# Benefits of hippotherapy on motor development of children with Down Syndrome

## Benefícios da Equoterapia no Desenvolvimento motor da criança com Síndrome de Down

## Beneficios de la hipoterapia en el desarrollo motor de niños con síndrome de Down

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Down syndrome (DS) is a genetic condition caused by the trisomy of chromosome 21 and which leads to an inadequate chromosomal distribution during the meiosis phase. Each cell of the normal individual has 46 chromosomes, these are divided into 23 pairs; in the holder of DS, the pair of numbers 21 has one more chromosome, resulting in 47 chromosomes.[1-2]

Furthermore, DS is also characterized as a genetic condition whose trisomy in the 21q22 chromosomal band is its most frequent alteration, in about 95% of cases. The other 5% include translocation, mosaicism or gene duplication. DS causes intellectual impairment with varying degrees of physical and cognitive difficulties, in addition, other health problems may occur in patients with DS such as: congenital heart disease; hypotonia; hearing problems; eyesight; changes in the cervical spine; thyroid disorders; neurological problems; obesity and premature aging.[2]

Thus, delay in motor development is expected in individuals with DS. Thus, in individuals considered normal, at birth, the Central Nervous System (CNS) is not yet fully developed, so it is able to perceive the world only through the senses; in this case, the stimuli of the external environment are capable of altering the CNS, allowing the individual to evolve in a learning process that allows better adaptation to the environment in which he lives. In the individual with DS, this development depends on biology, behavior and the environment and not only on the maturation of the CNS.[3]

Prenatal diagnosis allows to detect during pregnancy if the fetus is affected by the syndrome, with the following indications for the diagnosis: maternal age over 35 years of age, previous child with DS, one of the parents with chromosome translocation involving chromosome 21 , fetal malformations diagnosed by ultrasound and altered prenatal screening tests. Children with DS do not always show all signs and symptoms, some have a mild to moderate degree of mental retardation, others do not have a delay and are located between the borderline and low average ranges and may still have the most severe delay.[4]

Law 13830/19 recognizes hippotherapy as a therapeutic and educational method that uses the horse within an interdisciplinary approach, in the areas of health, education and riding, seeking the biopsychosocial development of people with disabilities. It works in line with physical therapy practices, recognized by Resolution 348/2008 of the Federal Council of Physiotherapy and Occupational Therapy (COFFITO), as a therapeutic resource, of a non-corporate character, transdisciplinary to the treatments used by Physiotherapists and Occupational Therapists inserted in the field integrative and complementary practices. [5-7]

Then working the motor part, the social and affective aspects, thus fulfilling the objectives of global rehabilitation and social reintegration, favoring the individual's contact with other patients, with the team and with the animal, thus bringing it closer, more and more of the society where he lives.[7]

Research on the child development aspects of DS focus on the factors that influence the child's motor acquisitions, revealing that they present a significant delay in the development of motor skills and postural control, compared to typical children. The aspects suggested as the cause of the delay in the acquisition of motor milestones are: muscle weakness and hypotonia thus being considered as the main causes of these differences.[8]

Physiotherapeutic treatment is aimed at developing proposals that are in accordance with the patient's needs and the problems related to frequent postural adjustments in DS, such as motor delays, especially sitting and standing. Thus, physiotherapy proposes to perform gait training, transpostural changes, static and dynamic balance through specific techniques and resources on the ground.[8-9]

In hippotherapy, the three-dimensional movements provided by the horse's walking awaken in the body of the practitioner with special needs, a large amount of sensory and neuromuscular stimuli that will directly interfere in the global development and in the acquisition of motor skills, facilitating the construction of a social life productive through independent activities of daily living, work, leisure and sports.[10]

Riding is in itself a stimulus for balance, but some maneuvers can be used to increase the amount of stimuli: the practitioner can be asked to close his eyes, remove his feet from the stirrup, exercise with the upper limbs; stand on the stirrup; kneel in supine or prone position on the horse's back, perform a turn or make the horse walk and stop several times.[10]

Furthermore, physiotherapy is aimed at developing proposals that are in accordance with the patient's needs and with problems related to frequent postural adjustments in DS, such as motor delays.[8] The patient is positioned according to the objectives of the stimulation, and this function is up to the physiotherapist as well as, the choice of accessories for the mount and the

transfers of the horse to the ground.[6-8] The three-dimensional movement performed during the horse's gait is similar in angles to the human gait so it passively moves the child's pelvis and causes disturbances in the center of gravity and tonic-postural adjustments. The horse riding practitioner is guided to follow the horse's movements, maintaining balance and motor coordination to simultaneously move the trunk, arms, shoulders, head and the rest of the body, within its limits.[3-4]

Even when standing still, the horse performs movements that promote tonic adjustments such as: moving the head sideways, up and down, and when changing the feet or even when wagging the tail. During the step shift, 1 to 1.25 movements per second will be generated, so in 30 minutes, the practitioner performs from 1,800 to 2,250 tonic adjustments.[11]

The practitioner must follow the movements performed by the horse having to maintain balance, the stimulus will favor the facilitation of balance by stimulating the key points. The sitting position on the horse with displacement at a step provokes proprioceptive information in muscular, periarticular and tendon regions, allowing the creation of new corporal schemes, being a neuromuscular reeducation technique. Still during the step displacement, the rhythmic tonic adjustments perform a bone-articular mobilization, which facilitates the proprioceptive information so that the practitioner adapts to the movements, the simultaneous contraction and relaxation of the agonist and antagonist muscles is necessary..[11-12]

The balance deficit can be explained by the fact that children with DS oscillate because of the difficulty in capturing the sensory information of proprioception, which determine the position of the body in space and the speed with which the body is moving. In a systematic review study about postural control in balance in individuals with Cerebral Palsy, they observed that most of the children studied presented visual alteration, thus proving this fact, it is known that for a good postural control, the harmonic integration of the three systems (visual, vestibular and somatosensitive), and the study showed that this interaction, in children with DS, was not occurring.[10]

At times when visual information was not available, the child with DS presented greater oscillation when compared to the condition where vision was preserved. Some studies have pointed to an increase in body sway when sensory information is removed or manipulated.[13]

The balance deficit can last until adolescence and compared to results before and after hippotherapy intervention, there was an improvement, however, not reaching what would be normal for the sample's chronological age. Exercises to stimulate the balance of the practitioners, performing the anterior trunk flexion, to caress the animal's head and perform its extension, lying on the animal's back, these exercises must be done first with the horse stopped, for the practitioner to create strategies to stay on top of the animal and after this habituation, therapy can be hindered, performing these movements with the animal in motion.[7,10]

During the practice of hippotherapy the proprioceptive, vestibular and sensomotor systems are also stimulated, helping to improve posture and muscle strength. Authors reported muscle weakness in these individuals, according to the deficit of strength in upper limbs and lower limbs, obtaining improvement in both after the intervention with hippotherapy, however, in the upper limbs it did not reach the degree of normality and in the lower limbs total recovery occurred.[2,4]

Thus, hippotherapy stimulates muscle strength, mainly of lower limb muscles, to provide this muscle strengthening, during therapy the practitioner is asked to use the stirrup to stay in the orthostatic position, in addition, muscle strengthening also occurs at the end of therapy when the practitioner helps to disassemble the animal's accessories, having an adjustment in the muscular behavior.[13]

Improvement of motor coordination is necessary, as it is essential for the improvement of balance, which is efficient to develop a better gait pattern. Then even a simple act such as: combing the horse's mane, directing the practitioner to pick up playful or natural objects (plants) suspended, will stimulate the patient's global motor coordination.[12]

Hippotherapy also acts positively to improve gait, balance reactions and weight transfer. The benefits in improving the gait are due to the three-dimensional movement of the horse that will generate more complex courses of rotation and translation. The proprioceptive information is interpreted by sensory organs of balance and posture thus requiring the child's adjustment, the horse's steps will stimulate the balance reactions providing the restoration of the center of gravity within the support base.[12]

Physiotherapy when put into practice through Equine Therapy will directly influence motor acquisition in patients with DS; with improvement in this aspect, this resource being more notable when associated with physical therapy treatment.[9]

Thus, hippotherapy has a positive impact on improving the motor development of children with DS. There are countless benefits of the technique, due to the fact that several systems are stimulated, such as proprioceptive, somatosensory, vestibular and visual, thus triggering a general improvement in balance. The maintenance of muscular strength and motor coordination are essential for a good execution of the gait, and hippotherapy is an important ally to obtain both.

The technique promotes the participation of the entire body, thus contributing to muscle relaxation, awareness of the body itself and soon resulting in the improvement of motor coordination, with the benefits of pelvic mobilization, lumbar spine, hip joints, and posture , developing the coordination of movements between trunk, limbs and vision, stimulating tactile, visual, auditory, olfactory sensitivity, effectively improving sensory and motor integration.[1]

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