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Positive impact of vestibular training along with neurodevelopmental therapy to improve overall quality of life of a cerebral palsy baby: A case report

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ABSTRACT

Cerebral palsy is a term used to represent a wide range of non-progressive motor disabilities caused by brain injury at or around birth. A lesion in the juvenile brain causes a disturbance of posture and movement. It is also known as static encephalopathy or little's disease. It is a condition that arises as a result of CNS injury, which can occur before, during, or shortly after the child's birth. The impact will not intensify but will remain continuous. However, if correct care is not provided, the kid's condition may worsen, not because of an increase in brain lesions, but because the damaged brain is unable to cope with the physical demands of the growing body and the rising demands of the environment in which the child lives. The greatest method to ensure a child's optimum quality of life as they transition into adulthood is to actively address the symptoms of cerebral palsy.

Keywords: Cerebral palsy, Ball exercises, Physiotherapeutic approach, Case report.

1. INTRODUCTION

A lesion in the developing brain can lead to a dysfunction of posture and movement. It can be called a little's disease. The most frequent type of motor disability in children is cerebral palsy (Wimalasundera and Stevenson, 2016). According to the Developmental Disabilities Monitoring and CDC's Autism, CP affects around one in every 345 children. Boys are more likely than girls to have CP, and black children are more likely than white children to have it. The majority of children with CP almost 85 percent have spastic CP (Reddihough and Collins, 2003). Antenatal Causes are first or second-degree consanguineous relationship, Rubella, CMV infections, low blood sugar, injury to the mother, if the fetus is malnourished, especially when there are

twins when the mother's womb was repeatedly exposed to X-ray. Mother's long-term use of steroid medicines. Premature neonates are more likely to suffer brain damage as a result of birth stress or later due to undeveloped respiratory and cardiovascular systems. As a result of their liver immaturity, they are more likely to acquire hypoxia and hypotension, as well as hypoglycemia, jaundice, and hemorrhage (Gilson et al., 2014).

The delayed cry is a postnatal cause that causes asphyxia to the brain, resulting in cerebral palsy, jaundice, severe trauma during birth; meningitis and encephalitis are infections that can cause brain damage. The following are some common indications and symptoms, difficulty in sucking, chewing, speaking, eating, excessive drooling, or swallowing difficulties delays in reaching milestones of motor skills, such as sitting up or crawling, difficulty in learning. Injuries to the brain can cause various neurological issues like seizures (epilepsy), hearing and vision impairments unusual eye movements, unusual touch or pain sensations, constipation, other bowel and bladder issues, and behavioral and emotional disorders.

According to topographical classification, C.P. is classified into quadriplegia, diplegia, paraplegia, triplegia, hemiplegia, and monoplegia and according to Swedish classification it is classified into spastic, athetoid, ataxic, and mixed types (Rethlefsen et al., 2010). It can be diagnosed child's growth and development through time. The persistence of basic reflexes, abnormal muscle tone, and delayed motor development are all early indicators of cerebral palsy, which depends on circumstances such as deformities and congenital abnormalities. Cognitive tests and medical assessments can also aid in the confirmation of a diagnosis. The severity of the condition can also be determined by mobility, speech-language, auditory, sight, feeding, and digestive tests. Genetic screening, computerized tomography scans (CT), cranial ultrasounds, electroencephalograms (EEG), and neuroimaging (MRI) scans are all other appropriate laboratory procedures.

The importance of early identification and intervention in the management of cerebral palsy is widely recognized, if not identified adequately, issues such as contracture, scoliosis, malnutrition heart, and lung illness, osteoarthritis, osteoporosis, fractures, and mental health issues Muscle stiffness, muscle weakness, and coordination problems might arise. Cerebral palsy has little effect on life expectancy. Treatment of physical and neurological symptoms, on the other hand, may enhance prognosis (Aisen et al., 2011).

2. PATIENT AND OBSERVATION

Patient Information

A 2.5-year-old child was admitted to the pediatric ward with chief complaints given by her mother were drooling of saliva, unable to achieve milestones such as head and neck control, unable to do quarter turn, difficulty in maintaining static sitting balance, and seziuring gait in supported standing. As per family members, the mother had a seizure on 18/4/2019 during ANC at home, and then she was taken to the hospital at Pune they reached after 4 hours, after which a detailed physical examination was conducted and found out mother had high blood pressure and got unconscious after which via LSCS (lower segment cesarean section) i/v/o to eclamptic mother on the same day which was her 36 week of delivery. After 1 hour of delivery, the mother got conscious. At birth, the patient weighed 2.3 kg, with a head circumference of 33 cm and height of 48 cm to a primigravida mother. The patient cried delayed after birth and was shifted to NICU for 5 days. And then again at 13 months, the patient had an episode of tonic type of seizure for 3 min after which investigations were conducted and diagnosed as meningitis and developmental delay, after which the patient was discharged with phenobarbitone medications and the patient was brought home. But again patient had the same episode of convulsion at 15 months with uprolling of eyeballs, tightening of limbs which was lasted for 2 min and with these complaints was taken to AVBRH with complaints of inability to sit and walk and a history of fever since morning with chills rigors and cold since 1 day. After which for further physical therapy treatment she was brought to a neuro physiotherapy rehabilitation center.

3. CLINICAL FINDINGS

Consent was taken by the patient's mother, after which a physical examination was performed. The patient was examined in a supine lying position. When examined patient had partial head control, ATNR was present over the right side, and startle reflex, plantar and palmar grasp with flexor withdrawal were also present. Milestones were noted in which gross motor dimensions were developed were head and neck control was partially developed and rolling, crawling, creeping, sitting, and standing was not achieved, while fine motor dimensions that the patient could achieve were holding the object and putting into her mouth, and other activities such as drawing, dressing were unable to achieve. Other social skills were as smiling, and crying was developed but eye-hand coordination was yet to develop. The patient was able to bable and responded by making sounds, the patient was able to respond to her own name.

On examination

Reflexes were taken of the biceps, triceps, knee, and plantar which were absent over the left side and normal over the right side. The tone was assessed which was grade 1 on MAS of both lower and upper extremities. Head circumference was noted which was approx 36 cm. Tendoacilies and adductor tightness were noted.

Outcome measure

A gross motor function measure- 88 scale was taken which pre-treatment score is 28% and post treatment score is 66%. There was a huge improvement in the Item A (Lying and Rolling) and Item B (Sitting). Gross motor function classification system pre-treatment scored 5 and post treatment scored 4. Modified ash worth scale was taken which on pre-treatment scored 1 and post treatment it scored 0 (normal). On voluntary control grading pre-treatment patient scored 0 and post treatment scored 2 (figure 1).

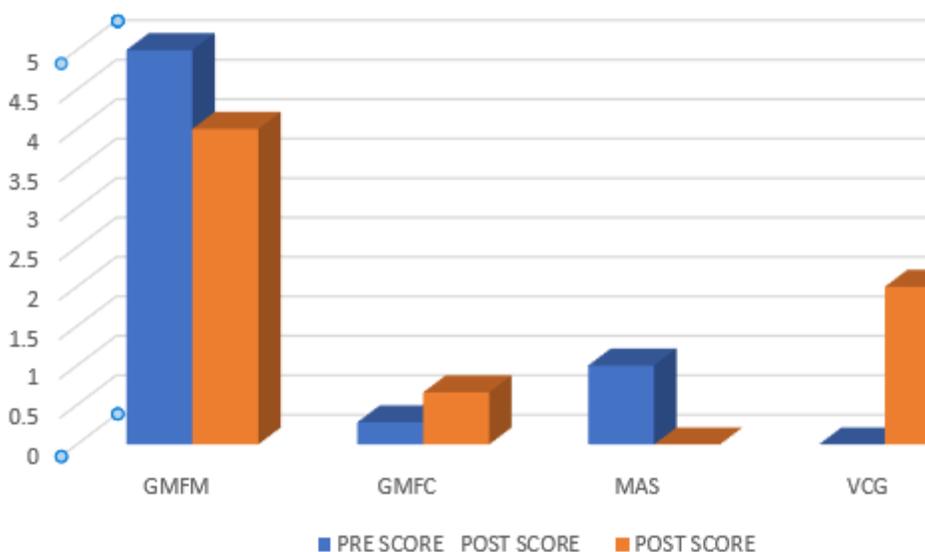


Figure 1 showing graphs of outcome measures used pre and post treatment in our case study.

Timeline of Current Episode

3 JAN 2022- Date of admission, 18 APRIL 2019 – date of seizure episode to patient’s mother, 12 APRIL 2020 – date of 1st seizure episode to the patient, 10th JUNE – date of 2nd seizure episode to the patient, date of physical therapy started – 8 FEB 2022.

Diagnosis

Spastic diplegic cerebral palsy with developmental delay

Therapeutic intervention

Physiotherapy is frequently used as the 1st step in the treatment of cp. Medication and surgery are two options for cerebral palsy treatment. The purpose of cerebral palsy treatment is to control symptoms, decrease discomfort, and increase independence so that you can live a healthy lifestyle. Physiotherapists strive to treat symptoms as soon as possible in order to avoid severe sequelae like scoliosis and contractures Strength and flexibility exercises, thermotherapy, and in physical therapy, devices are utilized to help children with cerebral palsy obtain more independence. The efficiency of physical therapy is based on the severity and type of cerebral palsy in each case.

Principles of Treating C.P patients

Careful evaluation and documentation of the child should be a continuous process rather than a one-time event; realistic plans and measures must be created on the basis of the evaluation, and initial therapy should be incorporated into the child’s daily management. Learning and adopting a changed motor pattern requires repetition and reinforcement. Maximize most of their proprioceptive interactions, involve the baby as the active patient, and maintain the child’s motivation throughout the treatment process. The baby’s therapy is a collaborative approach, and the therapist should include family members in the child’s care. The

therapist can also provide general advice on topics that can affect your daily life, such as posture and proper lifting or carrying procedures to avoid injuries. Developmental training should be given due care. To aid in the development of the function, the abnormal tone should be modified. The therapist should use as many afferent stimuli as possible. All active actions with a goal should be made easier. Secondary impairments such as contractures and deformities should be reduced to a bare minimum. Functional independence, with or without compensation, is necessary.

Stretching and mobility

To maintain normal muscular control and postural corrections, the muscles shall be properly retained at their normal length. Muscles with CP are frequently in a shortened position as a result of the deferred or absent of typical movement, therefore stretching is necessary to improve neuromuscular control.

Developing postural reaction

If the baby requires mobility freely and adjust to a variety of environmental challenges quickly, postural modifications are required. Good postural reactions are the greatest way to attain motor milestones. Righting reactions, protective extension, and equilibrium reactions are the three types of postural reactions. Righting reflexes are first developed in youngsters. Because of the child's righting reactions, they can reposition their head in space so that their eyes and lips are horizontal regardless of their body's orientation. It also aids in maintaining good head alignment in relation to the body and vice versa. Protective extension emerges after a righting reaction develops in a specific location. Finally, an equilibrium reaction occurs, assisting the patient in counteracting the opposing force and maintaining balance. Various exercises on vestibular balls and tilt boards are the most effective in developing these reactions. Sensory integration is the ability to perceive and arrange numerous sensations so that they can be used to conduct various actions. The therapy might include a variety of functional tasks using various objects, sizes, colours, textures, and weights.

Oromotor control training

Good head control is essential for oromotor function other oromotor difficulties include drooling, swallowing, sucking, body movements associated with speaking, hypo or hypersensitivity, and insufficient tongue movements. As a result, therapy should include developing good neck control, developing good trunk control, and using a brush to reduce drooling. Other strategies employed to enhance the patient's condition included the Phelps Technique, in which we used a variety of exercise modalities such as passive movements, active assisted movements, and condition motion employing fundamental PNF patterns to achieve the required response.

The deformity was corrected after a sufficient amount of rest and the usage of braces. The following ontogenic motor patterns were used: *supine withdrawal*: In the supine posture, complete flexion is achieved. Arms are crossed across the chest, while the legs are flexed and abducted. To gain trunk stability and generate flexion reflexes, this technique is used. *Rollover*: As the trunk rotates, the arm and leg on the same side flex. Used to induce lateral trunk responses as well as for people whose tonic reflexes are dominant; *Prone Extension*: The child is lying prone with his or her upper torso and head extended. While the hips and knees extend off the support surface, the shoulders abduct, extend, and externally rotate. The extensors and abductors contract isometrically as a result of the pattern. *Prone on Elbows*: A trunk extension pattern that inhibits tonic neck reflexes while also providing trunk and proximal limb stability; *Quadruped*: A person stands "on all four limbs" to generate co-contraction patterns in the limbs and trunk. Further physiotherapeutic program with their rationale is given in table 1 in tabular format and explained in picture format in figure 2, 3, 4 and 5.

Table 1 showing physiotherapeutic intervention with their rationale.

Sr.no.	Goals	Intervention	Plan of care	Rationale
1	Family education	Education given regarding the condition and Proper handling of a child is explained to the parents.		
2	To prevent drooling	Child should sit erect with support and fill a spoon with honey or sugar and let him try and lick it off and suck and swallow it off the spoon. Or		It will help the child in swallowing and taking feed.

		give a child a lollipop and make him lick it off.		
3	Proper positioning	<p>A spastic child is made to lie on the stomach with hip and knee straight and feet apart, upper limbs should be positioned overhead.</p> <p>AFO is given to prevent contracture deformity.</p>		<p>Positioning prevents contractures and deformity to facilitate movement and to enable function.</p> <p>AFO maintains the ankle in a neutral position.</p>
4	To reduce tightness in bilateral hamstring, adductors, and tendon Achilles	<p>Hamstring stretching –the child in supine position hip in 90 flexion and with the other hand extend the knee.</p> <p>Adductor stretching – to stretch left adductors put the left leg over the right in a figure of four and then apply stretch on the left side in down word direction.</p> <p>Tendoachilles stretching- stabilize the leg to be tested at the middle one 3rd of the tibia, and with the other hand. Take the patient’s foot into dorsiflexion.</p>	<p>30 sec holds with 3repetition.</p> <p>30sec holds with 3 repetition</p> <p>30 sec hold with 3 repetitions.</p>	<p>Stretching helps to maintain muscle length and prevent contracture development</p>
5	To improve neurodevelopment	<p>Child is made to lie on the stomach on the therapeutic ball and a stroking stimulus is given over the neck.</p> <p>To initiate rolling made a child lies on back with the shoulder (of turning side) above the head. And then the caregiver bends the opposite knee with one hand and the other hand supports the pelvis.</p> <p>prone on elbow –the child is made to lie on stomach on bolster with elbow and hands resting on the bed keeping arms slightly away from the body and hands touching each other, both lower limbs should be straight. Similarly after gaining control on prone on the elbow make the child prone on hands and then half prone.</p>	<p>2-3 strokes for 10 repetition</p> <p>10 repetition</p> <p>10 repetition</p>	<p>This stroking stimulus helps the child to develop neck control.</p> <p>The stimulus of pulling pelvis toward, and the whole pelvic girdle is rotated. This encourages to rotate independently.</p> <p>This stimulates all the muscles of shoulder region to stabilise the position. This position is useful to counteract stooping posture when there is minimal loss of normal extensibility.</p>

		<p>On all four limbs, both upper limbs are straight with hands on the bed and both the knees are bent with weight bearing at knees and hands. Maintain the position once it is achieved, do dynamic activities by showing toys reach-outs are given.</p> <p>Crawling can be started when all four limb position is maintained. The child is put in all four limb positions with a crawler, alternate upper and lower limbs are moved. Initially, the child needs support in the abdomen.</p>	<p>10 repetition</p> <p>10 repetition</p>	<p>It is a crawling beginning position that allows the patient to move in any direction at floor level.</p> <p>It improves whole-body coordination, including the reciprocal movement of the arms and legs essential for walking.</p>
6	To improve the strength of abdominal and pelvic girdle	<p>To strengthen abdominal muscles, the child in supine lying either on a bolster or on a bed with legs straight or bent. The child tries to lift her upper body and come to a sitting position.</p> <p>The child is in a supine position with knee bent, feet are flat on the bed and leveled with each other stimulus is given to actively lift the pelvis up the bed.</p>	<p>sec holds with 10 repetition</p> <p>5 sec holds with 10 repetition</p>	<p>Helps to strengthen the rectus abdominal muscle and pelvic bridging helps to strengthen the gluteus muscles and hamstrings. this will help a child to develop trunk control and to make a base of support to achieve sitting.</p>
7	To make a child sit	<p>On the therapeutic ball place the child on side-lying with humerus flexed above the head and bearing weight on the upper trunk and arm. This helps to stabilize the insertion of latissimus dorsi and the therapist control the pelvis, ribs, lateral trunk or spine to lengthen the muscle.</p> <p>Take the child on the therapeutic ball in a sitting position and then roll the ball side to side.</p>	<p>5sec hold with 5 repetitions on each side.</p> <p>10 repetitions</p> <p>10 repetitions</p>	<p>When bilaterally acting latissimus dorsi helps to stabilize the spine in sitting position to prevent collapse in either flexion or extension. Thus it is necessary to lengthen it.</p> <p>This helps to develop postural control in child.</p> <p>This helps to facilitate</p>

		<p>The child is taken on the therapeutic ball in a sitting position with lower extremities in a dissociation position. The ball is moved forward and backward diagonally.</p> <p>Long-legged sitting – child is made to sit on the floor or bed with knee straight and legs slightly apart. Support to the child is given by an adult sitting on the floor with legs astride, the child sits in the same direction obtaining support for the trunk and pelvis.</p>	<p>20 min sitting position maintained</p>	<p>controlled use of flexors and extensors across the body and pelvic femoral rotation which leads to equilibrium control in the trunk and hips.</p> <p>This provides stretch to muscles at the back of the thigh and calf muscles. This position enables hand function by bringing the hands into midline assisted by gravity.</p>
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Figure 2 showing vestibular rehabilitation on therapeutic ball.



Figure 3 showing child is made to lie on the stomach on the therapeutic ball and a stroking stimulus is given over the neck.



Figure 4 shows helping the child to bear weight in side lying position on ball.



Figure 5 showing seizing gait.

4. DISCUSSION

People with special needs, like in this example, are a particularly vulnerable segment of the population who are frequently overlooked on a national level, particularly in developing countries so appropriate treatment is necessary for them. Scholtes et al., (2010) conducted a study and found that the most studied intervention was strength training, followed by dynamometry demonstrating considerable gains in several muscle areas showed increased strength, although fewer trials showed substantial changes in function. Gross motor function, endurance, and temporospatial assessments all improved after functional training. Moraes et al., (2016) conducted a study and found out hippotherapy has to maximize the functional performance of children with CP, considerable improvements in dimension E and the GMFM -66 total score were made.

Elbasan et al., (2018) conducted a study with modality neuromuscular electrical stimulation along with NDT and found a great effect for training postural control, while the same group conducted another study in which they compared Kinesio taping with the neuromuscular electrical stimulator and found that both were effective for training postural control.

5. CONCLUSION

The importance of early identification and intervention in the management of cerebral palsy is widely recognized. Treatment of physical and neurological symptoms, on the other hand, may enhance prognosis. It helps with pain alleviation and muscle stiffness,

as well as improving balance, coordination, and overall wellness. The goal of cerebral palsy treatment is not to cure or entirely correct a child's condition. Treatment focuses on preserving a child's residual abilities in order to lessen symptoms and promote independence. In our case study, we discovered that treating the child with various approaches resulted in a significant improvement in her condition, as well as assisting the patient's parents in reaching milestones and gaining confidence. It has the potential to aid in the improvement of motor skills balance, flexibility, mobility, posture, strength, coordination, strength, flexibility, endurance, gait, manage pain, overall health, and prevent movement problems from getting worse over time.

Patient Perspective

The patient's parents had physiotherapy rehabilitation, which helped them improve their child's development, achieve milestones as well as gain confidence.

Informed consent

Written and oral informed consent was obtained from all individual participants included in the study. Additional informed consent was obtained from all individual participants for whom identifying information is included in this manuscript.

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Abbreviations

CP- cerebral palsy

CMV- cytomegalovirus

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Conflicts of interest

The authors declare that there are no conflicts of interests.

Data and materials availability

All data associated with this study are present in the paper.

REFERENCES AND NOTES

1. Aisen, ML, Kerkovich D, Mast J, Mulroy S, Wren TAL, Kay RM, Rethlefsen SA. Cerebral palsy: clinical care and neurological rehabilitation. *Lancet Neurol* 2011; 10, 844–852. doi.org/10.1016/S1474-4422(11)70176-4
2. Elbasan B, Akaya KU, Akyuz M, Oskay D. Effects of neuromuscular electrical stimulation and Kinesio Taping applications in children with cerebral palsy on postural control and sitting balance. *J. Back Musculoskelet Rehabil* 2018; 31, 49–55. doi.org/10.3233/BMR-169656
3. Gilson KM, Davis E, Reddihough D, Graham K, Waters E. Quality of life in children with cerebral palsy: implications for practice. *J Child Neurol* 2014; 29, 1134–1140. doi.org/10.1177/0883073814535502
4. Moraes A, Copetti F, Angelo V, Chiavoloni L, de David A. The effects of hippotherapy on postural balance and functional ability in children with cerebral palsy. *J Phys Ther Sci* 2016; 28, 2220–2226. doi.org/10.1589/jpts.28.2220
5. Reddihough DS, Collins KJ. The epidemiology and causes of cerebral palsy. *Aust J Physiother* 2003; 49, 7–12. doi.org/10.1016/s0004-9514(14)60183-5
6. Rethlefsen SA, Ryan DD, Kay RM. Classification systems in cerebral palsy. *Orthop Clin North Am* 2010; 41, 457–467. doi.org/10.1016/j.ocl.2010.06.005
7. Scholtes VA, Becher JG, Comuth A, Dekkers H, Van Dijk L, Dallmeijer AJ. Effectiveness of functional progressive resistance exercise strength training on muscle strength and mobility in children with cerebral palsy: a randomized controlled trial. *Dev Med Child Neurol* 2010; 52, e107-113. doi.org/10.1111/j.1469-8749.2009.03604
8. Wimalasundera N, Stevenson VL. Cerebral palsy. *Pract Neurol* 2016; 16, 184–194. doi.org/10.1136/practneurol-2015-001184