A Comparative study on Task-specific Training with Trunk Restrain versus Constraint Induced Movement Therapy on Upper extremity function in Sub-Acute Stroke Conducted in a Physiotherapy Hospital in Nepal

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***Abstract*- Background:** Stroke is one of the major causes of human morbidity and mortality; it was the sixth leading cause of disability-adjusted years in 1990 and is projected to rank fourth by the year 2020.[1]It is also a leading cause of functional impairments, with 20% of survivors requiring institutional care after 3 months and 15% - 30% being permanently disabled. Aim &**Objectives:** To determine the beneficial effect of task specific training with trunk restrain versus constraint induced movement therapy in improving the function of hemiplegic upper limb in the sub-acute period after stroke.**Methods:** It was a Quasi-Experimental Comparative study done in 30 samples. Statistical analysis was done using convenient sampling for duration of 4 weeks in a Physiotherapy rehabilitation hospital present in Nepal.**Results:** The study tends to find out if there is any significant difference between Constraint Induced Movement Therapy and task specific training with trunk restraint group in context of post therapy in, Barthel Index score, Wolf Motor Function Test functional ability score and Wolf Motor Function Test time score. **Conclusion:** Administration of CIMT resulted in statistically significant andclinically relevant improvements in paretic arm motor ability and use compared with participants receiving trunk restraint.

***Index Terms*-** Stroke, Rehabilitation, Constraint Induced Movement Therapy, Task Specific Training with Trunk Restraint

I. INTRODUCTION

Stroke is defined by the National Institute of Neurologic Disorders and Stroke (NINDS), USA, as a sudden loss of brain function resulting from an interference with blood supply to the brain. One of the major causes of human morbidity and mortality, it was the sixth leading cause of disability-adjusted years in 1990 and is projected to rank fourth by the year 2020.[1]Stroke is also a leading cause of functional impairments, with 20% of survivors requiring institutional care after 3 months and 15% - 30% being permanently disabled. (AHA 2009).[4]

Hemiplegia which is paralysis of one side of the body is a striking manifestation of stroke involving cerebral hemisphere or brainstem.[2]Common impairments post stroke are impaired motor function, balance, sensory deficits, perceptual deficits, cognitive limitations, visual deficits, aphasia and depression.[3] Dr. Edward Taub a professor of psychology at the university of Alabama in developed Constraint Induced Movement Therapy. Constraint Induced Movement Therapy "forced use" is a form of rehabilitation therapy that improves upper extremity function in stroke and other Central Nervous System damage victims by increasing the use of their affected upper limb.[5]

Long-term motor deficits in stroke patients may be due to "learned non-use", a process enhanced by the teaching of compensatory activity during rehabilitation. Recovery may be improved by constraint-induced movement therapy which involves the restraining of the unaffected upper extremity and training the affected extremity. [6]In 2004 Dr. Taub introduced three principles:[5]

- Constraining the unaffected limb.
- Forced use of the affected limb.
- Massed practice should get prominent.

In addition studies have been done to find out role of Constraint Induced Movement Therapy in spasticity and the results suggested marked reduction in spastic muscle groups. Since spasticity is a adverse feature in stroke survivors, Constraint Induced Movement Therapy might help in improving functional outcome in such patients.[5-13]

Trunk anterior displacement is a common motor compensation used by patient with hemiparesis for arm transport during bilateral swinging, reaching and for hand orientation during grasping. Despite widespread use of motor compensations, studies of therapeutic effectiveness focus on outcome with less consideration of how functional gains are achieved: by recovery of lost movement elements or by increased use of compensatory movements. Because increased compensation may potentially limit recovery, it is essential to describe training paradigms that both improve motor function while reducing compensations.[8]It has recently been suggested, however, that the presence of excessive trunk movement in hemiparetic individuals while reaching may limit the potential recovery of normal arm movementpatterns. Reducing compensatory mechanisms by limiting trunk displacement may encourage the return of movement patterns typically seen in healthy individuals.[14-17]

Recent studies in patient even with chronic stroke indicate that trunk restrain can promote improvement in arm coordination

patterns.[8]A single session of 60 repetitions of reach to grasp task during Trunk restrain led to better retention of newly learned arm movement patterns than practice with verbal instruction alone. What remains to be determined is whether change persist beyond the intervention period and may be related to decreased impairment and improved function.[18-19]

No studies have been done to compare the effectiveness of Constraint Induced Movement Therapy versus task specific training with trunk restrains in upper extremity function especially in sub-acute phase after stroke.

II. AIM OF THE STUDY

To determine the beneficial effect of task specific training with trunk restrain versus constraint induced movement therapy in improving the function of hemiplegic upper limb in the sub-acute period after stroke.

III. METHODOLOGY

It was a Quasi-Experimental Comparative study done in 30 samples. Statistical analysis was done using convenient sampling for duration of 4 weeks in a Physiotherapy hospital present in Nepal.

The subjects admitted in the Physiotherapy rehabilitation hospital were assessed with a detailed history and evaluation. 30 subjects were selected based on the inclusion and exclusion criteria and assigned to two groups on convenient sampling they are:

1. group A- constraint induced movement therapy and
2. group B-task specific training with trunk restraint.

Pretest values were measured before the commencement of the study and after 4 weeks, post test evaluation was done. After first assessment, patient was encouraged to used their uninvolved extremity for functional task. The task performed was under the guidance of physiotherapist, the mistakes, were explained and verbal cues was continuously given for the completion of the respective functional task.

IV. RESULTS

Majority (66.7%) of the respondents were aged between 51-70 years of age among which 53.3% were male and 46.7% were female. Ischemic stroke was the main stroke type among respondents followed by Hemorrhagic stroke i.e. 53.3% and 46.7% respectively. 76.7% respondents had stroke since 3-9months of duration of time (Table no. 1).

Table 1. Demographic Characteristics of Respondents

Characteristics	Frequency	Percentage
Age		
31-50	10	33.3
51-70	20	66.7
Gender		
Male	16	53.3
Female	14	46.7
Stroke type		
Ischemic	16	53.3
Hemorrhagic	14	46.7
Stroke duration		
< 3 months	6	20.0
3-9 months	23	76.7
9-12 months	1	3.3
HTN		
Yes	22	73.3
No	8	26.7
Diabetics		
Yes	11	36.7
No	19	63.3
CVD		
Yes	3	10
No	27	90

Alcohol Yes No	 23 7	 76.7 23.3
Smoking Yes No	 15 15	 50 50

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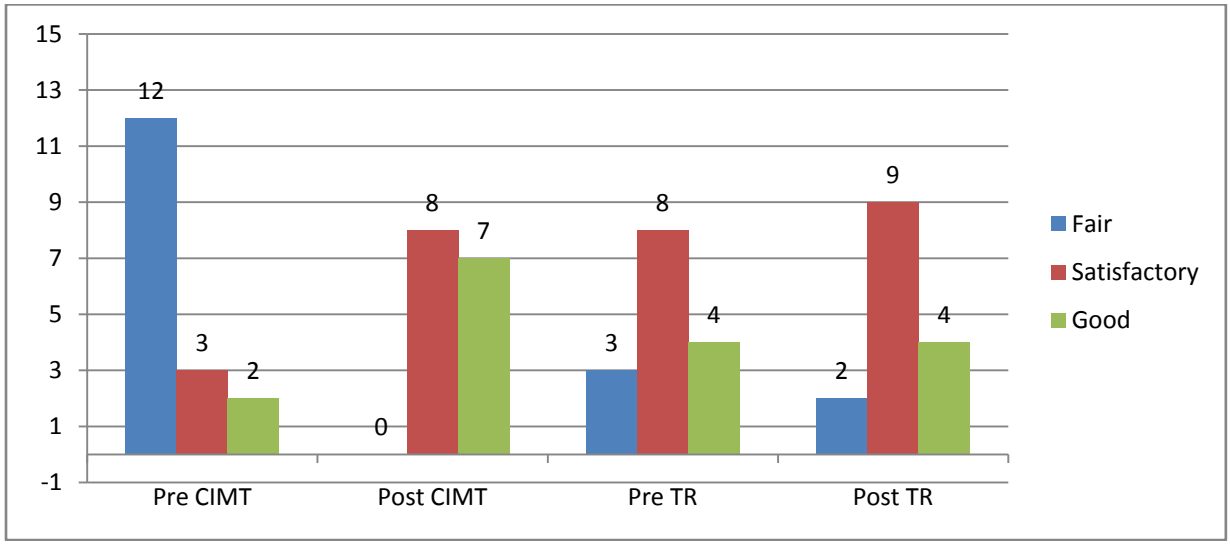
Barthel Index Score was calculated for pre and post therapy for both the Constraint Induced Movement Therapy and Trunk Restraint group. All 10 functions of Barthel index scale was rated by standard scores given in index and mean score of each group in pre therapy and post therapy period was compared among the groups. The Constraint Induced Movement Therapy group shows significant improvement in Barthel Index Score as compared to Trunk Restraint group. The significant mean difference of 25.67 between pre (58.33) & post (84.0) Constraint Induced Movement Therapy infers that the Barthel Index Score is improved statistically significantly as compared to Trunk Restraint groupGraph no. 1.



Graph no. 1 Barthel Index Score for pre and post therapy for both the Constraint Induced Movement Therapy and Trunk Restraint group

Pre and post Time of total 17 standard tasks for Wolf Motor Function Test were recorded for both the group. The mean time taken for doing all 17 task were compared within the group. Paired t- test shows the significant mean difference in mean time for the task pre and post therapy, Although both the group shows significant change in mean time taken for performing the tasks the mean difference in Constraint Induced Movement Therapy group is much more greater and with lesser standard deviation as compared to Trunk Restraint group stating that Constraint Induced Movement Therapy group have better improvement in post therapy as compared to Trunk Restraint group in context of Wolf Motor Function Test time.

The study tends to find out if there is any significant difference between Constraint Induced Movement Therapy and task specific training with trunk restraint group in context of post therapy in, Barthel Index Score, Wolf Motor Function Test functional ability score and Wolf Motor Function Test time score (Table no.2).

Table no. 2 Paired t-test Pre & Post functional ability score for Constraint Induced Movement Therapy & Task specific training with trunk Restraint group.

S.NO	Statistics	CIMT		TR	
		Pre Func. Ability Score	Post Func. Ability Score	Pre Func. Ability Score	Post Func. Ability Score
1	Mean	29.8667	55.200	41.20	50.55
2	Std. Deviation	4.223	7.032	14.283	8.517
3	T-Value	-12.71		-4.087	
4	Significance	0.00		0.01	

The independent t-test shows that in context of Barthel Index score variance are not equal i.e. difference in variance is present

in Constraint Induced Movement Therapy and Task specific training with trunk restraint group as the significance is .002. As significance (2-tailed) is more than 0.05 we can conclude that there is no significance difference in Constraint Induced Movement Therapy & Task specific training with trunk Restraint for Barthel Index score and Wolf motor function test function and time.

V. DISCUSSION

In the two studies that compared trunk restraint with constraint induced movement therapy, subjects in the constraint induced movement therapy group performed significantly better on at least one of the outcomes assessed.The main results of this study are that improvement in motor function of the affected Upper Extremity didnot differ significantly between patients who receivedCIMT and those who received trunk restraint therapy. On all measures of motor functionof the affected arm and hand, patients who receivedCIMT showed apparent advantageous overpatients who received trunk restraint therapy.

Relative to the trunk restraint group, the CIMT group reportedsignificantly greater improvement in quality of motor activity log in performing daily activitiesusing the affected hand. In addition, on Barthel Index score motor performance by the affected Upper Extremity, they demonstrated significantly better improvement over the 4-week treatment period.However, no other comparisons showed a statisticallysignificant between-group difference in motor functionof the affected Upper Extremity, including improvement on the WMFT from pre-test to post-test which was primary end-point. Therefore, as an evaluation of the relative effectiveness of CIMT in sub-acute stroke rehabilitation, ascompared to trunk restraint interventions provided at thesame frequency and duration, the results are overallneutral but contain some encouraging trends.

In the one previous randomized controlled trial of CIMT during early stroke rehabilitation, Dromerick et al[13] reported that patients who received CIMT demonstrated better motor performance relative to a traditional therapy group when assessed immediately after treatment.Similar to this findings, they reported greater improvement by the CIMT group on all motor function measures, including motor performance and motor activities log, but the advantage was statistically significanton only 1 subscale of the Action Research Arm Test.[13]The consistency of our motor performance results and their similarity with previous findings support the interpretation that the present study was underpowered to detect a relative therapeutic advantage of CIMT as compared to trunk control therapy provided at equal frequency and duration.

In recent study (Dromerick et al. 2009) including 2 CIMT groups (standard and high intensity), subjects in the higher-intensity group fared, on average, worse than those in either the control group or the standard CIMT group, demonstrating an inverse dose-response curve. This result ran counter to the authors' hypothesis, predicting the greatest gains in the most intensive group. The authors proposed too soon timing of the intervention following stroke, overtraining and a practice schedule that better resembled a blocked, rather than distributed one as possible explanations for their findings.

Schmidt and Wrisberg (1999) note that it is well established that task-specific practice is required for motor learning to occur.Galea et al. (2001) reported that stroke patients who underwent a 3-week long program that consisted of 45-minute task-specific, upper limb training showed improvements in measures of motor function, dexterity, and increased use of the more affected upper limbs.

Timmermans et al. (2010) conducted a review that examined the effectiveness of task-oriented training following stroke. 15 components were identified to characterize task-oriented training. They included exercises that were: functional, directed towards a clear goal, repeated frequently, performed in a context-specific environment, and followed by feedback. Sixteen studies representing 528 patients were included. From 3 to 11 training components were reported within the included studies. The components associated with largest effect sizes were "distributed practice" and "feedback". There was no correlation between the number of task-oriented training components used in a study and the treatment effect size. "Random practice" and "use of clear functional goals" were associated with the largest follow-up effect sizes.

VI. CONCLUSION

In summary,Constraint induced movement therapy is a feasible technique for rehabilitation of sub-acute stroke patients with impaired upper extremity function among patients who hadexperienced a first stroke with dominant side hemiperesis. Administration of CIMT resulted in statistically significant andclinically relevant improvements in paretic arm motor ability and use compared with participants receiving trunk restraint. Improvementswere not influenced by age, sex, or initial levelof paretic arm function. These findings suggest that further research exploring central nervous system changes that accompany the observed motor gains and research on alternate models of CIMT delivery are warranted.

VII. LIMITATIONS

- The sample size was small
- In this study randomization was not done
- This was a short term study of 4 weeks and follow up was not been done.
- Based only on rehabilitation centre

VIII. RECOMMENDATIONS

- In Constraint induced movement therapy patient shows mild depression on the first few attempt so verbal cueing, encouragement, motivations and inspiration to achieve goals are the foremost important criteria to fulfill.
- Follow up can be done for future gain.
- It is cost-effective, and patient has to attempt themselves (force-use) to gain upper limb function, so this physiotherapy management is more feasible for developing country like Nepal and India.

- It can be performed in the hospital as well as in community set up.
- It is easily understandable as well as easy to perform so group exercise can be recommended.

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