Institute of Post Graduate
Childhood Studies
Ain Shams University
Medical Department

The Effect Of Electrical Stimulation On The Trunk Control In Children With Spastic Cerebral Palsy

Thesis
For Fulfillment of Ph.D. Degree in Medical Childhood studies

By
Laila Ahmed Abdul Fattah
M. B., B.Ch-M SC Pediatrics

Supervised By
Prof Dr. Mostafa M. EL-Nashar
Professor of Ear-Nose and Throat
Ain Shams University

Dr. Eman Zaki
Professor of Pediatrics
Faculty Of Medicine
Ain Shams University

Dr. Ahmed El Kahky
Professor of Physiotherapy
Institute Of Postgraduate
Childhood Studies
Ain Shams University

2009

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Supervisors: prof-Dr-Mustafa M-El-Nashar, Prof-Dr-Eman Zaki, Prof – Dr. Ahmed El-Kahky – Ain shams university – Doctoral Thesis

Abstract

Background: Cerebral palsy could contribute to significant scoliosis which affect sitting, standing, and trunk balance.

Methods: In the current study forty spastic C.P. patients were classified into two groups, both groups received physiotherapy training program, patients of group I received an additional program of Electrotherapy in the form of Electrical stimulation of trunk muscles by Faradic current using Wave Health Tronic set in the form of twenty four sessions.
After treatment Cobb's angle of back curvature was measured from X-Ray spine. Gross Motor Function was evaluation clinically for all patients.

Results: After comparing the results patients of group I Showed marked improvement both in Cobb's angle of back curvature and in Gross Motor Function as well.
The improvement's, percentage was among patients of Group I as follow:
25.53% improvement in Mean Cobb's angle for spastic diplegic C.P patients – 18.18% improvement in Mean Cobb's angle for spastic Quadriplegic patients – 24.28% improvement in mean Cobb's angle for spastic hemiplegic patients – and 60% improvement in sitting balance among the twenty patients of (Group I).

Conclusion:
The results of the current study clear the efficacy of Electrical Stimulation on trunk muscles by Faradic Current as an effective additional line of management for spastic C.P. patients

Key wards: ***Spastic cerebral palsy – Scoliosis – Electrotherapy – Faradic Current – Cobb's angle.***

تأثير الإثارة الكهربية لعضلات الجذع في معالجة مرض الشلل الدماغي التقلصي في الأطفال

أستاذ دكتور/ مصطفى محمد النشار – أستاذة دكتورة إيمان زكي – أستاذ دكتور أحمد الكحكي – جامعة عين شمس – رسالة دكتوراه طبية.

مستخلص الرسالة

مرض الشلل الدماغي التقلصي من الإعاقات التي يمكن أن تؤدي إلى إعوجاج ملحوظ بالعمود الفقري وهذا يؤثر على الجلوس والوقوف وعلى إتزان الجذع.

من خلال الدراسة الحالية تم اختيار أربعون طفلاً مريضاً بالشلل الدماغي التقلصي تم تقسيمهم إلى مجموعتين وتم تطبيق برنامج تمرينات العلاج الطبيعي على كل أطفال المجموعتين. وتطبيق برنامج إثارة كهربائية على عضلات الجذع لأطفال المجموعة الأولى عن طريق جهاز يبث تيار كهربائي فارادي وذلك من خلال أربعة وعشرون جلسة علاج. بعد استيفاء المعالجة لكل الأطفال تم تقييم زاوية انحناء الظهر بعد أخذ صور إشعاعية وتحديد زاوية الانحناء بطريقة كوب للعمود الفقري وتم تقييم وظائف الحركة واتزان الجذع إكلينيكياً. وكانت النسب المئوية للتحسن في متوسط زاوية كوب كالتالي ١٨.١٨% ← ٢٤.٢٨% ← ٢٥.٥٣% وكانت نسبة التحسن في اتزان الجذع والجلوس بدون مساعدة ٦٠% وذلك لأطفال المجموعة الأولى. وكان هذا التحسن بفضل التدخل العلاجي بالإثارة الكهربائية لعضلات الجذع بتيار كهربائي فارادى من خلال أربعة وعشرون جلسة معالجة.

الكلمات الدالة: ***الشلل الدماغي التقلصي – إعوجاج العمود الفقري – الإثارة الكهربائية – التيار الكهربائي الفارادي – زاوية كوب.***

Contents

* قالوا سبحانك لا علم لنا إلا ما علمتنا
إنك أنت العليم الحكيم *

صدق الله العظيم

الآية (٣٢) سورة: البقرة

DEDICATION

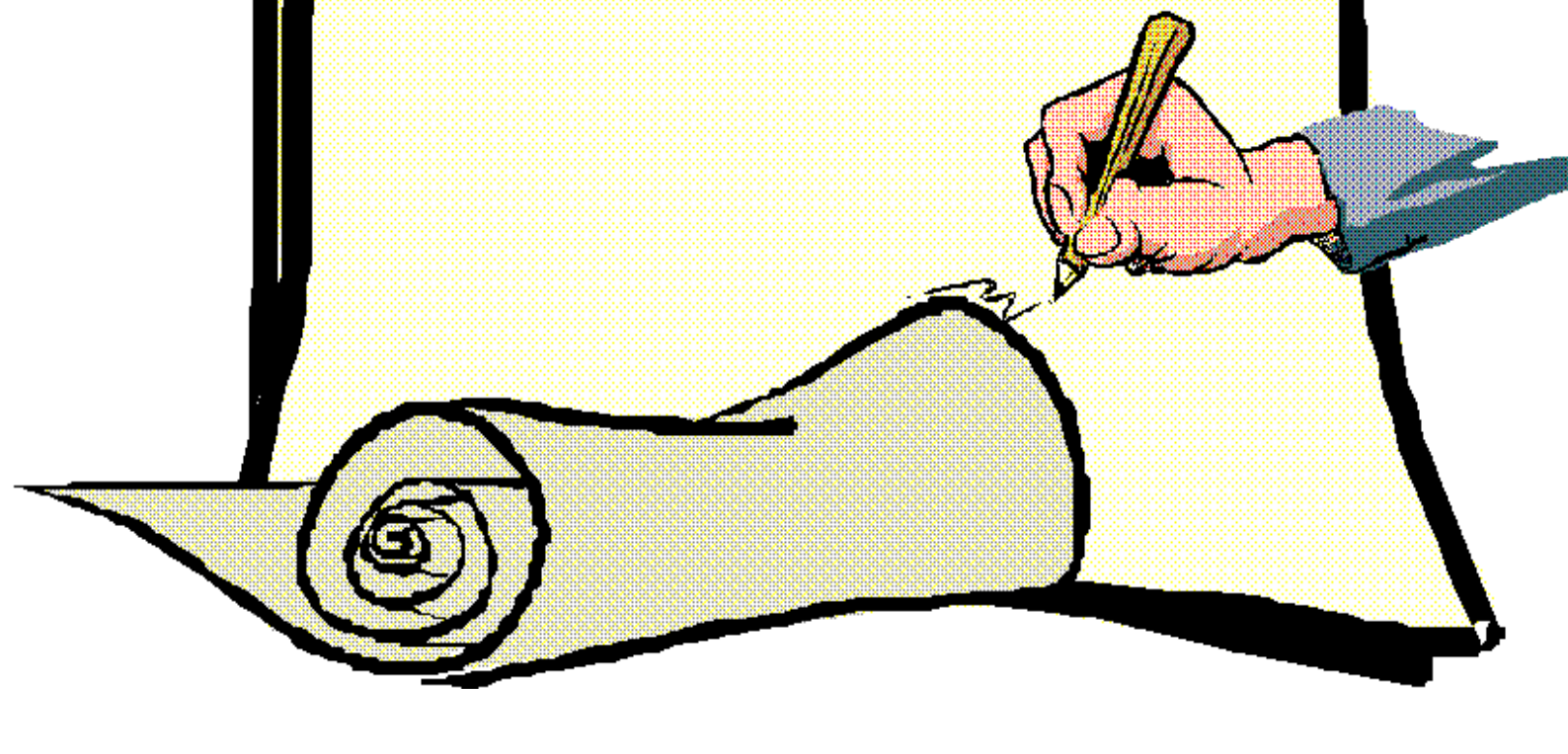
with all my love

caring and respect

I dedicate this work

to my late mother

WHO I MISSED A LOT



The Effect of Electrical Stimulation on The Trunk Control in Children With Spastic Cerebral Palsy

Introduction:

Cerebral Palsy is the term used to describe a collection of non progressive disorders that manifest as abnormalities of motion and posture and result from CNS injury in the early periods of brain development. **(Koman, et al., 2004)**

Incidence:

Cerebral palsy incidence is 1 to 7 per 1000 children throughout most of the world, theoretically being more common in geographic regions where prenatal maternal and perinatal infant cares are poor. In regions where sophisticated neonatal intensive care units exist, the risk of brain damage may be reduced by early treatment of certain problems, but also the lives of very premature infant and those with other life-threatening problems are often saved. In this latter group, the incidence of CP is higher than in the general population **(Morrissy and Weinstein, 2001)**.

Cerebral palsy is one of the most common disabling conditions affecting children. The reported incidence varies but is approximately 1-2.3 per 1000 live births. There were hopes that recent improvements in neonatal care would decrease the incidence of CP, but the prevalence in full-term infants has remained relatively constant **(Braddom et al., 2007).**

Cerebral palsy is a clinical entity characterized by a three-part definition: a disorder of movement and posture (1) caused by a non-progressive injury (2) to the immature brain (3). The distinctive characteristic of these syndromes is the change in muscle tone and posture, both at rest and with voluntary activity **(Braddom et al., 2007).**

Classification of cerebral palsy

a. Spastic C.P.
b. Dyskinetic C.P.
c. Ataxic C.P.
d. Mixed type C.P.

Classification by distribution Pattern (Spastic-type):

a. Spastic diplegic.
b. Spastic Quadriplegic.
c. Spastic hemiplegic. **(Stephen, et al., 2000)**

Progressive spinal deformity is a common and potentially serious abnormality associated with cerebral palsy. Progression is usually continuous once deformities begin. The magnitude of the deformity depends on the severity of the involvement and the pattern of weakness. As this deformity progress sitting balance may be lost and affected individuals must use their arms to support an upright position thus further increasing their disability. It is therefore important that spinal evaluation be part of periodic examination of children with neuromuscular disorders as cerebral palsy. Ambulatory patients have a much lower incidence of spinal deformity than non ambulatory or more severely involved patients. The standing or setting forward bending test can be used for assessing the symmetry of spinal alignment. Any asymmetry is an indication for radiographic evaluation this should include PA and lateral standing radiographs of the entire spine if the child can't stand then a sitting or supine (AP) radiograph may be necessary. The goal of treatment of neuromuscular spinal deformities is to prevent progression and loss of function secondary to the spinal deformities. Early intervention has been defined as systemic and planned effort to promote development. **(Paramleen, etal., 2006).** Cerebral palsy results in abnormal tone and uncoordinated muscle action. Physiotherapy aims at promoting normal movement patterns and inhibiting the abnormal ones in order to maximize function motor independence. When started early it helps in preventing contractures and deformities **(Berger et al., 1982).** When a patient is unable to produce a muscle contraction, or finds difficulty in doing it so, electrical stimulation may be of use in assisting voluntary contraction.

Several workers have reported improved muscle power and gait patterns and a reduction of spasticity after the application of various forms of electrical stimulation to children with CP **(Hazlcwood,etal.,1994)**. Beneficial therapeutic electrical

stimulation of trunk improves posture and trunk control in young children with spastic diplegic cerebral palsy. **(Korean Medical School, 2001).**

Hypothesis:

Cerebral palsaid patients with improper trunk control improve after adding electrical stimulation course to the regular physiotherapy training program that improvement will be demonstrated in their sitting balance and improvement in the cobb's angles compaired with the management by regular physiotherapy training program only.

Aim of the work:

To assess the efficacy of electrical stimulation on trunk muscles of children with spastic cerebral palsy and its effect on their sitting balance.

Type of the study:

The type of the current study is an intervention study. Patients of Group I were subjected to an additional program of Electrotherapy that added to the program of physiotherapy which was applied for all patients of both groups. The efficacy of that additional program was evaluated and showed significant improvement of Cobb's angle and sitting balance among patients of Group I.

Cerebral Palsy

Cerebral palsy is defined as a permanent disorder of movement and posture it is caused by a defect or a non progressive lesion in the immature brain In 1980 the World Health Organization introduced a model of disablement that defined handicapped as "disadvantage for a given individual resulting from an impairment or disability that limits or prevents the fulfillment of a role that is normal for that individual **(WHO, 1980).** Over the last decade, a conceptual evolution has led to the introduction of the concept of handicap situations, which are defined as a disruptions in the accomplishment of a person's life habits (activities of daily living and social roles), taking into account his age, sex and sociocultural identity, resulting on the one hand from impairments or disabilities and on the other hand from environmental factors **(Fougeyrollas et al., 1980).** This concept illustrates appearing in the person's life context. This interaction is summarized in conceptual frame work. The handicap creation process (fig I) **(Fougeyrollas et al., 1980).**

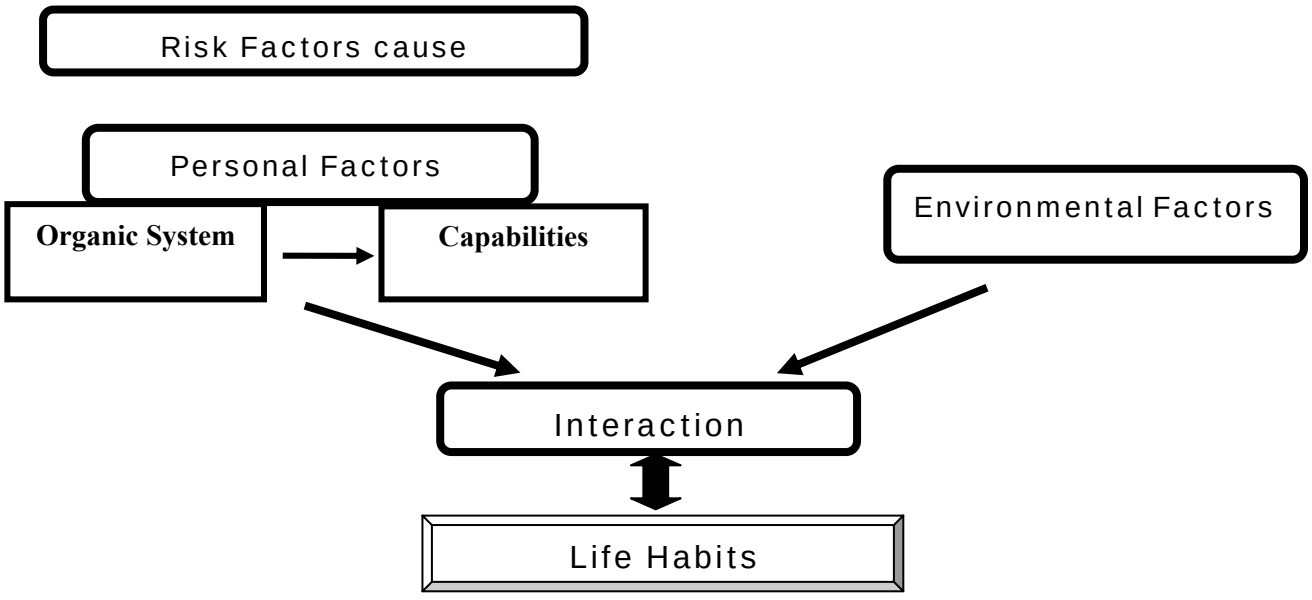


Figure 1 (**Fougeyrollas et al.**, 1980).

Among locomotion variables, gait speed is a good indicator of overall function (the ability to ambulate during activities of daily living and ability to perform functional gait related activities) **(Rose et al., 1991)**. Cerebral palsy is a common neuro developmental disorder of childhood with a prevelance of 1.5-2.5 per 1000 live birth **(Mutch et al., 1997).** While the etiology of CP is unexplained in almost half the cases a large number of epidemiological risk factors for CP have been identified. The relative role of prenatal and genetic factors has been debated. Adverse intra uterine factors like developmental malformation of brain, neuronal migration disorders, intrauterine infection etc. account for more cases **(Singhi et al., 1997)**. Significant perinatal damage has been reported in 8% of cases **(Nelson et al., 1986)**. An increased incidence of non cerebral congenital malformation was found in children with CP. In the national collaborative perinatal project genetic factors contribute in about 2% of cases of CP **(Hughes et al., 1992)**.

Birth Asphyxia and Cerebral Palsy:

The causal role of birth asphyxia in CP has been questioned, it has been suggested that asphyxia may be consequence rather than cause of the processes that lead to CP, in many cohort studies, markers of asphyxia have not correlated with increased numbers of children with CP. Those markers of birth asphysixa have yield an approximate figure of 10% for an asphyxial cause for CP **(Gaffney et al., 1988).**

permaturity and cerebral palsy:

An increased prevalence of CP has been associated with decreasing birth weight or gestational age **(Stanley et al., 1992)**, but this association is not absolute. In western studies most children with CP are term babies. The increased proportion of premature children within the total CP population in epidemiological studies **(Pharoah et al., 1996)** is large because of increasing the number of preterm survivors. The underlying pathological lesions in these babies are periventricular leukomalacia (P.V.L), and periventricular hemorrhage **(Sciberras et al., 1999)**. Majority of these cases are secondary to CNS infections, namely meningeoencephalitis,

bilirubin encephalopathy, cerebrovascular accident and head trauma **(Phgarooh,etal., 1989)**.

Types of Cerebral Palsy:

Depends on predominant motor pattern and based on the clinical features only **(Rosenbloom, et al, 1995)**.

A. Spastic cerebral palsy:

This accounts for 70-75% of cases. It is characterized by upper motor neuron signs, namely clasp knife hypertonia, exaggerated deep tendon reflexes and extensor planter response **(Eicher et al., 1993)**.

1- Spastic Quadriplegia:

All four limbs are affected with upper limbs being equally or more affected than lower limbs. Vast majority of patients have sever mental handicap, microcephaly, growth failure, visual and hearing deficits and often epilepsy. Motor finding include hypertonicity leading to arching of the back and scissoring of legs. Walking is markedly delayed, and often the child has toe walking because of tendo-achilles tightening. Arms are internally rotated, elbows extended or lightly flexed and hands fisted. Later flexion contractures develop at ankles, knees and elbow. Swallowing difficulties and aspiration pneumonia are common due to supranuclear bulbar palsy **(Singhi et al., 1988)**.

2- Spastic Diplegia:

Lower limbs spasticity is more than upper limbs. It is often detected during the crowling phase, the infant uses the arms in normal reciprocal way but drags the lower limbs. Growth of lower limbs may suffer, and intellectual involvement is minimal, it is characteristically seen in pre-term babies with periventricular leukomalacia. However in many western studies we see a large number of term babies with spastic diplegia **(Singhi et al., 1988).**

3- Spastic Hemiplegia:

It refers to involvement of one side of the body. The arm is usually more severely affected than the leg. Right sided involvement is more frequent than left. Since normal development is cephalocaudal abnormal signs are noticed first in

arms then in legs. The following clinical signs help in arriving at early diagnosis:

(I) Poverty of movements and fisting of hand on affected side.

(II) Definite hand preference.

In children less than 12 months of age; sitting and crowling are not much delayed, walking is delayed generally. In supine position the affected lower limb is externally rotated. In sever cases the arm is held abducted. Flexed and internally rotated at the shoulder with the elbow flexed and forearm pronated, wrist flexed and thumb abducted. In long standing cases asymmetries of limb growth and vasomotor changes may occur **(Singhi et al., 1988**).

B. Dyskinetic cerebral palsy:

Including the dystonic and choreoathetoid forms. Dyskinetic CP is caused by damage to basal ganglia and other extra pyramidal structures. Often because of kernicterus and perinatal hypoxic brain damage. Clinical feature are characterized by sever motor disability with preservation of neonatal reflex pattern. Asymmetric tonic neck response (ATNR) is prominent, and postural reflexes appear later. Infants are usually hypotonic with marked head lage, drooling of saliva and feeding difficulties. Athetosis manifests generally after one year of age and tends to coincide with hypermyelination of the basal ganglia, phenomenon called status marmoratus: Reaching for objects leads to flaying of fingers. Overflow movements and facial grimacing are prominent. These are exaggerated with intention, emotion, and holding a posture. Standing and walking are delayed although intelligence is often preserved. Presence of sever physical and communicative disabilities gives a mistaken diagnosis of mental retardation **(Stanely et al., 1992).**

C. Ataxic cerebral palsy:

This occurs due to predominant involvement of cerebellum. These infants are hypotonic and inactive. Walking is delayed and gait is ataxic wide based accompanied by exaggerated balancing movement of arms. Cerebral signs are present, nystagmus is however rare **(Singhi et al., 1997).**

D. mixed type of cerebral palsy:

This is extremely rare. In many cases, it may in fact represents an evolving form of dyskinetic or spastic CP **(Singhi et al., 1997).**

Associated problems in CP:

In spastic CP children, asymmetric muscle pull and immobility could contribute to significant deformities of the spine, including lordosis, kyphosis, scoliosis, or rotational deformities. These spinal deformities can significantly affect comfort, tone, sitting and standing alignment and balance **(Braddom et al., 2007).**

Evaluation of the CP child's passive and active movement of the trunk is an essential part of the evaluation because mobility of the spine in all planes is necessary for correct alignment, smooth and symmetric movements of the spine and for full range of motion of the extremities. The therapist must document any deviation from normal, note scoliosis, excessive kyphosis and lordosis and whether the curves are structural or functional. **(Tecklin, 1999).**

Spinal deformities are important orthopedic problems among children with CP.A detailed evaluation of all these areas when the child first arrives for treatment is essential **(Weinstein, 2001).**

It is widely accepted by physiotherapists that control of normal alignment and trunk activity can positively influence the quality of peripheral and functional movement in children with neurological impairment **(Bear and Ashburn, 1995)**.

Physical therapy program for spastic children should emphasis active trunk extension and increased trunk and pelvic mobility, which can lead to improve posture and balance **(Binder et al., 1989)**.

A number of non-motor disabilities often accompany CP, their frequency varying with the type of CP, being maximum in spastic quadriplegia. Most of these are potentially treatable, namely seizures, hearing or visual problems. Some of these problems especially mental retardation, uncontrolled seizures can interfere with rehabilitation activities. Apart from these, orthopedic problems like scoliosis, dislocation of hips and medical problems like neurogenic bladder, are also seen especially in sever cases and in spastic quadriplegia **(Rosenbloom et al., 1995).**