

Development of everyday occupations of children with cerebral palsy using occupational therapy and physical therapy

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Published online: December 31, 2018

(Accepted for publication December 02, 2018)

DOI:10.7752/jpes.2018.04355

Abstract

The purpose of the current study was to examine the peculiarities of the effects of two rehabilitation programs on performance, motor and process skills, quality of life, and also comparing their effectiveness in the main and control groups, which had statistically identical initial characteristics. The main hypothesis was that the use of targeted therapy and modified exercises, constraint-induced movement therapy, bimanual training, integrated therapeutic exercises may be better to affect everyday occupations or its components, quality of life of children with cerebral palsy. The contingent of the subjects is 106 children of 4-6 years old, of which 54 with spastic hemiplegia and 52 with spastic diplegia. The study presents the output data and dynamics in groups according to the Gross Motor Function Classification level; key aspects in groups level changes according to the Manual Ability Classification System. The quantitative changes in the pediatric evaluation of Pediatric Evaluation of Disability Inventory, as well as the dynamics of individual points from the sections of self-care, mobility, social function capability, which were distinguished by the most significant changes, were highlighted. In particular, the analysis revealed the presence of significant changes in most items of the "self-service" section among all groups of children. A significantly better impact on the children of the main groups has a developed program in the eight items of the self-service section. According to the results of the Cerebral Palsy Quality of Life questionnaire, most domains have significantly improved. Really better results in the main groups are detected by the "Feelings of Function" domain.

Keywords: self-service, household and social skills, exercise, therapy

Introduction

Infantile cerebral palsy (ICP) is a heterogeneous group of syndromes that are a consequence of brain damage in the intrauterine, intranatal and early postnatal period, leading to sensory, perceptual, cognitive and behavioral disorders, as well as secondary skeletal-muscular problems (Aleshina, 2014; Rosenbaum et al., 2007). Cerebral palsy is the most common cause of motor disorders in the childhood (Guyard et al., 2011). Over the past 40 years, the prevalence of cerebral palsy has risen significantly above 2.0 cases per 1,000 live births (Odding et al., 2006; Stavsky et al., 2017).

Depending on the cerebral palsy subgroup, 25-80% of patients have additional disorders, other than motor. A large proportion of children have a kind of cognitive impairment. The sensitivity of the hands is weakened in about half of the cases. Chronic pain is observed in more than a quarter of children. Up to 80% of children have at least some speech disorders. Low visual acuity is reported in nearly three quarters of children. A half of all children have problems with the gastrointestinal tract and feeding (Odding et al., 2006).

The heterogeneity of residual effects after brain injury points to the need for the integrated use of medical, rehabilitation, educational and social resources for the physical and psychological recovery of a sick child. (Paskaleva et al., 2010). Restrictions in activities require individual rehabilitation throughout life (Gunel, 2009; Shepherd, 1995). Low functioning of the upper limbs, lowered support function of the lower limbs, and statokinetic capabilities of the spine restrict the household self-service and social functioning of children with ICP (Bardashevskyy, 2011).

Recovery and rehabilitation of the child contingent is a very important social task (Paskaleva et al., 2010; Vitomskiy et al., 2017).

Rehabilitation approaches for children with ICP are also complex and comprehensive character. In general, the physical rehabilitation of the child contingent requires strict adherence to methodological approaches, taking into account the features of the existing pathology (Vitomskiy, 2015). The programs are complemented by medical and surgical procedures, physical therapy, occupational therapy, speech therapy, entertainment activities, adaptation to school and training, psychosocial support, application of orthoses and other adaptive equipment (Gunel, 2009; Helders et al., 2003).

Occupational therapy focuses on the development of the skills needed to carry out activities in everyday

life (Steultjens et al., 2003), therefore it is the basis for improving the ability to function, increase the level of activity and participation of the child, the quality of life of children and the close surroundings. Focused on solving these problems occupational therapy, which is a bit new for our country, is a very relevant area of practical rehabilitation and science. The use of physical therapy also plays a central role in the rehabilitation of children with cerebral palsy. It focuses on a function, active motions and optimal use of the child's potential (Gunel, 2009), and also uses physical approaches to encourage, support and restore physical, psychological and social well-being (Caspersen et al., 1985; Bobath, 1971). Improving the quality of life among the children with cerebral palsy is also one of the key goals as in the rehabilitation of children with other pathology (Vitomskiy & Lazarieva, 2015).

However, despite the existing positive experience with the use of occupational therapy and physical therapy in the rehabilitation of children with ICP, the problem of both isolated and complex use of methods and tools still remains unresolved in many respects. Thus, there is a problem regarding the possibility of improving the efficiency of programs for the rehabilitation of children with cerebral palsy in the territory of our country.

Methodology of research

General Background

The work was performed in accordance with the "Consolidated Research Work Plan in the Area of Physical Culture and Sport for 2011-2015" on the topic 4.4 "Improvement of the Organizational and Methodical Foundations of the Programming of Physical Rehabilitation for Dysfunctional Disorders in Different Systems of the Human Body" (state registration number 0111U001737) and the NUUPES Research Work Plan for 2016-2020 on the theme: 4.2. "Organizational and theoretical-methodical bases of physical rehabilitation of persons of different nosological, professional and age groups", state registration number 0116U001609 for the period 16.01.2017 - 30.12.2017.

Research Sample

The materials were obtained during a research on the basis of the Kyiv City Rehabilitation Center for Children with Disabilities (main groups) and the Special Education and Training Complex "Mriya" (Kyiv) (control groups). The contingent of the subjects is 106 children of 4-6 years, of which 54 are with spastic hemiplegia (HP) and 52 are with spastic diplegia (DP). 28 children with HP (MG1) and 27 with DP (MG2) entered the main groups who worked on the developed program. There were no differences between the main and control groups at the beginning of the course of therapy.

Research Procedure

The children passed the course of occupational therapy and physical therapy. The exercises with control groups included the following procedures and techniques: bimanual training, unimanual training, therapeutic exercises, massage and games. The main groups received a part of the modified standard procedures: constraint-induced movement therapy (CIMT), bimanual training (bimanual intensive training), complex therapeutic exercises. The key difference was the use of goal-directed training (GDT) in main groups, which required the transfer of mastered movements in the practice of activities of daily living (ADL) and instrumental activities of daily living (IADL).

Also, the developed program required the observance of modern methodological requirements for the development of rehabilitation program, the organization of the rehabilitation process, as well as the design and correction of the individual plan for children with cerebral palsy. This was the way to comply and take into account multi-, inter- and trans-disciplinary approaches; philosophical and methodological approach of the international classification of functioning for determining the vector of influence of means of physical therapy and occupational therapy; SMART methodology in the formulation of individual goals (tasks) for children and parents; family-center approach, child-center approach, specific needs of patients and their family members; principles of physical rehabilitation, pedagogical principles; neuroplasticity of the brain; clinical features of the child. The course lasted 30 days, of which 22 were filled with occupations with occupational therapy and physical therapy. The duration of therapy per day was the same in groups and lasted 6 hours.

The main *hypothesis*: the use of targeted therapy and modified according to the current provisions methods from the standard protocol can improve the everyday occupations or its components, quality of life in children with cerebral palsy.

Instruments

To display the child's functional capabilities and need for auxiliary equipment for transportation Gross Motor Function Classification System was used (five levels; the first's the best). An assessment of the possibilities of using hands and manipulating objects in everyday life was conducted using the Manual Ability Classification System (five levels; the first's the best). The Pediatric Evaluation of Disability Inventory (PEDI) is a comprehensive functional assessment designed for use by physical and occupational therapists, as well as other rehabilitation and educational professionals.

The original version of the PEDI measures self-care (15 items, 73 subitems / points), mobility (14 items, 59 subitems / points), and social function capability (12 item of sections, 65 subitems / points) in everyday occupations with 197 items in three Functional Skills Scales. The quality of life assessment was performed using

the adapted and specific Cerebral Palsy Quality of Life questionnaire (CPQOL-Child) in accordance to the seven domains of the child's life.

Data Analysis

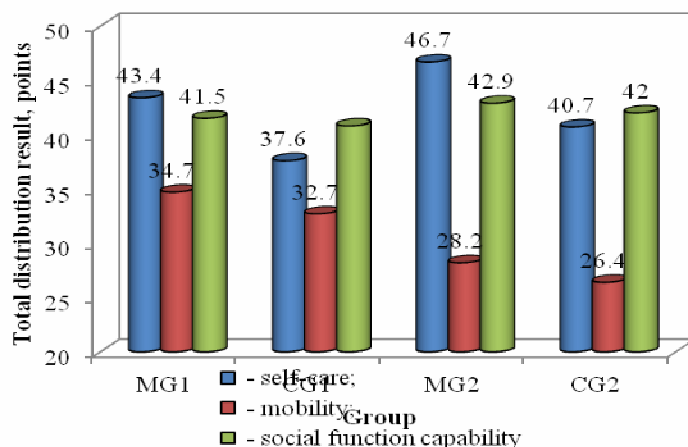
Mathematical processing of numerical data was carried out using methods of variation statistics. The analysis of the correspondence of the type of distribution of the quantitative indices of the normal distribution law was checked by the criterion of Shapiro-Wilka (W). For quantitative indices with normal distribution, the average and the mean square deviation (S) were determined. For quantitative indices with distinctions from normal distribution were additionally determined the median (Me) and the upper and lower quartiles (25%, 75%). The U-Mann-Whitney criterion (for independent groups) and Wilcoxon criterion (for dependent groups) was used to assess the significance of the difference between the baseline and control groups. Data were analyzed with the computer program SPSS 21. For all tests, an alpha level (the probability of rejecting a null hypothesis when it is in fact true) of statistical significance was set at $p < 0.05$.

Results of research

Before passing the course in the group of children with hemiplegia ($n = 54$) 14 children had level II, 29 - III level 29, and 11 - IV according to GMFCS classification. Thus, the highest percentage received level III (53,7%). Among the group of children with diplegia ($n=52$) according to GMFCS classification 6 children had level II, 19 - level III, and 27 - level IV. The highest percentage received level IV (52%). According to MACS classification there was the following situation in HP group: 6 children had II level, 30 - III level, and 18 - IV level. Thus, the highest percentage received level III (55,6%). Among the group of children with DP according to GMFCS classification there was the following situation: 13 children had level II, 33 - level III, and 6 - level IV. The highest percentage received level IV (52%).

The main and control groups were not statistically different at the time of admission. Conducting rehabilitation programs positively influenced the studied indicators. However, the benefits of the developed program, which was used in the main groups, were identified. According to the data, at the time of the final examination, the distribution by level of GMFM among the main and control groups did not change statistically ($p > 0.05$). The results according to MACS levels have not changed reliably in MG1 and CG1; MG2 and CG2 ($p > 0,05$) and after rehabilitation course. However, reliable changes by MACS level were detected in MG2: the proportion of children with level II increased from 22.2% to 48.2% due to a decrease in the proportion of children with level III. The analysis concluded that there were significant changes in most items of the "self-service" section among all groups of children. The developed program had a significantly better impact on the children of the main groups in eight items of the self-service section according to PEDI: those responsible for the use of food dishes, drinking, cleaning teeth, hand hygiene, washing, clothes, fasteners, and trousers. In particular, in the item "Using food dishes", the dynamics of average values was the following: in MG1 group the increase was 1.29 points; in CG1 group - 0.58 points; MG1 - 1,22 points; CG1 - 0.56 points. In the item "Washing the body and face" also there were significant differences between the MG1 and CG1, MG2 and CG2 ($p < 0,05$), which was the result of the following dynamics: in MG1 the increase was 1.46 points; in CG1 group - 0.65 points; MG2 - 1,33 points; CG1 - 0.6 points. The assessment of the item "Clothes dressing over the head / fastened in front" had a statistic dynamics in four groups ($p < 0.01$), but the final results were significantly better in the main groups ($p < 0.05$), as influenced by the following increase: MG1 - by 1.18 points; CG1 0.54 points; MG2 - 1,15 points; CG2 - 0.64 points. The overall score of the section "self-service" also provides statistically better results in MG1 compared to CG1 ($p < 0,05$), in MG2 compared with CG2 ($p < 0,01$).

However, the standard program also was effective in "self-service" section ($p < 0.01$). Me values (25%; 75%) are set at levels: 46 (35; 49) points in MG1; 40 (27.8; 43.3) points in CG1; 46 (42; 53) points - in MG2, 39 (37; 49) - in CG2. The increase in average values was respectively: 13.89 and 7.62 points, 13.26 points and 7.16 points. The final average values are presented in Picture 1.



"Move in the bathroom", and among children with hemiplegia - "Moving within the house - dragging /

moving objects” items of the "Mobility" section of the developed program had a statistically better impact on children with cerebral palsy.

Thus, both programs had a reliable ($p < 0.01$), but the same efficiency in the overall score of the section "Mobility" ($p > 0.05$). Me values (25%; 75%) are set at levels: 34,5 (23,3; 47,3) points in MG1; 31 (27; 44,3) points in CG1; 23 (20; 34) points in MG2; 25 (17,5; 32) points – in CG2. The increase in average values was respectively: 8; 4.73; 6.33 and 3.88 and 7.62 points.

Table 1

The average indicators of quality of life of children in accordance with Cerebral Palsy Quality of Life after the course of therapy

Domains	$\bar{x} \pm S$		p	$\bar{x} \pm S$		p
	MG1	CG1		MG2	CG2	
Social wellbeing and acceptance	71,2±8,10	70,6±6,62	>0,05	72,9±7,46	73,6±7,28	>0,05
Feelings about functioning	67,5±7,66**	63,1±7,75**	<0,05	67,4±8,73**	61,4±9,57**	<0,05
Participation and physical health	50,4±13,78**	49,5±12,92**	>0,05	43,9±13,81**	44,5±13,49**	>0,05
Emotional wellbeing and self-esteem	68,1±6,23**	65,6±6,90**	>0,05	67,6±9,48**	65,6±8,82**	>0,05
Access to services	57,6±12,19**	57,8±12,51**	>0,05	58,5±11,02**	59,9±11,03**	>0,05
Pain and impact of disability	48,5±9,49	50,6±9,02*	>0,05	44,6±10,18*	45,4±12,24*	>0,05
Family health	59,6±10,13	58,1±8,89	>0,05	56,7±10,53	56,6±11,52	>0,05

Note. * – the difference between the indicator is statistically significant compared to the indicator during the entering $p < 0,05$; ** – $p < 0,01$.

The only one item “Home obligation” of section «Social function capability” of the developed program had a statistically better impact on children with cerebral palsy ($p < 0,01$). The results of the general score of this section of the groups among main and control groups have improved statistically ($p < 0.01$), but did not differ ($p > 0.05$). Me values (25%; 75 %) are set at levels: 41,5 (37,3; 46) points in MG1; 41 (35,8; 44,3) items in CG1; 42 (37; 47) items - MG2, 42 (38,5; 46) items - CG2. The increase in average values was respectively: 5,14; 4.04; 4,93 and 3.88. Most of the domains of quality of life have improved significantly, only "Social wellbeing and acceptance", "Family health" have not changed in all groups ($p > 0,05$). Besides,

In addition, the most reliable results in the main groups were identified by the "Feelings about Functioning" domain (Table 1). According to the "Feelings of Functioning" domain in MG1, the average increased by 10.49 points and CG1 by 4.69 points; in MG2 11.92- points, and at CG2 it is 4.37 points. The increase in the average values of the "Participation and Physical Health" domain was 7.54 points in MG1 and 5.38 points in CG1; children with diplegia had the following dynamics: 5.46 points in MG2 and 5.05 points in CG2. According to the results of the analysis of the obtained points of the domain "Emotional wellbeing and self-esteem", the average values increase amounted to 7,14 points and 3,29 points in MG1 and CG1 respectively, as well as 7,18 points and 4,92 points in MG2 and CG2, respectively.

Discussion

Since cerebral palsy occurs at the beginning of life and remains present throughout the life of the person, occupational therapy and physical therapy play a central role in the management of children with cerebral palsy and focus on the functions, active movements and optimal use of the child's potential, on the development of the skills necessary to carry out activities in everyday life.

Our study complemented the data on life quality of children with cerebral palsy and possibilities for improvement. In particular, the study of E. Davis and co-authors (2009) indicates the following results of the assessment of life quality in accordance with the questionnaire CPQIL-Child (form for parents): “Social wellbeing and acceptance” domain – 78 items; «Feelings about functioning» domain - 68 items; «Participation and physical health» domain - 62 items; «Emotional wellbeing and self-esteem» domain - 77 items; «Access to services» domain - 60 items; «Pain and impact of disability» domain - 32 items, «Family health» domain - 67 items.

It should be noted that in general, the data which we received, were lower, but according to GMFCS in the study by E. Davis and co-authors (2009) the children had better levels in general, the groups had fairly identical shares in the I, II and III levels (28-35%), and children from IV level did not get to the sample. It should be stressed that the biggest difference in scores was found in the "Participation and Physical Health" domain. In addition, changes of life quality indicators have not modified in the study (10 classes with therapeutic horse riding for 30-40 minutes within 10 weeks).

Also in the study of Sakzewski (2012) the results of assessing life quality of children (average age of 10 years) with spastic forms of cerebral palsy in parental and children form CPQIL were presented. No

differences were found. Thus, according to the parental form, the results were: 79 items under the domain "Social Wellbeing and Adoption", 69 items under the "Feelings of Functioning" domain, 68 items - "Participation and Physical Health" domain, 78 items - "Emotional Wellbeing and Self-esteem" domain, "Access to services" domain - 64 items, domain "Pain and impact of disability" - 27 items, and for the domain "Family health" - 68 items. It should be noted that according to GMFCS, in the Sakzewski study (2012), 75% of children with level II and 25% with level I; and according to MACS: 73% with level II and 24% with level I.

The study confirmed the effectiveness of the use of comprehensive rehabilitation programs for children with cerebrovascular accidents, which include several methods of occupational therapy interventions and various methods of physical therapy.

So, in the study of Yushkovskaya & Strashko (2013) the benefits for children with spastic form of cerebral palsy of using complex therapeutic impact on muscle spirals, biomechanical muscle stimulation and sinusoidal modulated current, manual therapy, mud applications, patient placement on special kit soft objects for "re-education" of pathological motor stereotypes and fixation of achieved stereotype were presented. The developed program has had a better effect on patients according to the Gross Motor Function Classification System.

Also the effectiveness of the application of the physical rehabilitation complex program for children with spastic form of cerebral palsy in the work of Taran (2013) has also been proved. In particular, for the reduction of muscle tone, increase in the range of motion and strength, an expanded complex of physical rehabilitation facilities consisting of therapeutic procedures (amplipulse therapy, paraffin-ozokeritotherapy), therapeutic massage and hydromassage, kinesiotherapy techniques, positioning treatment, hydrocolonotherapy, and mechanotherapy were used.

The data on the impact on the quality of life and the effectiveness of such methods for improving the function of the upper limbs as bimanual training and unimanual training (induced by limitation of motion therapy) are confirmed in the performance of targeted tasks.

Thus, in a randomized comparative study of Sakzewski (2012) the results of BIM, CIMT (6 hours, daily, 10 days in a 2-week period) received in children with spastic form of cerebral palsy and it was concluded that the intense, using both the unimanual and bimanual approach can more broadly influence the perception of children's wellbeing in areas related to feelings of functioning, participation and physical health.

Conclusions

The obtained results of the conducted analysis and generalization of the data of special scientific literature confirmed the significant importance of occupational therapy and physical therapy in solving the problems of comprehensive improvement of the health of children with cerebral palsy and prevention of its deterioration. The social significance of the problem of cerebral palsy and the presence of a significant number of somatic disorders that accompany it is confirmed. The greatest role of occupational therapy and physical therapy is given to the development of high motility and functioning of hands, self-service skills, increased activity and participation of patients, social functioning and quality of life.

The analysis of the dynamics of sections of pediatric evaluation of activity limitations revealed a positive dynamics in the vast majority of them among the main and control groups of children. The increase in the total amount of the "self-service" section was reliable in all groups ($p < 0.01$). Also, there were significant differences between the main and control groups. In the total score of the section "mobility", all groups had positive dynamics ($p < 0.01$), but no significant differences were found between the main and control groups ($p > 0.05$). Similar conclusions are obtained from the section of social functionality. However, in this section, the differences between the main and control groups are set in the "Home duties" item, which along with the highlighted changes in self-service confirmed the better effectiveness of the implemented program.

The largest increase in the main groups was found in the "Feeling of Function" domain: in the group with spastic hemiplegia by 10.49 points to 67.5 ± 7.66 points; in the group with spastic diplegia by 11.92 points to 67.4 ± 8.73 points. Also, after the course of rehabilitation on this domain, there were significant differences between the main and control groups according to the form of cerebral palsy ($p < 0.05$).

Thus, the use of targeted therapy in combination with other methods, the effectiveness of which is proven, contributes to the improvement of everyday occupations and its components, and the quality of life of children with cerebral palsy to a greater extent.

References

- Aleshina, A. (2014). Physical Rehabilitation of Children with CP. *Youth Scientific Bulletin of Lesya Ukrainka Eastern European National University. Physical Education and Sport*, 16, 120-126. [in Ukrainian].
- Bardashevskyy, Y. V. (2011). Correction of motion functions of students with the consequences of cerebral palsy by means of physical rehabilitation. Extended abstract of candidate's thesis. Kiev. [in Ukrainian].
- Bobath, K. (1971). The normal postural reflex mechanism and its deviation in children with cerebral palsy. *Physiotherapy*, 57, 515-525.
- Caspersen, C.J., Powell, K.E., & Christenson, G.M. (1985). Physical activity, exercise, and physical fitness: definitions and distinctions for health-related research. *Public Health Rep*, 100, 126-131.

- Davis, E., Davies, B., Wolfe, R., Raadsveld, R., Heine, B., Thomason, P., Dobson, F., & Graham, H. K. (2009). A randomized controlled trial of the impact of therapeutic horse riding on the quality of life, health, and function of children with cerebral palsy. *Developmental Medicine & Child Neurology*, 51(2), 111–119.
- Gunel, K. M. (2009). Rehabilitation of children with cerebral palsy from a physiotherapist's perspective. *Acta Orthop Traumatol Turc.*, 43(2), 173-180. doi:10.3944/AOTT.2009.173.
- Guyard, A., Fauconnier, J., Mermet, M.A., & Cans C. (2011). Impact on parents of cerebral palsy in children: a literature review. *Arch Pediatr.*, 18(2), 204–214.
- Helders, P.J., Engelbert, R.H., Custers, J.W., Gorter, J.W., Takken, T., & van der Net, J. (2003). Creating and being created: the changing panorama of paediatric rehabilitation. *Pediatr Rehabil.*, 6, 5-12.
- Odding, E., Roebroeck, M.E., & Stam, H.J. (2006). The epidemiology of cerebral palsy: incidence, impairments and risk factors. *Disabil Rehabil.*, 28(4), 1831-91.
- Paskaleva, R., Mihaylova, S., Mollova, K., & Petrova, M. (2010). Features of kinesitherapy and ergotherapy for children with cerebral damage. *Trakia Journal of Sciences*, 8 (2), 346-348.
- Rosenbaum, P., Paneth, N., Leviton, A., Goldstein, M., Bax, M., Damiano, D., Dan, B., & Jacobsson, B. (2007). A report: the definition and classification of cerebral palsy April 2006. *Dev Med Child Neurol Suppl.*, 109, 8-14.
- Sakzewski, L., Carlon, S., Shields, N., Ziviani, J., Ware, R. S., & Boyd, R. N. (2012). Impact of intensive upper limb rehabilitation on quality of life: a randomized trial in children with unilateral cerebral palsy. *Developmental Medicine & Child Neurology*, 54(5), 415-423.
- Shepherd, R.B. (1995). Cerebral palsy. In: *Physiotherapy in paediatrics*. (pp.110-144). Oxford: Butterworth-Heinemann.
- Stavsky, M., Mor, O., Mastrolia, S.A., Greenbaum, S., Than, N.G., & Erez, O. (2017). Cerebral Palsy-Trends in Epidemiology and Recent Development in Prenatal Mechanisms of Disease, Treatment, and Prevention. *Front Pediatr*. 5, Article 21, 10p. doi: 10.3389/fped.2017.00021.
- Stultjens, E.M.J., Dekker, J., Bouter, L.M., Nes, J.C.M., Lambregts, B.L.M., & Ende, C.H.M. (2003). Occupational therapy for children with cerebral palsy. *Cochrane Database of Systematic Reviews*, 4, 7. <https://postprint.nivel.nl/PPpp1798.pdf>.
- Taran, I. V. (2013). Effective in tegrated influence of physical rehabilitation children with cerebral palsy spastic form. *Naukovyy chasopys : zb. nauk. pr. z haluzi fiz. kult. i sport*, 7 (33), 287-291. [in Ukrainian].
- Vitomskiy, V. (2015). Methodical Bases of Construction of Program of Phisical Rehabilitation for Schoolchildren with Functoinal Single Ventricle of Heart. *Youth Scientific Bulletin of Lesya Ukrainka Eastern European National University. Physical Education and Sport*. 18, 111–116. [in Ukrainian].
- Vitomskiy, V., & Lazarieva, O. (2015). Indicators of posture bio-geometrical indicators and life quality of children with functionally one ventricular. *Fizichne vikhovannia, sport i kul'tura zdorov'ia u suchasnomu suspil'stvi*, 4(55),156–160. [in Ukrainian].
- Vitomskiy, V.V., Lazarieva, O.B., Imas, E.V., Zhovnir, V.A., & Emets, I.N. (2017). Dynamic of bio-geometric profile indicators of children's with functionally one ventricle posture at stage of physical rehabilitation. *Pedagogics, psychology, medical-biological problems of physical training and sports*, 21(3), 146–151. doi:10.15561/18189172.2017.0308
- Yushkovskaya, O.G., & Strashko, E.Y. (2013). Assessment of level of motor disorders and efficiency of rehabilitation measures in patients with spastic forms of cerebral palsy. *World of Medicine and Biology*, 1, 82-84. [in Ukrainian].