

Impact Of Balance On Daily Activities And Quality Of Life Of Children With Cerebral Palsy

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Abstract

There are various causes of cerebral palsy, a brain injury that impacts movement, posture, and balance, and it affects 1-2 out of every 1,000 live births. There are four types of movement disorders that can be associated with cerebral palsy: spasticity, dyskinesia, ataxia, and mixed/other. Among children with cerebral palsy, spasticity is the most prevalent movement disorder, affecting 80% of cases. Children with CP often struggle with functional balance due to their impaired postural control mechanism. Prior research on the topic of balance indicated that, in comparison to normally developing children, children with CP exhibited significantly worse static and dynamic balance reactions. Maintaining a stable and oriented body position is the goal of postural control. Enhancing postural control and balance requires core stability. One novel approach to strengthening muscles in a range of therapeutic contexts is whole-body vibration. Children with CP already struggle with mobility, participation, and ADL performance, and these balance issues make falls more likely. Children with cerebral palsy (CP) are among the many populations that have their functional mobility and balance evaluated using the Timed Up and Go (TUG) test. The present review highlights the importance of practising balance exercise for the children with CP.

Keywords: Brain, Cerebral Palsy, Children, Exercise, Mobility

Introduction

Muscle movement and coordination are impacted by a group of disorders known as cerebral palsy (CP). Visual, auditory, and tactile impairments are common in cerebral palsy patients. Anything pertaining to the brain is what the word "cerebral" implies. The term "palsy" refers to a lack of strength or difficulty moving the body [1]. When it comes to childhood motor disabilities, cerebral palsy is by far the most common culprit. One to four out of every 1,000 people will be affected by it, according to the CDC. Depending on the individual, cerebral palsy symptoms can be mild, moderate, or severe. Both sitting and walking can be challenging for some people with cerebral palsy. Some people with cerebral palsy have problems with dexterity when it comes to holding things. As a child matures and enhances their motor skills, the impact of the condition may become more apparent or more restricted. Additionally, they differ based on the specific region of the brain that was impacted [2,3].

It is possible for these children to have defects in their postural mechanisms, such as righting and equilibrium reactions, antigravity mechanism, proximal stability, and postural fixation. In a typical child, the development of core strength begins with the consistent practice of active movements against gravity, which is followed by the utilisation of the functional pattern. Children who have cerebral palsy, on the other hand, have restricted movement patterns, which subsequently results in a reduction in the strength and endurance of the primary muscle groups later in life. The impairment of motor control in the lower extremities of children who have diplegia is significantly greater than the impairment in the upper extremities. In addition, because children who have hemiplegia have motor disabilities in one half of their body, they exhibit limited postural adjustment of the lower extremities when they are exposed to certain external disturbances [4].

For children with cerebral palsy, it is possible to modify core stabilisation and strengthening programmes in order to facilitate both fine and gross motor functional movements more effectively. Furthermore, these programmes have the potential to enhance gait, balance, postural control, stability, and reduce muscle tone during the process. Systems of global and local stability have been utilised in conjunction with one another in order to accomplish core stability. The superficial and longer muscles of the abdominal and lumbar regions are included in global stability systems. These muscles include the rectus abdominis, paraspinals, and external obliques, which are the primary movers of the trunk or hip. The transverse abdominis and multifidus are two examples of deep abdominal muscles that are part of the local stability systems. These muscles are responsible for maintaining the stability of the lumbar spine during movements that are used to gain postural adjustments [6,7].

The ability to maintain a steady state of equilibrium is known as balance. One can categorise it as static balance or as dynamic balance. Balancing, motor function, activity, and participation disturbances are symptoms of cerebral palsy [8].

To generate motion, one must keep their back straight and rely on their abdominal muscles to build up enough strength, stamina, and power. To better understand the role of the core muscles, think of them as a muscular box: the diaphragm on

top, the hip girdle and pelvic floor muscles on bottom, the abdominals in the front, and the gluteal and paraspinous muscles on the back. These muscles not only provide the groundwork for movement of the limbs, but they also aid in controlling the position and movement of the central portion of the body. Children with CP can benefit from core stabilisation and strengthening programmes, which can help them become more stable and balanced [9,10].

Understanding Cerebral Palsy in Children

Cerebral palsy can be caused by abnormal brain development or by an injury to the brain while it is still developing. The damage has an effect on the region of the brain that is responsible for controlling posture, coordination, and movement of the body. Damage to the brain typically takes place prior to birth, but it is also possible for it to take place during birth or in the first few years of life [11].

These are some additional potential causes: head injuries as a result of a car accident, fall, or child abuse; intracranial haemorrhage, or bleeding into the brain; brain infections, such as encephalitis and meningitis; infections acquired in the womb, such as German measles (rubella) and herpes simplex; asphyxia neonatorum, or a lack of oxygen to the brain during labour and delivery; gene mutations that result in atypical brain development; severe jaundice in the infant. If you have any reason to believe that your child may be suffering from cerebral palsy, you should seek medical attention as soon as possible. Treatment and diagnosis at an early stage are of utmost importance [12,13]. Infants are more likely to develop cerebral palsy if specific risk factors are present. Some examples are: a low birth weight, before the due date; a low Apgar score, a measure of the baby's physical health at birth; breech birth when the baby's legs or buttocks emerge first; Rh incompatibility when the blood of the pregnant parent is incompatible with that of the baby. Being a twin or triplet increases the risk of a mother's exposure to harmful substances, such as illicit drugs or prescriptions, which can harm the developing baby [14].

Depending on the specific brain regions impacted, cerebral palsy can cause four distinct motor effects: disorders of smooth muscle tone; dyskinesia; hypotonia. As a child develops and tries new things, like walking with more accuracy, the visible effects can also change over the course of a lifetime, and many people have a combination of the two [15].

The Spinal muscular dystrophy, is the most prevalent form of the disorder. It makes walking difficult due to rigid muscles and heightened reflexes. Spastic cerebral palsy is associated with abnormal gait patterns in many patients, including involuntary knee crossing and scissor-like leg movements. Possible symptoms include paralysis and weakened muscles.

Paralysis of the cerebral cortex
Dyskinetic cerebral palsy is characterised by a lack of control over one's motor skills. The affected person may experience tremors, stiffness, and tremors of the limbs as a result of this disorder. The facial muscles and the tongue can be impacted by dyskinetic cerebral palsy in certain instances. The motions might be sluggish and writhing or quick and jerky. Because of the tremors, the affected person may find it difficult to speak, swallow, walk, or sit still [16].

Brachycephalic cerebral palsy
Among cerebral palsies, ataxic cerebral palsy occurs in an extremely rare occurrence. Voluntary muscle movements in people with ataxic cerebral palsy tend to be clumsy, jerky, or otherwise uncoordinated. Coordination and balance issues are common among people with this type of cerebral palsy. They might have trouble getting around and with fine motor skills like writing and grasping small objects [17].

Observable issues in daily activities of children suffering from cerebral palsy

Cerebral palsy with low tone, Hypotonic cerebral palsy is characterised by excessively relaxed muscles and reduced muscle tone. Its floppy, easily-moving limbs give the impression of being a rag doll.

Babies afflicted with this form of cerebral palsy often struggle to breathe and exhibit limited head control. Due to weakening muscles, individuals may find it difficult to sit up straight as they age. They may also encounter or undergo: speech issues; slow reflexes; abnormalities in gait. [18]. Other potential issues that may arise in individuals with cerebral palsy include issues with expression, including linguistic and speech disorders; problems with the spine, including kyphosis, lordosis, and scoliosis; Contractures caused by osteoarthritis happen when muscles become stuck in painful positions; bones are more brittle due to osteopenia, a condition characterised by low bone density; dental issues; leakage of urine.

Evidence based approaches for improving quality of life in children with Cerebral Palsy
Physical therapy, which includes a wide range of therapeutic interventions aimed at improving a patient's physiological and functional outcomes, is an integral part of cerebral palsy (CP) management. The efficacy of physiotherapy varies, despite its widespread use and recommendation by the entire healthcare team. Results from goal-directed/functional training, gait training to increase gait speed, and constraint-induced movement therapy for the recovery of the upper limbs were moderately effective. The effects of exercises on cardiorespiratory and strength training have been the subject of contradictory research. Treatments like neurodevelopmental therapy (NDT) failed to alleviate symptoms [19, 20].

In the study by Das and Ganesh, they concluded that the lack of motor skills in children with CP is a well-known fact, and physiotherapy treatments for the disorder should aim to increase the amount and quality of motor control. It is still unclear what kinds of activities and approaches should be promoted or if any external equipment is necessary to

supplement motor acquisition, despite the fact that the evidence of different techniques has been examined. Gait training, task-oriented functional training, and cognitive-motor training all showed promise in this group of patients. The evidence for other interventions is of very poor quality. There is insufficient evidence to support interventions like NDT, contrary to popular belief. Given the vital role that physiotherapists play in CP management, it is critical that all clinicians treating these children use the most up-to-date evidence to inform their treatment decisions. There needs to be immediate funding for more research with strict protocols [21, 22].

Another study by Ali *et al*, they studied that the lack of motor skills in children with CP is a well-known fact, and physiotherapy treatments for the disorder should aim to increase the amount and quality of motor control. It is still unclear what kinds of activities and approaches should be promoted or if any external equipment is necessary to supplement motor acquisition, despite the fact that the evidence of different techniques has been examined. Gait training, task-oriented functional training, and cognitive-motor training all showed promise in this group of patients. The evidence for other interventions is of very poor quality. There is insufficient evidence to support interventions like NDT, contrary to popular belief. Given the vital role that physiotherapists play in CP management, it is critical that all clinicians treating these children use the most up-to-date evidence to inform their treatment decisions [5].

Functional balance is affected in children with Cerebral Palsy (CP) due to impaired trunk control. Nevertheless, research on the connection between CP children's trunk control and their balance is scarce. When considering we used TCMS and PBS to assess twenty-four children with spastic CP, ranging in age from eight to fourteen years old and classified as Level I to III on the Gross Motor Function Classification System (GMFCS). The summary measures used to express the results were the interquartile range (IQR) and the median (M). We used Spearman's correlation coefficient to see how well TCMS and PBS were related to one another. The findings revealed the children achieved a median TCMS score of 52 out of 58 and a PBS score of 50 out of 56. An extremely strong correlation was observed, with $r_s=0.77$ and $p<0.01$. All three components of TCMS and PBS, static, dynamic, and total, showed a significant correlation ($p<0.01$). There was a strong correlation ($r_s=0.74$) between the median scores of TCMS and PBS for boys and a very strong correlation ($r_s=0.84$) for girls. There was a highly significant correlation ($r_s=0.85$) between the types of spastic CP and diplegics. Although there was a weak correlation for level I ($r_s=0.27$), there was a very strong correlation for level II ($r_s=0.81$) and level III ($r_s=0.86$) based on GMFCS levels [23].

Role of Balance in improving quality of life in children with cerebral palsy

Thirteen different balancing exercises that can aid children with Cerebral Palsy in developing stronger legs and better overall balance. Individuals with a moderate level of core stability, the ability to sit independently on the floor, and a basic level of standing balance can all benefit from these exercises. Maintaining one's balance by means of the legs, knees and hands, asymmetrical standing, bridging, high kneeling, half kneeling, standing at furniture, cruising, standing against a wall, playing while free-standing, walking with a walking aid, walking independently, and trampoline jumping are all part of the programme [24].

In one of the studies, children with diplegic cerebral palsy were the subjects of this study, which aimed to assess the impact of balance training on postural control and fall risk. **Methods:** The research included 30 children, ranging in age from 10 to 12, who suffered from spastic diplegic cerebral palsy. The kids were split evenly between a control group and a study group. A conventional physical therapy exercise regimen was administered to participants in both groups. In addition, the research participants learned how to use the Biodex balance system for stability exercises. For three months in a row, patients received treatment for 30 minutes three times a week. The children who took part in the study were given the Biodex balance system to use both before and after the treatment to determine their level of stability and fall risk. Overall stability index of the fall risk test, total score of the paediatric balance scale, total time to complete the test, and overall direction control were all measured. The outcomes demonstrated that after treatment, the children in both groups significantly improved the mean values of all measured variables ($p<0.05$). Additionally, the study group demonstrated noticeably greater improvement in the measured parameters in comparison to the control group ($p<0.05$). In conclusion, children with diplegic cerebral palsy can benefit from balance training on the Biodex system, which can help them improve their postural balance control [25].

Concluding remark

Additional issues that can arise from cerebral palsy movement disorders include dislocation or pain in the hips, issues with balance, dysfunction in the hands, and equinus deformity. Though clinical presentation is the gold standard for cerebral palsy diagnosis, MRI may help rule out other possible causes of the patient's symptoms and confirm brain damage. The Gross Motor Function Classification System is one tool that can be used to assess the severity of cerebral palsy and the response to treatment after a diagnosis has been made. Occupational and physical therapy, intramuscular onabotulinumtoxin A, selective dorsal rhizotomy, systemic and intrathecal muscle relaxants, and other treatments are available for the movement disorders linked to cerebral palsy. Many adult-onset complications in cerebral palsy patients include cognitive dysfunction, seizures, pressure ulcers, osteoporosis, behavioural or emotional issues, speech and hearing impairment, and issues unrelated to movement. Some of the methods of improvement in condition include physiotherapy, balance therapy, and other exercise. Balance exercise benefits regardless of the type of cerebral palsy they have. These

exercises can help strengthen weak muscles, reduce the risk of falling, and help them become more independent. On the other hand, children who have spastic or dyskinetic cerebral palsy may sometimes struggle with balance issues as a consequence of spasticity or movements that are difficult to control. But with the practising, the muscular moments can be trained to help improve the quality of life for the child with CP.

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