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HIPPOTHERAPY AS AN ALTERNATIVE REHABILITATION METHOD IN CHILDREN WITH POSTURAL BALANCE DISORDERS

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Abstract: *Using the movement of a horse, hippotherapy is a type of treatment meant to enhance the motor and psychosocial capabilities of children with infantile cerebral palsy (ICP). This approach is predicated on the idea that the horse's movement reflects the human gait pattern, so fostering motor skills development and central nervous system stimulation. The research's goal was to develop and evaluate the efficacy of hippotherapy as an alternative rehabilitation technique for children with cerebral palsy (CP), specifically in addressing postural balance difficulties. Research subjects: four youngsters (one girl and three boys) spanning four to six years were diagnosed with different forms of cerebral palsy. Finally, the study validates that in children with cerebral palsy, a customized rehabilitation program integrating hippotherapy, physiotherapy, and occupational therapy greatly enhances postural balance, mobility, and motor performance.*

Key words: *hippotherapy, postural balance, cerebral palsy, rehabilitation, motor control*

1. Introduction

Cerebral palsy (CP) is a non-progressive neurodevelopmental condition characterized by mobility and postural difficulties, arising from brain injury or abnormal brain development [12]. It signifies the most common motor disability identified in childhood, with a worldwide frequency varying from 1.5 to over 4 cases per 1,000 live births [16].

In the Republic of Moldova, data on cerebral palsy (CP) is not centralized in a national database, which obstructs accurate evaluation of the condition's prevalence [11]. In 2020, over 1,200 new cases of primary disability were documented, with a substantial

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proportion attributed to neurological illnesses, including cerebral palsy [3].

The total number of children with disabilities aged 18 and under has varied during the past five years. In 2020, there were 11,746 recorded instances, followed by 11,676 cases in 2021, 10,635 cases in 2022, 10,684 cases in 2023, and 10,429 cases in 2024. These oscillations signify a yearly variability in the prevalence of impairments, maybe reflecting changes in diagnostic and reporting procedures [3], [8].

Cerebral palsy includes various motor abnormalities such as stiffness, muscle weakness, postural control deficiencies, and balance and gait difficulties. The complex motor impairments significantly impact the functional capacities of children with cerebral palsy, reducing their independence, limiting their participation in daily activities, and greatly impacting their overall quality of life [6]. A primary motor deficit noted in children with hemiparetic cerebral palsy is the lack of postural control [4]. Various factors influence postural control, both individually and collectively. The factors encompass hypertonia or hypotonia, tissue retractions, biomechanical alterations in body alignment, and sensory-perceptual dysfunctions [11]. Children diagnosed with cerebral palsy exhibit difficulties in the efficient sequential coordination of postural muscle recruitment, a shortcoming that is most apparent during the performance of functional activities [2].

There are four primary categories of balance: Stable static balance—maintaining a fixed posture while stationary; stable dynamic balance—remaining balanced throughout movement; anticipatory balance—preparing the body for a potential loss of balance; compensating balance—adapting to an unforeseen loss of balance [7].

When analyzing balance in relation to gravity, it is essential to consider the role of the foot. It helps keep you balanced by using the support from the arch of your foot, working together with the muscles in your legs, and sending information about your body position through the sensors in the skin on the bottom of your foot. People are increasingly recognizing the importance of the foot and its influence on the spine and lower back pain.

For effective balance control, the spine must exhibit excellent postural competence. This means finding a balance between outside forces on the spine and how the trunk muscles respond based on senses, to keep the body stable when standing still or moving. The way sensory information from the foot interacts with the spine's responses is crucial for keeping good posture and balance, for both adults and children [15].

Koch et al. found that better pelvic movement can lead to better posture and balance. In this context, the close correlation between pelvic kinematics and the spasticity of the hip muscles can negatively influence postural balance [7]. Therefore, reducing the spastic tone of the hip adductors could promote improved postural control and more efficient postural stability [13].

Hippotherapy represents a therapeutic intervention method based on the use of the horse's three-dimensional movements under the supervision of a physiotherapist [5, 9]. The horse's back is considered a dynamic support surface, thus facilitating the development and optimization of postural control, trunk muscle strength,

and balance [14]. This form of therapy contributes to strengthening overall optimizing motor planning [1]. Studies suggest that hippotherapy may have beneficial effects on the symmetry of trunk and hip musculature in children with cerebral palsy in the short term and may temporarily reduce spasticity in conditions such as spinal cord injuries [10].

2. Material and Methods

2.1. The aim of the research. The development and assessment of hippotherapy's efficacy as a substitute rehabilitation approach for children diagnosed with cerebral palsy (CP) in terms of postural balance problems (correction).

2.2. Research hypothesis. Based on multimodal stimulation, it is hypothesized that using a tailored hippotherapy program will help children with cerebral palsy improve their motor control and relieve postural balance problems. This alternative rehabilitation approach will help these youngsters to functionally postural strength and endurance, improving weight-bearing capacity, and integrate into everyday and school activities and ease the process of motor recovery.

3. Objectives of the Research

1. The study is investigating the effects of hippotherapy on postural balance deficits in children with cerebral palsy, emphasizing multimodal stimulation mechanisms and enhancements in motor control.

2.Developing and evaluating a customized hippotherapy program to help improve balance and support children with cerebral palsy in their daily and school activities.

3.1. Research subjects

Diagnosed with various types of cerebral palsy, the study group comprised four children (one girl and three boys) ranging in age from four to six years (Table 1).

Demographic data of the analyzed group Table 1

No.	Variable		n=4
1.	Age	Average	4-6 years
2.	Gender	Male	3
		Girls	1

Table 2 shows the location and degree of the motor deficiency of the four subjects. Of them, 25% have significant hemiparesis—equal distribution between right and left—while 75% have mild hemiparesis, 50% on the right side and 25% on the left side. The Republican School of Equestrianism and Modern Pentathlon and the Kinetica Medical Rehabilitation Center hosted the physiotherapy and occupational therapy courses.The Gross Motor Function

Classification System was applied for the explanation of motor ability in children with cerebral palsy.

Table 2

The topographic distribution in relation to the identified motor deficit typology

Topography	**Motor difficulty**	**n=4**		**%**
		Right	**Left**	
Hemiparesis	**Mild**	2 (50%)	1 (25 %)	75
	Moderate		1	25
	Total	2	2	100

With the help of the GMFCS, the presence, amplitude, and strength of active movements were evaluated for each patient, especially gait. In grade II, patients (75%) were classified as able to walk independently, but with restrictions on outdoor activities, while in grade III, one patient (25%) was included, who could walk with support, also with restrictions on outdoor activities (Table 3).

Table 3

Classification of children with cerebral palsy according to the GMFCS

GMFCS	**Characteristics**	**No. of patients**	**%**
Grade I	Independent walking, without restrictions, but there are difficultes in more advanced gross movements	–	–
Grade II	independent walking, but with the restriction of outdoor activities	3	75
Grade III	walking possible with support, with restrictions on outdoor activities	1	25
Grade IV	impossible, limiting global mobility	–	–
Grade V	impossible with the significant limitation of global mobility	–	–

4. Research Results and Discussions

Starting with a thorough medical history, clinical examinations, and pertinent paraclinical studies, the process started with diagnostic establishment. The diagnosis sought to pinpoint the particular kind of infantile cerebral palsy and the related motor problems. Every topic was assessed with standardized instruments to find functional capacities, motor deficits, and effects on daily life. This phase gave an objective foundation for intervention design. The acquired data led to the development of a customized rehabilitation plan with well-defined and

reasonable goals. The idea combined several therapy approaches to meet the requirements of every patient.

Ten physiotherapy sessions, with an eye toward enhancing motor control, muscle strength, and postural balance using a variety of neurodevelopmental approaches including Vojta therapy, Temple Fay, Rood and Kabat methods, sensory integration, and the Bobath concept, comprised the rehabilitation program. Fifteen sessions of occupational therapy also helped the patients achieve functional autonomy in daily tasks including eating, dressing, and utilizing modified objects. Fifteen hippotherapy sessions were also used to induce balance, coordination, and sensory integration. Every topic's development was routinely tracked by standardized re-evaluations, which let treatments be changed depending on the noted improvement.

The participants were helped to engage in modified learning environments with interventions meant to foster social interaction and inclusion. The outcomes of every step were examined at the end, and the intervention strategy was modified to guarantee best continuation of the rehabilitation process and to react to changes in the demand of the patients.

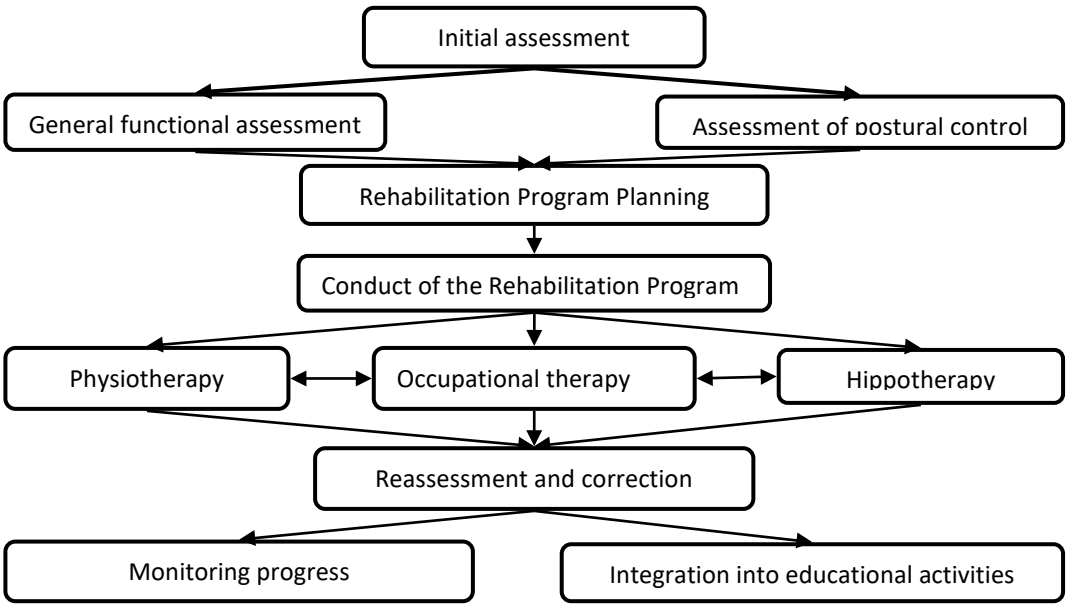

Fig.1 *The algorithm of the rehabilitation process of children with CP*

Table 4 displays the BBS (Berg Balance Scale) scores for four patients, recorded during both the first and final assessments, indicating substantial enhancements in postural balance. The mean of the initial evaluations is 45, while the mean of the final evaluations is 49.4, resulting in an average enhancement of 4.4 points. This indicates advancement in motor control, balance, and postural stability, corroborated by the implemented treatments.

The noted enhancements can be ascribed to an extensive rehabilitation

regimen, comprising 10 physiotherapy sessions aimed at augmenting muscle strength and motor control, 15 occupational therapy sessions designed to foster functional independence in daily activities, and 15 hippotherapy sessions intended to enhance coordination balance. These therapies were crucial in eliciting appropriate motor responses and enhancing sensory integration, positively affecting postural balance in children with cerebral palsy. The rehabilitation algorithm indicated that the integration of various therapies produced a cumulative impact, enhancing the development of motor skills and balance.

Presentation of the initial and final assessment of the BBS scale Table 4

Patient	**BBS scale**		**improvement**
	Initial assessment	**Final evaluation**	
1	46,2	49,8	3,6
2	43,5	48,1	4,6
3	46,8	51,1	4,3
4	43,5	48,7	5,2
Media	45	49,4	4,4

Table 5 shows for four patients the beginning and final evaluation data of the "Up and Go" (6 m) test, so stressing notable increases in their mobility and reaction times. With an average improvement of 5.5 seconds, the first evaluations average 26.8 seconds; the final evaluations average 21.2 seconds. These findings show a clear improvement in rapid and under control movement abilities.

Table 5

Presentation of the data of the initial and final evaluation of the Up and Go test

Patient	**Test Up and Go (6 m)**		
	Initial assessment	Final evaluation	Improvement
1.	26,1	20,9	5,2
2.	27,3	21,7	5,6
3.	26,8	21,1	5,7
4.	27,0	21,4	5,3
Media	26,8	21,2	5,5

The noted gains could have something to do with the applied rehabilitation program, which comprised hippotherapy, occupational therapy, and physiotherapy

all of which help to raise muscle strength, coordination, and postural balance. motor control and increased mobility that reflected the shortened time needed to cover the 6 meters. Achieving these outcomes was much aided by the rehabilitation algorithm, which concentrated on developing motor and functional abilitie.

3. Conclusions

The findings of the studies show that hippotherapy significantly helps children with cerebral palsy have better postural balance and motor function. Applied differently depending on the particular motor problems of every patient, integrated treatment modalities including physiotherapy, occupational therapy, and hippotherapy helped each patient to achieve functional and motor improvement.

After the analysis of the acquired data, it was shown that the implementation of a customized rehabilitation program combining several therapeutic approaches had a cumulative effect in raising mobility and enhancing the motor abilities of the patients. The improvements noted in the "Up and Go" tests (from 26.8 to 21.2, with an improvement of 5.5) and BBS (from 45 to 49.4, with an improvement of 4.4) demonstrate development in dynamic mobility and postural stability, therefore verifying the efficacy of the integrated strategy in the rehabilitation process.

Simultaneously, it is important to stress the need of a tailored rehabilitation strategy that satisfies the particular requirements of every child. Based on ideas of adaptability and personalization, the recovery program has shown that constant modification of therapeutic Personalized and complementary therapies helped to enhance the better interventions is necessary for maximizing development in the acquisition of motor skills and the functional integration of children with infantile cerebral palsy into daily activities.

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