A SYSTEMATIC REVIEW OF ELECTRICAL STIMULATION IN CEREBRAL PALSY

Thesis

Submitted in partial fulfillment of the requirements for the master degree in physical therapy

By

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فحص منهجى للتنبيه الكهربائي

فى حالات الشلل الدماغى

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إجراء فحص منهجي للتنبيه الكهربائي في حالات الشلل الدماغي/منال محمد عبد المجيد ؛ المشرفون : الأستاذ الدكتور فاتن حسن عبد العظيم،كليةالعلاج الطبيعي ، جامعة القاهرة.الأستاذالدكتور ايمان عبد الرؤوف،كلية الطب، جامعة القاهرة.ماجستير في العلاج الطبيعي.قسم العلاج الطبيعي لاضطرابات مراحل النمو و التطور عند الأطفال وجراحتها عام ٢٠٠٩ (١١٨) صفحة في ترتيبات متعددة–درجةالماجستير.

المستخلص

الهدف : تهدف هذه الدراسه الي تقييم فعالية التنبيه الكهربائي في الأطفال المصابين بالشلل الدماغي. طرق البحث: فحص منهجي. وتم البحث في Medline وOvid ، وجميع الدراسات كانت بعد عام ٢٠٠٠ باستثناء واحدة كانت في عام ١٩٩٧.أدرجت فقط التجارب العشوائية المحكومة على أنواع معينة من التنبيه الكهربائي في الأطفال الذين يعانون من الشلل الدماغي. وكانت تتراوح أعمارهم بين ثمانية أشهر وثمانية عشر عاما ، نتائج التدابير هي : المهارات الحركية والشلل التشنجي.النتائج : تم التعرف على ١٦تجربة عملية عشوائية. خمس تجارب استبعدت بالعنوان والخلاصات وآخر استبعد بعد الحصول على النص الكامل.استخدمت دراسات عن تأثير التنبيه الكهربائي على الشلل التشنجي وقوامها مجموعة من النتائج: القدرات الفنية ، مشية ، الانكماش ونمط الحياة. النتائج : نظرا لعدم تجانس الدراسات في العينة ، والتدخلات والنتائج. الشلل التشنجي والمهارات الحركية عثران التنبيةالكهربائى فعال في بعض الحالات وغير فعال في حالات أخرى. وهناك حاجة للتجارب العمليه العشوائية المصممة جيدا.

الكلمات الدالة : فحص منهجي، الشلل الدماغي،التنبيه الكهربائي ، المهارات الحركية والشلل التشنجي.

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A systematic review of electrical stimulation in cerebral palsy/ **Supervisors: Prof. Dr. Faten Hassan Abd El-Azim** Chairman and Professor in Department of Growth and Development Disorders in Children and its Surgery, Faculty of Physical Therapy, Cairo University **Prof. Dr.Eman Abd El Raouf** Professor in Department of Pediatrics, Faculty of medicine, Cairo University. **Manal Mohammed Abd El-Mageed**. Physical Therapy Department for Growth and Developmental Disorders in Children and its Surgery, Faculty of physical therapy**,** Cairo University. Thesis 2009

Abstract

Objective: The aim of this review was to assess the effectiveness of electrical stimulation (ES) in children with cerebral palsy (CP).**Methods: Design:** Systematic review. A search was made in Medline and Ovid; all studies were after 2000 except one was in 1997. Only randomized controlled trials (RCTs) on certain types of electrical stimulation (Neuromuscular electrical stimulation, functional electrical stimulation and threshold or therapeutic electrical stimulation) in children with diagnosed CP were included. Ages were between eight months and eighteen years, Outcome measures were: Spasticity and motor skills. **Results:** 16 trials were identified, five trials were excluded by title and abstracts and another one was excluded after obtaining the full text. We used studies on the effect of ES on spasticity, strength, range of motion, functional abilities, gait, contracture and life style. **Conclusions:** Due to the heterogeneity of the studies in population, interventions and outcomes; Spasticity and motor skills were found effective in some studies and ineffective in others. Well-designed trials are needed especially for different electrical stimulation interventions.

Key words: Systematic review, Cerebral palsy, electrical stimulation, spasticity and motor skills.

Contents

	Page
Chapter I: Introduction……	1
Statement of the problem**……..**	2
Purpose of the study ……	2
Significance of the study…..……...……	2
Delimitations……	4
Limitations…….	4
Chapter II: Review of literature……	5
Cerebral palsy……...…...…..…..	5
Incidence…….…	6
Etiology…….....	6
Classification…….....	7
Clinical manifestations…….……....	7
Treatment of Cerebral Palsy……..…….….....	9
Treatment approaches used in physical therapy…….....	12
Electrical Stimulation……..	19
Evidence based practice and systematic review……	25
Levels of Evidence……	28
Steps in conducting a systematic review……..…	31
Formulation of the question……..…….	33
Search and inclusion of primary studies…….....	33

Quality assessment and data extraction ……..... 36

Different types of possible bias and ways to avoid them…….. 39

Chapter III: Methodology …… 42

Search Strategy……..……..... 44

Study Selection……..... 46

Data Extraction……..….. 48

Validity (Quality) Assessment……..…..... 50

Data Analysis (Synthesis)……..... 50

Chapter IV: Results…….. 52

Chapter V: Discussion…… 91

Chapter VI: Summary and Conclusion…… 102

References……..……...…… 104

Arabic Summary

List of tables

Table No. **Page**

Table (1): Comparison of traditional and systematic reviews. **26**

Table (2): An overview of general and subject-specific electronic databases. **34**

Table (3): Search filters for specific study designs in PubMed. **35**

Table (4): Important quality features of selected study designs. **37**

Table (5_a): The quality of reporting meta-analysis of randomized controlled trials: The QUOROM statement checklist**.** **42**

Table (5_b): The quality of reporting meta-analysis of randomized controlled trials: The QUOROM statement checklist**.** **43**

Table (6): PubMed search strategy. **45**

Table (7): Data extraction sheet. **49**

Table (8): Khalili's data extraction sheet: (2008). **52**

Table (9): Van der Linden's data extraction sheet: (2008) **55**

Table (10): Ho's data extraction sheet: (2006) **58**

Table (11): Kerr's data extraction sheet: (2006) **61**

Table (12): Ozer's data extraction sheet: (2006) **68**

Table (13): Van der linden's data extraction sheet: (2003) **71**

Table (14): Dali's data extraction sheet: (2002) **74**

Table (15): Park's data extraction sheet: (2001) **77**

Table (16): Sommerfelt's data extraction sheet: (2001) **79**

Table (17) : Steinbok's data extraction sheet: (1997) **81**

Table (18): The evidence synthesis. **85**

List of figures

Figure No.		Page
Figure (1):	Types of review articles.	**27**
Figure (2):	The pyramid of evidence in Evidence Based Medicine.	**30**
Figure (3):	Steps in conducting a systematic review.	**32**
Figure (4):	An overview of the literature search strategy.	**35**
Figure (5):	How to conduct a systematic review?	**38**
Figure (6):	Flow chart of included studies.	**47**

List of Abbreviations

Abbreviation	Interpretation
CP	Cerebral Palsy.
CRD	Centre of Research and Dissemination.
EBM	Evidence Based Medicine.
ES	Electrical Stimulation.
FES	Functional Electrical Stimulation.
GMFM	Gross Motor Function Measure.
IPD	Individual Patient Data.
ITT	Intention to treat analysis.
LAQ	Lifestyle Assessment Questionnaire.
MEDC	Medical Education and Development Centre.
MeSH	Medical Subject Heading.
NMES	Neuromuscular Electrical Stimulation.
PlCO	(patient, intervention, comparison and outcome)
PT	Physical Therapy.
QUOROM	Quality Of Reporting Of Meta-analyses Of Randomized Controlled Trials.
RCT	Randomized Controlled Trial.
ROM	Range Of Motion.
TES	Therapeutic Electrical Stimulation or Threshold Electrical Stimulation.

CHAPTER I

INTRODUCTION

Cerebral palsy (CP) is an umbrella term covering a group of non progressive lesions or anomalies of the brain arising in the early stage of its development but often changing, secondary to motor impairment syndrome **(Toso et al., 2005)**.

Cerebral palsy is considered as a chronic disorder of movement and posture caused by non progressive damage to the developing brain, which occurs prenatally, perinatally or postnatally **(kulak et al., 2006).**

Andrew et al., (2004) add that it is a common case of disability insults to different areas within the developing nervous system which partly explain the variability of clinical findings.

One of the methods used in the treatment of CP is neuromuscular electrical stimulation or functional stimulation which is used for muscle re-education, strengthening, decreasing spasticity or as a biofeedback for training function such as gait pattern or rest with hand function. The desirable action of a muscle within function is used to provide feedback **(Carmick, 1993; Hazlewood et al., 1994)**.

Neuromuscular electrical stimulation (NMES) involves application of transcutaneous electrical current that results in muscle contraction **(Kerr, 2004)**. NMES has been postulated to increase muscle strength by increasing the cross-sectional area of the muscle and by increased recruitment of type 2 muscle fibers.

Functional electrical stimulation (FES) refers to the application of electrical stimulation during a given task or activity when a specific muscle is expected to be contracting **(Kerr et al., 2004; Johnston et al., 2004).**

Threshold electrical stimulation (TES) is also applied transcutaneously, it is of low intensity, and does not elicit actual muscle contraction. TES is supposed to act by increasing the muscle blood flow and bulk **(Dali et al., 2002; Kerr et al., 2004).**

Shumway-Cook and Woolacott, (2001) have used electrical stimulation with biofeedback in adults and its use with children is relatively new. The evidence in children is steel controversial and poor, especially for Carmick's studies **(Siebes et al., 2002)** but there is increasing interest in this therapy option.

Statement of the problem:

- Does electrical stimulation reduce spasticity in children with CP in available systematic review?
- Does electrical stimulation affect motor skills in children with CP in available systematic review?

Purpose of the systematic review:

The purpose of this systematic review is to assess the current evidence supporting the use of electrical stimulation on cerebral palsied children.

Significance of the study:

Traditionally, physical therapists have assumed that it is the responsibility of the researchers in our profession to determine the effectiveness of interventions. In contradictory to this perspective the viewpoint of **Harris, (1996)** that "the responsibility to deliver evidence-based treatment rests with all members of a profession. Physical therapists are strongly encouraged to consider the levels of evidence that form the basis for their clinical decisions.

There is a need for systematic review, as clinicians cannot cope with the rapid increase in the amount of medical knowledge. In 1987, it has been estimated that there are more than 20000 biomedical journals in press and more than two million articles are published every year. Such a huge volume is an obvious limitation to be followed-up and represents an obstacle for any one who would like to keep up to date in his practice. In the same time looking for information about a specific topic, concerning for example effectiveness of a therapeutic intervention or harms from certain exposure, is limited once again by the presence of tens and perhaps hundreds of primary research articles on the same topic that usually show confusing and sometimes contradictory results, Another important limitation of primary research is the flaws in its methodology and its relevance to clinical practice. An evaluation of 60352 articles from 170 journal titles published in 2000 revealed that only 4132 (6.8%) of the articles were of high quality and clinically relevant (**Mckibbon et al., 2004).**

Thus there is a general agreement that research needs to be critically appraised for its quality (validity), filtered to exclude poor research, studies of high quality needs to be summarized, their results are analyzed and, if the results of similar studies are combinable, they should be combined to give a combined single estimate **(Attia and Abdel-Raouf., 2007).**

Systematic reviews help overcoming limitations of primary research by testing its findings for consistency and whether they can be generalized across populations or not. Meta-analysis in particular increase power and precision of estimates of treatment effects and exposure risks. Besides, the explicit methods used in systematic reviews limit bias and

improve reliability and accuracy of conclusions (**Mulrow, 1994).** In this way systematic reviews and meta-analysis can help physicians, health care providers and policy makers to take informed decisions in health care.

Delimitations:

The study will be delimited to:

- Researches of randomized controlled trials on children who have CP.
- Researches of cerebral palsied children from (0-18) years old.
- Published manuscripts in English language.

Limitations:

The heterogeneity of researches that follow the criteria of the study.

Certain types of electrical stimulations such as neuromuscular electrical stimulation, functional electrical stimulation, therapeutic electrical stimulation and threshold electrical stimulation.

CHAPTER II

REVIEW OF LITERATURE

The review of the literature of the present study which was conducted to systematically review the effect of different types of electrical stimulation in cerebral palsy was presented as follow:-

- Cerebral palsy
- Electrical stimulation
- Evidence based practice and systematic review

Cerebral Palsy

Definition

Cerebral palsy (CP) is defined as “an umbrella term covering a group of non progressive, but often changing, motor impairment syndromes secondary to lesions or anomalies of the brain arising in the early stages of the development” **(Maenpa, 2005).**

Motor impairment refers to the objective evidence of abnormal neurologic signs, which is frequently associated with other neurologic disabilities. These include significant developmental delay in other domains (global developmental delay), frank cognitive impairment (mental retardation), primary sensory impairment (visual and/or auditory), learning disorders (learning disabilitiy, attention deficit hyperactivity disorder) and epilepsy **(Shevell and Bodensteiner, 2004).**

The term “Cerebral palsy” is descriptive and includes a number of etiologies and clinical presentation. CP is a symptom complex rather than a disease. It is a dynamic changing clinical picture derived from static pathology. There is no consensus about a precise age cutoff either for the timing of the insult or for the onset of symptoms but affected individuals