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# ARM TRAINING WITH AUDITORY CUEING IS MORE EFFECTIVE FOR UPPER LIMB MOTOR FUNCTION THAN MODIFIED CONSTRAINT INDUSED MOVEMENT THERAPY IN SUB ACUTE STROKE PATIENTS : AN EXPERIMENTAL STUDY.

Neurology

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## ABSTRACT

**Question:** IS ARM TRAINING WITH AUDITORY CUEING IS BETTER THAN CONSTRAINT INDUSED MOVEMENT THERAPY FOR IMPROVEMENT OF UPPER LIMB FUNCTION IN POST STROKE PATIENTS?
**Design:** A comparative study randomized controlled trial design
**Participants:** .patients diagnosed with subacute stroke and needs physiotherapy for improvement of upper limb function.
**Intervention:** arm training with auditory cueing , constraint indused movement therapy
Outcome measures: , Fugl Meyer post stroke upper limb assessment scale (FMPSULAS), chedoke arm and hand inventory activity (CHAI)
**Results:** On compairing the pre test and post test treatment FUGL MEYER assessment of motor function score ,the motor functioning group A increased significantly at post treatment 50.15 3.78 as compared to pre treatment 41.23 4.17 when compared by Wilcoxon signed ranks test.
The motor functioning group B increased significantly at post treatment 40.75 5.24 as compared to pre treatment 40.75 5.24 when compared by Wilcoxon signed ranks test . but the improvement in group B was 1.6 fold less as compared to group A.
On compairing the pre test and post test treatmentCHEDOKE arm and hand activity scores ,the motor functioning group A increased significantly at post treatment 56.92 .3.25 as compared to pre treatment 48.54 3.69 when compared by Wilcoxon signed ranks test.
The motor functioning group B increased significantly at post treatment 53.4.61 as compared to pre treatment 49.42 4.64, when compared by Wilcoxon signed ranks test . but the improvement in group B was 2.2 fold less as compared to group A.
The analysis revealed that both types of training influence upper limb function of hemiparetic Stroke patients during the study period. This analysis showed that both groups improved with training over time i.e. from pre to post.
**Conclusion:** Study found both the treatments modified constant induced movement and arm training with auditory cueing effective improving the function of upper extremity in sub acute hemiparetic stroke patients but modified with constraint- induced movement was found to be significantly more effective then arm training with auditory cueing alone.
The Fugl-Meyer assessment of motor function score and chedoke arm & hand activity inventory scores improved 1.6 & 2.2 times more respectively in patients those who received modified constraints-induced movement than those who received arm training with auditory cueing alone. Study concluded that modified constraints- induced movement will be more effective then arm training with auditory cueing alone regaining the functional performance of upper limb following MCA stoke. Addition of constraints for six hours is more effective in improving upper limb function.

## KEYWORDS:

## INTRODUCTION

Stroke is the main cause of mortality and is the leading cause of disability. According to World Health Organization, Stroke is defined as an acute onset of neurological dysfunction persisting more than 24 hours due to an abnormality in cerebral circulation with resultant signs and symptoms that corresponds to the involvement of focal area of brain.

A variety of symptoms are possible after stroke including the change in level of consciousness, impairments of sensory, motor, cognitive, perceptual and language functions.

Stroke survivors are predisposed to a sedentary lifestyle that limits the performances of activities of daily living, increases risks for falling and contribute to heightened risks for Cerebrovascular Disease.

A common component of handicap after stroke is inability or reduced ability to use the affected upper limb. Specific disturbances of bimanual motor acts have been described after lesions of midline structures with and without callosal damage. Irrespective of their more anterior or posterior location,awide spectrum of disturbances (mirror movement, alien hand syndrome, callosal dyspraxia) has been described.

Recovery in stroke occurs most rapidly after 3 months. Improvement in motor function and self-care function slows 3 months after stroke but continue at a slower pace throughout the first year.

Rehabilitation plays an important role in functional recovery of stroke survivors.

Arm training may serve as an effective therapy for patients in whom the corticospinal tract (CST) system is seriously affected therapies are urgently lacking and prospects of arm function recovery are particularly poor.

Arm training can improve unilateral paretic limb functions of the upper extremity after stroke; however, specific training approaches need to be matched to baseline characteristics of the patients; given the importance of bilateral activities in daily life, there is a need to recognize, train and assess the important contribution of supportive role functions of the paretic arm used on its own and as part of complementary functional skills.

Audioitorycueing has been used successfully to promote immediate and post training gait changes over and above those produced by gait training alone in subacute stroke patients. Through this study, its effect on upper limb after hemiparetic stroke is evaluated.

Modified Constraints-induced movement therapy (mCIMT) is a form of rehabilitation therapy that improves upper extremity functions in stroke by increasing the use of their affected upper limb. The intervention aims to improve active wrist-and finger extension, which is assumed to be a key factor for upper limb function.

The research questions were:
1. WHAT ARE THE EFFECTS OF TASK ORIENTED INTERVENTION ON GAIT OF STROKE PATIENTS
2. IS TASK ORIENTED INTERVENTION IS MORE EFFECTIVE THAN TRAIDMILL TRAINING FOR GAIT IMPROVEMENT IN STROKE PATIENT

## METHOD

### Design

A comparative study randomized controlled trial design

### Participants, therapists, centres

A total of 30 subjects from yashoda hospital physiotherapy center were

screened out of which a sample 24 subjects were taken in the study according to the convenience sampling. The sample was divided according to permuted block randomization into experimental group A and experimental group B.

Experimental group A-Modified constraint-induced movement therapy
Experimental group B- Arm training with auditory cueing

**Intervention**
**Experimental group-A**
12 patients of this group performed the sequence of exercises given .Tasks were done according to patient capability to a maximum of 10 repetions with the rest period of 2-3 seconds in each repetition. 45-60 minutes treatment session was given to the patients for 4 days in week for 4 weeks.

Individuals in this groups received mCIMT as categorized by wearing a mitt on the unaffected hand for 10 hours per day combined with 2 hours of intensive training of the affected UE. Functional practice task that were addressed during therapy included picking up marbles, flipping cards, combing hairs and writing. For each individual the therapist graded the skill level for the activities to create an appropriate challenge.

**Experimental group-B**
12 patients of this group performed the sequence of exercises given .45-60 minutes treatment session was given to the patients for 4 days in week for 4 weeks. Sequences was same and tasks were done for 10 times or according to patient capability with the rest period of 2-3 seconds and intensity of exercise increased according to the patients performances.

A practice session was given to the patient prior to actual performance of each activity. Auditory cueing was given with the help of metronome.in each exercise the pacing frequency was set at a frequency which allows the patient to comfortably complete exercise. Because metronome beats at frequencies below 0.67 Hz(and above 4 Hz) are not perceived as rhythmic patterns, a minimum frequency of 0.8 Hz i.e. 48 beats per minute was used in the exercise. To enhance the training effect, the actually used pacing frequency was the highest possible comfortable frequency for each individual patient, and was increased over the intervention sessions

**Outcome measures**
Fugl Meyer post stroke upper limb assessment scale (FMPSULAS) CHEDOKE arm and hand inventory activity (CHAI

**Data analysis**
Data was analyzed using SPSS 15.00 version software and statistical tests used were t-test for age, chi square test for finding the differences between sex ratio, Mann Whitney U test for finding difference in FUGL-MEYER assessment of motor function scores and CHEDOKE arm & hand Wilcoxon Signed Ranks Test for finding the difference within the group (i.e. pre vs. post).Both tests are non parametric test because outcomes measures are ordinal scales that is chedoke hand and arm inventory Fugl Meyer upper limb assessment scale. The significant level of $p \geq 0.05$ was fixed.

## RESULTS
**Flow of participants, therapists, centres through the study**
40 patients diagnosed with subacute stroke out of which 24 patient registered for therapy in pushpanjali hospital Ghaziabad .

**Research question 1**
Is upper limb training with constraint indused movement therapy effective for improvement of upper limb function?

**Research question 2**
Constraint indused movement therapy is more effective than functional training with auditory cueing for upper limb function?

**Table 1. Comparison of mean Age between two groups**

| Groups | Mean ± S.D | t value | P value |
|---|---|---|---|
| Group A | 56.31±6.59 | 0.973 | 0.341NS |
| Group B | 58.83±6.37 | | |

**NS=not significant**

**Table 2.Comparisons of proportion of sex between two groups**

| Sex | Group A (n=13) | Group A (n=12) | X2 value | P value |
|---|---|---|---|---|
| Male | 8(61.5%) | 9(75.0%) | 0.520 | 0.471NS |
| Female | 4(38.5%) | 3(25.0%) | | |

**NS=not significant**

**Table 3.Comparison of FUGL-MEYER assessment of motor function scores within the groups**

| Groups | Treatments | Mean ± S.D | Z value | P value |
|---|---|---|---|---|
| Group A | Pre treatments | 41.23±4.17 | 8.93 | 0.001* |
| | Post treatments | 50.15±3.78 | | |
| Group B | Pre treatments | 42.15±3.78 | 3.10 | 0.003* |
| | Post treatments | 46.25±5.34 | | |

***significant at p≤0.01**

**Table 4.Comparison of CHEDOKE arm and hand activity inventory scores within the groups**

| Groups n | Treatments | Mean ± S.D | Z value | P value |
|---|---|---|---|---|
| Group A | Pre treatment | 48.54±3.69 | 3.18 | 0.002* |
| | Post treatment | 56.92±3.25 | | |
| Group B | Pre treatment | 49.42±4.64 | 2.96 | 0.006* |
| | Post treatment | 53.25±4.61 | | |

***significant at p≤0.01**

**Table 5.Comparison of FUGL-MEYER assessment of motor function scores between the two groups at pretreatment and post treatment**

| Treatments | Groups | Mean ± S.D | U value | P value |
|---|---|---|---|---|
| Pre treatment | Group A | 41.23±4.17 | 76.00 | 0.913NS |
| | Group B | 42.75±5.24 | | |
| Post treatment | Group A | 50.15±3.78 | 41.50 | 0.047* |
| | Group B | 46.25±5.34 | | |

**NS=not significant**

**Table 6.Comparison of CHEDOKE arm and hand activity inventory scores between the two groups at pretreatment and post treatment**

| Treatments | Groups | Mean ± S.D | U value | P value |
|---|---|---|---|---|
| Pre treatments | Group A | 48.54±3.69 | 74.50 | 0.848NS |
| | Group B | 49.42±4.64 | | |
| Post treatment | Group A | 56.15±3.78 | 37.50 | 0.039* |
| | Group B | 53.25±5.34 | | |

NS=not significant
*=significant at $p \leq 0.05$

## DISCUSSION
The purpose of the study was to test the hypothesis that modified constraint-induced movement will be more effective then arm training with auditory cueing alone in regaining the functional performance of upper limb following MCA stroke.

There was no significant difference between the study groups in the assessment based on age, sex. Previous study suggests not to exclude the subject on the basis of predictors like side of stroke, hand dominance, chronicity, ambulatory status. Age is the only predictor for the functional outcome after stroke Right side and Left side dominance stroke does not differ from each other.

Subject in experimental Group A shows significant improvement. Modified constraint-induced movement proved effective for improving upper limb functions in sub acute stroke patients.

- **There are 3 major components:**

1. Shaping is training method in which a major task is gradually made more difficult. Shaping programs are individualized consisting of 10-15 tasks selected primarily from a basic battery of tasks. Each task is usually performed in a set of 10-30 sec trials. At the end of each set of 10 trials the task is changed. Only one shaping parameter is changed at a time. Requires constant therapist involvement.

2. Task practice is repetitive practice of individual functional tasks that takes roughly 15-20 min. Rest is provided as required. Encouragement is given on an infrequent basis (i.e. every 5 min) with feedback at end of task as well about how they performed. Requires less therapist involvement.

3. Package of behavioral techniques is designed to transfer gains from the clinic to daily life. Includes a behavioral contract that identifies task that the participant will attempt to perform. Furthermore, this allows for identification of barriers and problem solving overcoming these obstacles. The daily administration of the motor activity log promotes adherence.

Subjects in Group B showed improvement by receiving arm training with auditory cueing each session for 45-60 minutes. As most of the goal directed movements in humans emerges from coordination of both the hands. This coordination of both the upper limb for goal achievement presents a challenge for central nervous system which in turn provides a paradigm for motor control of these actions. When one limb moves further or aims towards a small target compared to the other the behavior of one hand is affected by the task requirement of the contralateral hand and this phenomena is called as assimilation effect is asymmetric in nature such that the limb performing the more difficult movement impacts the limb performing the easier one to a greater extent.

The brain is equipped with music-specific neural networks, while auditory cues are processed in the brain differently for language and music with some over lapping regions especially when singing or listening to the lyrics on the music.

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