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RESEARCH ARTICLE

A COMPARATIVE STUDY ON THE EFFECT OF ELECTRICAL STIMULATION ALONE AND COMBINED EFFECT OF ELECTRICAL STIMULATION AND SPLINT ON HAND FUNCTIONS IN SPASTIC HEMIPLEGIC CEREBRAL PALSY CHILDREN

***[1]Vadivelan, K. and [2]Rajeshwari Hariharan**

[2]Associate Professor, SRM College of Physiotherapy, SRM Institute of Science and Technology, Kattankulathur, Chennai-603202
[1]Vice Principal, Vels College of Physiotherapy, Vels University

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ABSTRACT

Objective: The combined intervention stratergies of electrical stimulation along with splinting to decrease neural and non-neural components of hypertonicity on hand functions in spastic cerebral palsy can be appropriated.

Methodology: STUDY DESIGN- Quasi-experimental, pre-test and post-test design, STUDY SETTING- Physiotherapy department in hospitals, clinics, special schools and subjects residences, SAMPLESIZE- 20 subjects, STUDYDURATION- 3months, STUDY POPULATION- Spastic Hemiplegic children, SAMPLING METHOD- Simple Random Sampling.

Procedure: The subjects with spasticity hand is graded by passive movements using modified ashworth scale. The ranges of motion both active and passive are noted down. The level of hand functions using jebsen taylor hand functions test is also noted.

Conclusion: The combined effect of ES and splinting showed more beneficial improvement than ES alone on hand functions in Spastic hemiplegic cerebral palsy children.

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INTRODUCTION

During development, the human have acquired the bipedal statnce which has facilitated the forelimbs or the upperlimb for manipulation of this environment. This function of manipulation is unique to human kind and it differentiates from rest of the animal world. This manipulative function is brought about by the development of thumb and its opposing actions against other fingers. The functions of the hand are multiple, though the most important are the sensory function of touch and the function of prehension. The hand has numerous other functions that play essential roles in lives- functions of expression through gesture, visceral functions in carrying food to the mouth, emotional and sexual functions in caressing and aggressive function in the closed fist or the ulnar border of the hand for primarly or offense, functions relating to body care, and thermoregulatory function. Prehension may be defined as all the functions that are put into play when an object is grasped by the hands- intent, permanent sensory control and mechanism of grip is the manual mechanical component of prehension. Visual control is essential for hand function.

Corresponding author:** ***Vadivelan, K.,
Associate Professor, SRM College of Physiotherapy, SRM Institute of Science and Technology, Kattankulathur, Chennai-603202

Grip consists of four stages- opening of the hand, closing of the digits in order to grasp the objects, regulation of the force of the grip and release of grip. The impairement of voluntary motor control is the hallmark of the cerebral palsy. Cerebral palsy is defined as non-progressive insult to a developing or immature central nervous system particularly to the area that affects motor function. Spastic hemiplegia, one of the clinical presentations of the cerebral palsy is characterized by abnormal movements patterns, primarly in the upper extremities that impair many functional abilities and reduces functional independence in daily life. This also often reduces the development process as exploration of the environment is hindered. The non-neural component of connective tissues exhibits various visco-elastic properties and deformation character when subjected to an external load. The visco-elastic soft tissues undergo deformation which is both time and rate dependent. Generally, the lower the lower the rate and the longer duration of the applied force, the greater the deformation. The deformation of tissue occurs until a state of equilibrium is reached. This phenomenon is known as creep. The loss of the energy when a load is applied and then removed results in the failure of the material to return to its original dimensions and this phenomenon is known as hysteresis. The modulus of elasticity or youngs modulus

defines. It is expressed as Modulus= Stress (load)/ strain (deformation). The load- deformation curve shows areas of creep, elastic region, plastic region and ultimate failure point of load application. Electrical stimulation is one treatment technique available that facilitates agonist movement by reciprocal inhibition of antagonist, which has been used in management of spasticity of flexors of wrist and hand. To address the non-neural component the corrective and protective functions of splinting procedures is used. When a splint is provided to maintain the extensibility of shortened soft tissues, over a period of time there is elongation of the soft tissue thus resulting in increase of range of motion.

Aim of the Study

The combined intervention stratergies of electrical stimulation along with splinting to decrease neural and non-neural components of hypertonicity on hand functions in spastic cerebral palsy can be appropriated.

Need of the Study

Hand functions are often affected in children with cerebral palsy. In older children, the tightness of soft tissues due to adaptive shortening dominates over spasticity hindering hand functions. The effect of electrical stimulation in the influencing reciprocal inhibition circuitry has been studied. This study tries to explore the possible effects of electrical stimulation alone and combined effect of electrical stimulation with splinting on hand functions of spastic cerebral palsy as both neural and non-neural components of hypertonicity is intervened.

MATERIALS AND METHODS

Study Design- Quasi-experimental, pre-test and post-test design
Study Setting- Physiotherapy department in hospitals, clinics, special schools and subjects residences.
Sample Size- 20 subjects
Study Duration- 3 months
Study Population- Spastic Hemiplegic children
Sampling Method- Simple Random Sampling.

Inclusion Criteria

- Mild and moderate spastic hemiplegics both congenital and acquired whose hand functions are affected.
- Grade 2 to 3 of modified ashworth spasticity scale
- 5-10 years of age
- Both male and female were selected.

Exclusion Criteria

- Multiple disabilities
- Mental retardation
- Congenital abnormalities
- Multiple deformities and contractures
- Uncontrolled seizures

Procedure

The subjects with spasticity hand is graded by passive movements using modified ashworth scale. The ranges of motion both active and passive are noted down. The level of hand functions using jebsen taylor hand functions test is also noted. These recordings of data constitute the pre-test score. The control group received ES alone and the changes in the level of spasticity, active & passive range of motions and hand functions are noted down. This constitutes the post-test scores of the control group. The experimental group received ES & splinting (both dynamic and static-dynamic during daytime-4hrs/day to facilitate activities and static during night at least 6hrs/day to maintain the extensibility of soft tissues). The changes in the level of spasticity, active & passive range of motion and hand functions are noted down. This constitutes the post-test scores of experimental group. Before introducing children to electrical stimulator, the experimenter demonstrates the application of ES to both parents and subjects to eliminate fear of electrical stimulation. The ES Was described as being like the "tickler" and children were told they would feel a tapping sensation. The electrode was then placed on the cleaned body part. The amplitude was increased very slowly until; the child indicated that he felt the stimulation or until a trace contraction was felt and accept the sensation. The amplitude is kept within the child's tolerance.

Electrical stimulation protocol

ES –Electrical Stimulation to inhibit spasticity neural component of hypertonicity to improve hand functions. A 2 channel electrical stimulator, was used for motor level electrical stimulation for spasticity reduction using the following the parameters.

Current type- pulsed current
Wave form- square waves
Pulsed width-100 micro sec
Frequency-30-50 pulses per sec
Amplitute- motor threshold as tolerated
Time-30 min
Electrical configuration- over the antagonistic muscle
Cock up splint- To inhibit the non-neural component of hypertonicity to improve hand functions.

RESULTS

Table 1. Comparison between the mean pre-test and post-test modified ashworth scores in control; group

TESTS	MEAN	SD	t-Test	SIG
PRE TEST	2.8	0.42	3.678	0.005
POST TEST	2.2	0.63		

P<0.01 SS

Table 2. Comparison between the mean pretest and post test modified ashworth scales in experimental group

TESTS	MEAN	SD	t-TEST	SIG
PRETEST	2.7	0.48	4.811	0.001
POST TEST	1.5	0.71		

P<0.001 SS

Table 3. Comparison between pre-test and post-test modified ashworth scores of control and experimental groups

Tests	Control		Experimental		t-TEST	SIG
	Mean	Sd	Mean	Sd		
Pretest	2.8	0.42	2.70	0.48	0.493	0.628
Post Test	2.2	0.63	1.50	0.71	2.333	0.031

PRE P>0.05 NS & POST P<0.05 SS

The combined effect of ES and splinting showed more beneficial improvement than ES alone on hand functions in Spastic hemiplegic cerebral palsy children. Hypertonicity is one of the most common problems faced by the specialist in neurological rehabilitation. The neural plasticity is more evident in childhood; early intervention programs will help the child acquired those motor skills that will help in improving independence in their daily activities.

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