EFFECT OF STATIC VERSUS DYNAMIC HAND SPLINT ON GRASPING IN SPASTIC HEMIPARETIC CHILDREN

Thesis

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Abstract

The purpose of this study was to compare the effect of using static and dynamic splint on grasping in spastic hemiparetic children. The study was conducted on thirty spastic hemiparetic children ranging in age from five to seven years from both sexes. They were classified into two groups of equal numbers group (A) and group (B). Both groups received the same exercise program for one and half hour, three sessions per week for three successive months while using static splint in group A and the dynamic one in group B. In all patients the hand grip was evaluated by JAMAR hand held dynamometer while the Peabody Developmental Motor Scale in the form of fine motor quotient (grasping and visual motor integration items) was used to evaluate hand function before and after three months. The mean values showed significant improvement of both groups when comparing their pre and post treatment results in all measuring variables. But upon comparing the post treatment results of both groups there were non significant difference. The results also showed a significant correlation between fine motor quotient and grip strength. This confirms the importance of using either static or dynamic hand splint with the exercise program to improve grasping in hemiparetic children.

Keywords: Hemiparesis, static hand splint, dynamic hand splint, grasping, Peabody Developmental Motor Scale.

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List of abbreviations

Abbreviation	Name
CP	: Cerebral palsy
CNS	**:** Central Nervous System
NDT	: Neurodevelopmental treatment
GMFM	:Gross Motor Function Measure
NMES	: Neuromuscular electrical stimulation
CIMT	: Constraint induced movement therapy
IP	: Interphalangeal
MCP	: Metacarpophalangeal
DIP	: Distal interphalangeal
SCS	: Splint classification system
ROM	: Range of motion
PDMS	: Peabody developmental motor scale
GMQ	: Gross motor quotient
FMQ	: Fine motor quotient
SD	: Standard deviation
Y	: Year
S	: Significance
NS	: Not significant
P-value	: Probability value
VMI	: Visual motor integration
r	: Person correlation coefficient
b	: Regression coefficient
GMFM	:Gross Motor Function Measure

CHAPTER I

INTRODUCTION

Cerebral palsy (CP) is the commonly used name for a group of conditions characterized by motor dysfunction due to non progressive brain damage early in life. There are usually associated disabilities as well as emotional and social family difficulties. The range of severity may be from total dependency and immobility to abilities of walking, independent self-care and walking, running and other skills, although with some clumsy actions **(Levitt, 2004).** The most common form of cerebral palsy 75% is the spastic type which can be represented in the form of hemiplegia, diplegia, triplegia and quadriplegia **(Hay et al., 2001)**.

Hemiplegia is a common form of cerebral palsy which usually results from damage to the sensori-motor cortex that controls one side of the body. Many children with CP have hemiplegia with weakness and spasticity predominantly affecting one side of the body, including the arm, leg and trunk musculature. Most children with hemiplegia are independent in both walking and most activities of daily life **(Mackey et al., 2006)**.

The major problem facing hemiplegic children is the inability to use their hands for reach, grasp and manipulation, such problem affects many of the activities performed in their daily life such as dressing, eating, grooming and hand writing. In addition, upper extremity function plays an important role in gross motor skills like crawling, walking recovering balance and protecting the body from injury when recovery is not possible (**Duff et al., 2007**).

The hemiplegic child has problems with grasping which may be due to significant increase in tone, muscle weakness, or joint limitation. This child may have wrist flexion with ulnar deviation combined with finger extension, also

may have sustained forearm pronation which interferes with use of redial finger grasp patterns. Inability to vary grasp in accordance with object characteristics (**Exner, 2005**).

Management of spasticity is based on the effects of this neurological condition on the bones and tissues of the growing child. The goal of such intervention is to maximize function, reduce disability and facilitate mobility. Goal- directed treatment plans are tailored for each patient and may include a combination of physical therapy modalities, occupational therapy, casting, orthoses and surgery **(Woo, 2001).**

The upper limb orthoses are used in musclo-skeletal problems including those resulting from trauma, sports and work-related injures. They are also used frequently on patients who suffer from neurological problems, such as stroke, traumatic brain injury, multiple sclerosis, cerebral palsy, spinal cord injury and peripheral nerve injury. They are often used in arthritic conditions as well. Splint is a type of orthoses which may be applied temporarily **(de Boer et al., 2008 and Yonclas et al., 2006)**

Splints may be static with no moving parts, it is used primarily to provide support, immobilization, stabilization and protection and it is used to put the tissues in an elongated position for prolonged periods (**Bell- Krotoski, 2002**) or dynamic splints which use moving parts to permit, control or restore movement. They are primarily used to apply an intermittent, gentle force with the goal of lengthening tissues to restore motion (**Colditz, 2002**).

In both groups of the current study one group used the static and the other group used the dynamic splint while receiving the exercise program.

Statement of the Problem:

Does training with static and dynamic hand splint have different effect on grasping in spastic hemiparetic children?

Purposes of the Study:

To compare the effect of static and dynamic hand splints on grasping in hemiparetic children.

Significance of the Study:

Hemiplegic cerebral palsy is a common form of cerebral palsy it accounts about one- third of all cerebral palsied cases as a result of unilateral brain lesion where the upper limb is much more affected than the leg **(Wilsdon, 1997 and Mac Lennon et al., 2005).**

Skilled hand movements involving grasping usually develop poorly in children with spastic hemiparetic cerebral palsy. With mild spasticiy, the range of wrist joint angle begun to decrease in relation to normal children. Decrease in strength of wrist flexors gradually could be attributed to the effect of weakness of the wrist extensor muscles which in turn limit functional range of motion and the flexion attitude in upper limbs which tend to overcome normal sequence pattern of wrist joint during grasping **(Duff et al., 2001)**

Such children typically learn to grasp with the whole hand, slowly and with excessive force, which hinder many of daily living activities such as feeding, dressing, grooming etc.

Stabilizing the wrist in greater extension enables the finger flexor muscles to nearly triple their grip force. Manually or orthotically preventing the wrist from flexing maintains the extrinsic finger flexors at an elongated length more conductive to the higher force production **(Barr et al, 2001)**.

Hand splints either static or dynamic are one of the assistive orthosis which could be used with these children to improve hand function and correct hand performance pattern.

Delimitation:

The study was delimited to:

Thirty congenital spastic hemiparetic cerebral palsied children selected from the National Institute of Neuro Motor System and The Out patient Clinic of Faculty of Physical therapy, Cairo University, according to the following criteria:

1- Their age ranged from five to seven years old.

2- They had mild spasticity grade 1 and1+ according to modified Ashowrth Scale.

3- They were able to understand and carry out the verbal commands included in the exercise program.

4- They were able to sit independently with good balance.

5- Subjects with significant structural changes related to the upper limb (e.g. fixed deformity) were excluded from this study.

Limitations:

The study may be limited by:

- In co-operation of some children in achieving home program.

- The irregularity of some children attendance more than two session.

Null Hypothesis:

It was hypothesized that there was no significant difference between static hand splint and dynamic hand splint on grasping in spastic hemiparetic children.

Basic Assumptions:

It was assumed that:

1- The home routine program conducted daily according to the instructions.

2- All children were co-operative during evaluation.

3- The distracting factors were controlled in evaluating and treatment room.

CHAPTER II

REVIEW OF LITERATURE

The review of literature of the present thesis which pertain to the determination of the effect of static versus dynamic hand splint on grasping in hemiparetic children were discussed Cerebral palsy, Hemiplegia, Hand function, Grasping and Hand splint**.**

Cerebral palsy

Definition:

Cerebral palsy (CP) has been used as an umbrella term for varying disorders. Generally, it refers to motor or postural abnormalities that are noted during early development. These anomalies are thought to be associated with prenatal, perintal, or postnatal events of varying etiologies (often multifactorial in nature) **(Woodward et al., 2006).**

Cerebral palsy is a neuromuscular condition resulting from damage to the immature brain. The brain problem itself is non progressive. Cerebral palsy is a disorder of movement, posture, and intellect, the severity of which varies depending on the region of the brain affected and the site of the brain injury. Many children with CP are low birth weight, premature children **(Flynn and Skaggs, 2006).**

Etiology:

According to Jacobson and Hagber, (2004), the causes of cerebral palsy may be classified as follows:

-Pre natal causes (from conception to birth): Including genetic disorders, maternal disorders, primary fetal abnormalities, infections, and cerebral infarcts.