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Positive influence of hippotherapy on the process of improvement of children with cerebral palsy in children

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Abstract:

Cerebral palsy is one of the most common neurological diseases in children. An important aspect of improvement is the development of motor functions, self-service, communication and social skills. Therefore, rehabilitation, in all forms one of them is hippotherapy, must be focused on motor education, as well as on improving the child's psyche. The beneficial effect of a horse is that it controls muscle tension, strengthens flaccid muscles and relaxes shortened muscles, which prevents contractures. Therapeutic riding improves the quality of life of such children, allows them to open up to the world, thus activating them and creating interaction between the child and the horse, and this improves

their physical and mental condition. Hippotherapy is one of the most effective complementary therapeutic methods used to improve children with cerebral palsy.

Key words: hippotherapy, cerebral palsy, improvement

Introduction:

Hippotherapy comes from two words: Greek "hippos" meaning horse and "therapeutics" meaning therapy. It is defined as therapy using animals in the form of a horse. Since 1960 it has been recognised in Germany, Austria and Norway as an addition to traditional rehabilitation. This term was then introduced into the medical literature. In the 1970s in the United States of America (USA) hippotherapy began to be standardized. It was standardized by a group of Canadian and American therapists who travelled to Germany to learn hippotherapy in the late 1980s. The American Hippotherapy Association (AHA) was founded in 1992 and in 1994 a certification document and standards for a certified hippotherapy clinic specialist were established. In 1999, the first certification examination was conducted [1]. Professor Marian Weiss was the precursor of hippotherapy in Poland in Konstancin near Warsaw. Since 1985, the first hippotherapeutic stays for children and adolescents have been held. Thanks to a group of Kraków doctors and the help of the Equestrian Club of the Provincial People's Sports Club "Krakus" in Swoszowice [2]. Hippotherapy is one of the forms used in the rehabilitation of disabled people. It is a kind of improvement of adults and children using a horse. Under the supervision of hypotherapists, horses help in improvement in various spheres: physical, emotional, cognitive and social [3]. Hippotherapy consists primarily in the creation and fixation of a proper pelvic movement pattern. It also helps to normalize muscle tension. Therapeutic horse riding improves coordination, balance and also teaches orientation in the body space of the patient. Hippotherapy also has an impact on the mental sphere. Contact with the horse increases self-esteem and reduces emotional disorders [4]. Horseback riding affects the physical zone through horse movements. They give the impression of human walking through three-dimensional movements of the horse's back forward and backward, up and down, right and left, as well as rotational movements around the vertical axis of the spine caused by the alternating protruding of the hips. Body training in sitting and forward movement in a manner typical of human walking lead to a proper posture[5]. The horse transmits 90 to 110 multidimensional swaying impulses to the patient within one minute. This makes it possible to get to know the movement patterns characteristic of human walking. During the ride, the muscles of the back, abdomen and pelvic girdle are strengthened, which leads to the

development of a proper posture. The movement of a horse during the movement of the tarsus is similar to the movement of a human pelvis in time walking [6]. Lack of support under the feet allows for greater concentration on the muscles of the body center, i.e. the torso muscles. Alternating rocking during walking causes tension and relaxation of postural muscles, which allows to normalize muscle tension. The temperature of the horse is one degree higher than in humans (37.5-38.5°C). The muscles are heated up in this way and excessively tense and it causes their relaxation. It is a good preparation for other forms of rehabilitation [2].

Horse riding in rehabilitation causes an increase in motivation in the therapeutic process. It is connected with increased self-esteem and reduction of emotional disorders connected with the disease. It awakens in patients undergoing this type of therapy a sense of responsibility and independence related to the care of the horse. Additionally, the rhythm of the horse's walk and a pleasant feeling of rocking causes relaxation and calmness. Classes conducted with the horse contribute to stimulation in the cognitive and social zone. This kind of therapy forces to leave home and get to know a new environment. It prevents isolation and develops the ability to cope with different life situations. The animal helps to develop human relationships. It gives a sense of attachment between a person and a horse, which can then be transferred to relations with people and improve interaction with another person [7]. Hippotherapy can take different forms. We can distinguish between horse movement therapy, i.e. passive submission to movement during riding, physiotherapy on horse - implementation of exercises during riding, therapy through direct contact with an animal and a psychopedagogical form (on horse or at the horse) which aims at intellectual, cognitive and emotional improvement [3].

Cerebral palsy (MPD) is not a disease, but rather a set of symptoms resulting from brain damage during pregnancy, childbirth or prenatal period, which occurs in 2-3/1000 newborns [6]. It causes various types of disorders associated not only with the intellectual sphere but also with the musculoskeletal system, which may cause abnormal posture, postural defects, disorders of body position, coordination, balance and muscle tension disorders. Treatment of this disease is a continuous multidisciplinary process lasting throughout life [6].

We can distinguish six forms of cerebral palsy:

- quadriplegic - four-legged paresis;
- bilateral hemiplegia - paralysis affects the upper limbs more than the lower limbs;
- diplegia - paresis of mainly lower limbs with simultaneous, but to a lesser extent, paresis of upper limbs;

- paraplegia - paresis of lower limbs only;
- triplegia - paresis of three extremities;
- hemiplegia - hemiplegic, one-sided paresis;
- monoplegia - single ended paresis [8].

Rehabilitation of children with MPD should be started as soon as possible, taking into account the child's developmental stages. Different neurophysiological methods such as NDT Bobath, Vojta method or sensory therapy are used in the rehabilitation of children with cerebral palsy. Hippotherapy is also an effective method in rehabilitation as a component of a complex system including specialists from various fields of medicine: physician, physiotherapist, psychologist, educator and speech therapist [9].

Recently, many studies have been conducted about the benefits of horseback riding for disabled people. In the literature, there are papers on the positive assessment of hippotherapy in children with cerebral palsy [10].

Motor functions:

Jang C.H. et al. conducted research on eight children with cerebral palsy in order to investigate the effects of hippotherapy on the motor, psychosocial and emotional parameters of these children. The study involved three men and five women with an average age of 7.3 years. Their performance before the Gross Motor Function Measure (GMFM) scale, used to assess the motor abilities of children with MPD, was 1-3. Hippotherapy sessions were conducted for 30 minutes once a week for 10 weeks. The measurement of motor function was evaluated by GMFM scale, balance scale (PBS) and Korean version of modified Barthel scale. All children were evaluated by means of a depression questionnaire, anxiety questionnaire for children, Rosenberg's self-assessment scale and Korean life satisfaction scale (K-SWLS). After 10 weeks of therapy, the PBS equilibrium parameter increased on average by 4 points, while the GMFM increased on average by 2.4 points. The results of GMFMs, walking, running and jumping also improved significantly. However, although the K-MBI index showed a tendency to increase the change was not significant. This study compared the motor function and psychosocial parameters of children with MPD before and after hippotherapy. Hippotherapy showed a positive effect on motor function and improved balance, but the results of studies of psychosocial and emotional parameters were not adequate to verify the improvement [6].

H.J. Chang et al. conducted a study to assess if hippotherapy can improve the functional performance of pre-school and school children with spastic bilateral paralysis. The aim of the research was to check whether the therapeutic effects of hippotherapy will be

different depending on the functional state of the subjects. The study included 33 children aged four years or older with spastic bilateral paralysis. Participants were classified through the GMFCS classification scheme as follows: Level I (n = 6), Level II (n = 13), Level III (n = 7) and Level IV (n = 7). Children were then divided into two groups according to the GMFCS level: GMFCS levels I and II were placed in group A, which included less autonomous patients, and GMFCS levels III and IV were placed in group B, which included more active children. Children received thirty minutes of hippotherapy twice a week for eight consecutive weeks. The values of motor function were assessed using the GMM and Pediatric Balance (PBS) scales. They were determined during the preride control period, at the beginning of hippotherapy and after hippotherapy. Therapists established the treatment plan and objectives for each subject and were responsible for selecting the appropriate exercises. The movements of each horse were modified during the treatment session according to the patient's needs, for example walking, changing pace or changing patterns and directions. Most of the patients rode slowly and evenly. While the horse was walking, the subjects were encouraged to maintain an even posture and stability with a symmetrical position of the torso, pelvis and lower limbs, and to sit up on their own with little or no help. The parameters of GMFMs and PBS in children with MPD improved significantly after hippotherapy. It turns out that hippotherapy can improve motor function and balance in paediatric patients with MPD without adverse effects. Therefore, it can be considered an effective therapeutic method in the rehabilitation of preschool and school-age children with spastic cerebral palsy [11].

The aim of the next study was to investigate the influence of hippotherapy on motor and functional functions also in children with spastic cerebral palsy (E. S. Park et al.). The study involved 34 children (15 men and 19 women) aged from 3 to 12 years. Hippotherapy classes lasted for 8 weeks, twice a week for 45 minutes. The control group consisted of 21 children with the same type of cerebral palsy with no intervention. The groups were homogeneous in terms of age and functionality. The results were measured using the motor function measurement (GMFM) and the Pediatric Disability Assessment Questionnaire: Functional Skills Scale (PEDI-FSS). The scales were used before therapy and after 8 weeks of intervention. The results did not show any significant differences between the intervention and control groups in the final GMFM and PEDI-FSS studies. After an 8-week intervention, mean GMFM results improved significantly in both groups. The overall PEDI-FSS score was significantly improved in the hippotherapy group but not in the control group. In conclusion, the study showed the beneficial effect of hippotherapy on overall motor function and functional efficiency in children with MPD compared to control group. The significant

improvement in PEDIFSS scores suggests that hippotherapy may be useful to maximize the functional performance of children with MPD [12].

L. Žalienė et al. compared the effects of short-term and long-term horseback riding therapy. The study involved 15 people (two girls and eleven boys) aged from 3 to 19 years. All patients were diagnosed with a spastic form of cerebral palsy in which only the types were different: nine patients had spastic diplegia, three had dyskinesia, and two had tetraplegia. The subjects were divided into two groups: advanced (group I) and basic (group II). The first group included people who had experience in horse riding from one to four years, and in the basic group there were people who had at least ten riding sessions. Group I consisted of eight persons (7 boys and 1 girl) and group II consisted of seven children (1 girl and 6 boys). The scale of GMFMs was used to assess motor function in this study. The results of the study showed that ten driving sessions had no effect on motor function for beginners with cerebral palsy. However, motor function improved significantly in half of the advanced riders with cerebral palsy. Meanwhile, the level of performance of motor abilities for four advanced riders increased, but the difference was not statistically significant [10].

Ebru Alemdaroglu et al. evaluated the short-term effects of equestrian therapy in combination with a conventional rehabilitation programme in children with cerebral palsy. The children were divided into two groups. Group 1 includes children who were hospitalized for rehabilitation and received riding therapy in addition to conventional rehabilitation. This group consisted of 9 people. The group 2 included children who received only conventional rehabilitation and their number was 7. In total, the study group consisted of 16 persons. Both groups were evaluated at the beginning of the study and again after 5 weeks of observation. All included patients received the basic rehabilitation program 5 days a week during the 5-week period of the study. The programme included a range of movement exercises, progressive resistance strengthening, postural exercises, neurophysiological exercises, balance and coordination training, walking training, orthosis training and assistance in moving, stretching and thermal and electrical stimulation according to the requirements of each child. In addition, 9 children in group 1 received equestrian therapy consisting of horse riding and horse exercises. Riding sessions were held twice a week for 5 weeks. All children were subjected to a Functional Test (MFRT), hip dislocation angle, hip adductor muscle spasticity and GMFCS. The motor status of children was assessed using the GMFCS. The balance has been tested with MFRT. It was made with a measure mounted on a wall at the level of the patient's shoulder blades, sitting in a chair with hips and knees at 90 degrees. The range was measured forward, left and right. Goniometric measurements of hip dislocation were

performed for both joints. Knee distance test and Ashworth scale were used to assess spasticity. The groups were homogeneous in terms of age, sex, body weight, pre-treatment GMFCS, knee distance test, MFRT and hip adductor spasticity. Pre- and post-treatment values within and between groups were compared. In group 1, MFRT forwards, rightwards and leftwards showed significant improvement after treatment. In group 1, Ashworth values for hip joint visits showed significant improvement. The percentage change in spasticity of the adductor in the Ashworth scale was 22% in group 1. In group 2, no improvement was observed in the spasticity of the adductor after treatment. Knee distance test values showed greater improvement in group 1 patients than in the control group. Neither hip angle nor GMFCS showed significant improvement in any of the groups after treatment. The results of this study show that horse therapy, in addition to conventional rehabilitation, caused a significant reduction in adductor spasticity in short-term observation [13].

Balance

Hippotherapy can be described as an excellent tool to improve the control of the torso and balance. It helps to build a proper posture and gives the possibility of a planned load transfer. Horse movements similar to those of the human pelvis can improve movement coordination, function and gait quality in patients with cerebral palsy [14].

One of the studies confirming the positive influence of hippotherapy on the above mentioned parameters is the study by J. Kwon et al. in which 92 children participated. They were randomly assigned to two groups (study group-46; control group-46). Children in the hippotherapy group received 30 minutes of private hippotherapy (1 child per therapist) twice a week for 8 weeks (16 sessions), in addition to conventional physiotherapy. Control group children received 30 minutes of home aerobic exercise (walking or cycling) twice a week for 8 weeks with conventional physiotherapy. The treatment was completed by 91 children (45 in the intervention group and 46 in the control group). The groups were similar in terms of gender, age, GMFCS level, neuromotor type, laterality, body weight, height, history of surgery and the amount of physiotherapy they received.

In this study, GMFMs used to assess motor function in children with MPD were used to evaluate the changes. The scale consists of 88 elements in five dimensions: lying and rolling, sitting, crawling and kneeling, standing and walking, running and jumping. The Pediatric Balance Scale (PBS) was also applied. Differences in improvement in the parameters studied differed significantly between the groups after the 8-week study period. In conclusion, this study showed beneficial effects of hippotherapy on general motor function and balance in children with MPD. Hippotherapy can be used in combination with standard

physical therapy to improve motor function and balance in children with MPD at different functional levels [15].

Neurophysiological model is a model that does not use horse exercises or take into account changes in riding position. It is focused on reaping the benefits of the animal's motor skills. The study involved 19 children aged 4-13 years suffering from MPD with spastic diplegia at the I-III level of functional state of GMFCS, who demonstrated an asymmetric compensation model. The Cosmogamma Balanced Platform was used to investigate the displacement. The study was conducted before and after the neurophysiological hippotherapy session. The study allowed to identify the overloaded side and adjust the course of the neurophysiological hippotherapy session. The post-session study was conducted to compare the parameters of COG transmission changes in the sagittal and frontal planes. The sessions lasted 30 minutes and took place in a circle and lasted 15 minutes in each direction. The aim of the session was to improve mobility of the less loaded limb and stability of the limb on the support progression side. During the neurophysiological hypotherapeutic therapy session, the patient sat in a straight forward sitting position with the pelvis in an intermediate position on the sciatic tumors. The results show that neuropsychological hippotherapy brought the desired results and the COG was moved towards the less loaded side. The mean value of the body's centre of gravity in the frontal plane was 18.33mm. After hippotherapy, the first study showed a result 21.84 mm higher in the direction of the relieved lower limb. The conclusion of the study is that one session of neurophysiological hippotherapy caused statistically significant changes in the position of the centre of gravity in the body in the frontal plane among children with MPD, showing an asymmetrical model of compensation [16].

Hippotherapy can improve the balance and quality of walking. In this study, 30 children, including 19 girls and 11 boys, with bilateral contractile paralysis were treated. The age of participants varied between 8-13 years. Hippotherapy sessions were conducted daily from Monday to Friday for two weeks and one session lasted 30 minutes. Tinetti and the Stand Up and Go Test were used as evaluation scales. They were used to examine the quality of posture and walk balance. All tests were conducted before and after the therapeutic horseback riding. After two weeks of treatment, the results showed a statistically significant improvement in balance and gait. Performance was observed in all children. Therefore, it can be concluded that the hippotherapy sessions have a positive effect on balance and gait disturbances in children with MPD [9].

Another study assessed the effect of hippotherapy on sitting postural balance, dynamic balance and functional efficiency in children with cerebral palsy (Andréa Gomes Moraes et al.), comparing the effects of 12 and 24 sessions on these parameters. The study involved 15 children with cerebral palsy aged from 5 to 10 years. To participate in the study, participants were required to meet the following criteria: diagnosis of MPD, age between 5 and 10 years, understanding of simple commands, ability to remain unassisted for at least 10 seconds and dislocation of the hips at least 20 degrees. The hippotherapy was performed for 30 minutes, twice a week, for 12 weeks. Sitting posture balance was measured using the AMTI AccuSway Plus force platform a week before the start of the hippotherapy program and after 12 and 24 weeks. The Berg Balance Scale (BBS) and Pediatric Evaluation of Disability Inventory (PEDI) were used before and after 24 sessions. Significant differences were observed for the variable centre of gravity (COP), including lateral displacement, antero-posterior displacement, and velocity of displacement. These changes were most visible after 24 sessions. Differences were also found in the scale of BBS and PEDI related to functional skills (autonomy, social function and mobility). Hippotherapy improved postural balance in sitting position, dynamic balance and functionality in children with cerebral palsy where the effects were most pronounced especially after 24 sessions of hippotherapy [17].

Conclusion:

Taking into account the findings from the studies collected above, it can be concluded that hippotherapy is one of the effective therapies complementing the rehabilitation of people with cerebral palsy. It has many benefits, such as improved stability and walking parameters, improved motor skills and functioning of people affected by this disease. It is also a positive aspect affecting the psyche of these patients, therefore it seems that its use may have a significant impact on their well-being and quality of life, if of course there are no contraindications.

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