

## **CORE STABILITY TRAINING IN CHILDREN WITH CEREBRAL PALSY (REVIEW ARTICLE)**

**Nadia H. Abd Elhamed<sup>1\*</sup>; Heba M. Kamal<sup>2</sup>  
and May S. Abbas<sup>2</sup>**

1- Department of Physical Therapy, Faculty of physical therapy, Cairo University,

2- Department of Physical Therapy for Growth and Development Disorder in Children and Its Surgery Faculty of Physical Therapy, Cairo University.

**\*E-mail-nadiaabuelmakarem@gmail.com**

### **ABSTRACT**

The aim of this article was to provide an overview of Cerebral Palsy (CP) and to review the effectiveness of core stability on function in these children CP is an expression that encompasses a variety of different a-etiological based symptoms, which change with age and are not classified as separate diseases. The term “cerebral palsy” was coined 170 years ago by William Little, an English orthopedic surgeon who related complicated labour and lack of oxygen for neonates to limb spasticity and sequential musculoskeletal deformity.

The stability of the lumbo-pelvic region is crucial to provide a foundation for movement of the upper and lower extremities, to support loads, and to protect the spinal cord and nerve roots. The core muscles stabilize the spine and trunk during movements such as jumping, running, and throwing.

**Key Words:** Core stability, cerebral palsy.

### **INTRODUCTION**

The term “cerebral palsy” was coined 170 years ago by William Little, an English orthopaedic surgeon who related complicated labour and lack of oxygen for neonates to limb spasticity and sequential musculoskeletal deformity (**Little, 2012**).

Cerebral palsy is a disorder of movement and posture that appears during infancy or early childhood. It is caused by nonprogressive damage to the brain during the prenatal, perinatal, or postnatal periods. Cerebral palsy is not a single disease but a name given to a wide variety of static neuromotor impairment syndromes occurring secondary to a lesion in the developing brain. The damage to the brain is permanent and cannot be cured but the consequences can be minimized. Progressive musculoskeletal pathology occurs in most affected children; intellectual, sensory, & behavioral difficulties may accompany CP, & are especially common in patients with spastic quadriplegia and severe motor disability (**Graham et al., 2016 ; Rodrigues and Voos 2017**).

The incidence of CP for all live births ranges from 1.5 to 3 per 1,000 live births, with variation between low, middle & high-income countries and

geographic region. According to surveys, approximately 0.2% children worldwide suffer from CP (Maryam *et al.*, 2013 ; Nelson and Blair 2015).

Males are more commonly affected by CP than females with a ratio of approximately 1.5 to 1 (Johnson *et al.*, 2019 and Himmelmann, 2020).

#### Etiology and risk factors

The etiology of CP is considered multifactorial and of a prenatal, natal or postnatal nature. Clinical manifestations depend on the chronological age of the individual, the location of the brain lesion and the gestational period of the mother (Van *et al.*, 2017).

#### Classifications of cerebral palsy

Cerebral palsy is a heterogeneous condition in terms of etiology, motor type, and severity of impairments. Consequently, CP is described using different classifications primarily motor type, topography, and motor severity (Rosenbaum *et al.*, 2007). It is classified according to motor impairment of the limbs into three types: spastic (87%), dyskinetic (7.5%) and ataxic (4%); in addition to the mixed type, which includes a combination of features (Abd-Elmonem and AbdElhady 2018).

The neurologic impairment of motor system in children who have CP is characterized, in order of frequency, by spasticity, dyskinesia, hypotonia, and ataxia (Johnson *et al.*, 2019). Mixed presentations are not uncommon. Hypotonia, with or without associated spasticity, generally truncal hypotonia and spasticity of extremities, are also seen. Based on clinical findings, CP is generally classified as spastic, hypotonic and dyskinetic or mixed (Figure 1) (Oskoui *et al.*, 2017 and Johnson *et al.*, 2019).

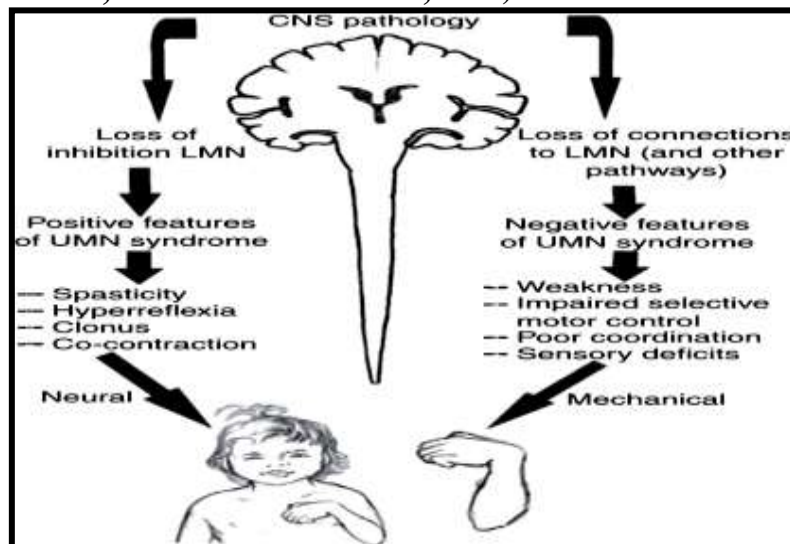


Figure (1): Central nervous system dysfunction. Adopted from (Nahm *et al.*, 2018).

### **Diagnosis and prevention**

Clinical diagnosis of CP is principally based on the recognition of features, such as a delay in reaching motor milestones and changes in muscle tone or reflexes. However, the clinical diagnosis of CP should be confirmed by neuroimaging (**Ellenberg and Nelson 2103**).

There are several neuroimaging studies used to identify the brain neural injuries including: magnetic resonance imaging, computed tomography (CT), diffusion tensor imaging, and ultrasound (**Reid et al., 2014 and Meyns et al., 2016**).

### **Management of cerebral palsy**

Treatment of CP takes an inter-professional team approach. The team includes physicians (primary care, neurologists, physiatrists, orthopedists, and other specialists needed based on co-existing conditions), therapists (physical, occupational and speech), behavioral health specialists, social workers/case managers, and educational specialists. Interventions should focus on maximizing the quality of life and decreasing disability burden. The patient, family, and team should set functional goals that are realistic and periodically reevaluated (**Novak et al., 2017**).

### **Medical treatments:**

Oral baclofen or diazepam is used to reduce spasticity which results in pain, muscle spasms or functional disability. Baclofen is used for a long-term effect and works at the spinal level (**Sewell et al., 2014**).

Botulinum toxin injections are given into muscles that are spastic or sometimes dystonic. The aim being to reduce the muscle hypertonus that can be painful. A reduction in muscle tone can also facilitate bracing and the use of orthotics. Most often lower extremity muscles are injected. Botulinum toxin is focal treatment, meaning that a limited number of muscles can be injected at the same time. The effect of the toxin is reversible and a reinjection is needed every 4–6 months (**Strobl et al., 2015**).

Bisphosphonates are used to treat osteoporosis in adults. Osteoporosis is common in children with CP, and non-oral bisphosphonates have been used to treat children with a very low bone mass density and a medical history of fragility fracture (**Boyce et al., 2014**).

### **Orthotics and assistive technology:**

Orthotic devices such as ankle-foot orthoses are often prescribed to achieve the following objectives: correct and/or prevent deformity, provide a base of support, facilitate training in skills, and improve the efficiency of gait (**Ross and Bowers 2009**).

### **Surgical management:**

Surgical management options include placement of a baclofen pump, selective dorsal rhizotomy, tendon releases, hip derotation/rotation surgery and spinal fusion (**Park et al., 2018**). Orthopedic surgery involves releasing tight muscles and fixed joint contractures, and corrective osteotomies

conducted basically to restore sagittal and rotational malalignment of bones (**Gendy et al., 2019**).

#### **Physical therapy management**

The management of motor disability in CP includes physical therapy and a wide spectrum of other therapeutic interventions. Physical therapy focuses on function, movement, and optimal use of the child's potential to maintain and restore physical, psychological, and social well-being. The process of rehabilitation is influenced by the clinical type and severity of the CP, the existence of additional disabilities (e.g. visual, auditory, or cognitive), emotional problems, the physiological age of the child, and the family's socioeconomic status (**Anttila et al., 2008**).

#### **Core stability**

Proximal stability is thought to allow for independent manipulation and purposeful use of the hands and arms (**Rosenblum and Josman 2003**). Children's balance improves with age, allowing them to perform daily activities on their own. Reaching quality improves as well, which is dependent on the adequacy of postural stability (**van der Heide et al., 2005**).

Children with CP may experience a range of functional limitations as a result of loss of trunk control and movement imbalance (**Seymour, 2002**). Balance is defined as the postural control elements which enable a child to safely execute daily tasks (**Woollacott and Anne 2002**).

Because maintaining stability is necessary for all movements, low balance control is one of the extreme common causes of unsafe walking or reaching function (**Koman et al., 2004**).

The term of "core stability" explains the capacity to control the position and movement of the central portion of the body. Core stability training targets the muscles deep within the abdomen that attach to the spine, pelvis and shoulders, that help in the preservation of proper posture and provide the basis for movements of extremities in a coordinated manner. The aim of core stability training is to achieve the optimal physical ability to the normal state of the spine in daily activities, in addition to developing the endurance and coordination of these core stability muscles (**Nasab & Sahebazaman 2012 ; Ahmed et al., 2014 ; Day et al., 2004 and Ghaeni et al., 2015**).

The Core stability may help to improve dynamic balance and muscle coordination between lower and upper extremities, as well as reducing injury risk and muscle imbalances (**Muir-Hunter et al., 2015**). Core stability exercises have a positive effect on reducing pain, activating deep abdominal muscles, elevating the stability of lumbar spine and improving physical function in patients (**Shirley, 1999 and Cachupe et al., 2001**).

The stability of the lumbo-pelvic region is crucial to provide a foundation for movement of the upper and lower extremities, to support loads, and to protect the spinal cord and nerve roots (**Panjabi, 1992**). The

core muscles stabilize the spine and trunk during movements such as jumping, running, and throwing (**Ozmen and Aydogmus , 2015**).

### CONCLUSION

Core strength training is widely used in improving their postural stability that in turn improve their movement ability and quality of life.

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### تدريب الثبات الأساسي للأطفال المصابين بالشلل الدماغي

#### (مراجعة المادة)

نادية حسن عبد الحميد<sup>1</sup> ، هبة محمد كمال<sup>2</sup> ، مي سيد عباس<sup>2</sup>

1- قسم العلاج الطبيعي - كلية العلاج الطبيعي - جامعة القاهرة.

2- قسم العلاج الطبيعي لاضطراب النمو والتطور عند الاطفال وجراحتها -كلية العلاج الطبيعي -جامعة القاهرة

الهدف من هذه المقالة هو تقديم لمحة عامة عن الشلل الدماغي ومراجعة فعالية الاستقرار الأساسي على الوظيفة لدى هؤلاء الأطفال ، الشلل الدماغي (CP) هو تعبير يشمل مجموعة متنوعة من الأعراض المختلفة المسببة للأمراض ، والتي تتغير مع العمر ولا يتم تصنيفها على أنها أمراض منفصلة. صاغ مصطلح "الشلل الدماغي" منذ 170 عامًا ويليام ليتل ، جراح العظام الإنجليزي الذي ربط المخاض المعقد ونقص الأكسجين لحديثي الولادة بالتنشج في الأطراف والتنشج العضلي الهيكلي المنتابح.

يعد استقرار منطقة الحوض القطني أمرًا ضروريًا لتوفير أساس لحركة الأطراف العلوية والسفلية ودعم الأحمال وحماية نخاع الشوكي وجذور الأعصاب. تعمل عضلات القلب على استقرار العمود الفقري والجذع أثناء الحركات مثل القفز والجري والرمي.