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RESEARCH ARTICLE

Effectiveness of Modified Constraint Induced Movement Therapy along with Conventional Physiotherapy on Upper Extremity Function for Children with Hemiplegic Type of Cerebral Palsy

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Abstract

To determine the effectiveness of modified CIMT on upper extremity function for children with hemiplegic type of cerebral palsy (CP). This research was pre-experimental research design. Twelve (12) children (age: 2 to 8 years) from pediatric physiotherapy clinics from Savar, CRP with hemiplegic type of cerebral palsy were included in this study. Modified constraint was applied to unaffected hand. The intervention was given for 3 hours/day including 30 minutes of therapy time and home program which could split into different sessions of no less than 30 minutes duration for consecutive two (2) weeks. Conventional physiotherapy treatment was also given this experimental group in official therapy session time period. Pre and Post outcome was measured by using Wilcoxon sign ranked test on QUEST (Quality of upper extremity skill test) and PMAL (pediatric motor activity log) were taken. Significant differences between Pre and Post values of all components of QUEST and PMAL (P=0.00) showing the effectiveness of MCIMT in improving upper extremity function and in ADL activities. This is statistically as well as clinically significant improvements in both motor function and functional use of the affected upper extremity in children between the ages of 2 and 8 years with hemiplegic CP.

Keywords: Hemiplegic CP; Modified CIMT; Upper Extremity Function

Introduction

Cerebral palsy (CP) is a group of movement disorder, postural developmental disorders and is characterized by the type of motor disorder (spasticity, ataxia, dystonia and athetosis) as well as it affect the predominance of the affected limbs (hemiparesis, paraparesis) [1,2].

In one study it has been described that hemiparesis is the most frequent manifestation of cerebral palsy (CP), affecting as many as 38% of cases and can lead to disuse of the affected upper limb, with negative consequences for reaching and bimanual tasks [2]. Constraint-induced movement therapy (CIMT) has been accepted as a method of teaching a child to use his/her affected upper limb through use of a restraint on the non-affected limb by splint or gloves [3].

Another research it has been shown that after applying CIMT it causes the result in large neuroplastic changes in the organization and function of the brain those who received CIMT protocol [4]. A modified version of constraint therapy (immobilization of the unaffected limb without intensive motor training) also results in clinical improvement in children with cerebral palsy and leads to cortical reorganization in a child with hemiplegic cerebral palsy [5].

In one study by Andersen *et al.* determined the comparisons between constraint-induced movement therapy and intensive bimanual training approach, in these 2 intensive upper extremity training approaches indicate similar improvements in unimanual capacity and bimanual performance outcomes; however, when considering participant and caregiver goal achievement, evidence favors a bimanual approach.

In one study, demonstrated in a pre-test and post-test design about three children wore a splint on the non-affected extremity for 3 hours of therapy a day during 10 days in a 2 week duration [6]. Constraint-induced therapy involves in case of hemiplegic CP by constraint of the unaffected upper limb with a splint, cast or mitt for 6 hour per day for a period of 2 to 3 weeks [7].

Risk factor using CIMT are: Some temporary loss of independence as the child will be using the affected arm to complete daily activities; There may be possible increase in frustration; Possible increase risk of injury to the involved arm and hand because the child is using the affected arm more but has decreased sensory awareness and motor control; In some children if a cast was used there have been reports of mild stiffness of the uninvolved hand upon cast removal [8]. As stated above CIMT and bimanual training approaches indicate similar outcomes so in order to avoid risk factors in CIMT, current study modified the CIMT method and conducted the study to identify effectiveness of Modified Constraint Induced Movement Therapy (mCIMT) along with conventional physiotherapy on upper extremity function for children with hemiplegic type of cerebral palsy.

Materials and Methods

Participants

Twelve participants diagnosed as hemiplegic type of cerebral palsy by consultant paediatric neurologists participated in this study after written consent from their parents. This sample was taken through convenience sampling method with a 3 month data collection period. The inclusion criteria followed was willingness to participate; age group between 2 to 8 years; muscle tightness mild to moderate according to Ashworth scale, active movement of shoulder, elbow, wrist, at least 20 degree wrist extension, 10 degree thumb flexion, no uncontrolled seizures, no visual problems.

Stimulation Device

Subjects participate in the study had provided to wear a fairly comfortable sling by Principal Investigator, as a modified restraint up to wrist was used which covers fingers, thumb and hand to avoid hand function of unaffected side. The subjects can however use the hand for support or for breaking a fall. The intervention was given for 3 hours/day including therapy time and home program which they can split into different sessions of no less than 30 minutes duration for consecutive 2 weeks (12 days therapy session as Friday was closed in working day). It had been decided 3 hours treatment time according to children play time when maximum use of hand was needed.

Assessment Tool

The assessment tool used in this study was QUEST (Quality of Upper Extremity Skill Test) (dissociated movement, grasp, protective extension, and weight bearing); PMAL (Pediatric motor activity scale) (How often and how well) and Upper limbs muscle tone (Biceps brachi, wrist flexor) measured through Ashworth scale Prior to treatment and after 2 weeks of treatment [9,10]. The expert Physiotherapist working in the Pediatric unit of CRP for more than five years conduct the assessment procedures in two times during course of the study.

Research Design

Pre-experimental research design was selected because there was no static comparable control group. Only one group of participants received interventions. Here, a pre-test score was obtained before intervention and again a post-test score was obtained after intervention.

Ethical approval

The selection of participants and design of study protocol was performed only after approval from the Institutional Review Board (IRB) of Bangladesh Health Professions Institute (BHPI). Besides, the ethical standard was established in the Declaration of Helsinki.

Statistical Analysis

Data analysis was done by using SPSS 20 for windows, for both outcome measures PMAL and QUEST were used. Mean difference scores and Standard deviation for each variable were done. As the data were not normally distributed, a non-parametric test like Wilcoxon sign rank test was employed to find out the effects of intervention (as quantitative data) was used for data analysis. The p-value of less than 0.05 was considered statistically significant.

Results

Study includes twelve children were aged range in between 2 to 8 years (the mean age was 6 years). There were of 42% (n=5) boys and 58% (n= 7) girls, and not equal numbers of the right arm (n=8) or left arm (n=4) affected (Figure 1 and 2).

Result of QUEST in which p value (p=0.00) showing significant difference between pre and post values for dissociated movements, grasp, weight bearing and protective extension showing in (Table 1). It indicates modified CIMT has significant effectiveness of all components of QUEST.

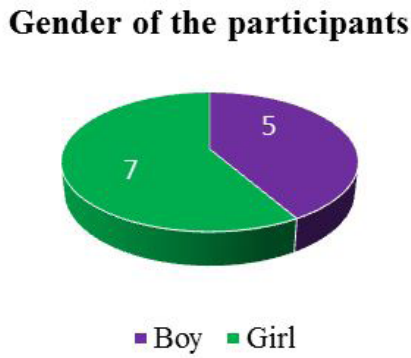

Figure 1: Gender of the participants

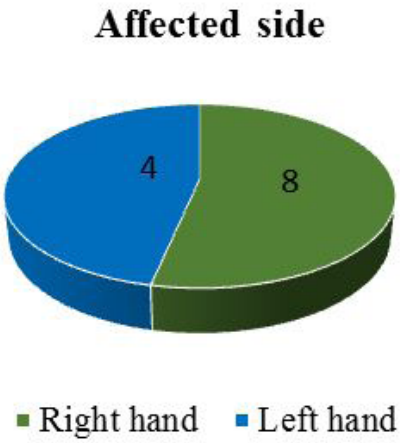

Figure 2: Affected hand of the participants

Components	Test	Mean	SD	'Wilcoxon sign ranked test' value	P value	95% CI
Dissociated movement	Pre	74.61	12.51	-3.05	0.000	Lower 0.00
	Post	87.07	9.72			Upper 0.22
Grasp	Pre	54.94	13.93	-2.94	0.000	Lower 0.00
	Post	77.49	8.14			Upper 0.22
Weight bearing	Pre	64.50	23.13	-2.87	0.000	Lower 0.00
	Post	81.83	18.73			Upper 0.22
Protective extension	Pre	49.07	33.34	-1.69	0.000	Lower 0.00
	Post	66.27	18.00			Upper 0.22
Total Score	Pre	64.24	10.53	-2.84	0.000	Lower 0.00
	Post	76.91	10.14			Upper 0.22

SD: Standard Deviation; 1 sided

Table 1: The Comparison of pre & post test score of QUEST components

Result of PMAL in which *p* value (p=0.00) showing significant difference between pre and post values of amount of use, quality of use and average score. It indicates modified CIMT has significant effectiveness of all components of PMAL.

Discussion and Conclusion

This study was planned to see the effectiveness of Modified CIMT that is on upper extremity function of hemiplegic CP children. In the QUEST there was significant improvement seen in overall 4 domains. Results from this study are consistent with other studies in showing a significant improvement in upper limb function after CIMT in children [11]. Since the potential for central nervous system plasticity in young children is increased relative to adults, it is postulated that this approach might prove to be especially effective in children [12]. In one study found that bilateral cortical activation was increased following CIMT including higher levels of activity in the contralateral sensorimotor cortex. This suggests that with CIMT, cortical reorganization occurs as new pathways between the damaged and healthy cortical hemisphere are made and control of the affected UE moves towards coming from the contralateral (lesion) hemisphere rather than solely from the ipsilateral hemisphere [10]. Modified constraint induced movement therapy yields clinically as well as statistically significant improvements in both motor function and functional use of the affected upper extremity in children between the ages of 2 and 8 years with hemiplegic cerebral palsy.

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