UDC [615.825:616.728.2-089.844]

ISSN (English ed. Online) 2311-6374

2021. Vol. 9. No. 5, pp. 40-56

PHYSICAL THERAPY AT THE STAGES OF RECOVERY AFTER REVISION ENDOPROTHESIS OF THE HIP JOINT

Borys Pustovoit[1]

Pavlo Yefimenko[1]

Mykola Tokhtamyshev[2]

Oksana Kanishcheva[1]

Kharkiv State Academy of Physical Culture[1],
Sytenko Institute of Spine and Joint Pathology National Academy of Medical Sciences of Ukraine[2],
Kharkiv, Ukraine

Purpose: scientific substantiation, development and evaluation of the effectiveness of the program of physical therapy of patients in the revision endoprothesis of the hip joint.

Material and methods: analysis of literary sources, indicators of blood pressure and pulse, anthropometry, goniometry, testing on the SCALE of VAS, mathematical statistics. The contingent of the studied was compiled by patients of the State Institution "Institute of Spine and Joint Pathology named after Prof. M.I.Sitenko AMNU in the number of 19 people divided into 2 groups, the main - 10 and control - 9. The duration of the developed intensive FT program for patients of the main group is 37 days, 10 days, the preoperative period - before surgery and 27 days after (early postoperative - 5 days, late postoperative - 7 days, early recovery - 15 days). Patients of the control group at the same time underwent a rehabilitation course according to the generally accepted method.

Results: dynamics, blood pressure and pulse indicators, anthropometry, goniometry of the hip and knee joints, intensity of pain syndrome on the SCALE of VAS, determined that all the indicated indicators were statistically better in patients of the main group.

Conclusions: during revision endoprosthesis, the patient's body should be prepared to prevent postoperative complications with the help of means and methods of physical therapy; patients of both groups had improved indicators of cardiovascular hemodynamics, indicators of dynamics of braided hip size, volume of movements in the hip and knee joints, testing the intensity of pain on the SCALE of VAS. However, in patients of the main group, in comparison with patients of the control group, a significant (statistically proven) improvement of all indicators was found; observations confirmed that segmental-reflex massage can be carried out in the early stages of rehabilitation; the studies obtained in dynamics make it possible to affirm that we have proven the high efficiency of the developed program of physical therapy of patients in the revision endoprothesis of the hip joint, which allows us to significantly improve the condition of the musculoskeletal system and the body as a whole.

Keywords: revision endoprothesis, hip joint, physical therapy.

Introduction

Injuries and diseases of the locomotive system (LMS) occupy one of the first places in terms of distribution among the population of different countries of the world, which is primarily associated with physical inactivity and an increase in the adverse effects of the environment, the presence of harmful industries, and low quality products. It is these conditions that are often the causes of incapacity for work, disability, and in severe cases can lead to death. In addition, they are a significant socio-economic problem for society.

The greatest discomfort in normal conditions of human life is caused by damage to the lower extremities, in particular, quite common diseases and injuries of

the hip joint (HJ), which provides mobility and body resistance. This pathology often leads to a deterioration in the activity of the entire LMS) (Buryanov O.A. (2015); Pustovoit B.A., Tets A.B (2019)) [1; 2].

Coxarthrosis is a chronic progressive lesion of the HJ related to serious human diseases. Dysfunctions of support and mobility of the lower extremities in patients with grade III – IV coxarthrosis lead to a significant decrease in working capacity and an increase in the level of disability. Numerous statistical data indicate not only a significant incidence of coxarthrosis, but also the absence of a tendency to decrease it. Disability for these diseases is 62-65%. Long-term coxarthrosis disease leads to the development of pain in the HJ, a decrease in the strength of the muscles of the diseased limb, contractures and restrictions on movement (Korzh M.A. (2012); Igla G.G., Buryanov A.A., Klimovichsky V.G. (2014))) [3; 4].

Conservative therapy is ineffective, and improvement occurs only in the initial stages of the disease. In this regard, the problem of rehabilitation treatment of this category of patients has now gone beyond the boundaries of medical science, has acquired great social significance (Roy I.V., Babova I.K., Belaya P. (2010); Zamorskiy T.V., Buchinsky S.N. (2017)) [5;6].

About 2 million hip fractures are registered annually in the world, of which 57% are hip fractures. There is evidence that mortality in the elderly is 14-36% within 1 year after fracture. With ineffective conservative treatment, surgical treatment is more effective, in particular, the most progressive technology is hip arthroplasty (HA) in order to obtain the last opportunity to improve the functions of the diseased joint [3; 4].

The growth in the number of primary HJ replacement operations in the world and in Ukraine inevitably leads to an increase in the absolute number of complications, including periprosthetic infection. According to modern literature, its frequency ranges from 0,5 to 3,0% [1]. In absolute numbers, these are hundreds and thousands of cases. In this case, the only way to treat patients is the repeated revision hip arthroplasty (RHA).

Today, despite the abundance of publications on the methods and ways of

treating injuries and diseases of the HJ, the study of rehabilitation measures for this pathology remains insufficient, first of all, approaches to the development and use of physical therapy (PT) methods in medical practice. The most urgent problem remains the problem of complex phased PT in orthopedic patients after RHA. When using the means and methods of PT, it becomes possible to prepare the patient's body for surgery, prevent postoperative complications, and increase the efficiency of the performed surgical intervention.

In the special literature, the problems of PT in patients after HA are widely covered (Glinyana O.A., Papadyukha Yu.A. (2011)) [7]. Nevertheless, insufficient attention has yet been paid to PT issues at RHA. Many researchers differ in the timing of patient activation, the duration of the recovery course, scattered information about the forms and content of PT activities, which generally indicates the need to solve the problems of improving the PT program for patients with RHA (Mansirov Asif Baglar oglu, Litovchenko V.A., Bezyazychnaya O.V. (2018), Babov KD (2017)) [8; 9]. It becomes obvious that the development of modern PT programs for patients with RHA is an urgent problem of modern trauma science and PT.

Connection of work with scientific programs, plans, themes. The study was carried out in accordance with the initiative research topics for 2019-2021. "Rehabilitation technologies for pathology of joints and ligamentous apparatus" (state registration number 0120U104881) and for 2021-2025 "Theoretical and methodological foundations of physical therapy and occupational therapy for organic and functional disorders of organs and systems of the human body in health care practice" (state registration number 0121U110141).

Purpose of the study is to scientifically substantiate, develop and evaluate the effectiveness of the PT program for patients with RHA.

Objectives of the study:

1. Based on the study of special scientific literature, analyze the etiology, pathogenesis, clinical characteristics, diagnosis and modern approaches to the prescription of PT for patients with RHA.

2. To study the functional state of the examined patients with RHA before starting the PT program.

3**.** Develop a PT program for patients with RHA.

4. To establish the effectiveness of the developed PT program for patients with RHA based on the study of the dynamics of the parameters of the functional state of patients.

Material and Methods of research

The study was carried out during 2017-2020 in the clinic of the State Institution "Institute of Pathology of the Spine and Joints named after prof. M.I. Sitenko National Academy of Medical Sciences of Ukraine ", which is the base of the Department of Physical Therapy of the Kharkov State Academy of Physical Culture. The selection of patients in the groups was carried out randomly; 19 patients with endoprosthesis instability were selected, who were tested at all stages of the study and were divided into two groups. There were 10 people in the MG, including 4 men (40%) and 6 women (60%), age restrictions ranged from 58 to 67 years, the average age among men was 63,5 years; among women – 64 years old.

In the CG there were 9 patients, including 4 men (44,5%) and 5 women (55,5%), age restrictions ranged from 57 to 68 years, the average age among men was 63 years; among women – 62 years.

The given comparative data on sex, age and volume of treatment of patients with MG and CG (Table 1) can be compared, compared and used for scientific analysis and pedagogical research.

Table 1

Comparative table of groups by age and gender

Group		Gender		Age
		Men	Women	
MG (n=10)	Abs.	4	6	62,5±3,6
	% in the group	40	60	
CG (n=9)	Abs.	4	5	61±3,4
	% in the group	44,5	55,5	
Statistical significance of the difference between groups		p>0,73		p>0,51

The objectives of the work within the framework of the study were to determine the clinical and functional state of the patient and his lower limb, as well as to create a PT program and evaluate the effectiveness of its use in RHA in the preoperative, postoperative (early and late) and early recovery periods. When performing this task, the following research methods were used: analysis of sources of special scientific literature; collection of anamnesis; biomedical methods (anthropometry, goniometry, hemodynamic parameters, understanding the intensity of pain syndrome); medical and pedagogical observations; methods of mathematical statistics

Anthropometry. In order to identify the presence of edema, hypotrophy or atrophy of muscles accompanying the patient's condition with coxarthrosis before and after RHA, the index of the thigh volume was determined using a centimeter tape. The reference point for measurement was the proximal edge of the patella, from which the volumetric dimension of the thigh is measured 25 cm higher. The condition of the diseased hip is characterized by the presence of pronounced atrophy of the muscles of the thigh after an earlier HA operation. The volumetric size of a healthy thigh is measured in the same way. The difference in indicators was used to compare the state of the limbs before and after PT.

The medical and biological methods also include the determination of the heart rate (HR) and the level of blood pressure (BP), which are important indicators characterizing the function of the cardiovascular system (CVS).

Goniometry. Determination of the range of motion in the knee joint and knee joint was determined using a protractor; the range of motion in the healthy joint was taken as the norm.

Measurement results consist of 3 digits: angle of end position; neutral position - 0^o; the angle of the end position opposite to the swing motion. The HJ has 3 axes of rotation in 3 planes, so 6 movements are possible in it. It should be noted that patients after RHA have movement limitations. The movements of internal and external rotation in the HJ after RHA are prohibited for the patient to perform, since they can cause subluxation or dislocation of the endoprosthesis. The

movement of the abduction is permissible only up to 30-40°, while the norm reaches 45°. The adduction movement is only possible to the midline, since crossing the legs can cause subluxation or dislocation of the endoprosthesis. In the knee joint, 2 types of movements are possible – flexion and extension. The starting position for measuring flexion and extension movements is on the back, therefore, these measurements taken during the study did not cause any inconvenience to the patient.

Visual analogue scale of pain (VAS). It was used to assess pain syndrome in patients according to the generally accepted method (in mm). In the course of the study, medical and pedagogical observation was carried out on the basis of external signs of fatigue and objective studies of the pulse and blood pressure at rest and during PT.

Methods of mathematical statistics. The research results were processed by the methods of variation statistics. In cases of group differences at p 0,05, they were assessed as statistically significant, at p<0,001 – statistically highly significant, at p>0,05 - statistically insignificant..

PT methods in CG patients. PT was carried out according to the scheme adopted in medical institutions. Preoperative preparation was not performed. In the early postoperative period, the following was carried out: breathing exercises (BE), remedial gymnastics (RG) – movements in healthy limbs, isometric gymnastics for the lower extremities. In the late postoperative period – RG twice a day, magnetotherapy, classical massage of healthy limbs and back muscles. In the early recovery period – RG, classical massage of healthy limbs and back muscles.

PT methods in patients with MG. In the course of the study, an intensive PT program was developed for patients with MG, which included the following methods: RG, therapeutic massage (TM), physiotherapeutic treatment (EMS of the muscles of the lower limb, magnetic and laser therapy, mechanotherapy). The duration of the intensive PT program is 37 days, 10 days – before RHA (preoperative period) and 27 days after (early postoperative – 5 days, late postoperative – 7 days, early recovery – 15 days).

Preoperative period (10 days). During this period, the patient was prepared for the future surgical intervention, which included not only physical training, muscle strengthening, but also gaining confidence in the positive result of treatment; the patient was familiarized with the developed intensive PT program for all periods of treatment. Patients with MG received: RG – two sessions a day for 20-25 minutes; TM course – daily massage of the paravertebral zones, as well as massage of a healthy leg three times a day for 10 minutes; physiotherapy apparatus treatment - daily electromyostimulation (EMS) of the quadriceps muscle, two sessions of 10 minutes each.

Early postoperative period (5 days). Carried out: BE (10-15 minutes 6 times a day); isometric exercises - from the first day; from the second day – EMS to strengthen the quadriceps and sciatic muscles; mechanotherapy using a computerized electric bus - two sessions of 30 minutes each; sparing TM. In order to reflex activation of blood and lymph microcirculation in the operated tissues, segmental reflex massage was performed. First, starting from the second day after the operation, massage of a symmetrical healthy limb, paying special attention to working out the thigh (in the initial position, bending the knee joint at a right angle, massaged the back surface of the limb), then straightening the limb, massaged it in front. Massage techniques: stroking, squeezing, superficial rubbing, active kneading of muscles with fascinating and pressing kneading and rubbing of the tendons of the muscles being massaged. At the end of the procedure, the base of the palm and the pads of four fingers were rubbed around a large swivel; EMS of the thigh muscles – 20 minutes from day 4.

Late postoperative period (7 days). Carried out: RG, 25-30 minutes, twice a day for all joints of a healthy limb and small joints of the operated limb; walking (on crutches) 1-2 times a day (5-10 minutes) with an assistant physical therapist; mechanotherapy using a computerized electric splint – three sessions daily for 30 minutes; TM - after the permission of the orthopedist to lie down on the healthy side, segmental reflex massage was performed, starting from the paravertebral zones of the spinal segments of the lumbosacral spine. Massage techniques: straight and line

rubbing, "saw" technique along and across, spiral kneading and deep circular rubbing (20 min); EMS of thigh muscles (20 min.) Twice a day; laser therapy of active zones of the lower extremities (15 min.)

Early recovery period (15 days). Carried out: RG – two sessions of 45 minutes each; walking (on crutches) 3-4 times a day (15-20 minutes) with an assistant physical therapist and independently, gradually increasing the distance and pace of walking; self-massage techniques were applied; magnetotherapy of active zones of the lower extremities (15-20 min.)

Results of the research

The study of the dynamics of hemodynamic parameters after the PT program showed that, upon repeated examination, the indicators of heart rate, systolic blood pressure and diastolic blood pressure statistically improved both in patients with MG and in patients with CG (Table 2).

Table 2

Dynamics of hemodynamic parameters in patients with both MG and CG after PT

Indicators	Norm	Research periods		t	p
		Primary research	Repeat research		
MG (n=10)					
Heart rate, beats / min	60-84	88,69±0,98	72,62±0,82	12,77	<0,001
SAT, mm Hg	100-129	138,06±2,56	130,7±1,65	5,32	<0,05
DAT, mm Hg	60-80	85,63±1,99	71,34±0,96	4,15	<0,005
CG (n=9)					
Heart rate, beats / min	60-84	87,98±1,23	78,66±0,92	6,01	<0,001
SAT, mm Hg	100-129	139,91±3, 61	136,37±2,80	1,86	<0,05
DAT, mm Hg	60-80	86,48±2,13	76,91±1,40	2,20	<0,05

In CG patients, the heart rate decreased by 18,1% in comparison with the primary examination, the SBP level decreased by 5,8%, the DBP level decreased by 16,7%. In CG patients, the heart rate decreased by 10,5% in comparison with the primary examination, the SBP level decreased by 2,6%, the DBP level decreased by 11,1%.

Comparing the hemodynamic parameters in patients of both groups, we can conclude that, upon repeated examination, the indicators of heart rate, systolic blood

pressure and diastolic blood pressure in patients with MG after using the PT program were somewhat better than in patients with CG.

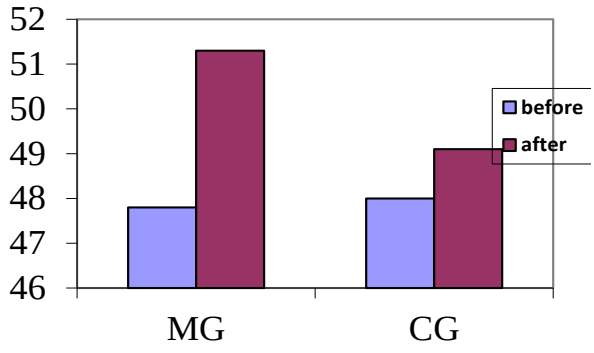
Anthropometry. The volume of the muscle mass of the thigh after the measures of the PT program with RHA increases slowly and depends on many factors, the main of which are RG, TM and physiotherapy procedures in the form of EMS. The dynamics of the circumferential dimensions of the thigh was characterized by an improvement (an increase in size due to an increase in muscle mass) (Table 3, Figure 1).

Table 3

Dynamics of the circumferential dimensions of the thigh in patients with MG and CG after PT (cm)

Group	Primary research	Repeat research	Statistical indicator
MG (n = 10)	47,8±0,95	51,3± 0,8	P<0,05
CG (n=9)	48,0±0,51	49,1±0,6	P>0,05

Coverage indicators improved in patients of both groups, but it should be noted that the improvement in the muscle mass of the thigh in patients in the MG was statistically better than in patients in the CG.



.

Fig. 1. Diagram of the dynamics of the circumferential dimensions of the thigh after PT (cm)

Goniometry. The range of motion in the hip joint and knee joint before treatment and PT was significantly less than normal values. At the repeated

goniometry, which occurred after the end of PT, the range of motion in the knee joint in both groups increased statistically (p0.005), but if in patients in the MG it reached the level of 104,4°±1,5°, then in the patients in the CG it was statistically significantly (p<0,001) smaller – 92,6 °±1,6° (Table 4, Figure 2).

Table 4

Dynamics of indicators of goniometry of the knee and hip joints (in degrees)

Parameter	MG (n=10)	CG (n=9)	Statistical indicator in the group
Flexion in the knee joint (degrees) before PT	84,4±2,5	85,6±3,2	P>0,05
Flexion in the knee joint (degrees) after PT	104,4 ± 1,5	92,6 ± 1,6	P<0,005
Statistical indicator between groups	P<0,001		
Flexion in the hip joint (degrees) before PT	50,5±3,1	51,0±2,6	P>0,05
Flexion in the hip joint (degrees) after PT	93,3 ± 1,9	82,6 ± 1,8	P<0,05
Statistical indicator between groups	P<0,001		
Extension in the hip joint (degrees) before PT	-13,7±1,9	- 14,2±1,7	P>0,05
Extension in the hip joint (degrees) after PT	2,0 ± 0,7	- 4,3 ± 1,4	P<0,05
Statistical indicator between groups	P<0,05		

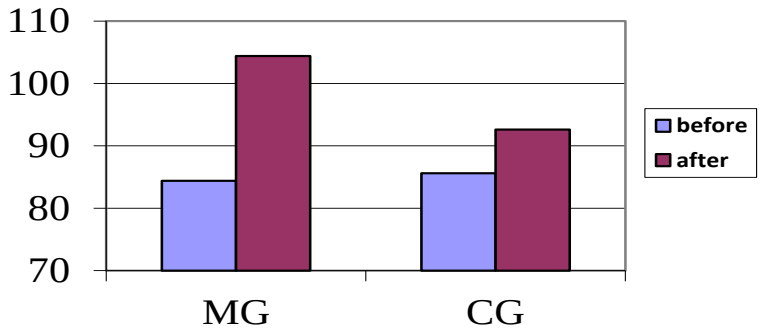


Fig. 2. Diagram of the dynamics of goniometry (flexion) of the knee joint after the PT program (degrees).

A similar pattern was observed in the HJ goniometry. After PT, repeated goniometry revealed that flexion in the knee joint in both groups statistically increased ($p<0,05$), but if in patients in the MG it reached the level of 93,3°±1,9°, then in patients in the CG it was statistically ($p<0,005$) smaller – 82,6°±1,8° (Table 4, Fig. 3).

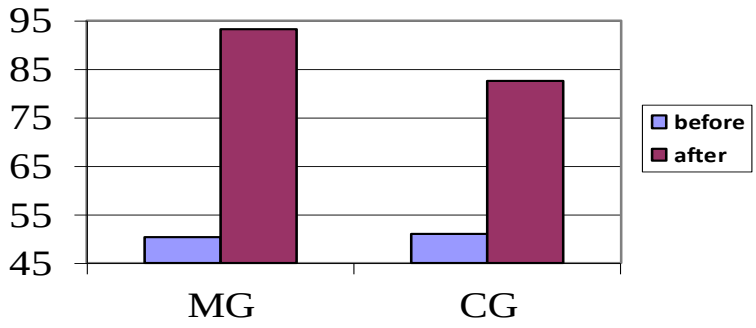


Fig. 3. Diagram of the dynamics of goniometry (flexion) of the hip joint after the PT program (degrees)

The volume of extension in the hip joint in both groups increased statistically ($p<0,05$), but if in patients in the MG it reached the level of 2,0º±0,7°, then in the patients in the CG it was statistically ($p<0,05$) smaller – -4,3°±1,4° (Table 3, Fig. 4).

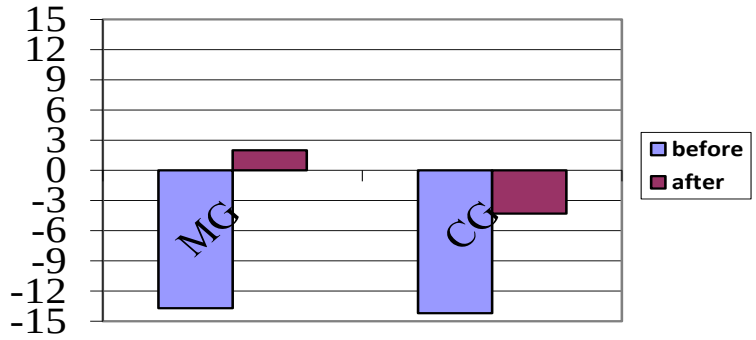


Fig. 4. Diagram of the dynamics of goniometry (extension) of the hip joint after the PT program (degrees)

The intensity of the pain syndrome. In both groups, the pain syndrome decreased significantly (p<0,001). But in patients with MG it was 14,2±6,1 mm, which was statistically significantly less (p<0,001) than in patients with CG – 34,6±7,2 mm (Table 5, Fig. 5.) .

Table 5

Dynamics of pain intensity testing indicators on the VAS scale (mm)

Parameter	MG (n = 10)		CG (n = 9)		Difference between groups
	Primary research	Repeat research	Primary research	Repeat research	Statistical indicator between groups p<0,005
VAS	63,8±7,4	14,2±6,1	64,8±8,3	34,6±7,2	
Difference	p<0,001		p<0,05		

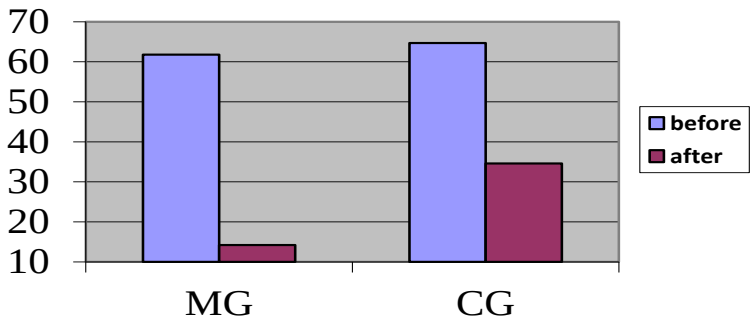


Fig. 5. Diagram of the dynamics of pain tests (VAS scale) (mm)

Thus, the conducted dynamic multicomponent study of the state of patients with MG and CG who underwent the corresponding PT programs confirmed the statistically efficiency of the developed PT program.

Conclusions / Discussion

The most important problem of modern physical therapy for patients undergoing revision hip arthroplasty is their return to a quality life.

It is known from many scientific sources that the greatest discomfort under normal conditions of human life is caused by injuries of the lower extremities, in particular, diseases and injuries of the hip joint (HJ) are quite common, which provides mobility and resistance of the body. This pathology often leads to a

deterioration in the activity of the entire LMS. Conservative therapy is ineffective, and improvement occurs only in the initial stages of the disease. The increase in the number of operations of primary endoprosthetics of the knee joint in the world and in Ukraine inevitably leads to an increase in the absolute number of complications. In this case, the only way to treat patients is the repeated revision hip arthroplasty. It becomes possible to prepare the patient's body for such an operation, to prevent postoperative complications with the use of means and methods of physical therapy.

In the scientific literature, the problems of PT in patients after endoprosthetics are widely covered, however, insufficient attention has been paid to the issues of PT in RHA, which, in general, indicates the need to solve the problems of improving the PT program for patients.

The developed PT program for patients with RHA, which lasted 37 days and was distributed over 4 recovery periods, has shown its effectiveness. The analysis of the results obtained showed that the patients of both groups showed an improvement in these indicators. But in the patients of the main group, compared with patients in the control group, a significant (statistically proven) improvement was revealed: hemodynamic parameters, dynamics of the circumferential dimensions of the thigh (due to an increase in muscle mass), range of motion (goniometry) in the hip and knee joints, testing the intensity of pain on a scale VAS, which complements the results obtained by other researchers (Glinyana O.A., Papadyukha Yu.A. (2011), Mahomed N.N. (2003)). The conducted observations confirm that segmental reflex massage can be carried out in the early stages of rehabilitation, which accelerates the processes of tissue regeneration after surgery. This complements the work Sliwinski M., Sisto S. (2006) [11], Vissers M.M., Bussmann J.B., Verhaar J.A.N., Arends L.R., Furlan A.D., Reijman M. (2011) [12].

Consequently, the totality of the results obtained in the dynamics of the study allows us to state that we have proved the high efficiency of the developed program of physical therapy for patients with revision hip arthroplasty, which can significantly improve the condition of the musculoskeletal system and the body as a whole.

Prospects for further research in this direction are aimed at using such methods as hydrokinesis therapy and taping in physical therapy programs.

Conflict of interest. The authors state that there is no conflict of interest that may be perceived as prejudicial to the impartiality of a state, public or commercial organization.

Financing sources. This article didn't get the financial support from the state, public or commercial organization.

References

1. Bur″yanov, O. A. (2006), Travmatolohiya ta ortopediya [Traumatology and Orthopedics]: pidruchnyk. Kyyiv, 435 p. (in Ukr.).

2. Pustovoyt, B. A., Tets, A. B. (2019), «The use and impact of a comprehensive program of physical therapy in the treatment of patients with coxarthrosis of 2-3 degrees», Slobozhans'kiy naukovo-sportivniy vísnik, №1 (69). pp. 31-36. (in Russ.).

3. Korzh, M. O. (2012), «The current state of the problem of joint replacement in Ukraine», Bol′, sustavy, pozvonochnyk, № 1 (05). pp. 10-12. (in Ukr.).

4. Holka, H. H., Bur″yanov, O. A, Klymovyts′kyy, V. H. (2014), Travmatolohiya ta ortopediya [Traumatology and orthopedics]: pidruchnyk. Vinnytsya, 416 p. (in Ukr.).

5. Roy, I. V., Babova, I. K., Bila, P. (2010), «Vyznachennya efektyvnosti etapnoyi reabilitatsiyi khvorykh pislya endoprotezuvannya kul′shovoho suhloba za faktom povernennya do pratsi», Suchasni pidkhody do orhanizatsiyi vidnovlyuval′noho likuvannya pratsivnykiv zaliznychnoho transportu: materialy naukovo-praktychnoyi konferentsiyi, Odesa, pp. 48-54. (in Ukr.).

6. Zamors′kyy, T. V., Buchyns′kyy, S. N. (2017), Vidnovlennya pislya endoprotezuvannya kul′shovoho suhloba [Recovery after hip arthroplasty]: metodychni rekomendatsiyi. Kyyiv, 76 p. (in Ukr.).

7. Hlynyana, O. O., Papadyukha, YU. A. (2011), «Rehabilitation algorithm after primary hip arthroplasty», Pedahohika, psykholohiya ta medyko-biolohichni problemy fizychnoho vykhovannya ta sportu, №8, pp. 30-32. (in Ukr.).

8. Mansyrov, Asif Bahlar ohly, Lytovchenko, V. O., Bez″yazychna, O. V. (2018), «Vplyv reabilitatsiynykh zakhodiv na yakist′ zhyttya patsiyentiv pislya endoprotezuvannya kul′shovoho suhloba», Fizychna reabilitatsiya ta rekreatsiyno-ozdorvchi tekhnolohiyi, №1. pp. 11-17. (in Ukr.).
9. Babov K.D. (2017), «Actual problems of early rehabilitation of patients after hip joint replacement», The International Scientific Congress The 60-th Session of General Assembly of the World Federation of Hydrotherapy and Climatotherapy. Italy, 156 p. (in Eng.).
10. Mahomed N.N. (2003), «Rates and outcomes of primary and revision total hip replacement in the United States Medicare population», J. Bone Joint Surg, Vol. 85-A, №1, pp. 27 – 32. (in Eng.).
11. Sliwinski M., Sisto S. (2006), «Gait, quality of life, and their association following total hip arthroplasty», Physical Therapy, № 29(1), pp.10 – 17. (in Eng.).
12. Vissers M.M., Bussmann J.B., Verhaar J.A.N., Arends L.R., Furlan A.D., Reijman M. (2011), «Recovery of physical functioning after total hip arthroplasty: systematic review and meta-analysis of the literature», Physical Therapy, №91, pp. 615 – 629. (in Eng.).

Received: 13.09.2021.
Published: 25.10.2021.

Information about the Authors

Borys Pustovoit: Doctor of Science (Medicine), Professor; Kharkiv State Academy of Physical Culture: Klochkivska str. 99, Kharkiv, 61058, Ukraine.
ORCID: https://orcid.org/0000-0001-7534-4404
E-mail: pustovoit203@gmail.com

Pavlo Yefimenko: PhD (Pedagogical Sciens), Professor; Kharkiv State Academy of Physical Culture: Klochkivska str. 99, Kharkiv, 61058, Ukraine.
ORCID: https://orcid.org/0000-0003-4674-6919
E-mail: pavlo748@gmail.com

Mykola Tokhtamyshev: junior researcher; Kharkiv Sytenko Institute of Spine and Joint Pathology National Academy of Medical Sciences of Ukraine, st. Pushkinskaya 80, Kharkov, 61024, Ukraine.
ORCID: https://orcid.org/0000-0003-0278-1675
E-mail: tokhtamyshev2121@ukr.net

Oksana Kanishcheva: PhD (Physical education and Sport) assistant professor; Kharkiv State Academy of Physical Culture: Klochkivska str. 99, Kharkiv, 61058, Ukraine.
ORCID: https://orcid.org/0000-0002-5030-5318
E-mail: oksanakan71@gmail.com