Multi-Knowledge Electronic Comprehensive Journal For Education And Science Publications (MECSJ)
Issues (60) 2022
ISSN: 2616-9185
www.mecsj.com

Effect of trunk control changes on access to children with progressive spastic cerebral palsy

Khulood Ahmed Bader
Physiotherapist
+966505268398
Saudi Arabia

Seina Marzouq Alghamdi
Physiotherapist
+966503231592
Saudi Arabia

Hanadi Ibraheem Aqueel
Physiotherapist
+966504140035
Saudi Arabia

www.mecsj.com

Multi-Knowledge Electronic Comprehensive Journal For Education And Science Publications (MECSJ)

Issues (60) 2022

ISSN: 2616-9185

Abstract

Cerebral palsy is a disorder of muscle control which results from some damage to part of the brain. Cerebral palsy (CP) is a series of long-term abnormalities of mobility and posture that limit activity and are thought to be the result of non-progressive disruptions in the developing foetus or infant brain. In children with spastic cerebral palsy (CP), trunk control is compromised. Proprioception's joint position perception, which is a key aspect of maintaining spinal mobility and stability, is extremely important. The goal of the current study is to analyze the impact of trunk control modifications on children with progressive spastic cerebral palsy and evaluate the impacts of trunk control on motor function, which is crucial for children with CP and frequently seen as lacking in these children. A majority of children with cerebral palsy—between 80% and 90%—have spastic cerebral palsy. Spasticity in children with CP must be diagnosed through a thorough physical examination and any necessary auxiliary testing. The aim of cerebral palsy management is to promote functioning, improve capacities, and maintains health in terms of movement, cognitive development, social interaction, and independence rather than to cure or reach normalcy. When the support provided by the outside source matches their innate level of trunk control, children with cerebral palsy and trunk dysfunction exhibit increased motor performance.

Key words: *Cerebral palsy, trunk control, Children, progressive spastic cerebral palsy*

1. Introduction

Cerebral palsy (CP) is described as a permanent but not progressive impairment of the immature brain that is affected in the prenatal, perinatal, or postnatal period. The most common variety of CP (up to 70%) is spastic, which is characterized by increased muscular tone. Postural problems can result from contractures and abnormalities that are inversely proportionate to the kind and severity of CP. Children's physical development is being significantly impacted by atypical motor patterns, immature trunk control, abnormal tonus, and disorder of postural control (Kerem, 2009).

Skeletal muscles and brain systems have a convoluted relationship that affects trunk control. Muscle traits, spinal flexibility, and relationships between individual body parts and muscles are all examples of musculoskeletal components. Neuromuscular synergy responses of the motor process, visual, vestibular, and somatosensorily systems, which are included in the sensorial process, are the main neurological components to acquire trunk control. A high level integration approach that results in intuitive trunk control is also included in addition to these (Nicholson, 2001).

Poor trunk control in CP patients results from a variety of circumstances. The most significant factors contributing to disordered trunk muscle activity are increased co-activation between agonist and antagonist muscles and decreased range of motion and contracture. Controlling traffic is crucial for daily operations. The posture and balance control occurs automatically in healthy children. Due to vestibular issues and

Multi-Knowledge Electronic Comprehensive Journal For Education And Science Publications (MECSJ)
Issues (60) 2022
ISSN: 2616-9185
www.mecsj.com

balance issues, it is challenging for children with CP to achieve this control (Van der Heide & Hadders-Algra, 2005).

The majority of postural control studies in children with cerebral palsy focus on the gravity responses to disturbances in lower extremity balance, standing before walking, or primary trunk control for sitting. These studies demonstrate that independent seated balance and trunk control are crucial for walking in children with cerebral palsy (CP) (Van der Heide & Hadders-Algra, 2005). Trunk control is characterized as a factor that affects daily living early on and is connected to balance, mobility, and other functional skills (Furukawa, 2001). Youngsters with CP require more energy than children of the same age who are healthy due to their limited mobility (Arı & Kerem Günel, 2017). Children with CP use up to 2–3 times more energy during a submaximal activity than children of the same age who are healthy due to anomalies in muscle tone, weakness, trunk control, and skeletal deformities (Ohrvall, 2010).

The aim of this study was to evaluate the effects of trunk control alterations on access for children with progressive spastic cerebral palsy and explore the effects of trunk training on the motor functions of the trunk, upper, and lower limbs in children with bilateral spastic cerebral palsy.

Multi-Knowledge Electronic Comprehensive Journal For Education And Science Publications (MECSJ)
Issues (60) 2022
ISSN: 2616-9185
www.mecsj.com

2. Literature review

2.1 Cerebral palsy (CP)

A series of mobility and postural issues that limit activities and are known as cerebral palsy (CP) are caused by non-progressive abnormalities in the developing brain. Deficits in cognition, communication, perception, breathing, behavior, and the sensory system frequently accompany the motor impairments in CP (Rosenbaum, 2007).

Cerebral palsy is a group of disorders that affect movement, muscle tone, or posture. It occurs as a result of damage to the brain before its development, often before birth. Signs and symptoms appear during the infancy and preschool years. In general, cerebral palsy causes a movement disorder that is accompanied by exaggerated reflexes, looseness or spasticity of the limbs and trunk, abnormal posture of the body, involuntary movements, unsteadiness while walking, or a combination of these symptoms. People with cerebral palsy may have problems swallowing, and they usually have an imbalance between the eye muscles so that the eyes don't focus on the same thing. They may have limited range of motion in a number of joints in the body due to muscle stiffness (Apaydin & Aribas, 2018)

Cerebral palsy has many causes, and its effects on body functions vary greatly. While some people with it can walk, others need help walking. Some people may have intellectual disabilities that do not occur to others. It may result in epilepsy, blindness or deafness in some cases. Cerebral palsy is lifelong disorder. There is no cure for it, but treatments may contribute to improving motor function (Pavao, 2014).

Multi-Knowledge Electronic Comprehensive Journal For Education And Science Publications (MECSJ)
Issues (60) 2022
ISSN: 2616-9185
www.mecsj.com

Primary motor abnormalities in children with CP include lack of selectivity, movement, muscle weakness, aberrant muscle tone, reduced agonist-antagonist coordination, and lack of postural control. Additionally, as people age, these motor deficiencies cause secondary issues such contractures and bone abnormalities. All of these issues, whether main or secondary, may cause children with CP of varying severity to become less independent in their daily living activities (ADL) (Heyrman, 2014).

By regulating the center of gravity in the base of support, postural control is defined as guaranteeing proper body placement in space as well as maintaining body alignment and stability (Pavao, 2014). In children with CP, dysfunctional postural control is a major issue. One of the key components for postural control is trunk control. The trunk, which is the core of the body, acts as a secure foundation of support during upper- and lower-limb activities, regulates balance reactions, and ensures the proper performance of functional tasks. It also plays a significant role in actions like reaching and walking (Saether & Helbostad, 2015). The inability to control one's trunk limits involvement in ADL and impairs functional mobility and balance in children with CP (Apaydin & Aribas, 2018).

A non-progressive interference, lesion, or anomaly of the developing or immature brain causes a series of permanent, but not unchangeable, abnormalities of movement and/or posture and of motor function, which are known as cerebral palsy. Movement and posture are the main aspects of cerebral palsy. According to its definition, it is an "umbrella term covering a range of nonprogressive, but frequently changing, motor dysfunction syndromes related to lesions or brain anomalies occurring in the early stages of the brain's development (Mutch, 1992)." EPIDEMOLOGY unfortunately, it is challenging to ascertain the prevalence and incidence rate of impairments in settings with limited resources.

In addition to the fact that cerebral palsy is one of the most expensive chronic diseases and that the prevalence of childhood disabilities is rising, improved life expectancies also add to the burden of cerebral palsy. For example, 2-5/1000 children born in the USA have cerebral palsy, which affects about 700,000 kids. The most prevalent motor disability in children is cerebral palsy. Cerebral palsy has a very broad and complicated etiology. Congenital, genetic, inflammatory, viral, anoxic, traumatic, and metabolic factors are the causes (Padmakar, Kumar, & Parveen, 2018).

According to population-based research conducted all over the world, the prevalence of cerebral palsy ranges from 1.5 to more than 4 per 1,000 live births or kids in a specific age group. Spastic Cerebral Palsy (77, 4%) affects the majority of kids with cerebral palsy. The capacity to walk independently is present in 58.2% of children with cerebral palsy, whereas 11.3% use a handheld mobility aid and 30.6% have limited or no walking abilities. For example, 41% of children with cerebral palsy also have epilepsy, which is a common co-occurring illness (Morris, 2007).

There are three distinct forms of cerebral palsy, which can be identified by their signs and methods of treatment. Spastic, ataxic, and athetoid cerebral palsy are the three male CP subtypes. A. Spastic Cerebral Palsy:

This form of CP is the most prevalent. Muscle spasticity is the primary disability in patients with spastic cerebral palsy (CP), which is distinguished by distinct muscle tightness. At least 70% of all CP cases worldwide are of this type. Compared to other varieties of CP, spastic CP is easier to manage since it may be treated with medication using a variety of neurological and orthopedic techniques. In people between the ages of 20 and 30, muscular spasticity causes secondary muscle stress symptoms like tendinitis and arthritis (Himmelmann. & Hagberg, 2010).

Utilizing strengthening, stretching, exercise, and other physical activities, occupational and physical therapy can be utilized to manage this type of CP on a daily basis. Medications that treat spasticity by destroying the nerves responsible for the disorder can also be used to treat the disorder. In comparison to spasticity, type B ataxic cerebral palsy is less frequent, accounting for 6–10% of all instances of CP. The "ataxia-type" symptoms of ataxic CP cause some cerebellar damage. The kid can show signs of shaky posture. Additionally, one could tremble while grasping something with their hand. Such symptoms are a result of the child's motor abilities becoming impaired (Ashwal & Russman, 2004).

One may struggle with their ability to manage their motor abilities, which include holding small items, typing, and writing. Additionally, the kid might have some disorientation and shaky balance while walking. In ataxic CP, visual and auditory processing may also be impacted. Cerebral palsy type C, often known as dyskinetic CP, affects at least 10% of all cases of CP. The prevalence of this kind of CP is lower than that of spasticity. The ability to maintain stable positioning may be difficult for

Multi-Knowledge Electronic Comprehensive Journal For Education And Science Publications (MECSJ)
Issues (60) 2022
ISSN: 2616-9185
www.mecsj.com

patients with this sort of disease. It can be difficult to sit still and stroll while doing so; people could make some unintentional movements. Patients may also lose the ability to grasp objects, particularly those that are small and require fine or advanced motor skills. Such patients may not be able to hold small objects such as pens, coins and other small objects (Padmakar, Kumar, & Parveen, 2018).

2.2 Trunk control changes

A non-progressive, diverse neurological disorder called cerebral palsy (CP) is frequently accompanied with cognitive-attentional and visuomotor deficits. Due to their persistent issues with learning, planning, and synchronizing postural and voluntary movements, motor dysfunction is thought to be the most distinctive clinical indication in these kids (Krageloh-Mann & Bax, 2009). Children classified at levels IV and V, who are actually an understudied subpopulation; show the most severe functional deficits, according to the Gross Motor Function Classification System (GMFCS) (Rosenbaum & Walter, 2002).

In both sitting and standing, children with CP have a delayed acquisition and dysregulation of automatic postural reflexes. Children with GMFCS level III may be able to walk short distances with the help of outside aids, but they may still need assistance sitting down at younger ages and a hip support to maintain postural balance and maximize hand function at older ages. Children with GMFCS levels III to V receive significantly less sensorimotor experiences than typically developing children, which has an impact on their postural control (Palisano, 2007).

Multi-Knowledge Electronic Comprehensive Journal For Education And Science Publications (MECSJ)
Issues (60) 2022
ISSN: 2616-9185
www.mecsj.com

When motor development reaches a plateau early in childhood and a child with CP is unable to sit independently by the age of two, a lack of movement complexity and a poor motor prognosis are also seen in these cases. The neurological and musculoskeletal components of posture create a framework for stabilization that supports the ability to plan and produce deft reaching and fine manipulation (Shumway-Cook & Woollacott, 2012). (195–222)–10 Although postural and reaching skills start to appear in infancy, fine control takes a while to develop in childhood because reaching tasks need coordination of several degrees of freedom in the upper body (Zimmermann, Toni, & de Lange, 2013).

The type and quantity of support that should be employed to improve posture and subsequent upper limb function has generated conflicting results in research on postural control in children with cerebral palsy (McNamara, 2007). A crucial biomechanical component for improving head stability, visual field alignment, and hand manipulation in a variety of children with CP14 is stabilizing the pelvis and/or trunk. Maximizing function and encouraging voluntary control of posture, especially of the hands and arms, while requiring the least amount of outside assistance are significant goals in rehabilitation. Therefore, giving partial support rather than intermediate levels of trunk stability for children with CP would be preferable. On the other hand, the ideal degree of trunk support for a child with moderate-to-severe CP still remains unknown (Cheng, 2013).

Multi-Knowledge Electronic Comprehensive Journal For Education And Science Publications (MECSJ)
Issues (60) 2022
ISSN: 2616-9185
www.mecsj.com

Recent studies in lab confirm that seated postural control develops during development after a cranial-caudal progression of the trunk segments, commencing with the head, followed by the upper trunk, lower trunk, and finally pelvic regions (Saavedra, 2012). The degree of segmental trunk control developed during sitting development affects postural control and reaching performance. Children with cerebral palsy (GMFCS III-V) who are unable to sit exhibit segmental trunk impairments similar to those shown during the sitting development of typical newborns (Rachwani, 2015).

In actuality, a child's functional impairment and the degree of segmental trunk control they have acquired, as determined by the Segmental Assessment of Trunk Control (SATCo), are related. The SATCo assesses trunk stability at seven separate trunk segments in the static, reactive, and active domains of balance while gradually modifying physical support from the shoulders to the hips. The test aids medical professionals in determining the level of the trunk where balance is lost (Curtis, 2015).

2.3 Management of Spasticity in Children with Cerebral Palsy

Spasticity and other types of muscle overactivity brought on by cerebral palsy may hinder function or caregiving, or they may result in discomfort or a negative perception of one's body. The treatment plan for a child with spasticity may involve orthopaedic surgery, selective dorsal rhizotomy, oral medicines, chemodenervation, exercise, casts, and constraint-induced therapy. For increased effectiveness and better adequacy to the needs of the kid, techniques may be combined (Russman, 2008).

Multi-Knowledge Electronic Comprehensive Journal For Education And Science Publications (MECSJ)
Issues (60) 2022
ISSN: 2616-9185
www.mecsj.com

Spasticity, according to the correct definition, is "a motor condition characterized by a velocity-dependent increase in tonic stretch reflexes (muscle tone) with excessive tendon jerks, arising from hyperexcitability of the stretch reflex, as one component of the upper motor neuron syndrome." Spasticity can have a significant functional impact on a child with cerebral palsy in addition to the other positive motor phenomena of the upper motor neuron syndrome, such as phasic stretch reflexes (clonus and hyperreflexia), flexor and extensor spasms, cocontraction, dystonia, and associated phenomena (CP) (Mayer, 2008).

Spasticity is frequently a useful, if too simplified, "shorthand" term for these many types of muscle overactivity, and they serve as significant therapeutic targets in the quest to improve the child's functional outcomes. It's crucial to understand that the negative symptoms, such as weakness and lack of dexterity, may be more functionally incapacitating and less treatable than the positive ones. Accepting the limitations is not a reason to forgo pursuing therapy, albeit tone reduction in the right patient can result in significant gains. Simple stretches, oral and injectable medications, and even surgery are all options for treating excess tone (Ozer, 2006).

The first step in the treatment program is a complete evaluation to see if there are any aspects of function, comfort, cosmesis, or care that are being hampered by muscular overactivity. If not, there is no need for treatment and it shouldn't be started. It should also be evaluated if the patient's spasticity is improving function, such as whether stiffness in the lower extremities enhances transfer capacity in the face of underlying leg muscle weakness (van der Linden ML, 2008).

Reducing such "useful" spasticity could potentially have the opposite effect; nevertheless, when paired with muscle strengthening and the appropriate orthotics, spasticity reduction may have a positive overall functional impact and can therefore be considered. The complete spasticity management team, including the patient and carers, doctors, physical and occupational therapists, nurses, orthopedists, and orthotists, as well as surgeons and other professionals in some circumstances, must be involved in a thorough evaluation. The team may also include psychologists, social workers, and educators (Tilton, 2009).

Permanent diseases that cause motor, sensory, cognitive, and activity limitations are referred to as cerebral palsy (CP). These conditions are connected to early-stage brain abnormalities, lesions, or deficits that do not progress. Spastic CP frequently manifests as trunk dysfunction, which also impairs the motor capabilities of the upper and lower extremities. Children with cerebral palsy exhibit a variety of trunk-related impairments, such as weak trunk muscles, shoulder protraction, poor head and trunk stability, and spinal curve abnormalities (Koop, 2009).

Insufficient control of the trunk muscles causes other muscles to compensate in order to maintain the upright posture. Reduced functionality during extremities movements results from the inability of proximal stability and greater activation of extremity muscles during postural adjustments (Karthikbabu, 2012). The majority of CP research and clinical therapies focus on the limbs and ignore trunk dysfunction.

Trunk training in the CP population has only been the subject of research. For training the trunk in these research, serious games and virtual reality were frequently employed (Curtis, Woollacott, & Bencke, 2016).

2.4 Relationship between Trunk Control and Balance in Children with Spastic Cerebral Palsy

Children with cerebral palsy (CP) exhibit abnormal posture, loss of selective motor control, poor trunk control, and poor balance, all of which contribute to poor postural control and considerable limits in their everyday activities. With anticipatory and instinctive postural modifications, balance and upright postural control are essential elements of movement that play a significant role in maintaining the body in equilibrium in a given sensory environment. Early in life, postural control develops over a considerable period of time. The postural control mechanism maintains a vertical posture while this process of growth is taking place, bracing the head and trunk against gravity to give a proper platform for carrying out appropriate actions including sitting, reaching, standing, and walking (Saether & Helbostad JL, 2013).

In this developing phase, the trunk is crucial for maintaining the postural control mechanism as well as for organizing the balance reactions. In order to perform functional tasks for limb motions, a secure foundation of support is necessary as well. One of the primary characteristics of children with CP is a weak postural control mechanism, thus it's important for the therapist to assess any trunk abnormalities and boost these kids' functional performance (Numanoglu Akbas & Kerem Gunel, 2019).

There are numerous clinical techniques available now that have been proven to be accurate and reliable ways to evaluate trunk control in children with CP. These assessments include the Segmental Assessment of Trunk Control (SATCo), the Sitting Assessment for Children with Neuromotor Dysfunction (SACND), the Spinal Alignment and Range of Motion Measure (SAROMM), the Trunk Impairment Scale (TIS), and the Trunk Control Measurement Scale (TCMS) (Heryman, 2011).

The only scale that assesses trunk control during functional tasks and measures both the trunk's stability as a base of support and its active movement is the TCMS (58 total score). In order to evaluate children with spastic CP, the TCMS was used. It was discovered to have excellent psychometric properties, including intra-class correlation coefficients (ICC) ranging from 0.91 to 0.99 for inter-rater and test-retest reliability, Cronbach's alpha coefficients ranging from 0.82 to 0.94, and Spearman's rank correlation with GMFM at 0.88 for construct validity, giving clinicians more specificity in evaluating trunk control (Heyrman, 2014).

Functional balance is a part of postural control that aids a kid in carrying out fundamental every day, social, and recreational tasks on their own at home, school, and in the neighborhood. Children with cerebral palsy have inadequate postural control mechanisms, which affects their functional balance. According to earlier studies on balance, children with cerebral palsy (CP) showed worse static and dynamic balance reactions than children who were usually developing. The performance of Activities of Daily Living (ADL), mobility, and involvement of children with CP were further impacted by these balance issues, which raised the likelihood of falls (Chen, 2013).

The Gross Motor Function Test (GMFM), Paediatric Reach Test (PRT), and PBS are now the techniques used to measure balance in children with CP (Jin, 2012). The PBS is simple and can be a more affordable substitute for usage in clinical practice. For kids with CP, it is a trustworthy and accurate instrument that can be used to assess balance and spot subtle changes in functional balance. It has 14 things, giving it a 56 overall score. A prior study utilizing PBS on children with CP showed that it had high to very high relative reliability and that absolute reliability was acceptable for test-retest, test-interrater, and intra-rater reliability (Intra-class correlation coefficient=0.901) (Intraclass correlation coefficient–0.958). Excellent concurrent validity (p0.01) was found between PBS and GMFM-66 at baseline (r=0.92-0.95) and follow-up (r=0.89-0.91), and moderate to good between Wee-FIM at baseline (r=0.47-0.78) and follow-up (r=0.44-0.87). According to the available research, children with CP have reduced trunk control and balance (Heryman, 2011).

Multi-Knowledge Electronic Comprehensive Journal For Education And Science Publications (MECSJ)
Issues (60) 2022
ISSN: 2616-9185
www.mecsj.com

2.5 Effect of trunk control changes on access to children with progressive spastic cerebral palsy

As previously established, cerebral palsy is a nonprogressive developmental disorder brought on by damage to the growing brain and is defined by abnormalities in muscle tone, mobility, and motor skills. Poor postural control affects daily functional activities like sitting, reaching, and walking because of abnormalities in tone and movement (Kim, 2018).

The trunk plays a crucial role in carrying out goal-directed tasks because it provides the first framework for postural control during postural stabilization and orientation. For the head and extremities to move freely and appropriately, trunk control, an active aspect of postural control, is necessary. Due to their limited trunk muscle strength, impaired brain control, and poor position perception, children with spastic cerebral palsy exhibit poor trunk control (Seyyar, 2019). According to a literature review, there is a connection between trunk control and sitting postural control. Children with cerebral palsy (CP) typically have poor trunk control and difficulty maintaining an upright posture because they have problems with anticipatory and reactive postural responses as well as changes in ground reaction force during postural adjustment (Butler, 2010).

Quadriplegics have the greatest topographically compromised trunk control, followed by diplegics and hemiplegics. Additionally, children with quadriplegia exhibit both static and dynamic trunk control impairments, whereas diplegic and hemiplegic children often only exhibit impaired static trunk control. The trunk motions in the sagittal plane are easier to control than the trunk movements in the frontal plane. Children in the lower Gross Motor Function Classification System (GMFCS) level exhibited severe trunk control impairment based on the motor involvement, indicating a link between functional abilities and trunk control. Additionally, poor trunk control in kids with spastic CP is linked to poor balance (Panibatla, 2017).

Postural control may be impacted by sensory impairments in children with cerebral palsy, including proprioceptive dysfunction. Proprioception's joint position sensing, which is one of its components, improves body awareness and aids in motor planning and control. The development of motor abilities and postural control as well as the preservation of normal spinal mobility and stability depend on trunk position perception. Alterations in trunk position sense have been documented in a number of populations, including those with post-stroke hemiparesis, older adults with balance issues, and those with orthopaedic spine disease. However, no studies have examined the trunk position sense in children with CP (Åsell, 2006).

www.mecsj.com
Multi-Knowledge Electronic Comprehensive Journal For Education And Science Publications (MECSJ)
Issues (60) 2022
ISSN: 2616-9185

3. Discussion

Numerous studies have established that poor trunk control is a significant motor dysfunction in children with CP, which can significantly impact how well they do activities of daily living like sitting, reaching, and walking. Achieving trunk control is crucial, according to numerous studies that contrasted healthy children with children who had CP. These data suggest that physical therapy and rehabilitation strategies that are created in accordance with these findings will be more effective for trunk control and motor functions. Given these, it is more likely that children with weak trunk control will have a high quality of life when they are evaluated in this way and given the appropriate care (Yilmazyürk, 2005).

The International Classification of Functioning, Disability, and Health for Children and Youth (ICF-CY) are currently a crucial tool for program planning and intervention implementation. TCMS was employed in our study to examine the primary issues, including static seated balance, selective motor control, and attention (Rosenbaum & Stewart, 2004).

Some investigations looked into whether or not trunk control is a significant indicator of motor functions. These investigations demonstrate how trunk control is connected to balance, walking, and functional skills, all of which are crucial for carrying out daily tasks. The spinal machine hypothesis is a fresh biomechanical strategy for body mobility that was established by nuclear physicist Gracovetsky as a specialist. Using only their tuberositas ischiadica bones, people without lower extremities is able to walk, he demonstrated in his studies. Body muscle strength has an impact on how well people walk and move, so the training group did particular, amplified trunk exercises (Assaiante, 2005).

The control group showed no significant differences in trunk muscular strength following the usual therapy program, but the training group showed a substantial improvement in trunk muscle strength after therapy. These results show that adding an exercise program to the physical therapy program, even for just six weeks, boosts the trunk muscles' strength, Static and dynamic trunk control benefit from increased body muscle strength. Trunk control evaluation is connected to balance, walking, and functional abilities, Verheyden et al. found in many investigations (Verheyden, 2004).

Pediatric Berg Balance Assessment has been used extensively to evaluate functional balance, according to literature reviews. In our study, the training groups both before and after therapy had favorable scores in the PBBS intergroup. PBBS comprises tasks evaluating balancing performances while sitting and standing, and the fact that they are related to trunk control demonstrates it is not merely a passive movement segment. Studies do not suggest that PBBS has a unique test battery for assessments of trunk control. This finding is significant since it shows that the functional balance is impacted by trunk love (Curtis, Woollacott, & Bencke, 2016).

Results of the Timed up and go and 1-minute walking functional mobility tests show improvements for both groups after therapy. After six weeks of exercise treatment, the training group had made considerable advancements. There were no appreciable variations between the exercise and control groups' intergroup relations before and after treatment.

Multi-Knowledge Electronic Comprehensive Journal For Education And Science Publications (MECSJ)
Issues (60) 2022
ISSN: 2616-9185
www.mecsj.com

However, according to our findings, the 1 MWT is a low-cost, practical, straightforward test that does not require any expensive equipment to evaluate gross motor function in the clinic. Therefore, this exam can be used as a benchmark when evaluating CP children who can walk (Arı & Kerem Günel, 2017).

Numerous studies that demonstrate the multiple layer effect of walking with a straight back support the association between functional movement assessments and trunk control. In the study, there was a substantial positive correlation between TCMS total scores and the PBBS, TUG, and 1-minute walking tests. These findings show the connection between trunk influence and functionality as well as the crucial part the trunk plays in maintaining postural equilibrium. Lower extremity spasticity affects children who are bilaterally spastic. The study's findings are supported by Barnes et al. and Filloux. They contend that lower extremity spasticity reduces motor functional capacities, distorts coordination in synergetic muscles, and increases co-contraction among antagonistic muscles, increasing the effect of the trunk (Ketelaar, 2009).

Finally, postural adjustment abnormalities related to voluntary control in static and dynamic activities are present in children with spasticity. Children with CP cannot transfer their body weight from one limb to another during dynamic balance or distribute it evenly during static balance. A core stability program enhanced balance in patients with low back pain and an unstable core due to greater load reduction and effective patterns of weight distribution28; hence, core exercises may help our children with CP balance (Gillen, 2013).

Multi-Knowledge Electronic Comprehensive Journal For Education And Science Publications (MECSJ)
Issues (60) 2022
ISSN: 2616-9185
www.mecsj.com

According to earlier research, whole-body vibration (WBV) training helps children with spastic CP adjust their balance. This outcome was favorably associated with the decrease in spasticity brought about by tonic vibration reflex stimulation, which awakens muscle receptors that monitor changes in muscle length. Vibration training has the potential to trigger proprioceptive reflexes and block the perception of pain through yet another method. In subpopulations at risk for falling, vibration training has a warming-up effect that enhances muscle strength and balance (Seo, 2016).

Functional improvement in children with spastic CP may be linked to WBV's strengthening of the muscles in the trunk and lower limbs. Vibration increased the g-forces operating on the muscles, improving the exercise load and enhancing neuromuscular activation. Muscle strength is impacted by vibration training, which also boosts the ability to balance. Previous researchers found that a WBV program can be an effective way to help children with the spastic type of CP gain strength and balance (Ali MS, 2019).

Multi-Knowledge Electronic Comprehensive Journal For Education And Science Publications (MECSJ)
Issues (60) 2022
ISSN: 2616-9185
www.mecsj.com

4. Conclusion

The most frequent reason for motor impairments in newborns and toddlers is cerebral palsy (CP). Over the past few decades, there has been no change in the reported incidence of CP. Although low birthweight and prematurity are significant risk factors, around 50% of all children who acquire CP were born at term, with a normal birthweight, and with no known risk factors. Only a very small fraction of cases have a definite underlying cause that can be determined. The results of the history and physical examination are mostly used to make the diagnosis of CP. Most CP patients grow up to be adults. The management of CP is best handled by a multidisciplinary team due to the numerous related conditions and complexity of the required assistance. One of the most restricting conditions in the CP population is postural dysfunction. It limits reaching capabilities, which in turn lowers participation in daily tasks. The absence of research and evidence-based studies on the impact of trunk control alterations on access to children with progressing spastic cerebral palsy served as the driving force behind the current study.

Children that can sit independently wouldn't need external trunk support above the pelvis, according to earlier studies. Training regimens with the objective of sitting without hip straps or restricting the levels below the pelvis may be a viable strategy for improving these kids' posture. In conclusion, the findings of this study offer more proof that children with spastic CP have reduced trunk control. Stronger trunk position sensing in children with spastic CP led to better trunk control. Children with higher functional performance also exhibited improved trunk control and

Multi-Knowledge Electronic Comprehensive Journal For Education And Science Publications (MECSJ)
Issues (60) 2022
ISSN: 2616-9185
www.mecsj.com

enhanced trunk position perception. The results of the current study further suggest that treatment interventions focusing on proprioceptive training on an unstable surface and a small base of support, which communicate contradicting somatosensory data, may further enhance trunk control in kids with spastic CP. Future studies could examine a multi-segmented approach to trunk control in children with cerebral palsy in the context of evidence-based upper limb training protocols like Constraint-Induced Movement Therapy or Hand-Arm Bilateral Intensive Therapy, extending the use of these interventions to kids with GMFCS levels III-V.

Multi-Knowledge Electronic Comprehensive Journal For Education And Science Publications (MECSJ)
Issues (60) 2022
ISSN: 2616-9185
www.mecsj.com

Reference

Ali MS, A. A. (2019). The effect of two therapeutic interventions on balance in children with spastic cerebral palsy: A comparative study. J Taibah Univ Med Sci. 2019 Jul 26;14(4):350-356. doi: 10.1016/j.jtumed.2019.05.005. PMID: 31488967; PMCID: P.

Apaydin, U., & Aribas, Z. E. (2018). The Effects of Trunk Control on Respiratory Muscle Strength and Activities of Daily Living in Children with Cerebral Palsy. Iran J Pediatr. ;28(6):e69849. doi: 10.5812/ijp.69849.

Arı, G., & Kerem Günel, M. (2017). A Randomised Controlled Study to Investigate Effects of Bobath Based Trunk Control Training on Motor Function of Children with Spastic Bilateral Cerebral Palsy. International Journal of Clinical Medicine, 8, 205-215.

Arı, G., & Kerem Günel, M. (2017). A Randomised Controlled Study to Investigate Effects of Bobath Based Trunk Control Training on Motor Function of Children with Spastic Bilateral Cerebral Palsy. International Journal of Clinical Medicine, 8, 205-215. doi: 10.4236/ijcm.2017.84020.

Åsell, P. S. (2006). “Are lumbar repositioning errors larger among patients with chronic low back pain compared with asymptomatic subjects?” Archives of Physical Medicine and Rehabilitation, vol. 87, no. 9, pp. 1170–1176, .

Ashwal, S., & Russman, B. (2004). Practice Parameter: Diagnostic assessment of the child with cerebral palsy. Neurology. ;62(6):851-63.

Assaiante, C. M. (2005). Development of Postural Control in Healthy Children: A Functional Approach. Neural Plasticity, 12, 109-118.

Butler, S. S. (2010). “Refinement, Reliability, and validity of the segmental assessment of trunk control,” Pediatric Physical Therapy, vol. 22, no. 3, pp. 246–257, .

Chen, C. S. (2013). Validity, responsiveness, minimal detectable change, and minimal clinically important change of Paediatric Balance

Scale in children with cerebral palsy. Res Dev Disabil. ;34(3):916–22.

Cheng, H. L. (2013). The effect of lower body stabilization and different writing tools on writing biomechanics in children with cerebral palsy. Res Dev Disabil. ;34(4):1152–1159.

Curtis, D. B.-H. (2015). The central role of trunk control in the gross motor function of children with cerebral palsy: a retrospective cross-sectional study. Dev Med Child Neurol.

Curtis, D., Woollacott, M., & Bencke, J. e. (2016). The functional effect of segmental trunk and head control training in moderate-to-severe cerebral palsy: A randomized controlled trial. Dev Neurorehabil. :1-10.

Furukawa, A. I. (2001). A Study on the Subjective Well-Being of Adult Patients with Cerebral Palsy. Journal of Physical Therapy Science, 13, 31-35.

Gillen, G. (2013). Trunk control: a prerequisite for functional independence: a function based approach. St. Louis: Mosby; . pp. 69e89.

Heryman, L. M. (2011). A clinical tool to measure trunk control in children with cerebral palsy: the trunk control measurement scale. Res Dev Disabil. ;32(6):2628–35.

Heyrman, L. F. (2014). Altered trunk movements during gait in children with spastic diplegia: Compensatory or underlying trunk control deficit? Res Dev Disabil. ;35(9):2044-52. .

Himmelmann., & Hagberg, G. (2010). The changing panorama of cerebral palsy in Sweden. X. Prevalence and origin in the birth-year period 1995-1998. Acta Paediatrica.;99(9):1337-43.

Jin, G. J. (2012). Reliability of the Paediatric Balance Scale in the assessment of the children with cerebral palsy. J PhysTher Sci. ;24(4):301–05.

Karthikbabu, S. C. (2012). A review on assessment and treatment of the trunk in stroke: A need or luxury. Neural Regen Res. ;7(25):1974.

Multi-Knowledge Electronic Comprehensive Journal For Education And Science Publications (MECSJ)
Issues (60) 2022
ISSN: 2616-9185
www.mecsj.com

Kerem, G. M. (2009). Rehabilitation of Children with Cerebral Palsy from a Physiotherapist's Perspective. Acta Orthopaedica et Traumatologica Turcica, 43, 173-180.

Ketelaar, M. V. (2009). Effects of a Functional Therapy Program on Motor Abilities of Children with Cerebral Palsy. Physical Therapy, 81, 1534-1545.

Kim, D.-H. A.-G. (2018). "Changes in trunk sway and impairment during sitting and standing in children with cerebral palsy," Technology and Health Care, vol. 26, no. 5, pp. 761–768, .

Koop, S. (2009). Scoliosis in cerebral palsy. Dev Med Child Neurol. ;51(s4):92-8.

Krageloh-Mann, I., & Bax, M. (2009). Cerebral Palsy. In: Aicardi J, editor. Diseases of the Nervous System in Childhood. 3. England, London: Mc Keith Press; . pp. 210–242. .

Mayer, N. E. (2008). Common patterns of clinical motor dysfunction, in Brashear A, Mayer NH (eds): Spasticity and Other Forms of Muscle Overactivity in the Upper Motor Neuron Syndrome: Etiology, Evaluation, Management, and the Role of Botul.

Mayer, N. E. (2008). Common patterns of clinical motor dysfunction, in Brashear A, Mayer NH (eds): Spasticity and Other Forms of Muscle Overactivity in the Upper Motor Neuron Syndrome: Etiology, Evaluation, Management, and the Role of Botulinum Toxin. New York, WE MOVE, 2008,.

McNamara, L. C. (2007). Seat inclinations affect the function of children with cerebral palsy: a review of the effect of different seat inclines. Disabil Rehabil Assist Technol. ;2(6):309–318.

Morris, C. (2007). Definition and classification of cerebral palsy: A historical perspective. Dev Med Child Neurol Suppl. [Historical Article]. ;49(s109):3-7.

Mutch, L. A. (1992). Cerebral palsy epidemiology: where are we now and where are we going? Dev Med Child Neurol. ;34(6):547-51.

Nicholson, J. M. (2001). Assessment of Upper-Limb Function and Movement in Children with Cerebral Palsy Wearing Lycra

Garments. Developmental Medicine & Child Neurology, 43, 384-391.

Numanoglu Akbas, A., & Kerem Gunel, M. (2019). Effects of Trunk Training on Trunk, Upper and Lower Limb Motor Functions in Children with Spastic Cerebral Palsy: A Stratified Randomized Controlled Trial . Konuralp Medical Journal , 11 (2) , 253-259 . DOI: 10.18521/ktd.453532.

Ohrvall, A. E.-S. (2010). Self-Care and Mobility Skills in Children with Cerebral Palsy, Related to Their Manual Ability and Gross Motor Function Classifications. Developmental Medicine & Child .

Ozer, K. C. (2006). Neuromuscular electrical stimulation and dynamic bracing for the management of upper-extremity spasticity in children with cerebral palsy. Dev Med Child Neurol 48:559-563, .

Padmakar, S. K., Kumar, S., & Parveen, S. (2018). Management and Treatment for Cerebral Palsy in Children. 104 Indian Journal of Pharmacy Practice, Vol 11, Issue 2.

Palisano, R. R. (2007). GMFCS-E & R: Gross motor functional classification system, expanded and revised. CanChild Centre for Childhood Disability Research; Hamilton, ON: . .

Panibatla, V. K. (2017). “Relationship between trunk control and balance in children with spastic cerebral palsy: a cross-sectional study,” Journal of Clinical and Diagnostic Research, vol. 11, no. 9, pp. YC05–YC08, .

Pavao, S. N. (2014). Relationship between static postural control and the level of functional abilities in children with cerebral palsy. Braz J Phys Ther. ;18(4):300-7.

Rachwani, J. S. (2015). The development of trunk control and its relation to reaching in infancy: a longitudinal study. Front Hum Neurosci. ;9:94. doi: 10.3389/fnhum.2015.00094.

Rosenbaum, P. P. (2007). A report: The definition and classification of cerebral palsy April 2006. Dev Med Child Neurol Suppl. ;109:8-14. .

Multi-Knowledge Electronic Comprehensive Journal For Education And Science Publications (MECSJ)
Issues (60) 2022
ISSN: 2616-9185
www.mecsj.com

Rosenbaum, P., & Stewart, D. (2004). The World Health Organisation International Classification of Functioning Disability and Health: A Model to Guide Clinical Thinking, Practice and Research in the Field of Cerebral Palsy. Seminars in Pediatric Neurology.

Rosenbaum, P., & Walter, S. H. (2002). Prognosis for Gross Motor Function Creation of Motor Development Curves. JAMA. 288(11):1357–1363.

Russman, B. G. (2008). A rational approach to a treatment protocol, and the role of botulinum toxin in treatment, in Brashear A, Mayer NH (ed): Spasticity and Other Forms of Muscle Overactivity in the Upper Motor Neuron Syndrome: Etiology, Evaluation, Management, and the Role o.

Saavedra, S. v. (2012). Learning about gravity: segmental assessment of upright control as infants develop independent sitting. J Neurophysiol. ;108:2215–2229.

Saether, R., & Helbostad JL, A. L. (2013). Reliability and validity of the Trunk Impairment Scale in children and adolescents with cerebral palsy. Res Dev Disabil. ;34(7):2075–84.

Saether, R., & Helbostad, J. A. (2015). The relationship between trunk control in sitting and during gait in children and adolescents with cerebral palsy. Dev Med Child Neurol. ;57(4):344-50. .

Seo, H. O. (2016). Effect of focal muscle vibration on calf muscle spasticity: a proof-ofconcept study. PM&R: J Injury Func Rehabil ; 8(11): 1083e1089.

Seyyar, B. A. (2019). “Trunk control and functionality in children with spastic cerebral palsy,” Developmental Neurorehabilitation, vol. 22, no. 2, pp. 120–125, .

Shumway-Cook, A., & Woollacott, M. (2012). Development of postural control. In: Shumway-Cook A, Woollacott M, editors. Motor control: Translating research into clinical practice. Baltimore, MD: Lippincott Williams & Wilkins; . pp. 195–222.

Tilton, A. .. (2009). Management of Spasticity in Children With Cerebral Palsy. Seminars in Pediatric Neurology . Volume 16, Issue 2, , Pages 82-89 .

Van der Heide, J., & Hadders-Algra, M. (2005). Postural Muscle Dyscoordi-nation in Children with Cerebral Palsy. Neural Plasticity, 12, 197-203.

van der Linden ML, H. M. (2008). Functional electrical stimulation to the dorsiflexors and quadriceps in children with cerebral palsy. Pediatr Phys Ther 20:23-29, .

Verheyden, G. N. (2004). The Trunk Impairment Scale: A New Tool to Measure Motor Impairment of the Trunk after Stroke. Clinical Rehabilitation, 18, 326-334.

Yilmazyürk, S. ü. (2005). Yürüme Analizi. In: Özcan, H. Ed., Cerebral Palsy, Boyut, Istanbul, 95.

Zimmermann, M., Toni, I., & de Lange, F. (2013). Body posture modulates action perception. J Neurosci. ;33(14):5930–5938.