	22.7±1.3	32.4±1.9	29.2±1.7
	27.6±1.3	27.3±1.7	34.5±1.1	32.1±1.8

Note. * p<0.05 between the indicators of the experimental and control group.

Application of the proposed technology of rehabilitation measures contributed to a significant improvement of the motor function in the affected joints

of patients of the experimental group compared with the indicators of patients of the control group. Thus, in general, after three months of rehabilitation, the patients

of the experimental group showed a better increase in the range of motion in the radiocarpal joint: flexion was up to $64.9 \pm 6.1^\circ$, extension was up to $44.9 \pm 3.6^\circ$, in contrast to the control group with flexion up to $54.2 \pm 4.8^\circ$, and extension up to $43.4 \pm 4.5^\circ$ ($p < 0.05$).

In the metacarpal phalangeal and proximal interphalangeal joints, the focus was on the results of the flexion indicators, as restoration of flexion of hand fingers is important for patients with rheumatoid arthritis. It is necessary to note a significant increase in the motor function indicators in the carpal phalangeal joints in patients of the experimental group: flexion was up to $72.7 \pm 6.2^\circ$, and in the proximal interphalangeal joints, flexion was up to $70.5 \pm 6.0^\circ$ ($p < 0.05$) in contrast to the control group (Table 2).

As a result of applying the recommended rehabilitation measures, the movement indicators in the ankle joint improved much better in the experimental group: dorsiflexion was up to $23.1 \pm 1.7^\circ$, plantar flexion – up to $36.7 \pm 1.5^\circ$ as compared with the control group, in which dorsiflexion was up to $19.2 \pm 1.7^\circ$, plantar flexion – up to $34.1 \pm 1.8^\circ$ ($p < 0.05$). In the metatarsal phalangeal joints, there was also a significant increase in the motor function indicators of the toes in patients of the experimental group: flexion – up to $32.4 \pm 1.9^\circ$, extension – up to $34.5 \pm 1.1^\circ$ as compared with the patients of the control group with flexion up to $29.2 \pm 1.7^\circ$, extension up to $32.1 \pm 1.8^\circ$ ($p < 0.05$).

Table 3

**Dynamics of the goniometric indicators in patients
of both groups six months after a course of physical therapy (M±m)**

Test movement (in degrees)	Indicators three months after		Indicators six months after	
	EG (n=96)	CG (n=92)	EG (n=96)	CG (n=92)
	M±m	M±m	M±m	M±m
Hand joints				
Radiocarpal joint				
Active flexion/extension	64.9 ± 6.1 44.9 ± 3.6	54.2 ± 4.8 43.4 ± 4.5	72.5 ± 6.0 60.6 ± 2.4	67.2 ± 5.0 48.7 ± 4.6
Carpal phalangeal (2nd – 5th fingers)				
Active flexion	72.7 ± 6.2	67.5 ± 4.7	83.2 ± 3.6	73.4 ± 5.0
Proximal interphalangeal (2nd – 5th fingers)				
Active flexion	70.5 ± 6.0	63.9 ± 4.8	84.1 ± 3.3	67.8 ± 4.8
Foot joints				
Ankle joint				
Active dorsiflexion/plantarflexion	23.1 ± 1.7 36.7 ± 1.5	19.2 ± 1.7 34.1 ± 1.8	27.7 ± 1.4 46.2 ± 0.9	23.4 ± 1.7 41.3 ± 1.8
Metatarsal phalangeal joints				
Active flexion/extension	32.4 ± 1.9 34.5 ± 1.1	29.2 ± 1.7 32.1 ± 1.8	37.1 ± 1.4 39.2 ± 1.0	33.5 ± 1.2 36.2 ± 1.1

Note. * – $p < 0.05$ between the indicators of the experimental and control group.

Analysis of the goniometric indicators of the affected hand joints in rheumatoid arthritis after six months of rehabilitation measures showed a significant improvement in the mobility of the carpal joint and fingers in the examined patients. In particular, active flexion in the radiocarpal joint significantly increased in

patients of the experimental group – $72.5 \pm 6.0^\circ$, and in patients of the control group this indicator was 5.3° lower ($67.2 \pm 5.0^\circ$) (Table 3) ($p < 0.05$).

A significant result was achieved in restoring the fingers flexion in patients of the experimental group: mobility of the fingers in the metacarpal phalangeal

joints was $83.2 \pm 3.6^\circ$; in the control group it was $73.4 \pm 5.0^\circ$. The indicator in the proximal interphalangeal joints in the experimental group was $84.1 \pm 3.3^\circ$, while in the control group it was $67.8 \pm 4.8^\circ$ (Table 3) ($p < 0.05$).

Positive dynamics of active movements in the joints of feet and fingers was also observed in patients of both groups at the end of the study. In patients of the experimental group, the active dorsiflexion in the ankle joint was $277 \pm 14^\circ$, the plantar flexion was $41.3 \pm 1.8^\circ$, which was much better than in patients of the control group: the dorsiflexion was $23.4 \pm 1.7^\circ$, the plantar flexion was $41.3 \pm 1.8^\circ$ ($p < 0.05$). Accordingly, there was a significant increase in the motor function indicators in the metatarsal phalangeal joints of patients in the experimental group: flexion – up to $37.1 \pm 1.4^\circ$, extension – up to $39.2 \pm 1.0^\circ$ as compared with the control group with flexion up to $33.5 \pm 1.2^\circ$, extension – up to $36.2 \pm 1.1^\circ$ ($p < 0.05$) (Table 3).

The provided data indicate that both standard treatment and its application along with physical therapy led to an increase in goniometric indicators in patients of both groups, which was manifested in an increase in the motor activity of the small joints of hands and feet, a decrease in joint pain and morning stiffness, and improvement in the elasticity of the muscles and ligaments at the end of the study,

however, in patients of the experimental group, most of the provided indicators were significantly better.

CONCLUSIONS

1. Suggested by us the technology of rehabilitation measures for patients with rheumatoid arthritis allows optimizing the prescription of physical therapy, which is aimed at restoring motor activity and functions of the affected joints.

2. The effectiveness of the developed technology is confirmed by the improvement of the results of goniometric indicators in patients of the experimental group compared with the control group.

3. Prospects for further research are to study the impact of rehabilitation measures on the quality of life of patients with rheumatoid arthritis.

Contributors:

Grygus I.M. – conceptualization, methodology, analysis tools; article writing – reviewing and editing;

Nogas A.O. – conducting research, materials, data interpretation, analysis tools, resources, article writing;

Zdanyuk V.V. – materials, analysis tools, resources.

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