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To Compare the Effectiveness of Modified Constraint Induced Movement Therapy versus Mirror Therapy along with Conventional Therapy to Improve Hand Function Acute and Sub-Acute Stroke Patient

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Abstract

Objective: To compare the effectiveness of modified constraint induced movement therapy versus mirror therapy along with conventional therapy on hand rehabilitation in patients with acute and sub-acute stroke.

Methodology Design: Comparative study

Setting: OPD and IPD of SMIH Patel Nagar, Dehradun (UK).

Participants: 30 acute and sub-acute stroke patients were included in this study and randomly divided into 2 groups 15 in each i.e. mCIMT along with conventional therapy(group A) and MT along with conventional therapy(group B).

Intervention: 30 subjects who were diagnosed with stroke onset <6 week were selected according to the inclusion criteria. Hand function and functional ability was evaluated with the help of w/h FMUE and ARAT scores. The subjects perform exercises in each group along with conventional therapy for 45 minutes 6 days per week for a consecutive 4 weeks. Along with daily therapy session constraining of less affected upper extremity with a mitt was done in group A patients. The post intervention data was compared with pre intervention data and improvement in the hand function was measured.

Outcome Measures: w/h Fugl-Meyer Upper Extremity Scale (sub scale B & C of FMUE)

Action Research Arm Test (ARAT).

Result: Data was analyzed by using paired t- test. Pre and post score were taken via w/h FMUE and ARAT. P value <0.05.

Conclusion: Modified constraint induced movement therapy and Mirror therapy along with conventional therapy both showed improvement in hand functions on acute and sub-acute stroke patient. But Modified constraint induced movement therapy along with conventional therapy showed more improvement in reaching forward, grasping, manipulating objects and also improves other fine motor functions of the hand after 4 weeks of therapy.

Keywords: Modified constraint induced movement therapy; Mirror therapy; Acute & sub-acute stroke; w/h FMUE; Action Research Arm Test; Hemiparesis.

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Introduction

The term stroke was coined and introduced to medicine by William Cole in the late 17th century (Cole 1689). Physiologically stroke is an acute, focal injury of the central nervous system of a vascular origin, contributing to a local or systematic neurological insult.[1]

Stroke is one of the largest causes of disability, half of the stroke survivors have a disability and approximately one third of all stroke patients suffer from a severe arm paresis.[2]

Functional loss of upper extremity causes difficulty in performing activities of daily living and causes to become dependent. The main aim of stroke rehabilitation is to enable the highest functional independence level possible for individual and to increase the quality of life.[3]

Constraint induced movement therapy is a neuro-rehabilitation approach developed by behavioral neuro scientist Dr. Edward Taub and colleagues.Constraint induced movement therapy was originally developed for patient with chronic upper limb paresis. There are indications that exercise intervention should start early as possible after stroke.[4]

Till date various modified form of constraint induced movement therapy (mCIMT) have been developed, resulting in different types with respect to the application of modified constraint induced movement therapy in terms of content, timing & intensity of the therapy.

Mirror therapy was first introduced by Ramchandran and Rogers-Ramachandran for the first time 1996. This therapy was effective in treating phantom limb pain based on the defects of visual illusion using a mirror.[5]

Background of study

The stroke is one of the major disease that may cause disabilities. Patients with brain stroke experiences difficulties in performing activities of daily living due to impairment caused by muscle weakness and stiffness, sensory abnormalities, imbalance and tension in the upper limb.[7] Impairment of hand function that is required for performing delicate movement make it difficult to perform activities of daily living (For example: dressing, eating and writing) and to return to work.[6] Stroke is the second most common cause of death worldwide (after ischemic heart disease) and is leading global cause of disability.[7] Approximately 15% of strokes are hemorrhagic (including intra-cerebral hemorrhage and sub-arachnoid hemorrhage), and 85% are ischemic. The mortality rate for hemorrhagic stroke can be as high as 50% and is approximately 20% for ischemic strokes of all types, but ultimate outcome and function are related to the sub-type of stroke.[8]

The 2 main causes of brain stroke are ischemia and hemorrhage. The ischemia may be due to arterial occlusion or stenosis and hemorrhage due to leakage or rupture of an artery.[9]

Around 50% of ischemic strokes are attributed to large artery atherothrombotic disease, 25% to disease of the small intracranial arteries (resulting in lacunar stroke), 20% to cardiac emboli, and 5% to various rare causes (e.g. extracranial artery dissection).[10]

The management comprises of 4 week intervention of modified constraint induced movement therapy and mirror therapy along with conventional therapy. w/h Fugl-Meyer Upper Extremity scale and Action Research Arm Test were used as outcome measure to assess wrist and hand functions in patients, pre-treatment and after 4 weeks of intervention.[11-12]

The mirror therapy was used as a possible method to help stroke survivors. This technique involves performing of unimpaired limb while watching its mirror reflection superimposed over the (unseen) impaired limb, thus creating a visual illusion of enhanced movement capability of impaired limb.[13]

Aim of study

To compare the effectiveness of modified constraint induced movement therapy and mirror therapy on hand rehabilitation in acute and sub-acute stroke patients.

Need of study

Many researches had been done on the effectiveness of Mirror Therapy and Modified Constraint Induced Movement Therapy for patient with chronic stroke but there is no study related to direct comparison of effects of Modified Constraint Induced Movement Therapy and Mirror Therapy on hand rehabilitation in acute and sub-acute stroke patients, so the need arises to find which therapy is more effective during acute and sub-acute phase.

Purpose of study

The purpose of present study was to regain hand function in stroke patient as early as possible because impaired hand function causes dependency in activities of daily living like eating, dressing, writing etc. By comparing therapeutic effects of modified constraint induced movement therapy and mirror therapy in acute and sub-acute patients we are able to know which therapy is more effective during acute and sub-acute stage.

Hypothesis

Alternate hypothesis

Modified Constraint Induced Movement Therapy may be more effective than the mirror therapy on hand rehabilitation in acute and sub-acute stroke patient.

Null hypothesis

Modified Constraint Induced Movement Therapy may not be more effective than the mirror therapy on hand rehabilitation in acute and sub-acute stroke patient.

Review of Literature

Ischemic strokes are the result of thrombus, embolism, or conditions that produce low systemic perfusion pressures. The resulting lack of cerebral blood flow (CBF) deprives the brain of needed oxygen and glucose, disrupts cellular metabolism, and leads to injury and death of tissues. A thrombus results from platelet adhesion and aggregation on plaques.

Thrombi can also become dislodged and travel to a more distal site in the form of an intra-artery embolus. Cerebral embolus (CE) is composed of bits of matter (blood clot, plaque) formed elsewhere and released into the bloodstream, traveling to the cerebral arteries where they lodge in a vessel, producing occlusion and infarction.

The most common source of CE is disease of the cardiovascular system. Occasionally, systemic disorders may produce septic, fat, or air emboli that affect the cerebral circulation. Ischemic strokes may also result from low systemic perfusion, the result of cardiac failure or significant blood loss with resulting systemic hypotension. The neurological deficits produced with systemic failure are global in nature with bilateral neurological deficits.

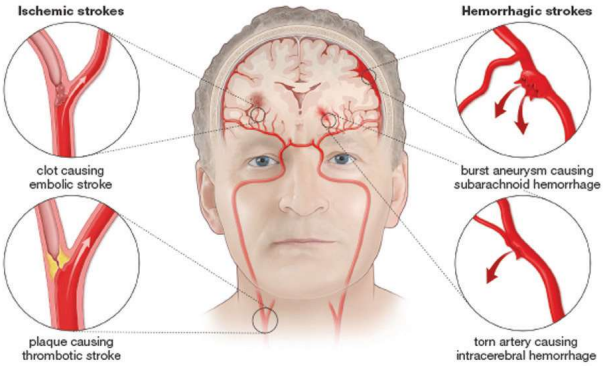

Fig. 3.2: Types of Stroke and Pathophysiological Features.

Author's Study Discription

- Jin A Yoon et. al. (2014) did a study on 26 patient with sub-acute stroke. They randomly divided the subjects into 3 groups: CIMT combined mirror therapy group, CIMT only group, and control group.[2] weeks of CIMT for 6 hours a day with or without mirror therapy for 30 minutes a day were performed under supervision. All groups received conventional occupational therapy for 40 minutes a day for the same period. The CIMT only group and control group also received additional self exercise to substitute for mirror therapy. They concluded that the short term CIMT combined with mirror therapy group showed more improvement compared to CIMT only group and control group in the fine motor functions of hemiplegic upper extremity for the patients with sub-acute stroke.[14]
- A study conducted by Asanordin et al. (2014) on 35 patient with impaired upper extremity function after stroke, two physiotherapist simultaneously assessed the participant's performance in all items of the ARAT twice in a day. They concluded that the action research arm test is a highly reliable observational rating scale at the item level after stroke.[15]
- A study conducted by Takashi Takebayashi, et. al. (2015)on 14 post stroke patients with mild to moderate impairment of arm function. They analyzed the patients one year after completing modified constraint induced movement therapy, participants consistently showed improvement in arm function and amount of daily arm use. They concluded that among post stroke patients mild to moderate impairments of arm function, modified constraint induced movement therapy without any other rehabilitation after interventions may improve arm functions and increase arm use for 1 year.[16]

- A study conducted by MR EL-Helow, et. al. (2015) On 60 acute stroke patients, they divided patients into 22 groups, 30 in conventional rehabilitation programme and 30 in mCIMT group. Both groups receives therapy for 2 consecutive weeks. FMA and ARAT were used for assessment pre treatment and after 2 weeks of treatment. Their result showed non significant improvement in FMA and ARAT in conventional rehabilitation group and significant improvement in mCIMT group. They concluded that mCIMT revealed a significant functional and motor evoked potential improvement in acute stroke patients indicating that mCIMT might more efficient treatment strategy.[17]
- Mohammad Nasb, et. al. (2019) did a study on 64 patients with stroke. The patient were randomly allocated to 2 groups, namely BTX-ICT and BTX-mCIMT, Modified ashworth scale, Fugl-Meyer assessment, and Barthel index assessment score were used to assess the patient before and at 4 weeks after the BTX injection. After 4 weeks of treatment both groups shows significantly higher scores than scores before the treatment in the assessment. They concluded that both BTX-mCIMT and BTX-ICT methods show a relatively high effectiveness in managing spasticity, enhancing motor function recovery and further decreasing the dependency of performing ADLs after stroke. However the BTX- mCIMT combination has a greater effects improving motor function then BTX-ICT and acts as a promising treatment method.[18]

  Edgar D. Hernandez et al. (2019) did a study on 60 patients with stroke (mean age 65.9) years. Two physiotherapists scored FMA-UE independently on 2 consecutive days within 10 days post stroke. They concluded that the FMA-UE is reliable both within and between raters in patient with stroke in the early sub-acute phase.[19]

Methodology

30 patients were taken by simple random sampling in OPD and IPD Department of physiotherapy Shri Guru Ram Rai Institute of Medical and Health Sciences and Shri Mahant Indiresh Hospital, Patel Nagar Dehradun.Study duration: 4 weeks. Study group: 2, Group A and Group B, 15 subjects in each group.

Sample selection

Inclusion criteria: patient who were diagnosed with hemiparesis due to stroke (onset time less than 6 week) and nopast history of stroke, Hemiparetic upper extremity had functional level of >10 degree active extension of more than 2 fingers and wrist and an active abduction of the affected thumb at an angle of >10 degree, Subject were > 18 years of age, Patient who can make a simple communication, Patient who can maintain a sitting position more than 30 min and Mini mental status examination score more than.[24]

Exclusion criteria: patient with depression who were unable to cooperate in the treatment, The patient who cannot perform the active task training due to presence of musculoskeletal problems, such as spasticity >grade 2 according to modified ashworth scale and patient who have secondary adhesive capsulitis and A visual field defect or neglect syndrome.Outcome measures: Fugl- Meyer Upper *Extremity Scale (FMUE scale):* The Fugl- Meyer Upper Extremity scale is a widely used and highly recommended stroke-specific, performance based measure of impairment. It is designed to assess reflex activity, movement control and muscle strength in upper extremity of people with post-stroke hemiplegia. It has been extensively used as an outcome measure in rehabilitation trials and to record post stroke recovery. The FMUE scale comprises 33 items, each scored on a scale of 0 to 2, where 0= Cannot perform, 1= perform partially and 2=performs fully.[20] In present study w/h FMUE (Sub-scale B and C of FMUE) were used that comprises 12 items in the scale with total score of 24.[21]

Action Research Arm Test (ARAT):The ARAT was first described by Lyle as an adaptation to Carroll's upper extremity function test. This test evaluates 19 tests of arm motor function, both distally and proximally. 19 tests spread across each of 4 subscales: grasp, grip, pinch, and gross movement. Items in each subscale are arranged in a hierarchical order of difficulty, with the most difficult item in the subscale tested first, followed by the easiest tested second. The quality of movement for each of the 19 tests examined in the ARAT is scored on an ordinal 4 point scale, with 0= no movement, 1= the movement task is partially performed, 2= the movement task is completed but takes abnormally long. And 3= the movement is performed normally.[22]

Material used Constraining Mitt, Mirror, Different Sizes of Boxes, Cricket Ball, Cylindrical Object (glass), Marbles, TrayDifferent Sizes Tubes,

6mm Ball Bearing, Rice, Tissue Paper, Goniometer, Data Collection Sheet and Consent Form.

Procedure

All the participants were explained about the purpose of study. The subjects were screened for inclusion and exclusion criteria and then the baseline measurement were taken. An informed consent was taken from the patients who were willing to participate in the study. Eligible subjects were randomly allocated into two groups. Group A-Participants receiving mCIMT along with conventional therapy. Group B-Participants receiving mirror therapy along with conventional therapy. w/h FMUE, ARAT were used as outcome measures for the study and was taken before treatment session and after 4 weeks of therapy. Therapy was given 6 times per week for 1 treatment session of 45 min for 4 weeks. Therapy for Group A and Group B along with conventional therapy included following exercises.

The reaching Exercise

Patient Position

- The patient sits on chair with a table, an anti-slip mat in front.
- Patient's shoulder is slightly flexed with elbow flexed to 90 degrees and forearm pronated.
- The patient puts the more affected elbow on the table and then places the hand on anti-slip mat and moves the hand in sideways, forward and backward direction.
- This helps in improving motor control of the distal arm in different directions, emphasizing wrist and finger extension.

The cylinder grip exercise

Patient position

- The patient sits in a chair with a table in front.
- The patient slightly flexes, abducts the internally rotates the shoulder, extends the ebow and the wrist and then grasp the cylindrical object by flexing the fingers around the object, moves and releases cylinders using a cylinder grip by extending the wrist and fingers.
- This will help in improving the cylinder grip with focus on extension of wrist and fingers.

The grasp exercise

Patient position

- The patient sits in a chair with a table in front. A ball is placed on the table.
- The patient grasp the ball by flexing, abducting and internally rotating the shoulder and extending the elbow, wrist and fingers, then moves and releases the ball using wrist and five fingers extension.
- This will help in improving the five-finger grip, by motor control of the intrinsic muscles and extension and flexion of fingers.

The pinch exercises

Patient position

- The patient sits in a chair with a table in front. A large checkers game is placed on the table.
- The patient grasps and moves the stones using a pinch grip by shoulder flexion, adduction, internal rotation, elbow flexion, forearm pronation with wrist in flexion. Release the object by fingers and wrist extension.
- This will help in improving the pinch grip, with the focus on the extension of the fingers and wrist.

Exercises for in hand manipulation

The marble exercises

Patient Position

- The patient sits in a chair with a table in front. A tray with marbles is placed on the table.
- The patient slightly flexes the shoulder extends elbow with forearm in mid prone or supination wrist and fingers flexed picks up the marbles one by one and hold them in hand while picking up the next one.
- The patient tries to pick up as many marble as possible.
- This will help in improving the in-hand manipulation of objects and fine motor control of the hand.

The Rice Exercises

Patient Position

- The patient sits in a chair with a table in front. Two trays are placed on the table. One tray is filled with water, the other one with rice.
- The patient places the more affected hand in the water and then in tray with rice by flexing adducting and internally rotating the shoulder with elbow slightly flexed and forearm pronated.

- The patient then uses the finger tips and the thumb of the same hand to get the rice of the hand.
- This will help in improving selective movements of the fingers and the thumb.

The tissue exercise

Patient position

- The patient sits in a chair with a table in front. Tissues are placed on the table. The patient picks up a tissue with the more affected hand by slightly flexing and abducting the shoulder, flexing elbow to 90 degrees and pronating the forearm.
- Then tries to crumble the tissue by opening and closing the fingers and pressing the tissue in the
- hand
- This will help in improving motor control of the intrinsic muscles of the fingers and the hand.[41]

Conventional Therapy

- Exercises in conventional therapy included ADL training, stretching, ROM exercises, Strengthening exercises of the affected site.

Fig. 4.2: Group A Patient Performing Exercises, while wearing A Mitt on Less Affected Hand.

Data Analysis

This chapter deals with the statistical analysis of the 2 outcome measures that is w/h FUME and ARAT, between group A and group B and within group A and group B.

The data was analyzed by Graph Pad Prism software version 8.3.4

Paired t-test used to compare pre and post treatment scores of w/h FMUE and ARAT within group A and group B.

Unpaired t-test used to compare post treatment scores of w/h FMUE and ARAT between group A and group B.

Fig. 4.3: Group B Patient Performing Exercises In Front of Mirror.

and standard error of mean (36.87±1.540) when compared with group A pre treatment, Mean and standard mean (21.20±1.535) (Table 6.1 & Fig. 6.3 & 6.4).

Result

- This chapter deals with the result of data analysis of the data of two outcome measures that is w/h FMUE and ARAT, within group A and group B and between group A and group. The score were analyzed and interpreted to determine which intervention is more effective in improving hand function in acute and sub-acute stroke patients.
- Paired t-test was used to analyze and compare pre and post treatment score within the group A and group B. Significant level of 0.05 was used for data analysis.
- Unpaired t-test was used to analyze and compare post treatment score between group A and group B.
- Analyzing w/h FMUE revealed significant difference in group A post treatment, Mean and standard error of mean (18.67±0.4328) when compared to group A pre treatment, Mean and standard error of mean (8.40±0.6817) (Table 6.1 & Fig. 6.1 & 6.2).
- Analyzing ARAT revealed significant difference in group A post treatment, Mean

Table 6.1: Within group comparison of pre and post data of both outcome measures in group A.

Outcome Measure	Pre (Mean± Sem)	Pre (Mean± SD)	Post (Mean±Sem)	Post (Mean±SD)	P Value
W/h FMUE	8.400±0.68177	8.400±2.640	18.67±0.4328	18.67±1.676	<0.0001
ARAT	21.20±1.353	21.20±5.240	36.87±1.540	36.87±5.963	<0.0001

- Analyzing w/h FMUE revealed slight significant difference in group B post treatment, Mean and standard error of mean (16.47±0.6752) when compared to group B pre tratment, Mean and standard error of mean (7.533±0.5925)(Table 6.2 & Fig. 6.5 & 6.6)
- Analyzing ARAT revealed slight difference in group B post treatment, Mean and standard error of mean (31.40±1.032) when compared

with group B pre treatment, mean and standard error of mean (17.71±1.136) (Table 6.2 & Fig. 6.7 & 6.8).

Table 6.2: Within group comparison of pre and post data of both outcome measures in group B.

Outcome Measure	Pre (Mean±Sem)	Pre (Mean±Sd)	Post (Mean±Sem)	Post (Mean±Sd)	P Value
W/h FMUE	7.533±0.5925	7.533±2.295	16.47±0.6752	16.47±2.615	<0.0001
ARAT	17.71±1.136	17.71±4.250	17.71±1.032	31.40±3.996	<0.0001

- Analyzing ARAT revealed slight significant difference between group A post treatment data and group B post treatment data, differences between means (B-A) and standard error of mean (-2.200±0.8020) that is group A shows more improvement in hand function after 4 weeks of intervention. (Table 6.3 & Fig. 6.9 & 6.10).
- Analyzing w/h FMUE revealed slight significant difference between group A post treatment data and group B post treatment data, differences between mean (B-A) and standard error of mean (-5.467±1.853) that means group A shows more improvement in hand function after 4 weeks of intervention. (Table 6.3 & Fig. 6.11 & 6.12).

Table 6.3: Comparison between group A and group B post data of both outcome measures.

Outcome Measure	Group A Post Data		Group B Post Data		P Value
	(Mean±Sem)	(Mean±SD)	(Mean±Sem)	(Mean±SD)	
W/h FMUE	18.67±0.4328	18.671.676±	16.47±0.6752	16.472.615±	0.0105
ARAT	36.87±1.540	36.87±5.963	31.40±1.032	31.403.996±	0.0064

- Analyzing and comparing both group's pre and post data, although both groups shows significant differences with in the group and between the group but group A (mCIMT) shows slightly more significant improvement in both outcome measures.

Therefore, result suggest that after 4 week of mCIMT and mirror therapy along with conventional therapy, both group shows improvement in hand function but mCIMT with conventional therapy shows more improvement in hand function in acute and sub-acute stroke patient.

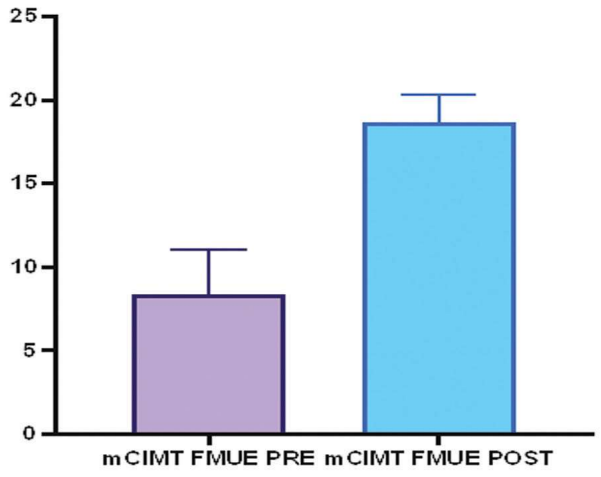

Fig. 6.1: Comparison of w/h FMUE pre and post treatment data of group A (Mean and SD).

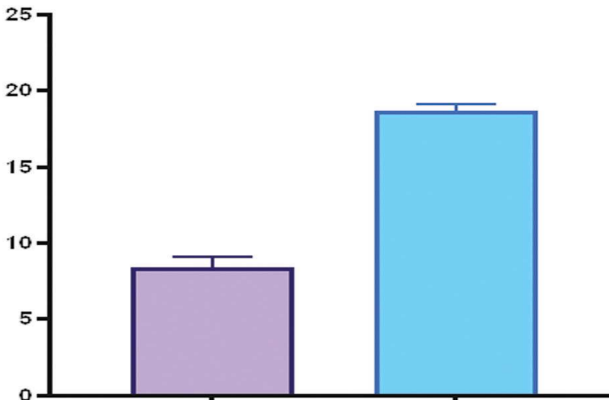

Fig. 6.2: Comparison of w/h FMUE pre and post treatment data of group A (Mean and SEM).

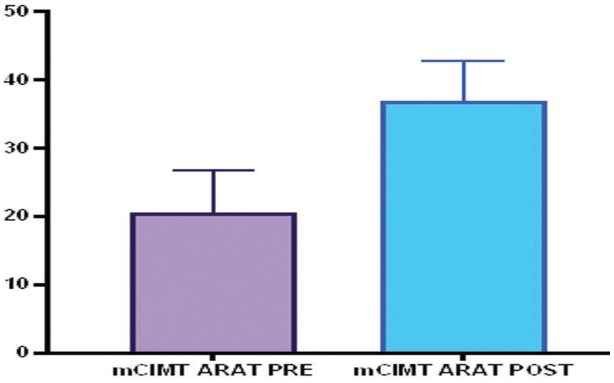

Fig. 6.3: Comparison of ARAT pre and post treatment data of group A (Mean and SD).

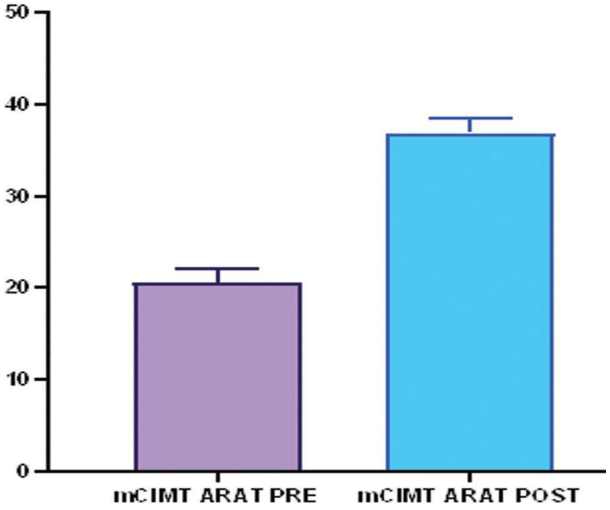

Fig. 6.4: Comparison of ARAT pre and post treatment data of group A (Mean and SEM).

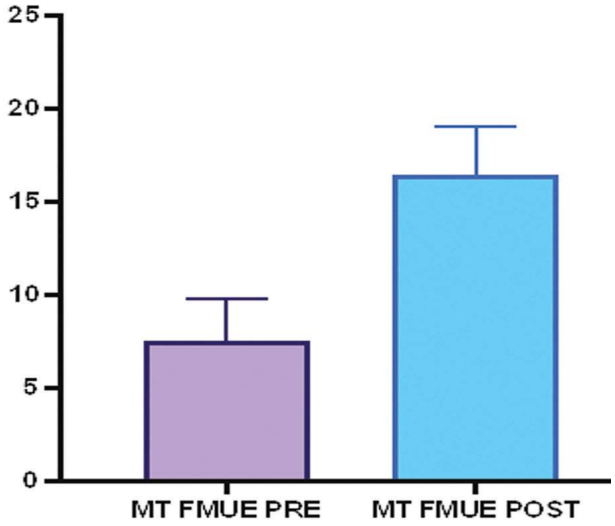

Fig. 6.5: Comparison of w/h FMUE pre and post treatment data of group B (Mean and SD).

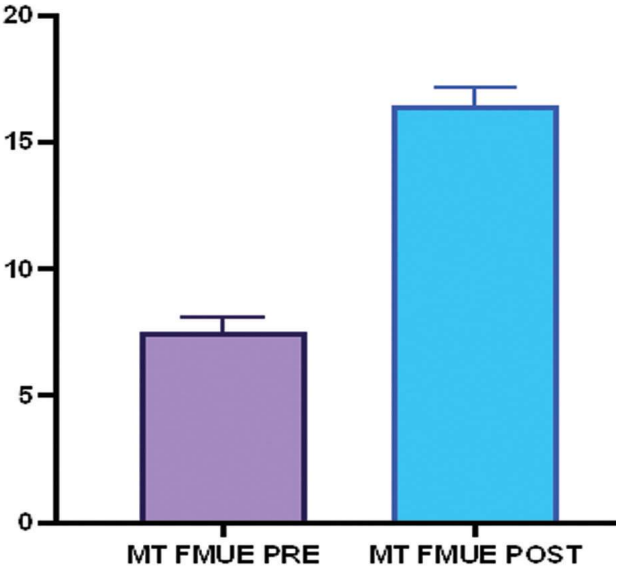

Fig. 6.6: Comparison of w/h FMUE pre and post treatment data of group B (Mean and SEM).

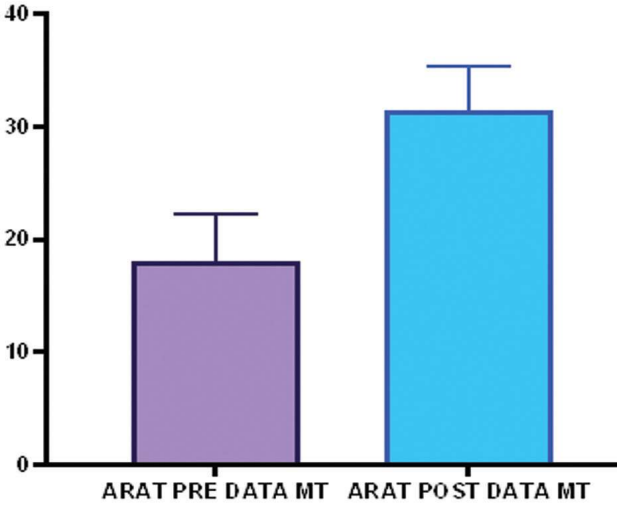

Fig. 6.7: Comparison of ARAT pre and post treatment data of group B (Mean and SD).

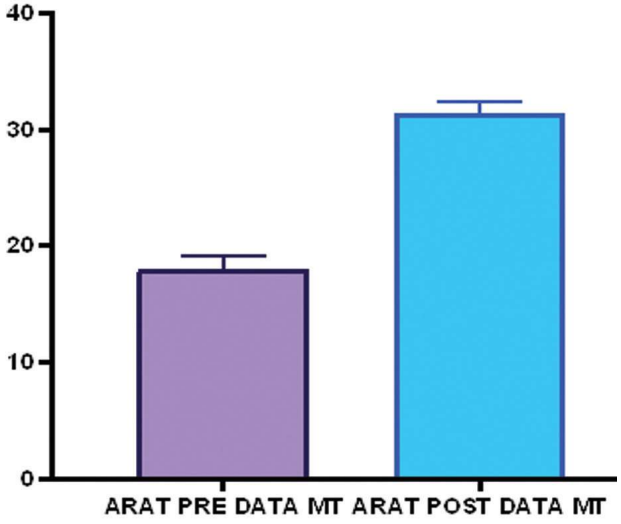

Fig. 6.8: Comparison of ARAT pre and post treatment data of group A (Mean and SEM).

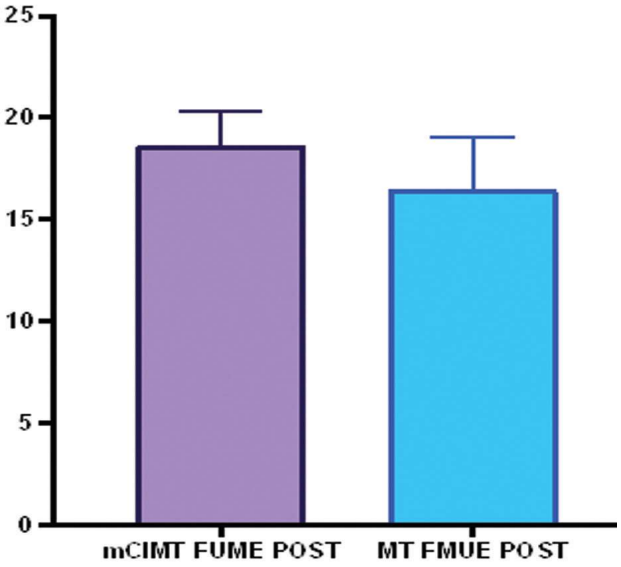

Fig. 6.9: Comparison between group A and group B w/h FMUE post treatment data (Mean and SD).

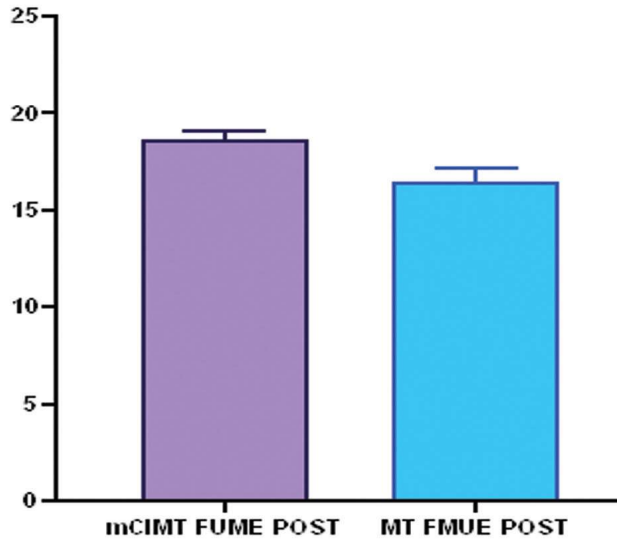

Fig. 6.10: Comparison between group A and group B w/h FMUE post treatment data (Mean and SEM).

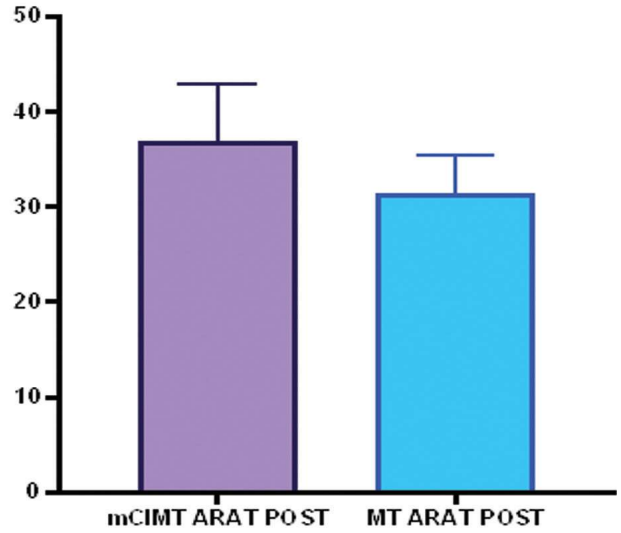

Fig. 6.11: Comparison between group A and group B, ARAT post treatment data (Mean and SD).

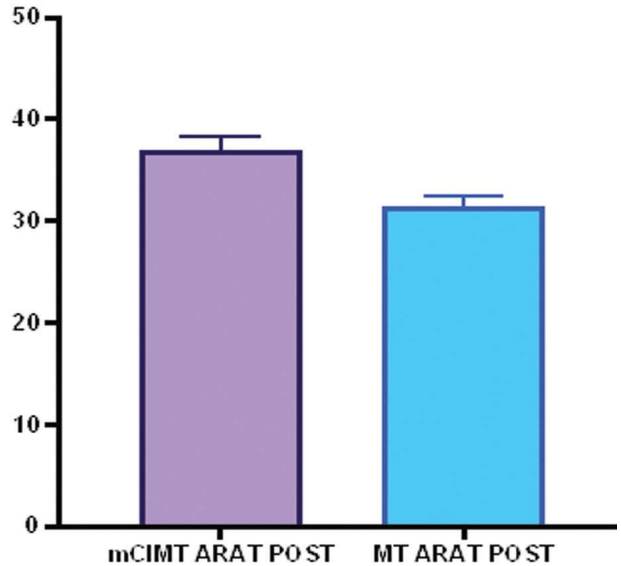

Fig. 6.12: Comparison between group A and group B, ARAT post treatment data (Mean and SEM).

Discussion

Motor impairment at the hand is common after stroke. At 6 months after severe stroke, one third of people develop wrist and hand contracture (loss of passive joint range of motion) and more than 50% of people with hand impairment do not regain function. The impaired muscle strength after a stroke poses a therapeutic challenge for patients, guardians and specialist in rehabilitation therapy. Modified constraint induced movement therapy and Mirror therapy are two promising approaches in rehabilitation of stroke patients, where mCIMT works on use of more affected upper extremity while constraining the less affected upper extremity to overcome the non-use phenomena in stroke patients, on other hand mirror therapy emphasizes observing the mirror reflection of arm movements in the non-affected arm, as if it were the affected one.

Improvement in hand function is one of the most important aim during stroke rehabilitation so that patient is able to perform his or her activities of daily living and not dependent on others.

The aim of present study is to find which therapy is more effective on hand rehabilitation in acute and sub-acute stroke patients. In this study 30 patients were included with 22 male patients (73.33%) and 8 female patients (26.66%)15 subjects in each group with the age >18 years and mean age of 57.17.

Improvement in hand function is one of the most important aim during stroke rehabilitation so that patient is able to perform his or her activities of daily living and not dependent on others.

W/h FMUE scale is used in this study to measure hand functions, pre and post treatment due to its superior and comparable psychometric properties, supported by Stephen J. Page. Along with ARAT. In which both groups shows significant improvement that is p value <0.05 but group A shows more significant improvement than group B. Both the scales are clinically reliable and significantly valid.

In a study by Riya Anpat et. al. reported that CIMT and MT both are individually helpful in hand function in chronic patient along with conventional therapy but CIMT shows more significant improvement than MT.

In another study by Sana Batool et. al. Showed that CIMT group showed more significant improvement in motor function and self care performances of hemiplegic upper extensive as compares to MRP group in patients with sub acute stroke patient assessed by the MAS and FIM scales. In one study by Jinhong Kim et. al. Showed significant improvement in the motor evoked

potential and hand function variables in both groups that is high frequency repetitive transcranial magnetic stimulation + task oriented mirror therapy (experimental group) and high frequency repetitive transcranial magnetic stimulation (control group) and experimental group showed positive effects on hand function and can be used for the rehabilitation of precise hand movements in acute stroke patients.

In a study by Iuly Treger et. al. Showed that modified CIMT group showed significantly higher changes in all 3 tests i.e. 1) transfer pegs from a saucer; 2) grasp, carry, and release a hard rubber ball; 3) eating using a spoon, compared to standard rehabilitation group. Thus this study provides additional support for the use of modified CIMT during sub-acute rehabilitation period of post stroke patients.

In this study there was direct comparison between modified constraint induced movement therapy and mirror therapy along with conventional therapy. The "t" test was used to analyze the pre and post data of both groups, both the groups showed significant differences in pre and post treatment and both treatment intervention were highlysignificant in improving hand function but modified constraint induced movement therapy along with conventional therapy showed more improvement. Based on this data we accept the alternate hypothesis and reject the null hypothesis.

Thus this study provides additional support for the use of modified constraint induced movement therapy during acute and sub-acute rehabilitation period of post stroke patients to improve hand function.

Limitation of Study

The duration of study was only 4 weeks, so further prognosis and long term benefits could not be recorded.

Sample size was small i.e. 30 patients and 15 patient in each group.

Proper follow up was not done due to COVID- 19 pandemic.

The study was limited only to hand function.

Future Research

Further studies are recommended to minimize this limitation in such a way that larger sample size of both sexes that include various age groups of people are studied.

The duration of study can be increased.

Various outcome measures can be used in order to record functional independence in better way. The study can be done to see the improvement of upper extremity as a whole.

Conclusion

Modified constraint induced movement therapy and Mirror therapy along with conventional therapy both showed improvement in hand functions on acute and sub-acute stroke patient. But Modified constraint induced movement therapy along with conventional therapy showed more improvement in reaching forward, grasping, manipulating objects and also improves other fine motor functions of the hand after 4 weeks of therapy.

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