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EFFECT OF FLEXIBLE WRIST HAND SPLINT ON GRIP STRENGTH IN CHILDREN WITH HEMIPLEGIC CEREBRAL PALSY -: AN ORIGINAL RESEARCH ARTICLE

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Abstract: **Background:** Orthoses and splints are commonly used to improve hypertonicity of children with cerebral palsy, to prevent the spastic muscle shortening and deformities, to protect the involved extremity, positioning, immobilization, and to support motor control functions such as grip, pinch and release of objects.

Study procedure – A total 30 no of children were divided into two groups i.e experimental and control group. The subjects under control group were only advised for therapy whereas the subjects under experimental group were advised for therapy programme& fitted with splint. In this study a digital handheld dynamometer was used to measure the grip strength. So, for all subjects Grip strength was assessed before and after the treatment.

Findings and Outcomes: The Mean grip strength of subjects with Cerebral palsy recorded without using splint post-test (4.746±0.944) compared to Cerebral palsy recorded without using splint post-test (3.866±0.859) shows a change on 0.89 with a t value of 2.67. This parameter shows a significant difference. (p=0.01).

Conclusion: This study concludes that the use of prefabricated neoprene splint giving significant improvement in grip strength in children with cerebral palsy.

Clinical relevance: This study gives an objective prescription of flexible wrist hand splint for improving grip strength in children with hemiplegic CP.

Keywords: Hemiplegic CP, Prefabricated Neoprene splint, Grip Strength.

I. INTRODUCTION

Cerebral palsy (CP) is defined as a clinical syndrome characterized by a persistent disorder of posture or movement due to a non-progressive disorder of the immature brain (1). The prevalence of CP is 2 to 2.5 per 1,000 live births (2) and its incidence may be increasing secondary to improved care in neonatal intensive care units and improved survival of low birth-weight infants. (3) There are significant functional limitations in 80% of the upper limbs of individuals with hemiplegic or quadriplegic CP.

ORTHOTIC MANAGEMENT;

Orthoses and splints are commonly used to improve hypertonicity of children with cerebral palsy, to prevent the spastic muscle shortening and deformities, to protect the involved extremity, positioning, immobilization, and to support motor control functions such as grip, pinch and release of objects. Common static and dynamic splints which respectively provide complete joint immobilization and appropriate position with slight movement. Dynamic splints permit controlled voluntary movements and may prohibit muscle shortening while activate antagonist force in order to resist spastic muscles.

Several case studies have indicated functional changes by using static splints in children with cerebral palsy. Grip strength, dexterity and thumb active range of motion, have increased on account of these splints. However static splints are rigid and immobilize the affected joint. The hand splints made of soft material might be biomechanically effective via appropriately positioning the wrist.

NEED OF STUDY

Former studies advocate the use of dynamic orthoses in children with cerebral palsy however there are a few studies on appraising the effect of prefabricated Neoprene orthoses on the hand function and skills of children with cerebral palsy.

SIGNIFICANCE OF STUDY

1. The effects of short-term usage and comparison with and without splint may be evaluated.

2. This study will result in better orthotic prescription rationale in children with hemiplegic CP.

AIM & OBJECTIVE

The purpose of the present study is investigating the effect of prefabricated Neoprene splint on hand grip in children with cerebral palsy.

HYPOTHESIS; (H1)

There will be significant difference in grip strength of children with CP while using splint than without using any splint.

NULL HYPOTHESIS (H0)

There will be no significant difference in grip strength of children with CP while using splint than without using any splint.

II. MATERIALS AND METHODOLOGY

Study population: Total 30 Children of either sex with hemiplegic CP were selected from study area (General OPD/IPDfor last 12 months, Swami Vivekananda National Institute of Rehabilitation Training and Research, Cuttack, Odisha) as per the inclusion and exclusion criteria. Out of 30 subjects 19 were male and 11 were female. Again from 30 hemiplegic subjects 13 were right hemiplegic and 17 were left hemiplegic.

Inclusion criteria:-

1. Children with hemiplegic CP
2. Age range-6 to 14 yrs
3. 1st and 2nd levels of manual ability classification system (MACS) reported by occupational therapist
4. Should have an ability to hold a thing.
5. Ability to understand and follow command

Exclusion criteria-

1 Subjects with fixed contractures, post operative and medication for decreasing spasticity through the recent 6 months and other neurological defect (seizure, visual deficits etc.) were excluded.

2 Visual impairment

3 Having other medical condition (related to upper limb)

4 Patient under medication for pain

5 Patient with assistive device.

Ethical approval: - The participants in this thesis received oral and written information and given their written informed consent. The study was approved by ethical committee of Swami Vivekananda National Institute of Rehabilitation Training and Research, Cuttack, Odisha – 754010 on 28/05/2019

Sample design: -Convenient sampling techniques

Study design: -Experimental study design

Parametersto be studied : -Grip strength

Study tools and instrumentations

Digital hand dynamometer (MODEL NO EH101)

STUDY VARIABLES

1. Independent Variable - Prefabricated neoprene hand splint

2. Dependent Variable – Grip strength

III. Study Procedure :-

The children with hemiplegic CP reported to OPD were first screened through the inclusion and exclusion criteria. Then children fulfilling the criteria were included in the study. They were all explained about the study procedure. The informed consent was obtained from the individuals or their attendant prior to their participation in study. Firstly, the participants were assessed and evaluated. The demographic data like age, gender, height and weight were taken. Participants were taken by convenient sampling method. Then they were divided into two groups: experimental and control. The subjects under control group were only advised for therapy whereas the subjects under experimental group were advised for therapy programme& fitted with splint (Fig 2). In this study a digital handheld dynamometer (fig:1) was used to measure the grip strength. So, for all subjects Grip strength was assessed before and after the treatment. Here only 15 days of acclimation period was given.

As orthotic intervention, a prefabricated Neoprene splint has used. It covers two third of the forearm &elongated distally to metacarpophalangeal joints while the thumb is free. This prefabricated splint has a volar thermoplastic bar so as to provide 20° wrist extensions. All participants were positioned equally for the proximal joints during the session. Subjects were advised to sit on chair with neutral shoulder adduction and rotation, 90° flexion of the elbow, and forearm and wrist in neutral on arm rest, and asked to carry out the movement with maximum strength while the examiner held the device. During the assessment of strength, all the subjects were advised to grip the dynamometer with thumb facing the fingers and fingers alongside each other.

Fig 1 -DIGITAL HAND DYNAMOMETER

Fig – 2 - PREFABRICATED NEOPRENE SPLINT

IV. Data analysis : -

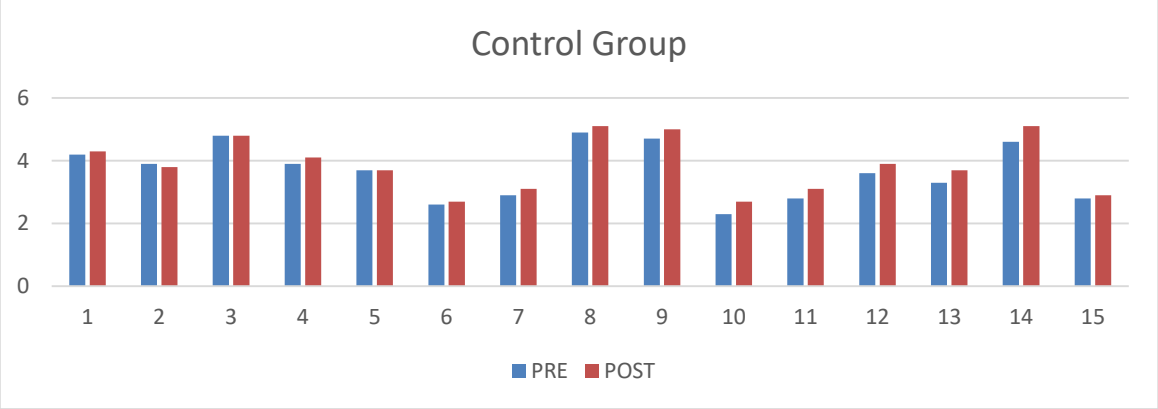
Statistical methods were used to check the significant difference between each comparisons in Statistical Package for the Social Sciences (SPSS) 20 and MS-Excel. Probability level of α=0.05 was accepted as indicative of a statistically significant difference in the individual comparisons.

V**. Results: - Grip strength of Control Group:**

The Mean grip strength of subjects with Cerebral palsy recorded without using splint pre-test (3.666±0.86) compared to post-test (3.866±0.859) shows a change of 0.2 with a t value of 4.58. This parameter shows a significant difference. (p=0.0004)

Parameter	CP without Splint - Pre (Mean +/- SD)	CP without Splint - Post (Mean +/- SD)	t- value	P value
Grip Strength	3.666±0.86	3.866±0.859	4.583	0.0004

Table 1- showing grip strength values of control group (mean with standard deviation)



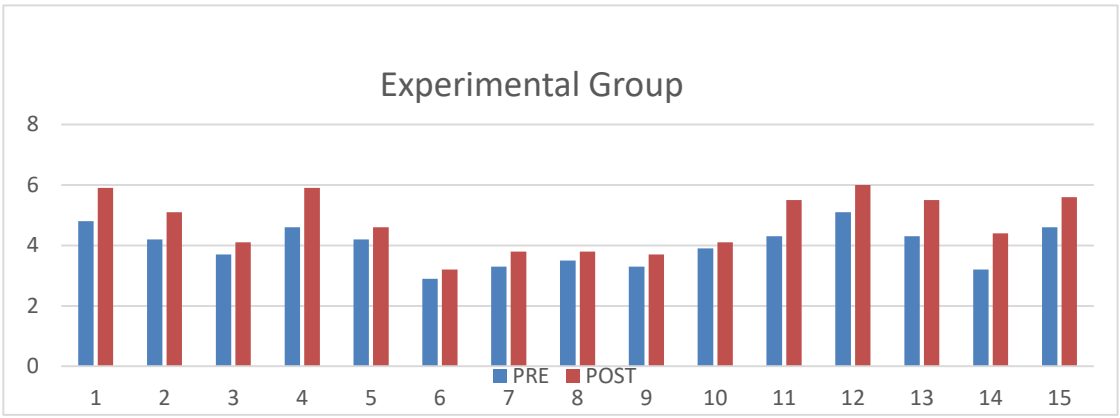
Graph 1: Comparative bar chat of pre and post in grip strength (control group)

Grip strength of Experimental Group:

The Mean grip strength of subjects with Cerebral palsy recorded without using splint pre-test (3.993±0.655) compared to post-test (4.746±0.944) shows a change on 0.7 with a t value of 7.234 This parameter shows a significant difference. (p<0.001)

Parameter	CP with Splint - Pre (Mean +/- SD)	CP with Splint - Post (Mean +/- SD)	t- value	P value
Grip Strength	3.993±0.655	4.746±0.944	7.234	0.000

Table 2: showing grip strength values of experimental group (mean with standard deviation)



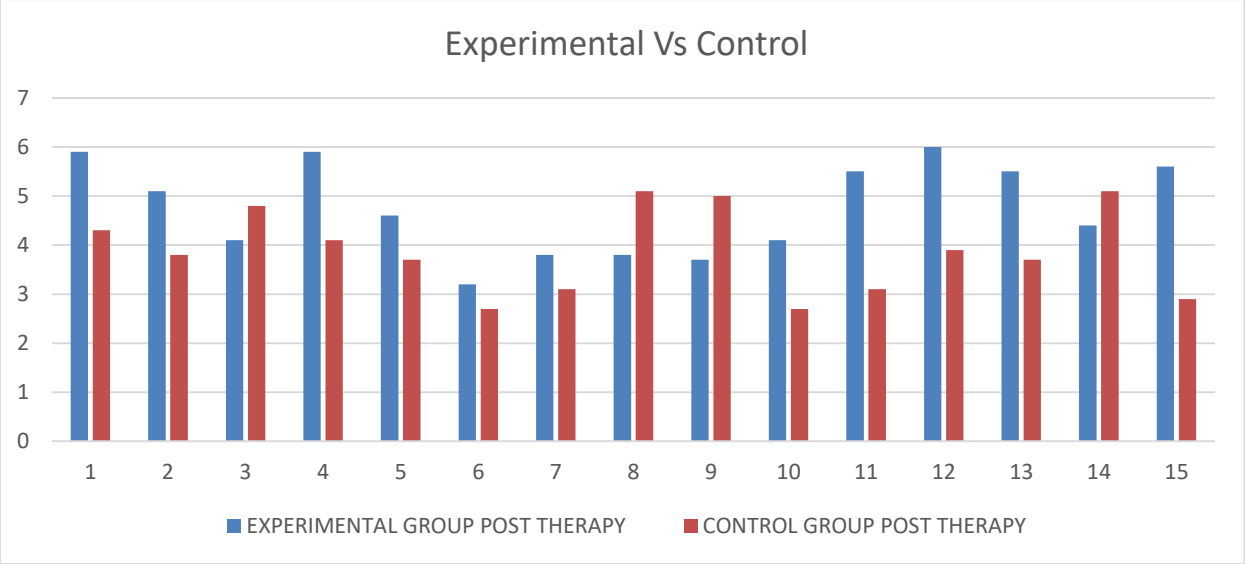
Graph 2: Comparative bar chat of pre and post in grip strength (Experimental group)

Comparison of Grip Strength of Experimental and control group:

The Mean grip strength of subjects with Cerebral palsy recorded without using splint post-test (4.746±0.944) compared to Cerebral palsy recorded without using splint post-test (3.866±0.859) shows a change on 0.89 with a t value of 2.67 This parameter shows a significant difference. (p=0.01)

Parameter	CP without Splint - Post (Mean +/- SD)	CP with Splint - Post (Mean +/- SD)	t- value	P value
GRIP STRENGTH (s)	3.866±0.859	4.746±0.944	2.67	0.01

Table 1: 4 showing GRIP STRENGTH (mean with standard deviation)



Graph 3: Comparative bar chart of post and post of experimental group and control group in grip strength

VI - DISCUSSION –

Grip strength is an important indicator and can be considered as a prognostic factor for hand function. The intent of this study was to compare the grip strength function of infantile hemiplegic CP associated with splint and therapy programme and the subjects with CP only associated with therapy. The result found out from this study that there is significant improvement in grip strength of the subjects with CP associated with splint. A study comparing the grip strength of persons with CP and able bodied found that the persons with CP had grip strength of 228N whereas able bodied had 505N. This shows that people with CP had grip strength less than half of that of able-bodied persons. The similar results have been observed by P.N.Barroso etal 2011 examined the hand movements of children with cerebral palsy during functional tests and compares the childrens' performance with and without the aid of an orthosis that provides wrist extension and thumb abduction in 32 subjects. The orthosis improved the range of motion of the trapeziometacarpal joint, muscle strength and manual ability. [4-8]

Conclusion –

Finally, this study concludes that the use of prefabricated neoprene splint giving significant improvement in grip strength in children with cerebral palsy. No doubt the continuous therapy programme will re-educate and re-strengthen the muscles involved and eventually improve the grip strength function but adding the use of a positional static functional wrist hand orthosis will further add on the improvement of hand grip strength.

Conflict of Interest –

The author does not have any conflict of interest regarding research, authorship and publication of this article.

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