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Effects of hand arm bimanual intensive therapy on upper extremity skills and fine finger dexterity among hemiparetic cerebral palsy children

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Abstract

Background: Cerebral palsy is a non-progressive lesion of the brain. It is one of the common causes of physical disability in the childhood period also affecting the education and social life of the children. Hemiplegia is a type of cerebral palsy, in which the children have limitations in using the affected upper limb for daily living activities. This study aims to find out the effects of Hand arm bimanual intensive therapy (HABIT) on upper limb skills and fine finger dexterity among children with hemiparetic cerebral palsy.

Methods: 10 children with hemiparetic cerebral palsy was undergone HABIT. Interventions lasted for 10 weeks, 3hrs/day. Quality of upper extremity skill (QUEST) to assess the children's upper limb skills and peg moving task to assess the fine finger dexterity were used before and after intervention.

Results: Result showed significant improvements on upper extremity skills of QUEST and fine finger dexterity of peg moving task.

Conclusion: HABIT is an effective therapy to improve the upper limb skills and fine finger dexterity in children with hemiparetic cerebral palsy.

Keywords: Cerebral palsy, Hand arm bimanual intensive therapy, Quality of upper extremity skills, Peg moving task, Fine finger dexterity.

1. Introduction

Cerebral Palsy (CP) is a non-progressive neurological disorder resulting from a lesion in the developing brain, affecting 2-3/1000 live births. CP is classified based on the type of neuromuscular deficit into spastic, dyskinetic, ataxic, and hypotonic and mixed. Spastic CP is the commonest and accounts for 70%-75% of all cases. The topographic classification of CP is monoplegia, hemiplegia, diplegia and quadriplegia. Hemiplegia is a non progressive damage in premature growing brain which causes disorders of movement in one side of the body. It exhibit pyramidal involvement with upper motor neuron signs of weakness, hypertonic, hyper reflexes and clonus ^[1, 2].

Spastic hemiparesis is a unilateral paresis with upper limbs more severely affected than the lower limbs. Hemiparetic CP is the most common cause of physical disability in the early childhood period, also affecting the family, child's education and social life ^[3, 4]. The upper limb functional impairments on both gross and fine motor may affect self-care activities such as drinking, feeding, dressing, and grooming. Recent evidence suggests that children with hemiplegic CP can improve motor performance if provided sufficient practice ^[5]. In everyday life, most of the activities are required both hands together with fine coordination. The intensive practice may improve function in the involved upper extremity that could lead to increased use in daily life ^[6].

Hand-Arm Bimanual Intensive Therapy (HABIT) is an advanced technique to improve the use and coordination of both arms in daily function in hemiparetic cerebral palsy children. Bimanual training is performed in group settings with an emphasis of having fun ^[7].

2. Methods

- **Aim of the study:** To find out the effects of bimanual therapy on children with hemiparetic cerebral palsy.

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- **Study Design:** Experimental study
- **Sample:** 10 subjects were selected after giving due consideration to inclusion and exclusion criteria.
- **Sampling method:** Random sampling technique was used to select the subjects.
- **Inclusion Criteria**
 - Diagnosed hemiplegic cerebral palsy
 - Both gender
 - Age 5 to 8 years
 - Modified Ashworth scale (MAS) grade >1 but <3
 - Cognitively competent and able to understand and follow instructions.
- **Exclusion Criteria**
 1. Prior upper limb surgery
 2. Uncontrollable seizures
 3. Visual problems
 4. Botulinum toxin an injection in the upper limb within 6 month prior to study.
- **Outcome measures**

1. Quality of upper extremity skills test (QUEST)

The QUEST is an outcome measure that evaluates movement patterns and hand function in children with cerebral palsy. The four domains evaluated by the QUEST include: dissociated movement, grasp, protective extension, and weight bearing. It is designed to be used with children who have neuro motor dysfunction with spasticity and has been validated with children from 18 months to 8 years of age [8, 9].

2. Peg moving task

The ‘‘Peg Moving Task’’ was proposed for the assessment of hand skill in children, and since then it has been widely used to study hand skill development and its relationships with cognitive development in children. A wooden board consisting of two rows of four holes. The timer was started when the first peg was raised and stopped when the last peg was inserted [10, 11].

Procedure

10 hemi paretic cerebral palsy children were selected. Consent was obtained for the participation of the child and the child's parent prior to enrolment. Pre evaluation was done by quality of upper extremity skill and peg moving task. Intervention was delivered to children; 3 hours per day for 10 weeks. Post intervention readings were taken after 10 weeks on the outcome parameters.

Bimanual activities were selected and directions were given to the child before the start of each task in order to specify how each hand would be used during the activity and to avoid use of non-involved extremity. If a child attempted to use the non-involved hand, the task was paused and the child was reminded of the task rules. Task difficulty was graded by speed and accuracy.

The data were collected from the samples and they were processed with the application of paired t- test for pre and post intervention.

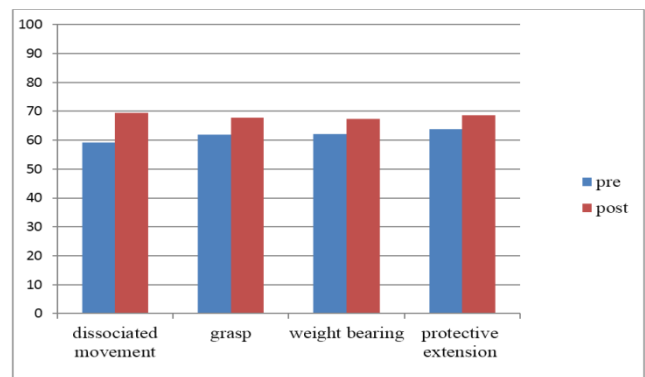
4. Data Analysis and Results

The aim of the study was to find out the effectiveness of HABIT to improve the upper extremity skill and fine finger dexterity on children with hemi paretic cerebral palsy.

Table 1: Comparison between Pre and Post in Quest

Variables	Mean difference	SD	Calculated ‘t’ value	Table value
Dissociated movement	6.54	1.73	11.95*	2.62
Grasp	5.56	1.94	9.05*	
Weight bearing	5.2	1.39	11.82*	
Protective extension	4.17	1.46	9.02*	

Table 1 displays the QUEST value of pre and post treatment. The results shows that there is significant differences in improvement of dissociated movement, grasp, weight bearing and protective extension (11.95, 9.05, 11.82 and 9.02) which is greater than table value (2.262) at 0.005 level. Hence the study shows significant improvement on QUEST scores in HABIT.

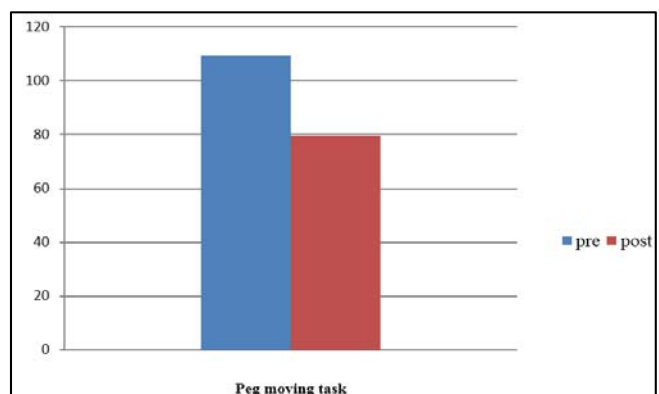


Graph 1: Comparison between Pre and Post Mean Of Quest

Table 2: Comparison between pre and post in peg moving task

Variable	Mean difference	SD	Calculated ‘t’ value	Table value
Peg moving task	33.1	3.38	21.44*	2.262

Table 2 displays the peg moving task values for pre and post treatment of bimanual therapy. The result shows that there is a significant difference on peg moving task (21.44) which is greater than table value (2.262) at 0.005 levels. Hence the study shows significant improvement on peg moving score in HABIT.



Graph 2: Comparison between pre and post Mean of peg moving task

5. Discussion

Present study was done to find out the effectiveness of HABIT to improve upper limb skills and fine finger dexterity in children with hemiparetic cerebral palsy.

The HABIT had been proven to be effective in improving upper limb skills and fine finger dexterity of upper limb in hemiparetic cerebral palsy. The result came in agreement with Syed^[4], Eliasson^[5], Carol dematteo^[8], and Nunes^[10].

It has long been believed that the brains of children are felt to have more capability than adults for cortical reorganization and it has been suggested that children with asymmetric upper extremity motor control may also be benefited from bimanual therapy. It may be effective in improving motor recovery in patients with hemiplegia because of increased size and shifting of cortical area neural firing after bimanual therapy. Bilateral practice may result in changes in cortical representations and excitability in the brain^[5, 7].

6. Conclusion

Hand arm bimanual intensive therapy is an effective treatment method to improve the upper limb skills and fine finger dexterity among the children with hemiparetic cerebral palsy.

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