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ORIGINAL ARTICLE

# COMPARISION OF MENTAL PRACTICE BASED TRAINING AND TASK ORIENTED TRAINING FOR UPPER LIMB FUNCTIONAL RECOVERY IN CHRONIC STROKE SUBJECTS

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## ABSTRACT

***Background:*** *Hemiplegia is one of the most common impairments after stroke and contributes significantly to upper limb activity. Although the majority of stroke patients experience on difficulty in daily activities, many do not reach a normal functions of arm level that enable them to perform all their daily activities. Similarly, upper extremity motor function after stroke is often impaired, causing restrictions in functional mobility. There is lot of literature supporting the efficacy of mental practice therapy in improving hand function of hemiparetic upper extremity, but there is lack of literature studies on the chronic subjects.*

***Methodology:*** *A total of 70 stroke patients were taken, out of that a sample of 60 subjects, who met the inclusion criteria and who are willing to participate in the study were recruited for the study. The group A practice performed in 5days a week for 4weeks mental practice given 20mins and Task practice 10mins. Total duration of therapy is 30mins. The functional task oriented training group B performed 5days in a week for 4weeks total duration is 30mins.*

***Results:*** *Paired t-test was done to compare pre and posttest values of group A and group B. comparison between pre and posttest values of functional ability score of group-A is 0.02 whereas group B 0.03 which was found to be significant.Comparison of pre and post interventions of time scores of task in group A and group B are 0.01 and 0.04 which was significant.Comparison between the groups reveals 0.02 which was significant with regards to time score and 0.01 for functional ability in group-A which was significant.*

***Conclusion:*** *It has been concluded that addition of 4weeks mental practice therapy to Task oriented therapy is a useful adjunct to improve upper limb functional recovery in chronic stroke subjects.*

***Keywords:*** *Mental Practice, Task Oriented Training, and Upper Limb Functions.*

## INTRODUCTION

Stroke is defined by World Health Organization as an "Acute neurological dysfunction of vascular origin with sudden or at least rapid occurrence of symptoms and signs corresponding to involvement of focal areas in the brain"; further, the symptoms should last 24 hours or longer.In developing countries, stroke is one of the foremost causes of morbidity, mortality and a major socio-economic problem[1].It has been estimated that every year stroke affects 15 million people in the world and approximately one-third will live with the sequelae of this disease. 'Global Burden of Disease study estimated the prevalence of India is projected to increase to 91/ 100,000 in 2015 and to 98/100,000 in 2030[2].

Nearly 85% of individuals with stroke present with upper limb hemiparesis and 55% to 75% have upper limb impairment[3].This involves mainly motor dysfunction which compromises ability to perform functional activities and there by leads to social restrictions and permanent disabilities in subjects with stroke. Although upper limb plays a key role in performing activities of daily living,but recovery of the paretic upper limb is often variable and incomplete. It has been estimated that 65% of chronic stroke presents with functional limitations of upper limb. Therefore various advanced rehabilitation strategies are needed, particularly in the chronic stages.

Evidence based stroke rehabilitation is limited but motor recovery follows a typical pattern in disabling impairments of hemiparesis[4]. During the Initial period of stroke the patients develops flaccid paresis associated with decreased or absent of reflexes then the recovery begins synergistic activations with reflexes[5]. According to Johanne et.al the upper limb shows impairment more than lower limb and also the recovery of upper limb rehabilitation remains a challenge, up to now several studies were done on the upper limb function but hand improvement was not gain full recovery than lower limb hence, this study aims in upper limb recovery. There are many recent therapies for improvement of hand function, the mental practice based training and task oriented therapy,[7]which were the research interest in this study.

Literatures have concluded that addition of mental practice therapy in stroke rehabilitation is found very beneficial. Mental practice is a one of the Neurorehabilitation technique to enhance the motor recovery following stroke[8]. The concept of mental practice has been evolved from sports

medicine where it is used to maintain the performance level of athletes during recovery from injury.

The Mental practice therapy stimulates neuroplastcity changes in brain by the action and function of movements during therapy the brain regenerates tissue. It is cognitive process of creating and mental experience without actual presence. This imagination activates the large brain areas and enhances neuroplastcity when movements are actually executed. This technique involves the activation of same brain areas and pathways that are used during the actual movement performance. Neuroplastcity plays an important role in stroke recovery. The ability of the brain to reorganize after an injury is key to understanding the mechanisms for how rehabilitation can improve recovery [12].The amount of practice of a particular skill leads to plastic changes in the central nervous system. The practice may be accomplished with overt movement performance of the task or with mental practice[6].

The task oriented therapy promotes neuroplastcity and increases the functional capacity and generate the cortical changes in improving daily functional skills and also contribute to motor relearning, motor control and strength in upper limb stroke. Task oriented training is a rehabilitation technique that involves goal directed practice and functional movements in natural environment for alleviation of limited movements[9].Task oriented practice is probably the most effective single therapeutic technique in upper limb recovery and It is advocated during stroke rehabilitation to improve functional performance of daily activities such as reaching to grasp objects[10].

Hence, in my study I have taken these two methods of therapies one is mental practice based training with task performance and I want to compare it with task oriented training for upper limb. So the purpose of this study is to compare the efficacy of mental practice based training with in task oriented training in functional ability and motor recovery for upper limb chronic stroke subjects.

## METHODOLOGY

Subjects were randomly recruited from department of physiotherapy, general wards, neurology department of GSL general hospital in Rajahmundry.A total of 70 stroke patients were taken, out of that a sample of 60 subjects, who met the inclusion criteria and who are willing to participate in the study were recruited for the study. Consent form has been taken from subjects and the subjects were recruited by lottery method. Chronic stroke subjects with a history of first time stroke diagnosed using CT/MRI and who was able to do actively flex at least 10degrees from neutral at the affected wrist and the metacarpophalangeal and interphalangeal joints of two digits were included in to the study. All subjects should belong to age group of 40-70 with Minimal or no sensory deficit. Subjects with excessive spasticity more than 3 on modified asworth scale were excluded from the study. Subjects with aphasia, cognitive impairment (MMSE<23), cardiovascular, orthopedic or neurologic impairment other than stroke were also excluded.

**Interventionfor group A:**

The practice performed in 5days a week for 4weeks mental practice given 20mins and Task practice 10mins. Total duration of therapy is 30mins.The procedure of the study was explained to the subjects and written consent was taken. Group A subjects were instructed about the procedure by making them aware of the fact that there is an audio recording which converted into Telugu, they have to listen and they are not supposed to perform the activity, they just have to imagine the task during audio tape for 20 min. and do the same task for 10 min. after tape.

Ask the subject to Relax them self, Sit comfortably by easily supported and slowly ask them to close eyes completely. Now ask the subjects to take deep breath and then gently exhale out breath, Inhale and exhale deeply. Repeat this 2-3 times. Then start to on audio tape which was recorded the practice of tasks.

**The speech recorded in audio tape:**

Imagine that you are in a peaceful and safe place, See green plants and feel great weather, try to visualize a clear picture. Look at to your eyes, they look relaxed, your whole body looks calm. Now it is the time for contracting the muscles. Imagine that you are sitting on a chair and there is a table lying in front of you having a mug place over it. Then Contract your hand muscles then forearm then upper arm and finally shoulder. Now feel that your hand try to reach for that mug by lifting your arm, extending your elbow and fingers. Try to imagine the movement in a slow motion and stay relaxed like that till the end of the session. Good going. Pay attention and grasp that mug, Sense the feeling of holding and grasping that mug. Now take that mug close to your mouth. Relax and make yourself comfortable and Place that mug to the same location. Again repeat the whole procedure of grasping and holding the mug. Now we are coming back to the surrounding of this room, listen to the noises surrounding you. Follow my count from 5 to 1, when I say 1 open your eyes. 5...4...3...2 ...1.

Mental practice continues in increasing speed and complexity of tasks with the Corresponding weeks with combining task oriented training and conventional therapy. During physical practice session emphasis was on performing task oriented activities like Grasping a cup, Turning pages and key opening and locking

**Intervention for group B:**

The functional task oriented training performed 5days in a week for 4weeks total duration is 30mins.The procedure of the study was explained to the subjects and written consent was taken. Group B subjects were instructed about the procedure by making tasks.This intervention focused on repetitive practice of meaningful tasks for patient by using affected upper limb. It included following functional tasks: reaching, grasping, lifting, placing objects and counting with fingers. Each of these tasks was performed for 10 repetitions. These tasks were performed with the participant seating and objects placed over the table of suitable height,

provided participants had sufficient movement in their affected upper limb to attempt the functional tasks.

For those participants who did not have sufficient movement in their affected upper limb to practice such tasks, therapist assisted the participant by guiding the limb through the tasks with the help of manual contact. The difficulty level of practiced task was increased gradually, with the goal being set just above the patient's ability level to perform it. Difficulty level was progressed by increasing the distance between participant and object and by decreasing the shape of the object. During treatment session, knowledge of results knowledge and knowledge of performance was provided as feedback.

Rest intervals were given whenever required for the total of 5 minutes in one treatment session. Task oriented training using functional meaningful activities to improve functional performance. Activities like moving 7cms block from table on to shelf, grasping empty glass to mouth and folding and hanging towel were included in this therapy group B.

**Fig1:** mental practice in group A

Task therapy Group A

**Fig 2:** Task oriented training in group B

## RESULTS

Statistical analysis was done using the statistical software SPSS 16.0 version for this purpose the data was entered into Microsoft Excel spreadsheet, tabulated and subjected to statistical analysis. All 60 subjects completed the entire study protocol as defined by 4weeks in the training session. To observe the treatment impact before and after the treatment in the groups, analysis is carried out by using paired t- test, the outcome measure – wolf function motor test. To compare both groups the t-test for paired sample observations has been utilized. It is observed that the post values of groupA have significant difference than group B.

| GroupS | Pre Treatment | | Post Treatment | | P value | Inference |
|---|---|---|---|---|---|---|
| | Mean | SD | Mean | SD | | |
| Group A | 51.43 | 5.06 | 64.93 | 4.81 | 0.02 | Significant |
| Group B | 51.76 | 61.23 | 62.72 | 4.98 | 0.03 | Significant |

**Table-1:** Analysis of pre and post interventions of functional ability and time scores group A and group B

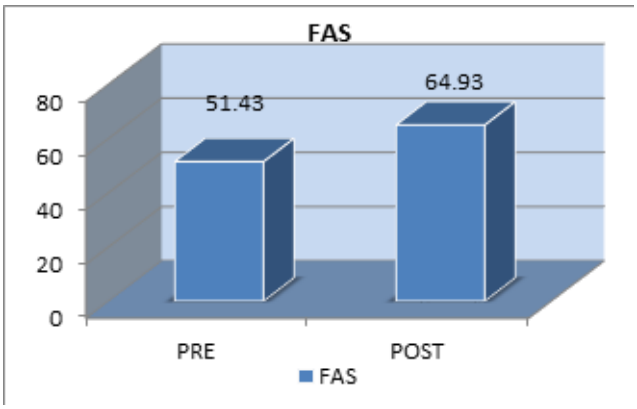


**Fig 3:** Group A Fas Mean Values Of Pre and Post Scores

| Group | PreTreatment | | PostTreatment | | Pvalue | Inference |
|---|---|---|---|---|---|---|
| | Mean | SD | Mean | SD | | |
| Group A | 62.23 | 5.51 | 46.43 | 6.77 | 0.01 | Significant |
| Group B | 62.23 | 5.25 | 52.90 | 5.93 | 0.04 | Significant |

**Table-2:** Comparison of pre and post interventions of time scores of task in groupa and groupb.

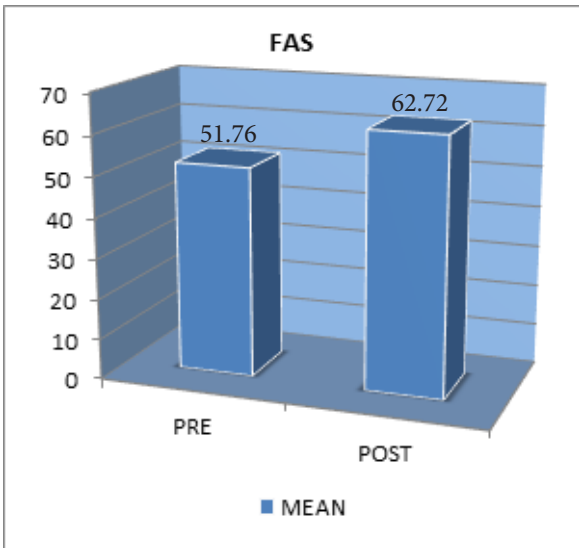


**Fig 4:** Group B Fas Mean Values of Pre and Post Scores

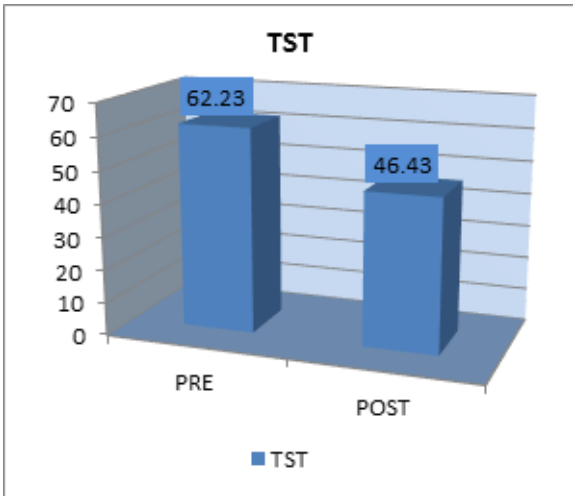


**Fig 5:** Group A TST Mean Values Of Pre and Post

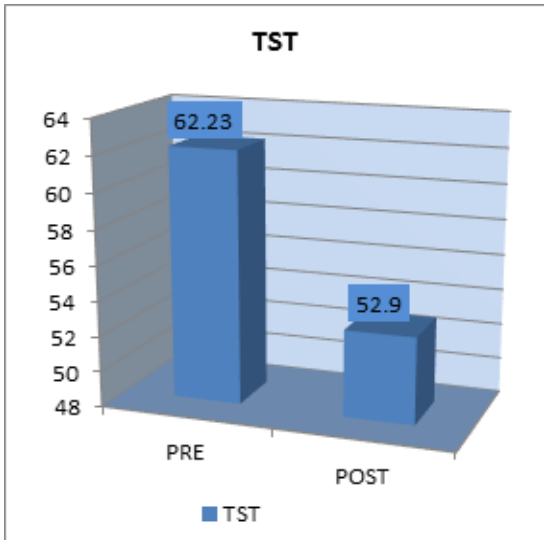


**Fig 6:** Group B TST Mean Values Of Pre and Post

| GROUP | Post Treatment ( Mean ) | SD | P value | Inference |
|---|---|---|---|---|
| A-MP+TO | 64.93 | 4.81 | 0.02 | Significant |
| B-TO | 61.23 | 4.98 | | Significant |

**Table-3:** Comparison of pre and post interventions of time scored of task in between groups.

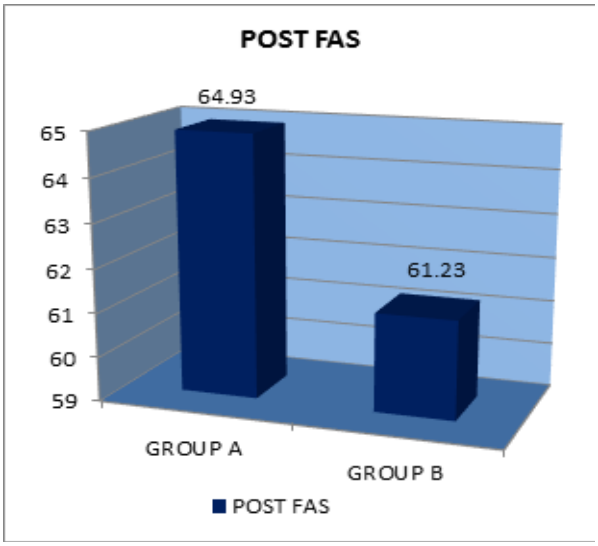


**Fig 7:** GROUP A AND B POST VALUES OF FAS

| Group | Post Treatment ( Mean ) | SD | P value | Inference |
|---|---|---|---|---|
| A | 46.43 | 6.77 | 0.01 | Significant |
| B | 52.82 | 5.93 | | Significant |

**Table-4:** Comparison of pre and post interventions of functional ability and time scored of beetween groups

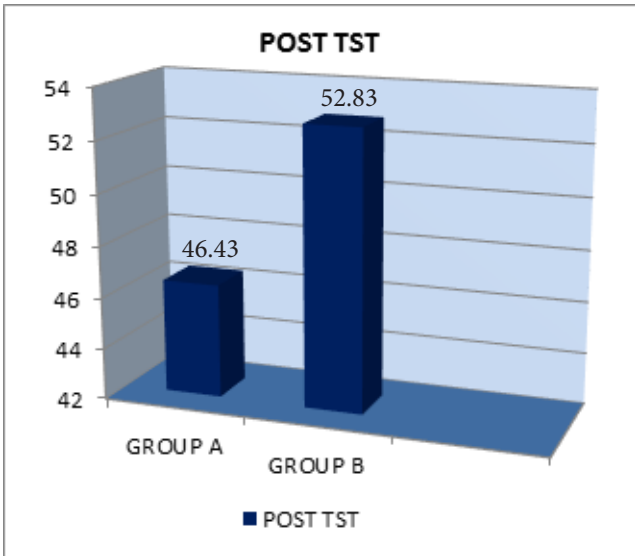


**Fig 8:** Group A and B Post Values of TST

## DISCUSSION

This study reveals that mental practice based training combined with task oriented training had shown beneficial effects when compare to the task orientation alone on upper limb functional recovery in stroke subjects. The parameters are functional ability and motor recovery which are measured by wolf motor function test. The wolf motor function test is the best outcome measure to assess the upper limb functional activity. It consists of 17components in which this study concentrated 15 components.

Several recent studies on paretic upper extremity has indicated that mental practice therapy may be a promising tool to promote motor recovery , muscle strength, dexterity and functionality after stroke. Both interventions are based on neuroplastcity according to the report of Stephen page on mental practice and on task practice but in my study my tasks was first given by mental imagination and then same tasks was performed physically then it shows fast recovery and response of cortical regeneration than task practice alone.

The above data suggest that a stroke patient participating in an addition of 4-week protocol of mental practice with task practice can improve motor function of the affected upper extremity. These data also suggest that a stroke patient can have the ability to mentally imagine such movements that they have previously idle ventral visual processing stream to imagine their same movements.

According to Andrew's et al the motor and cortical changes and functional measureswere markedfor subjects receiving the combined intervention of mental practice and task practice the mechanism behind rental practice is neuroplastcity[15]. The patient showed increased contralateral

cortical activation in motor areas during execution of the flexion and extension task. This activation may be due to the patient's involvement in intervention, causing the brain to recruit the same motor pathways used before the stroke. However, bilateral cortical activation of inferior and middle temporal gyrus was observed when the patient was asked to imagine the same flexion and extension task.

Butler et al noticed that the most notable activation after mental practice was in the right cerebellar hemisphere that was not activated in the first scan during the imagery task. Ipsilateral activation in the anterior lobe of the cerebellum during an executed task in able-bodied participants reflects the organization of the spinocerebellar pathways. Furthermore, evidence to support our data comes from a study in which hemiparetic patients with good recovery showed changes in the activation of the cerebellar hemisphere opposite the injured corticospinal tract, whereas patients with poor recovery did not show such changes in cerebellar activation. The appearance of cerebellar activation after mental practice may reflect unmasking of pre-existing connections or mechanisms of long term potentiating, because certain forms of learning lead to an enhancement of synaptic responses in a variety of brain structures. Recently, long-term potentiating has been shown to be involved in learning new motor skills and provides compelling evidence for long-term potentiating to be a mechanism involved in natural learning. The cerebellum may have transferred some of its motor program knowledge to the premotor network as a result of the intervention.Although immediate functional change was not observed, plasticity may be occurring in the inferior olive, premotor networks, basal ganglia, and cerebral cortex. This activity might interact with the cerebellar cortex to create an advantageous environment for overall motor learning if long-term follow-up had occurred in this patient.

Stephen J Page et al suggested that that mental practice is a potentially useful method of practicing motor skills[16]. Magill et al suggested that mental practice is effective because it augments existing motor schema, subjects participating in a regimen combining mental practice and Physical practice showed large reductions in affected arm impairment as measured by the FMAS, and large increases in movement as measured by the ARAT[17].

In this study we found greater changes in the mental practice group (functional score p=0.01, time score p=0.02) corresponding to the reasons shown above.Another reason behind better recovery in groupA may be due to additional auditory feedback such as by audiotape. This audiotape was make under supervision of psychologist suggestions and also converted into Telugu it consists of voice recording tasks shown in groupA protocol which was provided, improves motor learning. Feedback can inform individuals about the accuracy and progress of their performance. In addition, feedback can motivate them by affecting their perceptions of competence and accomplishment.Jeannerod et al. implemented verbal information because current motor cognition theories, which suggest that language resonates with motor representations and activation of motor areas, can therefore be achieved through verbal route.

This study also showedmental practice could be used to augment the frequency with task repetition of movement at a cerebral level, with no increase in the physical demand for the patient. It could also be useful in maintaining the results achieved.

## CONCLUSION

This study had shown that groupA, who received 30 minutes of mental practice along with Task orientated physiotherapy, has shown beneficial improvement than groupB who underwent only task oriented therapy over 4weeks treatment. So this study concludes that addition of 4weeks mental practice therapy to Task oriented therapy physiotherapy is a useful adjunct to improve upper limb functional recovery in chronic stroke subjects.

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