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RESEARCH ARTICLE

EFFICACY OF CONSTRAINT-INDUCED MOVEMENT THERAPY IN CHILDREN WITH HEMIPLEGIC CEREBRAL PALSY

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ABSTRACT

Aim: The aim of this study is to investigate the effect of constraint induced movement therapy in improving upper limb function of children with hemiplegic cerebral palsy. **Methodology:** After satisfying inclusion and exclusion criteria the subjects were randomly selected and assigned in two group: group1 (Experimental Group) and group 2 (Controlled Group). Each group consists of 15 samples on which after applying QUEST, T- test also applying to analysed difference between two groups which is further sub- divided between Pre- Treatment and Post Treatment. **Results:** QUEST and Parametric Test were the statistical tools evaluating the result at the end of 6 Weeks intervention in which both the group shows significant improvement. Group 1 t- test value (2.03) is better than the group 2 t value (0.164). **Conclusion:** Both the treatment techniques are effective to gain success on the recovery of C.P children. Group 1 shows higher score than group 2. Similarly post treatment in both the groups shows higher response than the pre treatment stage in both the groups.

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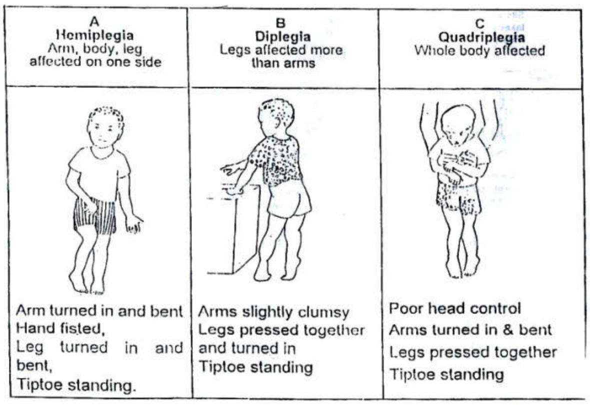
INTRODUCTION

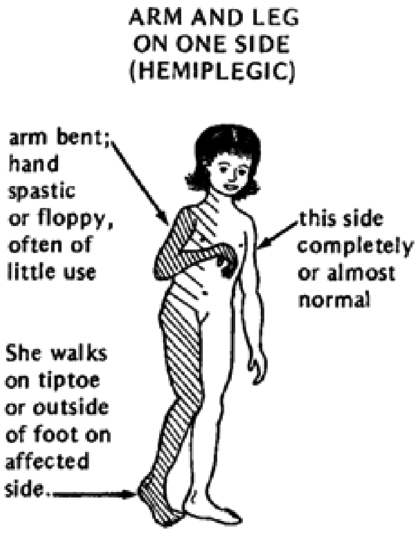
Cerebral Palsy (CP) describes "a group of disorders of the development of movement and posture, causing activity limitations that are attributed to non-progressive disturbances that occurred in the developing fetal or infant brain" (Bax *et al*., 2005). It is characterised by sensorimotor dysfunction as manifested by atypical muscle tone, posture and movement. The motor disorders of cerebral palsy are often accompanied by disturbances of sensation, perception, cognition, communication and behaviour, by epilepsy and by secondary musculoskeletal problems (Rosenbaum *et al*., 2006). The estimated prevalence in the general population is 2/1000 (Bax *et al*., 2005; Odding *et al*., 2006). The limitations in activity require individual rehabilitation throughout life (Scrutton *et al*., 2004). Hemiplegia characterised by a clinical pattern of unilateral motor impairment, is a common type of cerebral palsy accounting for 15- 40% of all cerebral palsy.[5] Severity of impairment varies widely, depending on the site and severity of brain damage (Carr, 1996; Maegaki *et al*., 1997). Reduced upper limb function may result from sensory abnormalities, weak grasp, loss of fine-sequenced movements of the fingers, loss of speed of movement, loss of fine motor skills, associated and mirror movements, retention of grasp reflex and spasticity (Brown *et al*., 1987; Eliasson *et al*., 1995; Eliasson and Gordon, 2000). For children with hemiplegic cerebral palsy (cp), one hand functions well while the other has some degree of dysfunction (Uvebrant, 1988; Scrutton, 2000). Impairment of the upper limbs generates complications in almost all forms of human activity: self-care, school or work, and engagement in play or leisure activities (Exner, 2001, Sköld *et al*., 2004). The characteristics of the hemiplegic hand can be described as slow and weak, with uncoordinated movements, incomplete finger fractionation, spasticity, and commonly, impaired tactile sensibility (Uvebrant, 1988; brown and walsh; 2000, krumlinde- sundholm and Eliasson; 2002). The cause of hemiplegic CP is heterogeneous: timing, location, and extent of the brain damage vary (Cioni *et al*. 1999). The different forms of lesions may influence the development of hand function as well as the likely response to treatment. It has been possible to correlate the morphological findings with neuropathological knowledge to characterize the lesions and assess the time of insult (Wiklund *et al*. 1991, Niemann *et al*. 1994).

On the basis of those studies, lesions are divided into three main groups

- Cerebral malformation – a lesion of early fetal origin
- Periventricular lesions which occur in the most vulnerable part of the brain between the 24th and 34th weeks of gestation; and
- Cortical/subcortical lesions which occur in areas that are the most vulnerable at term.

Using this grouping it was found that the involvement of hand function was mild in a group of children with cerebral malformation compared with a group with periventricular lesions.





Also, hand function was most severely impaired in the group with subcortical/cortical lesions, (Wiklund and Uvebrant, 1991). From an early age, children with a unilateral impairment will tend to use their non-affected hand as the dominant hand even when the actual functional loss is mild (Krumlinde-Sundholm *et al*., 1998). Over time these children learn to disregard the affected arm which has the potential to lead to further impairment including increased muscle tone, poor motor control, decreased active and passive range of motion of the joints of the limb, generalised weakness and a delay in skeletal maturation (Roberts *et al*., 1994; Scrutton *et al*., 2004). Another important factor which may contribute to a developmental disregard of the affected upper limb in a child with hemiplegic cerebral palsy is the presence of mirror movements. These occur when repetitive voluntary movements of one hand are accompanied by involuntary mirrored movements of the other hand (Kuhtz-Buschbeck *et al*., 2000). Considered to be normal early in motor development, mirror movements are observed to be more pronounced or are prolonged with childhood hemiplegia. The mirror activity was associated with poor bimanual coordination (Kuhtz-Buschbeck *et al*., 2000).

This is because the two hands perform asymmetrical actions in most activities of daily living and in these situations mirror movements disturb co-ordinated performance. In children with hemiplegic cerebral palsy, mirror activity was stronger in the non-affected hand than in the affected hand (Kuhtz-Buschbeck *et al*., 2000). Physical therapy (PT) plays a central role in managing the condition; it focuses on function, movement and optimal use of the child's potential. PT uses physical approaches to promote, maintain and restore physical, psychological and social well-being. Physiotherapists also teach parents how to handle their child at home for feeding, bathing, dressing and other activities, and give advice on mobility devices. Conventional management of the upper limb of children with hemiplegic cerebral palsy has involved the use of modalities such as splinting, casting, passive stretching, the facilitation of posture and movement (for example through neuro-developmental therapy), spasticity medication such as Baclofen, surgery and the use of Botulinum toxin-A (Boyd *et al*., 2001; Hoare and Imms, 2004; Wasiak *et al*., 2004). In general, the primary aim of these therapies is to reduce muscle tone and spasticity, increase range of movement of the affected limb and improve functional use of the limb (Hoare *et al*., 2007). Traditionally therapists working with children with hemiplegia have attempted to encourage normal movement of the affected hand by utilising bimanual tasks or voluntary repetitive practice of unilateral activities. In order to engage in these activities often verbal and physical prompting is required to encourage repeated practice with the affected hand (Hoare *et al.,* 2007). Such persistent prompting can become frustrating for a child when movements are clumsy and effortful and often do not result in a successfully completed task as perceived by the child. Negative behaviours can occur in response to this persistent prompting (Hoare *et al*., 2007). Forced Use of the affected limb removes the need for persistent prompting and may be a more effective way of improving outcomes (Hoare *et al*., 2007). Further mirror movements cause poor bimanual coordination and a decrease in the use of the affected hand as they interfere with the skilled performance of the non-affected hand (Kuhtz-Buschbeck *et al*., 2000). These findings support a unilateral approach to treatment in children with hemiplegic cerebral palsy (Hoare *et al*., 2007). Constraint-induced movement therapy (CIMT) is emerging as a treatment approach for use with children with hemiplegic cerebral palsy.
It aims to increase spontaneous use of the affected upper limb and thereby limit the effects of developmental disregard.

CIMT is based on two fundamental principles: constraint of the non-affected limb and massed practice of therapeutic tasks with the affected limb (Hoare *et al*., 2007). CI therapy has been advocated as an effective intervention for adults who have had a stroke resulting in upper-limb dysfunction (Taub *et al*., 1999). It belongs to a group of cognitive neurorehabilitation therapies based on the premise that 'learned non-use' occurs when individuals fail to use the affected hand.

The elements of CI therapy 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 (Taub 1980, Taub *et al*., 1993, Taub and Uswatte 2003).

A few case studies and small randomized studies have examined the effects of restraining the unaffected hand of children diagnosed with hemiplegic CP, all of which have indicated a positive outcome for the treatment (Yasukawa 1990, Crocker *et al*. 1997, Charles et al., 2001, Willis *et al*., 2002, Taub *et al*., 2004). CI therapy has also been investigated in a group of adolescents with hemiplegic CP engaged in a 2-week day camp (Eliasson *et al*. 2003). The results revealed that hand function did improve. However, additional controlled studies are needed to understand better,

- The kind of improvements that can be expected,
- Which children would benefit from the treatment,
- At which age the treatment is most efficient, and
- If the results vary with the type of impairment and the severity of the hemiplegic CP.

This study aimed to evaluate the effects of a modified version of CI therapy and make comparisons with conventional paediatric treatment in young children with hemiplegic CP. In particular, we wanted to consider whether this type of unimanual treatment has an effect on the performance of tasks where, commonly, two hands are needed. Though CIMT is found a have significant treatment effect in children with hemiplegic cerebral palsy the evidence is based on trials with methodological limitations and ambiguous reporting (Hoare *et al.,* 2007) and therefore there is a need for additional research to adequately support the use of this therapy.

Objective: The Objective of this study is to investigate the effect of constraint induced movement therapy in improving upper limb function of children with hemiplegic cerebral palsy.

Hypothesis

Experimental Hypothesis: There is significant improvement in the upper limb function of hemiplegic cerebral palsy children after undergoing constraint induced movement therapy.

Null Hypothesis: There is no significant improvement in the upper limb function of hemiplegic cerebral palsy children after undergoing constraint induced movement therapy.

Review of Literature: Adults with hemiparesis following stroke are believed to exhibit a phenomenon termed learned no-use (Taub, 1980). Similarly as children with hemiplegic cerebral palsy grow and develop they learn strategies and techniques to manage daily tasks (for example play) with one hand. Performance of tasks is discovered to be more efficient and effective using the non-affected hand even if there is only mild impairment in the affected limb (Kuhtz-Buschbeck *et al*., 2000). Recently, DeLuca introduced the term developmental disregard to describe a child with hemiplegia who may disregard or learn not to use, the affected limb during the development of motor function (DeLuca, 2002). Despite the similar behavioural mechanisms of reinforcement of the unaffected hand and suppression of the affected hand, as identified in adults, Eliasson suggested that the learned non-use may be a different phenomenon in children who sustain an early brain lesion (Eliasson *et al*., 2003). Unlike an adult who has had a neurological insult later in life, a child with hemiplegia has not had the experience of normal motor function of the limb. There is not the potential to unmask motor function that is inhibited. Therapy must, therefore, create the opportunity, experience and environment in which a child can learn how to use their affected limb. This experience must reverse the behavioural aspect of suppression of use of the affected limb and reward use of that limb in even the simplest tasks such as stabilisation of an object. CIMT is proposed as a method of achieving this (DeLuca, 2002). CIMT has its foundation in behavioural research with non-human primates, conducted by Taub and co-workers.[20] The researchers surgically abolished somatic sensation in a single forelimb in a monkey using dorsal rhizotomy (de-afferentation). Following surgery, the forelimb was not freely used by the monkeys in usual activities despite intact motor function roots.

After restricting the movement of the intact forelimb continuously for a period of days however the monkey could be induced to use the de-afferented extremity (Taub, 1980). Taub reported that although the movements were not normal they were extensive and effective and the authors considered the intervention to have provided a substantial rehabilitation of movement (Taub, 1980). CIMT is based on two fundamental principles: the constraint of the non-affected limb and massed practice of activities with the affected limb. CIMT attempts to change the contingencies of behavioural reinforcement so that the learned non-use of the more affected upper limb is "counter-conditioned or lifted" (Morris and Taub, 2001). The consequent increase in the use of the more affected limb is argued to "induce expansion of the contralateral cortical area controlling movement of the more affected limb" and to recruit new ipsilateral areas (Morris and Taub, 2001). It is proposed that this may serve as the neural basis for the permanent increase in use of the affected limb following treatment (Morris and Taub, 2001). Taub (1980) suggests that CIMT for the upper limb involves inducing use of the more-affected limb for a target of 90 percent of waking hours by using a sling or half glove over a period of two to three weeks (Taub and Wolf, 1997). During this time, concentrated, repetitive training of the more affected limb is provided daily for six hours using a shaping technique (Taub *et al*., 1999). The shaping procedure involved '(a) providing explicit verbal feedback and verbal reward for small improvements in task performance; (b) selecting tasks that were tailored to address the motor deficits of the individual patient; (c) helping the patient to carry out parts of a movement sequence, if they were incapable of completing the movement on their own at first; and (d) systematically increasing the difficulty of the task performed' (Morris and Taub, 2001). Huang *et al*. (2009) in a systematic review report that evidence from more-rigorous studies demonstrated an increased frequency of use of the upper extremity following CIMT for children with hemiplegic CP but the critical threshold for intensity that constitutes an adequate dose cannot be determined from the available research and further research should include a priori power calculations, more-rigorous designs and comparisons of different components of CIMT in relation to specific children and measures of potential impacts on the developing brain (Huang *et al*., 2009). Hoare *et al*. (2004) in a systematic review found a significant treatment effect using modified CIMT and a positive trend favouring CIMT and Forced Use but the evidence available is limited. They conclude that the use of CIMT and Forced Use should be considered experimental in children with hemiplegic cerebral palsy and further research using adequately powered RCTs, rigorous methodology and valid and reliable outcome measures is essential to provide higher level support of the effectiveness of CIMT for children with hemiplegic cerebral palsy (Hoare *et al*., 2007). Boyd *et al*. (2001) in a systematic review of the literature on the management of upper limb dysfunction in children with CP report that the range of management options includes physiotherapy, occupational therapy, neurodevelopmental therapy and conductive education; peripheral splinting and casting; focal or generalized pharmacotherapy and surgery to improve upper limb function or correct deformity but constraint induced movement therapy is an emerging therapy in the management of the upper limb in cerebral palsy (Boyd *et al*., 2001). Charles *et al.* in a single-blinded, randomized, control study examined the efficacy of modified child friendly CI therapy, in children with hemiplegic cerebral palsy (CP). Children wore a sling on their non-involved upper limb for 6 hours per day for 10 out of 12 consecutive days and were engaged in play and functional activities.

Results suggest that for a carefully selected subgroup of children with hemiplegic CP, CI therapy modified to be child-friendly, appears to be efficacious in improving movement efficiency of the involved upper extremity (Charles *et al*., ?). Taub *et al.* (1994) report that in a randomized, controlled clinical trial of pediatric CI therapy subjects acquired significantly more new classes of motoric skills; demonstrated significant gains in the amount and quality of more-affected arm use at home; and in a laboratory motor function test displayed substantial improvement including increases in unprompted use of the more-affected upper extremity and the benefits were maintained over 6 months, with supplemental evidence of quality-of-life changes for many children (Taub *et al*., 2004. DeLuca *et al.* (2002) in a randomized crossover trial demonstrated that pediatric constraint-induced therapy involving constraint of the functional upper extremity and intensive therapy with the hemiparetic upper extremity is superior to conventional physical and occupational therapy and pediatric constraint-induced therapy produced significantly greater gains than conventional rehabilitation services (Deluca *et al*., 2006). Sung *et al.* (2005) in a study to determine the efficacy of forced-use therapy (FUT) on the improvement of upper-extremity function in children with hemiplegic cerebral palsy report that FUT combined with a conventional rehabilitation program appears to be more effective than a rehabilitation program alone in improving affected hand function in children with hemiplegic CP (Sung *et al*., 2005). Gordon *et al.* (2006) in a study report that the intensive practice associated with CI therapy can improve movement efficiency and environmental functional limitations among a carefully selected subgroup of children with hemiplegic CP of varying ages and that this efficacy is not age-dependent (Gordon *et al*., 2006). DeLuca *et al.* (2003) in a case report reveal that Pediatric Constraint-Induced Therapy given to the less affected UE on 2 separate occasions for a young child with quadriparetic cerebral palsy resulted in development of independent reach, grasp, release, weight bearing (positioned prone on elbows) of both UEs, gestures, self-feeding, sitting, increased interactive play using both UEs and increased independence and improved quality of UE movement (DeLuca *et al*., 2003). Willis *et al.* (2002) in a study to determine the efficacy of forced use or constraint-induced, movement therapy in improving function of the paretic arm in children with chronic (>1 year) hemiparesis report that forced use can be an effective rehabilitation technique in children with chronic hemiparesis (Willis *et al*., 2002). Eliasson *et al.* (2005) in a study to evaluate the effects of a modified version of constraint-induced (CI) movement therapy on bimanual hand-use in children with hemiplegic cerebral palsy report that children who received CI therapy improved their ability to use their hemiplegic hand significantly more than the children in the control group (Eliasson *et al*., 2005). Wallen *et al* (2008) in a study to determine the feasibility of family-focused, modified constraint-induced therapy with children with hemiplegic cerebral palsy report that modified constraint-induced therapy is acceptable to participants and over the intervention period, participants experienced improvements in the performance of important daily activities as determined by the primary outcome measures (Wallen *et al*., 2008). Sutcliffe *et al.* (2009) in a study to evaluate cortical change after constraint therapy and explore a novel approach to quantify developmental disregard report that Functional MRI laterality indices were variable pretreatment and exclusively contralateral post-treatment and clinical improvement post-treatment and suggest that a shift to or persistence of contralateral cortical activity for affected hand movement is important for constraint therapy mechanism of action and developmental disregard may be a predictor of positive response to treatment (Sutcliffe *et al*., 2009).

In a study to measure the clinical improvement and cortical reorganization in a child with hemiplegia who underwent modified constraint-induced movement therapy report improved clinical measurements, Functional magnetic resonance imaging showed bilateral sensorimotor activation before and after therapy and a shift in the laterality index from ipsilateral to contralateral hemisphere after therapy and Magnetoencephalography showed increased cortical activation in the ipsilateral motor field and contralateral movement evoked field after therapy and the cortical reorganization was maintained at the 6-month follow-up (Sutcliffe *et al*., 2007). Juenger *et al.* (2007) in a study to assess neuromodulative effects of CIMT in congenital hemiparesis report that increases in MRI activation were consistently observed in the primary sensorimotor cortex of the affected hemisphere. Thus the potential for neuromodulation is preserved in the affected hemisphere after early brain lesions and even a short period of CIMT can induce changes of cortical activation in congenital hemiparesis (Juenger *et al*., 2007). Kim *et al.* (2004) in study to determine the plastic changes of motor network after constraint-induced movement therapy report that MRI showed new activation in the contralateral motor/premotor cortices and increased activation of the ipsilateral motor cortex and SMA. They concluded that plastic changes of the motor network occurred as a neural basis of the improvement subsequent to CIM therapy following brain injury (Kim *et al*., 2004).

Sakzewski *et al.* (2009) in a systematic review of the efficacy of nonsurgical upper-limb therapeutic interventions such as intramuscular botulinum toxin A combined with upper-limb training; constraint-induced movement therapy; hand-arm bimanual intensive training and neurodevelopmental therapy for children with congenital hemiplegia conclude that no one treatment approach seems to be superior. However, injections of botulinum toxin A provide a supplementary benefit to a variety of upper-limb–training approaches and additional research is needed to justify more-intensive approaches such as constraint-induced movement therapy and hand-arm bimanual intensive training (Sakzewski *et al*., 2009).

MATERIALS AND METHODS

Research Design: Single factor experimental design used for the study.

Source of data: Data collected from subjects who attended Maharaj Vinayak Global Hospital jaipur with diagnosis of hemiplegic cerebral palsy.

Sampling method: Random sampling method

Method of collection of data

Subject selection criteria: 18 patients diagnosed with hemiplegic cerebral palsy within the age group of 2 - 8 years of both gender recruited. To be eligible for the study the subjects should fulfill the following inclusion and exclusion criteria.

Inclusion Criteria

- Hemiplegic cerebral palsy
- Spastic type CP
- Good health
- Good cognition
- 2 - 8 years of both gender recruited

Exclusion criteria

- Associated mental impairments
- Athetoid, ataxic or mixed types of CP
- Children on spasticity medications
- Surgery for reduction of spasticity
- Unwilling to use upper limb sling
- Restricted passive JROM in the affected upper limb

Procedure: The subjects who fulfilled the inclusion and exclusion criteria assigned to one of two groups after obtaining written informed consent from the parents.

Group 1: This group consist of 15 subjects (N=) of both gender and they undergo constraint induced movement therapy. (Experimental group)

Group 2: This group consist of 15 subjects (N=15) of both gender and they undergo conventional physiotherapy. (Control group)

Interventions: Both groups took treatment for six times a week for six weeks.

Constraint Induced Movement Therapy: The CIMT involves 2 components. First, the child's unimpaired upper extremity constrained in an upper limb sling. Second, the pediatric CIMT training procedures by shaping began (Taub *et al*., 1994; Taub, 1977). The therapy given for 2 hours per day. Shaping involves presenting interesting and useful activities to the child in ways that provided immediate, frequent and repetitive rewards (primarily verbal praise, smiles and supportive gestures with some food and toys) for the child's efforts and increasingly functional use of the impaired extremity. Shaping tasks selected by considering 1) the family and child's goals, 2) the intrinsic motivating properties of an activity, 3) promotion of independence by acquisition of age-appropriate self-help skills and 4) the movements that therapist believed has the greatest potential for improvement (Taub *et al*., 1994). Tasks such as reaching, grasping, holding, manipulating an object, bearing weight on the arm and making hand gestures were divided into their small component skills, which worked on individually and later chained together to comprise a target activity. When the child demonstrates a new movement skill, the therapist will proceeded to shape this by increasing the demands for more precision, strength, fluency, automaticity, and functional versatility. The CIMT will also incorporate everyday tasks (eg, dressing/undressing, eating, bathing and grooming) in the therapy sessions. Parents encouraged to join in therapy-related activities and to encourage their child to use newly acquired skills when the therapist is not present. When a child showed signs of fatigue, frustration or reduced interest, the activities adapted but not cease the therapy. Rest intervals provided as needed.

Conventional Physiotherapy: Conventional Physiotherapy provided for 1 hour a day and include passive stretching of spastic muscles, strengthening of antagonistic muscles, passive and active free movements to improve ROM, trunk balance exercises, weight bearing through the affected upper limb, reaching activities in seated position, peg board activities and other task oriented activities.

Outcome measurements: The upper limb function measured at the beginning and at the end of 6 weeks of intervention using the Quality of upper extremity skills test.

Quality of upper extremity skills test: Children with cerebral palsy move in certain abnormal patterns. These patterns movement often interfere with functional ability. The Quality of upper extremity skills test (QUEST) is a standardized test that was developed to assess the qualitative components of movement in children who have a neuromotor dysfunction with spasticity. QUEST has been validated with children with 18 months and 8 years age. It evaluates the quality of movement in four domains: dissociated movement, grasp, protective extension and weight bearing. These movement forms part of normal development and are the foundation for the upperlimb function. It has good interrater reliability over time (Dematteo *et al*., 1992; Dematteo *et al*., 1993). The dissociated movement domain will be used in this study to assess the quality movement. The subject's performance in the QUEST will be facilitated by demonstrating the various positions or actions in the dissociated movement domain and providing verbal encouragement. All the items in the domain will be scored for both left and right upper limbs using a dichotomous (yes/no) scale. The no. of positive and negative responses will be tallied to calculate the percentage scores. The dissociated movement domain requires the subject to perform items in which they had to move out of the typical patterns of spastic synergies e.g. shoulder flexion with elbow and wrist in extension instead of the typical pattern of flexion at all joints. The items in this domain represent each joint of the upper limb: shoulder, elbow, wrist, finger and thumb. The subjects will be required to move the upper limb into various positions. If they met the required criteria they will score respectively.

Data analysis and Results: The data collected will analyzed using parametric tests. The intra group pre and post-test data will be analyzed using paired t test while the post-test inter group data will be analyzed using unpaired t test.

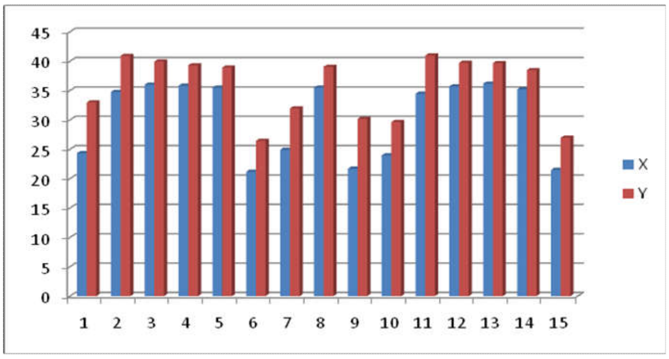
RESULTS

QUEST and Parametric Test were the statistical tools evaluating the result at the end of 6 Weeks intervention in which both the group show significant improvement. Group 1 t- test value (2.03) is better than the group 2 t value (0.164).

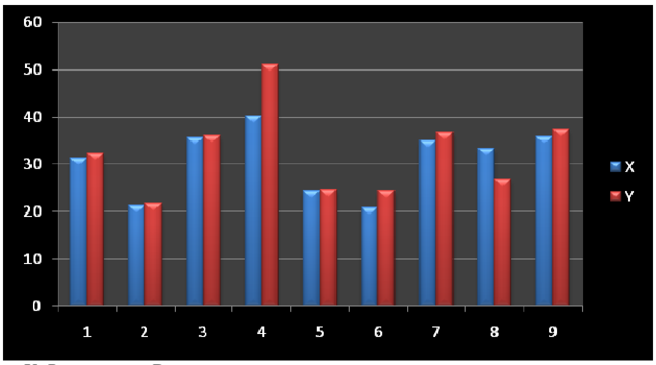
Table 1. Experimental Data Analyses

X	Y	X''	Y''	X2	Y2
24.38	33	5.61	-2.54	31.47	6.5
34.77	40.94	4.78	5.4	22.84	29.05
36.03	39.98	6.04	4.44	36.48	19.62
35.87	39.33	5.88	3.79	34.57	14.28
35.53	38.94	5.54	3.4	30.69	11.49
21.2	26.48	8.79	-9.06	77.26	82.26
24.94	31.97	-5.05	-3.57	25.5	12.81
35.53	39.08	5.54	3.54	30.69	12.46
21.71	30.2	8.28	-5.34	68.55	28.62
24	29.66	-6.29	-5.5	39.56	30.25
34.5	41	4.21	5.84	17.72	34.1
35.75	39.75	7.07	-5.75	49.9	33.66
36.2	39.7	5.91	4.54	34.92	20.61
35.25	38.5	4.96	3.34	24.6	11.15
21.5	26.98	-8.79	-8.16	77.26	66.58
427.21	492.82			567.95	379.78

1%level t value =1.3
5%level t value=1.746



Pre Treatment Mean	Post Treatment Mean	Mean Difference	Standard Deviation Combined	Standard Error	T value	Degree Of Freedom
28.68	32.85	-4.19	5.79	2.11	1.97	28



X=Pre treatment Data
Y= Post Treatment Data

Chart: Graphical Representation of Controlled Data
Table of Controlled Data

X	Y	X''	Y''	X'2	Y'2
31.33	32.41	1.56	-0.27	2.45	0.077
21.2	21.7	-8.56	-1048	73.3	120.73
35.66	36	5.89	3.312	34.78	10.96
40.21	51.14	10.44	1.42	109.16	340.47
24.38	24.6	-5.38	-8.08	28.96	65.415
20.75	24.4	-9.01	-8.28	81.21	68.69
35.14	36.7	5.37	4.012	28.92	16.096
33.32	26.96	-6.44	-5.72	41.49	32.8
35.87	37.29	6.1	4.6	37.3	21.17
31.12	31.87	3.61	-7.64	12.96	58.36
21.2	22.45	-6.31	-17.09	39.81	292.11
35.66	37	8.51	-2.54	72.42	6.45
31.97	34.64	4.46	-4.9	19.89	24.01
24.38	24.94	-3.13	-14.6	10.32	213.16
20.75	24.28	-6.76	-15.26	45.69	232.56
432.88	536.36			638.69	1503.24

DISCUSSION

In this study, young children with hemiplegic CP have been shown to benefit from a period of CI therapy. The improve-ments were considerably larger than those appearing in the control group. Thus, the unilateral hand training executed was found to improve the usefulness of the hemiplegic hand for bimanual activity performance. There were, however, large interindividual differences. It has been shown that both intensity and type of training are important factors in rehabilitation outcome, although there is more evidence for intensity than for type of training (Kluzik *et al*., 1990, Reddihough *et al*., 1994, Kwakkel *et al*., 1999). Surprisingly, the amount of improvement in this study was not related to time spent wearing the constraining glove, e.g. the training intensity.

The reason for this can only be spec-ulated on. The commitment from the persons in the child's environment to a 2-month training period, to keeping a daily diary, and having regular visits from a therapist who focused specifically on supporting hand training, must certainly affect the overall awareness and stimulation of the child's hand function beyond the treatment sessions. Another expla-nation may be related to differences of underlying causes for not using the hand. Some children possibly have fairly well-developed sensorimotor mechanisms but, for some reason, they do not use their full capacity. This could be related to what Taub calls learned non-use behaviour or developmen-tal learned non-use behaviour which, perhaps, is a more ade-quate expression for children with congential hemiplegia (Gordon *et al*. 2004). Supposedly, these children just had to 'get over a threshold' to comprehend that they had other and more efficient ways to perform tasks than 'one-handed'. Other children may, as a predominant cause of their hand dysfunction, experience the typically described sensorimo-tor dysfunction, i.e.weakness, spasticity, decreased tactile sensibility and/or mirror movements resulting in difficulties in controlling grip forces and adjusting movement. These children may benefit more from extensive practice. How-ever, for children who already used their involved hand effectively relative to their capacity before CI therapy, big improvements are difficult to achieve.

CI Therapy: Cortical reorganization and forms of lesions: It has been established from animal studies that practice induces plastic dynamic changes in the central nervous system, and there is also an increasing body of knowledge related to humans (Nudo *et al*., 1996, Liepert *et al*., 2000). A relation between CI therapy and neuroplasticity has also been found in several studies involving adults (Kopp *et al*. 1999, Liepert *et* *al*., 2000, Wolf *et al*., 2002). These findings demonstrate that suc-cessful treatment is not exclusively related to early interven-tion. Another important finding from animal models showed that only those specific movements that were used to perform motor tasks successfully resulted in cortical changes: cortical changes were not apparent after performing easy unskilled movements (Plautz *et al*., 2000). This emphasizes the impor-tance of careful tuning of the level of difficulty of the tasks prac-tised, which was regarded as crucial for guiding the treatment in this study. Another issue concerning plasticity was whether a certain type of lesion was more responsive to treatment than another type. Our hypothesis was that it should be easier to improve functioning for those children with impairments asso-ciated with cortical/subcortical lesions than for those with lesions of earlier origin in the periventricular white matter affecting the cortico-spinal tracts. At most, there was a very weak trend supporting this hypothesis, however, the lack of supporting evidence might depend on the rather small num-bers in each group.

CI Therapy: Beneficial, but for whom? The results indicated a somewhat larger improvement in the older children undergoing therapy in this study, while the opposite seems to be the case for the control group. This is in agreement with earlier results for intensive therapy and cast-ing, where older children appeared to accomplish upper-limb movements of greater quality than younger children (Law *et al*. 1991, 1997). It has also been shown that it is possi-ble to improve the hand function of older children and ado-lescents (Charles *et al*. 2001, Eliasson *et al*. 2003). These findings, however, challenge the common ideas concerning the importance of early intervention. In this study we did not exclude children on the basis of having too poor hand function. It has been suggested previ-ously, that inclusion criteria for adult stroke patients should involve the ability to extend the wrist actively by at least 20 degrees, and for fingers by at least 10 degrees (Wolfgang *et al*. 1999).

Similarly, is it recommended that children who cannot grasp objects should be excluded as their frustration at being restrained from dominant hand use would be too great (Gordon *et al*. 2004). We found that children with very poor hand function improved considerably, more, in fact, than the more capable ones. This may be related to the ada-pted treatment approach and to the assessment method used as the AHA measures a large range of skills, even very low abilities, making it possible to detect changes other than those related to grasping. The modification of the CI therapy model to involve only 1 to 2 hours of practice each day may be suitable for children with poor hand use. It is difficult to find attractive activities for the commonly recommended 6-hour training programme, especially for children with poor hand function. The long-term effects of CI therapy are not known. Moreover, little is known about the natural history of hand function in children with hemiplegic CP. Fedrizzi *et al*. (2003) have shown that, over time, grip patterns rarely change and that the spontaneous use of the hand remained stable in a group of children above 4 years old. In this study, items related to grasping did show improvement but the greatest improve-ment in specific AHA items were related to the control of the arm movements, which affects the ability to position the hand more effectively. This study demonstrated that the functional use of the hand can improve and if no sponta-neous development takes place after the age of 4 years, as suggested by Fedrizzi *et al*. (2003), then as a minimum, these children will have achieved a higher ability level to continue from. Overall, most parents seemed enthusiastic about the effect of the CI therapy and commonly reported that the chil-dren were using the hemiplegic hand more. Typically, posi-tive effects were reported even when the changes captured by the AHA demonstrated minimal improvement. Even though there are few children who demonstrate drastic changes as a result of CI therapy, small improvements can have a considerable impact for children and their families (Eliasson *et al*. 2003, Sköld *et al*. 2004). The purpose of the study was to compare the effectiveness of CIMT on hemiplegic C.P patients. It conventional exercises led the improvement after the treatment. The study consists of 18 patients from the age group of few months till 8 years of age who are assigned in two groups. Both groups were further sub- divided between pre treatment stage and post treatment stage and T-test was applied on the groups and first group experimental shows the better result than the second controlled group and post treatment stage showed improvement than the pre treatment stage in both the groups

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ANNEXURE

QUEST

Quality of Upper Extremity Skills Test

Carol DeMatteo, Mary Law, Dianne Russell, Nancy Pollock, Peter Rosenbaum, Stephen Walter

Child's Name: ______________________ Date: ______________ Time of Day: ________

year/month/day

Evaluator: ______________________ Age: ________ years ________ months

Testing Conditions:

Room ______________________

Seating (e.g., insert) ______________________

Table (e.g., cutout) ______________________

Orthotics (e.g., splints/AFOs) ______________________

Others Present (e.g., parent) ______________________

Score Key

✔ = Yes (able to complete item according to specification)

✘ = No (can not or will not complete item)

NT = Not Tested (not able to administer item)

If a complete section is not tested, insert ***NT*** *in summary score*

MAKE SURE THERE IS A SCORE ENTERED IN EVERY SCORING BOX

SUMMARY SCORE (transfer from QUEST Scoring Sheet)

A:	DISSOCIATED MOVEMENTS	
B:	GRASPS	
C:	WEIGHT BEARING	
D:	PROTECTIVE EXTENSION	

TOTAL SCORE = SUM OF SCORES FOR EACH SECTION TESTED / TOTAL # OF SECTIONS TESTED

= ______________________

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