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EVALUATING THE EFFECTIVENESS OF PHYSIOTHERAPY FOR MENTAL DEVELOPMENT DELAY IN A 9-YEAR-OLD CHILD COMPLICATED BY A WAR-RELATED CONTUSION

The article analyzes six months of physical rehabilitation for a 9-year-old boy using therapeutic exercises. The goal was to improve his physical and psycho-emotional indicators to help him adapt to social life, meet educational and sports needs on par with peers, and overcome stress from bombing and contusion.

Physiotherapy methods proved effective for preventing conditions leading to disability and improving overall physical and psycho-emotional states, including complications from contusion due to being in a war zone. Negative traits targeted included

aggressiveness, reluctance to communicate, refusal of physical activity, overeating due to discomfort, unwillingness to study or attend school, and a negative reaction to overcoming difficulties.

Individualized physiotherapy was necessary, with personalized exercises and constant modifications, ensuring a natural and minimally traumatic process. Positive results appeared within two months, and over six months, these results were consolidated and improved, demonstrating the effectiveness of the rehabilitation strategy.

Keywords: physiotherapy, contusion, war-induced contusion, mental development delay, children.

Серпутько О., Степанюк С., Глухова А., Харченко-Баранецька Л., Грабовський Ю. Ефективність фізіотерапії при затримці психічного розвитку у 9-річної дитини з перших місяців життя, ускладненого перенесеною контузією внаслідок воєнних дій. У статті здійснено аналіз результатів піврічного досвіду фізичної реабілітації 9-річного хлопця методами ЛФК, мета якої полягала в покращенні фізичних та психо-емоційних показників з метою адаптації дитини до життя в соціумі та можливості задоволення ним своїх освітніх та спортивних потреб на рівні з однолітками, а також соціалізація та ефективне подолання стресового стану після пережитого бомбардування та отриманої контузії.

Визначено, що методи фізіотерапії є ефективними не тільки для профілактики станів та показників, що є причинами встановлення інвалідності, а й покращення загального фізичного та психоемоційного стану дитини, в тому числі на фоні ускладнень, викликаних контузією після бомбардування через перебування в зоні воєнних дій. Серед негативних характеристик та станів, на подолання яких була направлена наша робота, найбільш яскраво вираженими були наступні: агресивність та небажання спілкуватися як з дорослими і навіть членами родини, так і з однолітками; відмова від будь-якої фізичної активності; переїдання як реакція на будь-який дискомфорт; небажання вчитися та ходити до школи; різко негативна реакція на подолання труднощів.

Виявлено, що в даному конкретному випадку єдиною можливою формою проведення фізіотерапії була індивідуальна робота, що базувалась та індивідуальному підборі як вправ, так і способів організації, які потребували постійної модифікації та залучення всіх каналів комунікації із піддослідним, аби для нього цей процес був якомога природнішим і найменш травматичним.

Показово, що перші позитивні результати ми отримали вже через 2 місяці після початку впровадження фізіотерапевтичних заходів, які за півроку спільної роботи нам вдалося не тільки закріпити, а й покращити, що дозволяє говорити про ефективність обраної стратегії реабілітаційної діяльності.

Ключові слова: фізіотерапія, контузія, контузія внаслідок воєнних дій, затримка психічного розвитку, діти.

Formulation of the problem. The future of any nation, as well as the global community, lies in its children. Thus, their health and well-being, motivation for life, timely acquisition of knowledge, and positive societal experiences are paramount today. Protecting our children from the destructive effects of military actions and their consequences is equally critical. Given the realities of the war in Ukraine, which undoubtedly impacts global geopolitics, it is important to understand the multifaceted influence of war events on the mental and physiological components of individuals, especially children. Stressful conditions caused by such events lead to long-term inhibitory processes that are unacceptable during periods of active growth and development.

Children who have experienced and witnessed bombings, seen the fear and reactions of adults, suffered contusions and psychological trauma, and were forced to change their living and learning environments require special attention and specific approaches from educators, doctors, teachers, sports trainers, and parents. Only coordinated efforts can ensure a normal future for these children and their adequate and equal role in building future society [1].

Physiotherapy plays a crucial role in the rehabilitation of children affected by military actions, especially those with pre-existing developmental delays. Practice shows that through physical exercises, and physical and personal contact, it is possible to stimulate other aspects of a child's life and activities, helping them overcome stress, recover from a state of shock following a contusion, and begin to enjoy childhood once more [4].

Analysis of recent research and publications. Any problem requires an individual approach, especially a combined one as in our case. We could not find similar studies by other researchers and practitioners, so we divided the problem into three components and studied and analyzed them separately.

The research findings of M.J.D. Jordans (2009-2016) [3, 4] in the field of children's mental health and psychological stability among subjects in war zones or those who became victims of military conflicts are particularly interesting and extremely useful. Effective methods for rehabilitating populations of different age groups after military conflicts in African countries are examined in the studies of R. Srinivasa Murthy (2006) [8], which emphasize that all population groups who have been in war zones, especially under enemy occupation, have psycho-emotional problems that are crucial to address at the state level. Physical exercises are highlighted as an important component of such rehabilitation.

The works of researchers R. Sartori and A. Tessitore (2022) [13] comprehensively explore the effectiveness of various physiotherapeutic procedures for treating developmental disorders and other somatic disorders in children and adolescents.

Among Ukrainian researchers, the topic of war and its impact has unfortunately become predominant in recent years, with most studies focused on the preparation and assistance of the adult population. Nonetheless, the works of M. Dudko and A. Hakman [2], who study the use of physical activity means for the rehabilitation of children affected by military actions in Ukraine, are noteworthy.

The aim of this study was to assess the effectiveness of physiotherapy and therapeutic exercise methods over a period of six months in overcoming the effects of contusion sustained during military actions in a 9-year-old child who has had a developmental delay since the first months of life.

To achieve the set objectives, the following **research methods** were utilized:

1. Literature Review: Analysis of literary sources and recent publications to familiarize with the results of other studies on the subject, as well as to incorporate the experiences of colleagues for a comprehensive understanding of the topic.
2. Theoretical Analysis and Synthesis: Interpretation and adaptation of scientific data to synthesize and understand research questions related to the study's theme.
3. Practical Experience: Application of personal coaching experience in aikido and general physical development exercises for rehabilitation purposes in working with children and adults with cerebral palsy [15]. Additionally, the use of aikidotherapy [14] to combat stress and other negative mental states induced by military actions in the area of residence.

Results of the research and discussion.

The subject of the study was a 9-year-old boy, born on July 24, 2014. In August-September 2023, he underwent treatment after leaving an occupied area of Ukraine due to military actions, during which he was diagnosed with: Minimal Brain Dysfunction Syndrome, moderate cognitive deficit, 3rd level HNR G 93.8; delayed mental and speech development after neonatal hyperbilirubinemia in the first month of life; mental development corresponding to the age of 6 years and 2 months; worsening condition due to an unconfirmed contusion in March 2022. At the time of diagnosis, the subject was 9 years old.

The study was conducted from November 2023 to May 2024, during which physical therapy was administered to improve the subject's mental and physical condition using therapeutic exercise methods.

At the start of rehabilitation, the subject exhibited increased aggression, often screamed without reason, refused to perform exercises, quickly became fatigued, was inattentive, did not listen, and could not repeat exercises or movements. Additionally, he had problems at school and with peer interactions, leading to a refusal to attend school, go for walks, and a decline in reading skills. He often could not finish his sentences, got confused in his thoughts, and could not clearly express his ideas.

A key aspect of the rehabilitation process was establishing a personal connection between the child and the trainer [7]. This connection extended beyond physiotherapy and included outdoor sports games, walks, crafting with paper and natural materials, drawing, educational conversations, and discussions on various topics. Additionally, the parents' support was crucial as they actively motivated the child to participate in the activities.

The strategy for planning and conducting sessions was based on the boy's age-specific characteristics, individual abilities, interests, and needs. Initially, therapeutic physical culture sessions lasted 30-35 minutes for the first few weeks, gradually increasing to 45 minutes, and after three months, sessions lasted 60 minutes [9].

Since the subject had no contraindications for physical exercise according to the condition of his cardiovascular, respiratory systems, and musculoskeletal apparatus, a training regimen of physical activity was chosen. The intensity of the exercises was adjusted according to the subject's age and well-being.

In our training approach, we adhered to the principle of progression, gradually teaching movements and systematically increasing the workload. Each session encouraged the subject to analyze his performance and notice that his physical capabilities were improving, results were getting better, and therefore, his condition was improving. This approach aimed at improving the primary defect, namely the delay in mental development, also allowed us to address secondary negative conditions acquired as a result of the contusion.

As previously mentioned, the subject's condition often manifested with aggressive reactions, particularly when he struggled with an exercise, felt fatigued, or simply did not want to participate. To avoid such states, we implemented the following methods in the training process [5]:

1. Emphasizing Breathing Technique: Focusing on the breathing technique during exercises helped not only improve the correct breathing technique (with attention to prolonged exhalation) but also promoted self-calming and autosuggestion.
2. Modifying Familiar Exercises: Changing the form of familiar exercises by altering the execution position (e.g., standing, sitting, lying down, or standing on one leg), as well as adjusting the movement amplitude and direction.
3. Using Weights: Incorporating weights (kettlebells, dumbbells, barbell) created additional load, which captured the subject's attention. Since the source of the load was not the trainer's commands but a specific object with a certain weight, the boy became interested in "overcoming" the object, feeling his physical strength, and performing the exercise correctly.
4. Emotional Engagement: Incorporating emotional engagement as an essential component made it easier to perform exercises, better memorize the logic and sequence of movements, and relate exercise execution to real-life needs.
5. Utilizing Breaks: Using breaks between parts of the session not only for rest but also for changing activities.

The training session aimed at addressing the specified tasks follows a familiar structure: organizational part, introductory part (preparing for the main load), main part, and concluding part [11].

Organizational Part: This serves as a moral preparation for the work ahead.

Introductory Part: Ensures systematic warm-up and physical preparation for the main load. Key aspects include:

- Forming the Habit of Correct Posture: Depending on the exercise, correct positioning of hands and feet is essential
- Emotional Preparation: The child must learn to focus emotionally on the session, disregarding distracting thoughts, fears, and concerns about being observed
- Moderate Load: The load during this stage should be moderate, aiming for preparation rather than training
- Activation of All Analyzers: Directed activation of all analyzers to improve muscle memory

At this stage, the following exercises were used: walking (on place, with changing directions), jumping, light running, arm and leg swings in various variations, basic balance and coordination exercises, movement mimicking animal motions, joint warm-up exercises, light stretching and muscle and ligament warm-up, all exercises were performed both with and without auxiliary equipment [12].

Main Part: The main part of the therapeutic exercise session aims to address both general and specific tasks [9]. It focuses on:

- **Mastering Basic Motor Skills:** Appropriate to the child's age
- **Overcoming Physical Development Deficiencies**
- **Teaching Correct Posture:** Both overall body posture and posture of individual parts
- **Learning Self-Control and Error Analysis:** Enhancing the ability to analyze mistakes in exercise execution
- **Stabilizing Cardiovascular and Respiratory Systems**
- **Strengthening the Muscular System:** Improving spatial orientation

Concluding Part: To normalize the functioning of the cardiovascular and respiratory systems, the concluding part included:

- **Attention exercises**
- **Games**
- **Rhythm repetition exercises**
- **Dance movements**
- **Juggling with one and two balls**

These activities help ensure a well-rounded and effective rehabilitation process [1, 6, 10].

Results after Six Months of Training. After six months of training sessions, conducted three times a week for 60 minutes each, we observed remarkable results, as detailed in Table 1. In addition to physical improvements, the subject showed significant progress in school. According to feedback from teachers and parents:

- **Enhanced Reading and Writing Skills:** The subject demonstrated better reading and writing abilities
- **Improved Expression:** He became more willing to express his thoughts, which were now logical, well-structured, and complete
- **Increased Social Interaction:** The subject interacted more with peers and expressed a desire to continue group activities
- **New Interests:** He successfully passed the selection process and chose to engage in swimming and basketball in a general group setting

Table 1

Summary of Six Months Work Results

№	Physical Indicators	State before Physiotherapy	State after 6 Months of Physiotherapy
1.	Theoretical knowledge about the importance of physical exercises for health	Apathy towards any activity, including a lack of understanding of the purpose of exercise and a lack of desire to engage in it	There is a well-developed interest and need in sports, orientation towards results, and a positive attitude towards health-related activities. There is also a conscious effort to maintain correct posture and the proper positions of hands, legs, and torso, as well as adherence to safety requirements during classes
2.	Formation of correct posture, as well as correct positioning of the arms and legs	The child does not maintain proper posture, presenting the following problems: stage II obesity, valgus deformity of the feet, and impaired coordination of both hands	Independently assumes the correct body position during exercises, as well as when sitting, standing, and walking; knows and performs sets of exercises; is able to maintain the correct body position independently, navigate in space, and maintain balance; has developed skills of self-control and willpower
3.	Development of fine motor skills	The child has fairly developed fine motor skills, skillfully assembles small Lego parts, bends and unbends the fingers, and can replicate figures. However, there is a delay in the coordination of the fingers of both hands, and the child often cannot catch or hold the ball	We managed to improve the skill of recognizing things made of different materials by touch and to control the fingers more skillfully, performing more complex simulation tasks. The general reaction time sped up significantly, and the ability to write, cut with scissors, and draw also improved. Basic exercises for juggling one and two balls led to significant progress
4.	Correct breathing and improvement of the cardiorespiratory system condition	Breathing through the mouth is often present, with the nose almost constantly blocked; breathing is uneven and erratic at the slightest physical exertion	The child knows how to breathe through the nose and does not feel discomfort when running, walking, or performing exercises. He knows how to perform exercises to restore breathing after exertion and has developed the skill of correct breathing during various activities. The range of these activities and the child's motor experience have significantly expanded, with the child more frequently demonstrating willpower in overcoming obstacles
5.	Improvement of the basic movements	The boy exhibited impaired coordination of movements and showed reluctance to exercise. He frequently tried to lie down and complained of persistent fatigue	The subject performs the learned exercises with proper coordination of the arms, trunk, and legs. They can coordinate movements of different body parts while executing elements and connections.

			They demonstrate good coordination in various positions, including standing, sitting, lying down, as well as performing handstands against the wall and on the head, and dynamic exercises. The subject knows how to break down complex actions into elements and can sequence them effectively. The number of unnecessary movements during exercises has significantly decreased, and their ability to voluntarily tense and relax muscles has improved. There is also a notable enhancement in self-control during exercise execution
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Taking into account the experience of Ukrainian and international physiotherapists working with children with developmental delays, and considering the child's specific condition due to a contusion, we decided to follow not only general didactic principles [5] but also to adhere to the following key approaches that have shown positive results:

1. Discipline and a focus on results, treating the child as a colleague and partner rather than as a dependent. We share a common goal for the sessions and work towards it together, thus overcoming difficulties, discussing them, and seeking solutions together.
2. We do not limit ourselves to therapeutic physical exercises but engage in activities that promote the child's overall psycho-emotional, physical, and intellectual development, especially if the child expresses such a desire.
3. Individualization of exercises and methods not just to make them easier for the child to perform, but to ensure that the child feels cared for, valued, and important.
4. Using consistent combinations of simple exercises that the child can learn and perform independently outside of physiotherapy sessions, at their own discretion.

Although our experience pertains to only one child, we believe and hope that it can be applied to similar situations in the future, as individualized work in our case has led to significant results.

Conclusions. The results of the conducted study allow us to assert that physiotherapy, implemented through the use of therapeutic physical culture methods, is an effective and efficient means of improving the physical and psycho-emotional state of a 9-year-old child with delayed mental development after experiencing a contusion due to military actions. It also aids in combating negative states associated with the awareness of the discrepancy between the child's condition and capabilities compared to the potential of their peers, as well as inhibitive processes and stress resulting from the contusion sustained during the bombing.

We see **the prospect of further research** in this direction in analyzing the impact of specific exercise groups on the physical and mental state of the child, in order to track dynamics and identify the most effective ones.

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