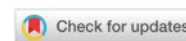


EFFECTIVENESS OF PHYSICAL THERAPY AND REHABILITATION IN IMPROVING MOTOR SKILLS AND MENTAL FUNCTION IN CHILDREN WITH CEREBRAL PALSY

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Abstract: Cerebral palsy was first described by William John Little in 1846. There are many definitions of cerebral palsy that vary from author to author. However, we can say that cerebral palsy (CP) is a chronic non-progressive brain damage, postural and body motility disorder. Apart from sensorimotor abnormalities, some cases are accompanied by mental disorders as well as disorders of cognitive functions. It can occur during pregnancy, at birth or during the postnatal period, ie. prenatal, perinatal and postnatal - equally in both sexes. There are different classifications of cerebral palsy: according to changes in muscle tone, according to topographic features and according to the severity of the clinical picture. According to changes in muscle tone, they are divided into: Spastic form, Athetoid form, Ataxic form, Hypotonic form and Mixed form. According to the topography they are classified as: Diplegia, Quadriplegia, Hemiplegia, Triplegia and Monoplegia. Physical therapy program is determined based on the clinical form of the disease. When determining a rehabilitation program, the principle of an individual approach is followed. Rehabilitation includes: physical medicine, kinesitherapy, reflex exercises according to Vojta, manual massage, thermotherapy, education of parents for rehabilitation at home; orthopedic aids; special education techniques. The aim of this study is to determine the role and impact of Physical Medicine and Rehabilitation in the treatment of children with Cerebral Palsy in early childhood. The research was conducted at the University of Southeast Europe - (Stul University) at the Faculty of Health Sciences in the Department of Physical Therapy and Rehabilitation, over a period of 6 months, from the beginning of April to the end of September 2023. 61 patients with cerebral palsy are included in the research, of which 28 are male, and the remaining 33 patients are female. The patients included in the research are classified into groups according to: gender, age and clinical form of cerebral palsy. The treatment of Cerebral Palsy (CP) has a complex character and includes medical, pedagogical and social rehabilitation. The individual tasks of the rehabilitation are determined after a functional examination of the motor abilities, where the main role is played by muscle tone, normal and pathological reflex motor activity, in the period up to 1 year of age. The goal of treatment with Physical Therapy and Rehabilitation is to achieve correct and timely development of movements and correction of pathological movement stereotypes (models), which occurred as a result of brain tissue damage. As for the motor deficit, kinesitherapy plays a major role. Established modern methods for kinesitherapy are the specialized methods for neuromuscular re-education of Vojta and Bobath. The Rood and Rabat methods were also used to facilitate the required movements and train coordination. Physical therapy and rehabilitation combined with kinesitherapy have an exceptional positive effect in: prevention of pathological primitive reflexes; creation and automation of normal active movements; saving irregular positions of the limbs and the whole body; establishment of balance and correct pattern of movement; fight against spasticity, secondary contractures and deformities; improvement of coordination and awareness of the body in relation to the environment.

Keywords: Cerebral palsy, symptoms, physical therapy, kinesitherapy, rehabilitation, exercises.

Field: Medical science

1. INTRODUCTION

Cerebral palsy (CP) is a serious disease, as a result of damage to the brain at the earliest stage of development, which leads to disruption of the normal development of motor functions, muscle tone and coordination. Some of the children have mental and speech disorders. Clinical picture: motor and sensory disorders, sometimes intellectual retardation, disorders of cognitive functions and epi-symptomatics. The disease usually occurs in the intra-uterine period or at birth itself, and is followed by incomplete development or brain damage. The main symptom is motor disorders (paralysis, paresis, hyperkinesia, ataxia), accompanied by speech and mental disorders, vision and hearing impairment. The clinical picture depends on the localization and degree of injury. The most common is the spastic form of cerebral palsy, which can be: Monoplegia – very rare, only one limb is affected.; Double spastic paraplegia – both legs are affected; Spastic hemiplegia - affected arm and leg on the opposite side of the brain injury; and

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Spastic quadriplegia – all four limbs are affected.

Depending on the changes in muscle tone, apart from the spastic form, there is also a hypotonic or atonic form, which is characteristic of early childhood. In these children, hypotonia can later turn into spasm, athetosis or dystonia. The injury can also be localized in the extrapyramidal system, which is clinically expressed by a hyperkinetic form of DCP. Cases with mixed forms are not rare, in which signs of pyramidal and extrapyramidal paralysis are combined, as a result of diffuse involvement of the brain. Cerebral palsy is a disease that very often leads to severe disability. In order to successfully combat the consequences and the severe disability that DCP leads to, early detection and the start of treatment from the first days of a child's life is necessary.

The aim of this study is to determine the role and impact of Physical Medicine and Rehabilitation in the treatment of children with Cerebral Palsy in early childhood

Physical therapy and rehabilitation program for children with cerebral palsy

Cerebral palsy cannot be diagnosed in infants younger than 6 months, except in very severe cases. The patterns of different forms of cerebral palsy appear gradually, with the earliest clues being developmental delay and abnormal muscle tone. Infants who have any risk factor for development of cerebral palsy should be monitored by pediatric neurologist to follow up this infant every 2 months by developmental quotient. Clinical examinations, complete neurological examination and assessment as motor power and tone of the muscle in upper limb and lower limb, reflexes (superficial, deep, and pathological reflex), examination of the sensory system, ask about sphincteric control to the urine and stool.

If the child diagnosed as cerebral palsy must be started physiotherapy and conductive education program early as possible and regular in this session to reach to the maximum level of improvement.

Physical therapy and kinesitherapy methods affect the improvement of CNS functions at an early age, when the brain has great plasticity and ability to rearrange. The goal of rehabilitation in early childhood is the correct and timely development of movements and the correction of pathological movement stereotypes (models), which occurred as a result of the brain injury. It is necessary to create movement habits and skills, following the motor development of a healthy child, according to the appropriate age: normal lying on the back, keeping the head upright, holding the hands of an adult, supporting the hands while lying on the stomach with active control of the head, turning from back to stomach and vice versa, sitting, crawling, straightening with and without support of the hands, standing and walking.

Various therapeutic interventions have been used in the management of children with cerebral palsy. Traditional physiotherapy and occupational therapy are widely used interventions and have been shown to be of benefit in the treatment of cerebral palsy

Physical therapy and kinesitherapy play a leading role in the rehabilitation of CP in parallel with medical treatment. This paper describes the Physical therapy methods used in the treatment of children with cerebral palsy. In the first stage, complex treatment aims to stimulate brain development, by removing brain edema and improving oxidative and metabolic processes in brain tissue. The individual tasks of the rehabilitation are determined after a functional examination of the motor abilities, where the main role is played by muscle tone, normal and pathological reflex motor activity, in the period up to 1 year of age

Physical therapy treatment includes: individual passive exercises, actively assisted joint movement exercises to normal physiological limits, sitting exercises with legs extended in bed, standing exercises with the help of a corset and splints, balance exercises in front of a mirror, walking exercises loom, medicine ball exercises, special Vojta poses, Kabat diagonals, water exercises and movement coordination exercises.

- To increase children's immunity, ultraviolet radiation is applied in suberythemic doses - several times a year;
- In case of muscle imbalance, electrostimulation with low-frequency currents is applied to relatively weak muscle groups (antagonists of spastic ones).
- In the diplegic form, electrostimulation of the thigh abductors, calf extensors and dorsiflexors of the feet must be applied;
- To deal with the motor deficit, special methods for the neuromuscular re-education of Vojta and Bobath are applied. The methods of Rood and Rabat are also used to facilitate movements and train coordination
- For relaxation of spastic muscles, paraffin applications, baths with water temperature of

37 degrees Celsius or underwater gymnastics are used.

Physical therapy and Kinesitherapy aims to:

- prevention of pathological primitive reflexes;
- creation and automation of normal active movements;
- saving irregular positions of the limbs and the whole body;
- establishment of balance and correct pattern of movement;
- fight against spasticity, secondary contractures and deformities;
- improvement of coordination and awareness of the body in relation to the environment;

Individual passive exercises, actively assisted exercises with movement in the joints up to normal physiological limits, exercises for sitting with legs extended in bed, exercises for standing with the help of a corset and splints, balance exercises in front of a mirror, exercises for walking in a loom, exercises for medicine ball, special Vojta poses, Kabat diagonals, water exercises and movement coordination exercises.

2. RESEARCH METHODS

The research was conducted at the University of Southeast Europe - (Stul University) at the Faculty of Health Sciences in the Department of Physical Therapy and Rehabilitation, over a period of 6 months, from the beginning of April to the end of September 2023. The research includes patients with cerebral palsy diagnosed by a pediatric neurologist, which fulfill the inclusion criteria. A classification of patients was made according to gender, age and clinical form of cerebral palsy. In the research are included 61 participants with cerebral palsy.

Classification of patients according to by gender: 33 female (54% and 28 male (46%).

According to age, patients are classified as follows:

- From 0 months to 1 year – 13 patients (21.3%)
- 1 – 3 years – 14 patients (23%)
- 3 – 6 years – 17 patients (28%)
- 6 – 9 years – 8 patients (13%)
- 9 – 13 years – 6 patients (9.8%)
- 13 – 17 years – 3 patients (4.9%)

Classification of patients according to the clinical form

- Monoplegia - 2 male patients and 1 female patient; (4.91%)
- Diplegia - 4 male patients and 7 female patients; (18%)
- Hemiplegia - 16 male patients and 19 female patients; (57.37%)
- Triplegia - 3 male patients and 4 female patients; (11.47)
- Quadriplegia - 3 male patients and 2 female patients; (8,2)

3. RESULTS

The participants are divided in two groups: first and second group. The participants in first group receives physical therapy treatment which includes: individual passive exercises, actively assisted joint movement exercises to normal physiological limits, sitting exercises with legs extended in bed, standing exercises with the help of a corset and splints, balance exercises in front of a mirror, walking exercises loom, medicine ball exercises,

The participants in second group receives Exercises to form the innate reflexes that are missing such as: grip reflex, foot reflex, labyrinth reflex, trunk turning reflex, special Vojta poses, Kabat diagonals, and movement coordination exercises. These exercises are necessary for the formation and development of the first independent movements in the first months and in the first year of the child's life.

To measure the severity of symptoms and also to monitor improvement after therapy interventions, the most commonly used tool is the Gross Motor Function Classification System (GMFCS).

After completing the six-month treatment with physical therapy, kinesitherapy and the methods of Vojta and Carl and Bertha Bobat, the results show great progress in almost all parameters. A decrease in tonic primitive reflexes, neck and labyrinthine tonic reflexes, reduction of extensor hypertonia, improvement of motor-reflex activity, proprioceptive afference, coordination, reduction of neck tone, foot reflex, stimulation of the grip reflex and

improvement of the position of the neck, limbs and body. The presented results shows significant improvement in both groups of participants

4. DISCUSSION

Physical therapy and Kinesitherapy have been shown to improve motor function, reduce disability, increase physical activity and improve quality of life for patients. Physical therapy has been associated with structural brain remodeling, which may contribute to improved motor function.

The goal of treatment with Physical therapy and rehabilitation was to achieve correct and timely development of movements and correction of pathological movement stereotypes (models), which occurred as a result of brain tissue damage.

Bobat's method inhibits pathological reflexes to allow normal body movement and position, and Vojta's method is based on reflex locomotion consisting of reflex crawling and reflex turning. These methods stimulate the development of the central nervous system (CNS).

The cooperation of the doctor with the parents is a very important condition to achieve a good result in the treatment of people with cerebral palsy.

5. CONCLUSION

Medical doctors are often surprised by the variety of physiotherapeutic techniques available; they are unfamiliar with the approaches of researchers such as Bobath, Coulter, and Brunnstrom, among others, as well as the scientific reasoning behind these techniques. There are numerous types of interventions available that are customized to address the specific requirements of each patient.

The active participation of parents in work at home is one of the most important conditions for the success of the treatment. The education of parents and close family members for rehabilitation in home conditions. Training of parents to perform the necessary exercises allows them to be repeated multiple times throughout the day.

Research has claimed that Physical therapy, neurodevelopmental treatment, proprioceptive neuromuscular facilitation, functional training, and motor learning all have beneficial effects, and none are more effective in promoting recovery than others.

6. REFERENCES

- Blanco.E., Andrés. J., Soto.B, García. Y., Villalba.M., Pérez-Corrales. J., Rodríguez. J. (2020). Influence of Aquatic Therapy in Children and Youth with Cerebral Palsy: A Qualitative Case Study in a Special Education School. *Int J Environ Res Public Health*. . 2020 May 23;17(10):3690. doi: 10.3390/ijerph17103690. PMID: 32456241
- Cantero M.J.P., Medinilla E.E.M., Martínez A.C., Gutiérrez S.G. (2021) Comprehensive approach to children with cerebral palsy. *An. Pediatr. (Engl. Ed.)* 2021;95 doi: 10.1016/j.anpede.2021.07.002
- Duran I., Stark C., Saglam A., Semmelweis A., Lioba Wunram H., Spiess K., Schoenau E. (2022) Artificial intelligence to improve efficiency of administration of gross motor function assessment in children with cerebral palsy. *Dev. Med. Child Neurol.* 2022;64:228–234. doi: 10.1111/dmcn.15010
- Fritsch S., Guenther F., Wright M.N. (2023) neuralnet: Training of Neural Networks: R Package version 1.44.2. [(accessed on 3 January 2023)]. Available online: <https://github.com/bips-hb/neuralnet>.
- Gonzalez. N., Raghavendra R., Osman. S., Kumar. A., Sadagopan. A, Mahmoud.A., Begg. M., Mawada., M. Tarhuni, M., Fotso. N., Khan. S. (2023). Physical Therapy Interventions in Children With Cerebral Palsy: A Systematic Review. *Journal List >Cureus >v.15(8); 2023 Aug > PMID: PMC10510427 PMID: 37736433*
- Mohamed, S., Fahmy, S., Mohamed, A. and El-Sabbagh, M. (2020) Efficacy of Physiotherapy and Conductive Education in Improving Motor Skills and Mental Function in Children with Cerebral Palsy. *Open Journal of Pediatrics > Vol.10 No.2, June 2020. DOI: 10.4236/ojped.2020.102038*
- NIH. Cerebral Palsy [internet].(2023) National Institute of Neurological Disorders and Stroke; [updated 2023 Jan 27; cited 2023 Mar 6]. Available from: <https://www.ninds.nih.gov/health-information/disorders/cerebral-palsy>
- O'Connor B., Kerr C., Shields N., Adair B., Imms C. (2019) Steering towards collaborative assessment: A qualitative study of parents' experiences of evidence-based assessment practices for their child with cerebral palsy. *Disabil. Rehabil.* 2019;23:1–10. doi: 10.1080/09638288.2019.1629652
- Russell D.J., Wright M., Rosenbaum P.L., Avery L.M. (2021) Gross Motor Function Measure (GMFM-66 and GMFM-88) User's Manual. Mac Keith Press; London, UK: 2021.
- Scholtes F., Kolh P. (2021). Big data to analyze patterns of care and improve outcomes for children with cerebral palsy. *Dev. Med. Child Neurol.* (2021). ;63:1246. doi: 10.1111/dmcn.15027