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

Objectives To determine the effectiveness of modified CIMT on upper extremity function for children with hemiplegic type of cerebral palsy (CP).

Design Quasi experimental research design

Participants and interventions 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 timeperiod.

Main outcome measures Pre and Post outcome measure by using QUEST (Quality of upper extremity skill test) and PMAL (pediatric motor activity log) were taken.

Results Significant differences between Pre and Post values of all components of QUEST and PMAL (P<0.05) showing the effectiveness of MCIMT in improving upper extremity function and in ADL activities.

Conclusion MCIMT is involved of intensive training of the affected arm and restriction of unaffected arm. It is used for improving manual function or ability in children with hemiplegic CP. 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. It is statistically proved that MCIMT therapy was effective for all QUEST components except protective extension.

INTRODUCTION

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 [1]. The fundamentals of CIMT are: Constraint of the unaffected hand to encourage the use of the affected hand; massed practice of the affected hand, and use of intensive techniques to train the affected hand [2]. 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 [3].

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 [4] (Taub et al., 2004). It has been shown that result in large plastic changes in the organization and function of the brain after receiving CIMT [5] (Liepert, et al. 2000). 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 [6] (Willis, et al. 2002). 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 [2]. 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.

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 (week days). 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) [7]; PMAL (Pediatric motor activity scale) (How often and how well) [8] and Upper limbs muscle tone (Biceps brachi, wrist flexor) measured through Ashworth scale Prior to treatment and after 2 weeks of treatment.

Research design:
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). Pretest–posttest designs were employed in quasi-experimental research in this study and used without control groups.

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. Paired- t test (as quantitative data) was used for data analysis. The p-value of less that 0.05 was considered statistically significant.

RESULTS

Result of QUEST in which p value (p<0.05) showing significant difference between pre and post values for dissociated movements, grasp, weight bearing and protective extension showing in (Table:1; Figure:1). But p value of protective extension was 0.073 (p>0.05) indicates that association between pre and post test was not significant.

<table>
<thead>
<tr>
<th>Components</th>
<th>Test</th>
<th>Mean</th>
<th>SD</th>
<th>‘t’ value</th>
<th>LOS 2sided</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dissociated movement</td>
<td>Pre</td>
<td>74.61</td>
<td>12.51</td>
<td>-4.58</td>
<td>0.001***</td>
</tr>
<tr>
<td></td>
<td>Post</td>
<td>87.07</td>
<td>9.72</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grasp</td>
<td>Pre</td>
<td>54.94</td>
<td>13.93</td>
<td>-4.95</td>
<td>0.000***</td>
</tr>
<tr>
<td></td>
<td>Post</td>
<td>77.49</td>
<td>8.14</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weight bearing</td>
<td>Pre</td>
<td>64.50</td>
<td>23.13</td>
<td>-3.20</td>
<td>0.008**</td>
</tr>
<tr>
<td></td>
<td>Post</td>
<td>81.83</td>
<td>18.13</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Protective extension</td>
<td>Pre</td>
<td>49.07</td>
<td>33.34</td>
<td>-1.98</td>
<td>0.073</td>
</tr>
<tr>
<td></td>
<td>Post</td>
<td>66.27</td>
<td>18.00</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

SD- Standard Deviation; LOS – Level of Significance, 2 sided
*P < 0.05; ** P < 0.01
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Table-1 demonstrated that paired ‘t’ test was used to compute the effectiveness of MCIMT in components of QUEST scale. The result shows that there was statistically significant difference between pre-test & post-test scores of all QUEST components except protective extension (t=-4.58, P < 0.05 for dissociated movement; t=-4.95, P < 0.05 for grasp; t=-3.20, P < 0.05 for weight bearing; t=-1.98, P > 0.05 for protective extension it indicates protective extension was not significant among the children).

Table 2: Comparison of pre-test & post-test of total score of QUEST

<table>
<thead>
<tr>
<th>Test</th>
<th>Mean</th>
<th>SD</th>
<th>‘t’ value</th>
<th>LOS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre</td>
<td>64.24</td>
<td>10.53</td>
<td>-3.87</td>
<td>0.003</td>
</tr>
<tr>
<td>Post</td>
<td>76.91</td>
<td>10.14</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

LOS- level of Significance

Table-2 indicates that paired’t’- test was used to find out effectiveness of MCIMT in hemiplegic CP. The results shows that there was statistically significant difference (t=-3.87, p < 0.05) between pre-test and post-test of total score of QUEST scale. So, it is statistically proved that MCIT therapy was effective for all QUEST components except protective extension.

Table 3: Variable, SD and p-value for PMAL score

<table>
<thead>
<tr>
<th>Variable</th>
<th>Pre Mean</th>
<th>Post Mean</th>
<th>‘t’ value</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>How Often</td>
<td>15.75</td>
<td>25.67</td>
<td>-4.890</td>
<td>0.000</td>
</tr>
<tr>
<td>How Well</td>
<td>16.33</td>
<td>26.50</td>
<td>-4.843</td>
<td>0.001</td>
</tr>
<tr>
<td>Average</td>
<td>16.04</td>
<td>26.09</td>
<td>-4.86</td>
<td>0.001</td>
</tr>
</tbody>
</table>

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 but less improvement in protective Extension. Results from this study are consistent with other studies in showing a significant improvement in upper limb
function after CIMT in children [9]. 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 [10]. 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 [8].

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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REFERENCES


