A COMPARATIVE STUDY TO ASSESS THE EFFECTIVENESS OF CONSTRAINT INDUCED MOVEMENT THERAPY AND CONVENTIONAL PHYSIOTHERAPY IN IMPROVING HAND AND WRIST FUNCTION IN THE HEMIPARETIC STROKE PATIENTS

A dissertation submitted in partial fulfillment of the requirement for the degree of

MASTER OF PHYSIOTHERAPY

(ELECTIVE – ADVANCED PT IN NEUROLOGY)

To

The Tamil Nadu Dr. M.G.R. Medical University

Chennai-600032

April 2012

(Reg. No.27101912)

RVS COLLEGE OF PHYSIOTHERAPY

(Affiliated to the Tamil Nadu Dr. M.G.R Medical University, Chennai – 32)

SULUR, COIMBATORE – 641 402

TAMIL NADU

INDIA

CERTIFICATE

Certified that this is the bonfire work of Miss. Vandhana.E of R.V.S. College of Physiotherapy, Sulur, Coimbatore submitted in partial fulfillment of the requirements for Master of Physiotherapy Degree course from The Tamilnadu Dr M.G.R Medical University under the Registration No: 27101912

ADVISOR
Mr. M. K. Franklin Shaju, MPT, MSPT, PG Dip (Bio-Stat), (Ph.D.),
Associate Professor,
RVS COLLEGE OF PHYSIOTHERAPY
SULUR, COIMBATORE.

PRINCIPAL
Prof. **Mrs. R. Nagarani, MPT, MA, S.R.P (Lon), (Ph.D.),**
RVS COLLEGE OF PHYSIOTHERAPY,
SULUR, COIMBATORE.

Place:

Date:

A COMPARATIVE STUDY TO ASSESS THE EFFECTIVENESS OF CONSTRAINT INDUCED MOVEMENT THERAPY AND CONVENTIONAL PHYSIOTHERAPY IN IMPROVING HAND AND WRIST FUNCTION IN THE HEMIPARETIC STROKE PATIENTS.

INTERNAL EXAMINER:

EXTERNAL EXAMINER:

SUBMITTED IN THE PARTIAL FULFILLMENT OF THE REQUIREMENT

FOR DEGREE OF "MASTER OF PHYSIOTHERAPY"

AT

THE TAMIL NADU DR. M.G.R. MEDICAL UNIVERSITY,

CHENNAI.

APRIL 2012

DECLARATION

I hereby declare and present my project work entitled "**A COMPARATIVE STUDY TO ASSESS THE EFFECTIVENESS OF CONSTRAINT INDUCED MOVEMENT THERAPY AND CONVENTIONAL PHYSIOTHERAPY IN IMPROVING HAND AND WRIST FUNCTION IN THE HEMIPARETIC STROKE PATIENTS. "** The outcome of the original research work undertaken and carried out by me, under the guidance of Associate Professor **Mr. M. K. Franklin Shaju, MPT, MSPT., (Ph.D)., RVS COLLEGE OF PHYSIOTHERAPY,** Sulur, Coimbatore.

I also declare that the material of this project work has not formed in any way the basis for the award of any other degree previously from the Tamil Nadu Dr. M.G.R Medical University.

Date: SIGNATURE

Place:

ACKNOWLEDGEMENT

I give my thanks to **God almighty** for providing me the wisdom and knowledge to complete my study successfully.

This study will be an incomplete one without my gratitude towards my **'Lovable Parents'** who made me what I am today.

I acknowledge my sincere thanks to **CHAIRMAN and SECRETARY OF R.V.S EDUCATIONAL TRUST,** Sulur, Coimbatore for providing me an opportunity to do this project.

I would like to express my gratitude to our Principal **Mrs. R.Nagarani M.P.T., S.R.P (Lon), (PhD),** for providing me constant support and motivation in the form of resources and inputs.

I would like to thank my guide **Mr. M. K. Franklin Shaju, MPT, MSPT., (Ph.D.).,** offering me perceptive inputs and guiding me entirely through the course of my work and without his tired less guidance and support this project would not have come through.

I also thank my friends for their co-operation in completion of this project.

I offer my thanks and gratitude to our librarians for their supports in providing books to complete my study.

I take this golden opportunity to thank each and every patient who took part in this study for their kind co-operation and needed information.

CONTENTS

LIST OF TABLES

LIST OF GRAPHS

LIST OF ANNEXURE

I. INTRODUCTION

Stroke is the third leading cause of death. Public Health Statistics shows that stroke has been on the increase. A great majority of stroke patients in rehabilitation improve in function, but the improvement is quite variable from one patient to the other. Approximately, 80% of stroke patients survive the acute phase. Although most patients regain their walking ability, 30% to 66% of the survivors are no longer able to use the affected arm. The recovery process of the function of the upper extremity is often slower than that of the lower extremity.

The incidence of dependence in activities of daily living (ADL) is highest immediately after a stroke and decreases significantly thereafter. Dependencies in ADL may vary by function, making a summated ADL score less representative of limitations in individual activities. For example, the dependence in more complex functions such as bathing is much greater than that in less complex activities such as grooming, repeated disappointment in attempts to use the affected arm in the acute and sub acute phases can lead to negative reinforcement of the use of the affected arm. Although motor function may gradually return as the combined result of spontaneous recovery and rehabilitation, actual use often seems much less than potential use. The demanding society of today and health care environment often necessitate the attainment of the highest functional level possible in the shortest time. For this reason, the therapeutic focus a patient's choice is often on compensating for lost movement by replying primarily on the side not affected by the stroke for activities of daily living (ADL).

Performing ADL tasks with one arm may still leave the individual with limited abilities. Persistent reliance on one side of the body may also result in certain consequences, such as overuse syndromes, pain, frustration, embarrassment.

Several converging lines of evidence suggest that nonuse of a single deafferented limb is a learning phenomenon involving a conditioned suppression of movement. As a background for this explanation, one should note that substantial neurological injury usually leads to a depression in motor and/or perceptual function that is considerably greater than will eventually be the case after spontaneous recovery of function has taken place. The processes responsible for the initial depression of function and the later gradual recovery of function, which occurs at the level of both the spinal cord and the brain, is, at present, incompletely understood.

Learned nonuse could also be relevant to humans after brain injury or CVA. The period of temporary, organically based inability to use an affected upper limb would be due to cortical mechanisms rather than processes associated with deafferentation at the level of the spinal cord. The learned nonuse model in no way obviates the general correlation between amount of neural damage following CVA and the amount of motor function that is recovered on the affected side. Such a correlation could be a sufficient explanation for the observed differences in amount of recovery among many patients. However, the fact that some patients with a given extent and locus of lesion recover more movement than others with CVA having similar lesions suggests that additional factors may be involved; one of these might be the operation of a learned nonuse mechanism.

A possible explanation for the substantial remaining motor deficits in stroke patients might be the occurrence of learned nonuse, a phenomenon first described by Taub. Stroke patients who initially attempt to use the affected extremity find themselves unable to do so because the process of spontaneous recovery of function has not yet proceeded sufficiently far. This results in the experience of failure or punishment for attempts to move the extremity and in positive reinforcement for compensatory movements by the unaffected extremity- a learning process that might be supported by the teaching of compensatory activity during rehabilitation. This learned nonuse impedes attempts to further rehabilitate the affected extremity. Based on this theoretical account, constraint-induced movement therapy was developed. It is designed to overcome this learned disability by restraining the unaffected extremity and training the affected extremity, thereby leading to massed practice in the use of the affected extremity

COMMONLY USED TREATMENT TECHNIQUES FOR HEMIPLEGIA

The followings are the current approaches to motor rehabilitation of the hemiplegic patients.

Neurofacilitation techniques.

They are the most common methods of intervention for the deficits in UE motor skills including Bobath, proprioceptive neuromuscular facilitation, Brunnstrom's movement therapy and Rood's sensorimotor approach. There is some evidence that practice based on the facilitation models can

result in improved motor control of UE. In Stroke Physical Therapy these therapeutic interventions use sensory stimuli (e.g. quick stretch, brushing, reflex stimulation and associated reactions) ,which are based on neurological theories, to facilitate movement in patients following stroke (Duncan,1997). The following are the different approaches: -

i.Bobath

Berta & Karel Bobath's approach focuses to control responses from damaged postural reflex mechanism. Emphasis is placed on affected inputs facilitation and normal movement patterns (Bobath, 1990).

ii.Brunnstrom

Brunnstrom approach is one form of neurological exercise therapy in the rehabilitation of stroke patients.

iii.Rood

Emphasize the use of activities in developmental sequences, sensation stimulation and muscle work classification. Cutaneous stimuli such as icing, tapping and brushing are employed to facilitate activities.

iv. Proprioceptive neuromuscular facilitation (PNF)

Developed by Knott and Voss, they advocated the use of peripheral inputs as stretch and resisted movement to reinforce existing motor response. Total patterns of movement are used in treatment and are followed in a developmental sequence.

It was shown that the commutative effect of PNF is beneficial to stroke patient (Wong, 1994).

b) Sensory re-education

Bobath and other therapy approaches recommend the use of sensory stimulation to promote sensory recovery of stroke patients.

c) Balance retraining

Reestablishment of balance function in patients following stroke has been advocated as an essential component in the practice of stroke physical therapy. Some studies of patients with hemiparesis revealed that these patients have greater amount of postural sway, asymmetry with greater weight on the non-paretic leg, and a decreased ability to move within a weight-bearing posture. Meanwhile, research has demonstrated moderate relationships between balance function and parameters such as gait speed, independence, wheelchair mobility, reaching, as well as dressing.

d) Tone management

A goal of Stroke Physical Therapy interventions has been to “normalize tone to normalize movement.” Therapy modalities for reducing tone include stretching, prolonged stretching, passive manipulation by therapists, weight bearing, ice, contraction of muscles antagonistic to spastic muscles, splinting, and casting.

e) Weight bearing Exercise

Active weight bearing exercise can be used as a means of improving motor control of the affected arm; introducing and grading tactile, proprioceptive, and kinesthetic stimulation; and preventing edema and pain. In Stroke Physical Therapy, Upper extremity weight bearing

can be used to lengthen or inhibit tight or spastic muscles while simultaneously facilitating muscles that are not active.

f) Functional electric stimulation

In Stroke Physical Therapy, Functional electric stimulation (FES) can be effective in increasing the electric activity of muscles or increased active range of motion in individuals with stroke. Some evidence shown that FES may be more effective than facilitation approaches.

g) Electromyographic biofeedback

In Stroke Physical Therapy, biofeedback can contribute to improvements in motor control at the neuromuscular and movement levels. Some studies have shown improvement's in the ability to perform actions during post-testing after biofeedback training. However, the ability to generalize these skills and incorporate them into daily life is not measured.

Constraint-induced movement therapy

Constraint Induced Movement Therapy of the upper extremity affected by hemiparesis has been credited with hastening the cortical map reorganization process in humans. In other methods of stroke treatment, patients learned to use the unaffected extremity for ADL. Such approaches of treatment may faster learned nonuse of the affected extremity. Learned nonuse is proposed to be a phenomenon in which an individual effectively forgets to use the affected extremity because of the extreme difficulty of movement experienced immediately after the onset

of stroke. Constraint Induced Movement Therapy is thought to offset learned nonuse, as it was developed to improve purposeful movement of the affected extremity by restricting the use of the unaffected upper extremity after stroke. In fact, the main therapeutic factor in Constraint Induced Movement Therapy is the intensive use of the paretic limb.

Constraint Induced Movement Therapy produces a permanent increase in arm use by two linked but independent mechanisms. First, as noted above, Constraint Induced Movement Therapy changes the contingencies of reinforcement (provides opportunities for reinforcement of use of the more affected arm and aversive consequences for its nonuse by constraining the less-affected arm) so that the nonuse of the more affected arm learned in the acute and early sub-acute periods is counter conditioned or lifted. Second, the consequent increase in more affected arm use, involving sustained and repeated practice of functional arm movements, induces expansion of the contralateral cortical area controlling movement of the more-affected arm and recruitment of new ipsilateral areas. This use-dependent cortical reorganization may serve as the neural basis for the permanent increase in use of the affected arm. Moreover, to the best of our knowledge, these recent studies are the first to demonstrate an alteration in brain structure or function associated with a therapy-induced improvement in movement after CNS damage. Furthermore, by providing a physiological basis for the observed treatment effect, these results are likely to increase confidence in the clinical findings.

The motor learning literature suggests that massed practice has only a neutral or negative effect on the learning of continuous tasks and a variable effect on the learning of discrete tasks. However, Constraint

Induced Movement Therapy employs massed practice to increase the tendency of patients to use their more-impaired limb, and thereby induces a use-dependent functional reorganization of brain structures. This is certainly a type of central nervous system plasticity, as is learning; but they probably represent somewhat different processes and their establishment may be, at least in part, governed by different principles.

1. 1. NEED FOR THE STUDY

- This study is aimed to give awareness to the practicing physiotherapist regarding the improvement of hemi paretic stroke patients by Constraint induced movement therapy.
- Thus the study was done to find out the difference between the effectiveness of constraint induced movement therapy and conventional physiotherapy in the hemi paretic stroke patients.

1. 2. STATEMENT OF PROBLEM

A comparative study to assess the effectiveness of constraint induced movement therapy and conventional physiotherapy in improving hand and wrist function in the hemi paretic stroke patients.

1.3. OBJECTIVES

- To improve the hand and wrist function by Constraint induced movement therapy.
- To improve the hand and wrist function by Conventional physiotherapy.

- To know the difference between the constraint induced movement therapy and conventional physiotherapy in improving hand and wrist function in the hemi paretic stroke patients.

1. 4. HYPOTHESES

Null Hypothesis

- H_{01}There is no significant difference between Constraint Induced Movement Therapy and Conventional physiotherapy in the improvement of hand function among hemi paretic stroke patients.
- H_{02}There is no significant difference between Constraint Induced Movement Therapy and Conventional physiotherapy in the improvement of wrist function among hemi paretic stroke patients.

Alternate Hypothesis

- H_{A1}There is significant difference between Constraint Induced Movement Therapy and Conventional physiotherapy in the improvement of hand function among hemi paretic stroke patients.
- H_{A2}There is significant difference between Constraint Induced Movement Therapy and Conventional physiotherapy in the improvement of wrist function among hemi paretic stroke patients.

1.5. OPERATIONAL DEFINITION

- Constraint induced movement therapy

It is designed to overcome this learned disability by restraining the unaffected extremity and training the affected extremity, thereby leading to massed practice in the use of the affected extremity.

- Fugl-meyer scale

Fugl-Meyer Assessment is a disease-specific impairment index designed to assess motor function, balance, sensation qualities and joint function in hemiplegic post-stroke patients.

II. REVIEW OF LITERATURE

STUDIES ON EFFECT OF CONSTRAINT INDUCED MOVEMENT THERAPY IN STROKE

1)Taub.E,Uswattie.G,Pidikitti.R,2002

In his article he said that CIMT includes concentrated repetitive practice that produces a massive use-dependent cortical reorganization that increases the area of cortex involved in innervation of movement of most affected limb.

2) Dettmers et al,2004

In his article he said that CIMT is proven to increase motor function movement and brain activity known as cortical reorganization on affected side.

3)Edward taub,Kaven echols,2005

In their study they said that CIMT is found to be a promising treatment for substantially increasing the use of extremities affected by such neurologic injuries as stroke in adults.

4)Kopp et al,2005

In their study they said that CIMT leads to recruitment of large number of neurons in the innervation of movement of the CVA affected limb adjacent to those originally involved in control of the limb.

5)Wolf et al,2006

In their study they said that CIMT is an intense and strength focus on reuse of the most affected side by restraining arm in patient with stroke.

6)Steven.C.Wolf,Lardie J.Winstein,2006

In their paper they reported that CIMT produced clinically relevant improvement in arm motor function that persisted for atleast one year.

7)Lance.M.Skelly,2006

In their study they said that Stroke patients who received CIMT Rehabilitative technique that restrains the less impaired arm show significant improvement in arm and hand function.

8)Taub E,Uswette.G,Morris D et al ,2006

In their study they concluded that CIMT produces clinically significant improvement in involved upper extremity in hemi paretic stroke patients.

9)Annet Kunkel,Bruno kopp,Arno villringer,2008

In their paper they reported that CIMT shows improvement in the performance times and in quality of movement, particularly in the use of extremity in “real world” environments.

10)American stroke association,2009

In their article they stated that CIMT is an innovative and highly researched method of therapy that facilitate stroke survivors to use their affected extremity.

11)Areerat Suputitade,Sunita Tumvitee,2009

In their study they said that CIMT of unaffected UE has an advantage for stroke patients which may be an efficacious technique of improving motor activity and exhibiting learned non-use.

12)Qiang Wang,Jing-li Zhao,2010

In their paper they reported that CIMT shows an apparent advantage over both conventional intervention and intensive conventional rehabilitation for patients after stroke.

13)Taub and et al 2006

He applied the CIMT therapy protocol to the rehabilitation of patients with chronic upper limb hemi paresis. The treated group showed a significant increase in the skill or quality of movement, and a much larger increase in real-world use over the 2-week period. Moreover, they showed no decrease in real-world arm use when tested 2 years after the treatment.

STUDIES ON EFFECT OF CONVENTIONAL PHYSIOTHERAPY IN STROKE

1) Bobath, 1990

Berta & Karel Bobath's approach focuses to control responses from damaged postural reflex mechanism. Emphasis is placed on affected inputs facilitation and normal movement patterns.

2) Duncan, 1997

In Stroke Physical Therapy these therapeutic interventions use sensory stimuli (e.g. quick stretch, brushing, reflex stimulation and associated reactions), which are based on neurological theories, to facilitate movement in patients following stroke.

3) Wong, 1999

Total patterns of movement are used in treatment and are followed in a developmental sequence. It was shown that the commutative effect of PNF is beneficial to stroke patient.

4) Dimitrijevic et al., 1999

In Stroke Physical Therapy, Functional electric stimulation (FES) can be effective in increasing the electric activity of muscles or increased active range of motion in individuals with stroke .

5) Kraft, Fitts and Hammond; Moreland and Thomson, 2002

In Stroke Physical Therapy, biofeedback can contribute to improvements in motor control at the neuromuscular and movement levels.

6)Donatelli, 2003

Active weight bearing exercise can be used as a means of improving motor control of the affected arm; introducing and grading tactile, proprioceptive, and kinesthetic stimulation; and preventing edema and pain. In Stroke Physical Therapy, Upper extremity weight bearing can be used to lengthen or inhibit tight or spastic muscles while simultaneously facilitating muscles that are not active .

7)Davies, 2005

In Stroke Physical Therapy, positioning can be therapeutic for tone control and neuro-facilitation of stroke patients

8)Nichols, 2005

Reestablishment of balance function in patients following stroke has been advocated as an essential component in the practice of stroke physical therapy .Some studies of patients with hemiparesis revealed that these patients have greater amount of postural sway, asymmetry with greater weight on the non-paretic leg, and a decreased ability to move within a weight-bearing posture.

9)Knutsson and Martensson, 2007

A goal of Stroke Physical Therapy interventions has been to "normalize tone to normalize movement." Therapeutic modalities for reducing tone include stretching, prolonged stretching, passive manipulation by therapists, weight bearing, ice, contraction of muscles antagonistic to spastic muscles, splinting, and casting.

10)Adams and coworkers 2009

Stroke Physical Therapy includes passive, assisted-active and active range-of-motion exercise for the hemiplegic limbs. This can be an effective management for prevention of limb contractures and spasticity.

STUDIES ON USE OF FUGL-MEYER SCALE IN STROKE.

1) Duncan et al. 1994.

The interpretability of the FMA is enhanced by the scale's strong foundation in well-defined stages of motor recovery. It is widely used and Internationally accepted. Classifications of severity of motor impairment by FMA score have been proposed by several sources.

2) Lindmark et al 2002

Fugl-meyer scale is a disease specific performance based measure of recovery following a stroke. It quantifies motor recovery, balance, sensation, joint motion and pain.

3)Gladstone et al. 2002

The Fugl-Meyer Assessment is a disease-specific impairment index designed to assess motor function, balance, sensation qualities and joint function in hemiplegic post-stroke patients.

4)Gladstone et al., 2004

The Fugl-Meyer assessment is widely used and internationally accepted. The motor assessment is grounded in well defined, observable stages of motor recovery (Gladstone et al., 2002)

5)Michelle.L..Woodburry,Craig A.Velozo 2007

Fugl-meyer scale-upper extremity shows that strong item level measurement properties that challenges the use of resting state reflex items to measure volitional upper extremity movement.

III. MATERIALS AND METHODOLOGY

3. 1 STUDY DESIGN

Two group pre – post test experimental design.

3. 2 STUDY SETTING

This study was conducted at Outpatient department, RVS Hospital, Sulur.

3.3 STUDY DURATION

The study was conducted for a period of 2 weeks (14 days).

3. 4 SUBJECTS

20 subjects who fulfilled inclusion and exclusion criteria were selected by random sampling method, out of them 10 were allotted in Group A for constrained induced movement therapy and 10 in Group B for conventional physiotherapy.

3. 5 CRITERIA FOR SELECTION OF SUBJECTS

Inclusive Criteria

- Right side Hemi paretic stroke patients of age 40-50 years.
- Having a minimum of 20 degree of active wrist extension, and 10 degree of finger extension.
- Having a history of single stroke.
- No aphasia and sensory disorder.
- No cognitive impairments.

- Actively participate for 6 hours of therapy without long rest/nap periods.
- Follow simple instructions (score of 20 or higher on mini mental test).

Exclusive Criteria

- Ability to make extensive use of the involved UE so that significant further improvement could not be expected.
- Health problems that put the participant at significant risk for harm during the study.
- Other neurological conditions.
- Medications for spasticity.
- Pain limiting participant in the study.

3.6 VARIABLES

Independent Variable

- Constraint induced movement therapy
- Conventional physiotherapy

Dependent Variable

- Hand and wrist function

3.7 ASSESSMENT TOOL

- Fugl-meter scale.

3.8 PROCEDURE

Treatment procedure:

Both Group A and Group B subjects were involved for pre test assessment by fugl-meyer scale. Group-A subjects was given Constraint induced movement therapy and Group-B subjects were given conventional physiotherapy. Treatment program was given for a period of (14 days) 2 weeks as 6 hours of training per week day of affected extremity.

Constraint Induced Movement Therapy:

During the 14 days of intervention, the unaffected upper extremity was restrained by an ensemble consisting of a resting hand splint placed in a sling; this required the patient to carry out all activities with the affected limb. The patient agreed to wear the splint and sling for 90% of waking hours. In a treatment contract, specific exceptions from this rule were listed, such as sleeping, use of water, and any activity where having the unaffected arm restrained might affect safety. The patients kept a diary in which they recorded all the activities that were performed with the affected arm either with the sling and splint in place or removed. On weekends, the patients continued to wear the sling and practiced the tasks they had learned in the laboratory for at least 1 hour per day. In addition to the unaffected arm restraint, the patients were given behavioral training of the affected limb for 6 hours per day on each of the 10 weekdays of the 14-day treatment period. Based on the results of the pre test assessment, 12 specific exercises were given(shaping) that were focused on improving movements involving the maximum deficit. Each shaping task was repeated 10 times in a block of trials, and blocks of trials for each task and for different tasks were repeated throughout the

day, with appropriate rest intervals between blocks. The difficulty of the tasks was continuously increased in small steps and proper verbal reinforcement was given for the slightest improvement in performance time or quality of movement.

Conventional Physiotherapy:

Group-B received Conventional physiotherapy ,which consisted strength by elastic band, spring resisted gripping device, and putty , balance by sitting, standing and reaching objects , manual dexterity exercises (e.g. grasp release,tapping tasks,hand cupping tasks etc), stretching/weight-bearing by the affected arm. At the end of 14 days of treatment program, subjects were involved for post test assessment.

Measurement procedure:

Fugl-meyer scale:

The Fugl- Meyer scale (FM), a motor performance test consisting of 32 tasks performed by the affected UE, evaluates the ability to make movements outside of a synergistic pattern. Performance on each task is rated 0, 1, or 2, with higher ratings representing better performance. The FM measure used in this study was the sum of the 32 ratings (possible range 0 to 66).

IV.DATA ANALYSIS AND RESULT

4.1 Data Analysis:

The data collected from 20 patients were evaluated statistically. Descriptive analytical study was done by using paired‘t’ test and unpaired‘t’ test.

a) Paired‘t’ test

$$\bar{d} = \frac{\sum d}{n}$$

$$s = \frac{\sqrt{\sum d^2 - \frac{\sum (d)^2}{n}}}{n-1}$$

$$t = \frac{\bar{d}\sqrt{n}}{s}$$

d – Difference between pre test and post test values

–

d – Mean difference

n – Total number of subjects

s – Standard deviation

b) Un paired‘t’ test,

$$s = \sqrt{\frac{\sum(x_{1-}\ \bar{x}_2)^2+\sum(x_{2-}\ \bar{x}_2)^2}{n_1+n_2-2}}$$

$$T = \frac{\bar{x}_{1-}\ \bar{x}_2}{S} \qquad \sqrt{\frac{n_1 n_2}{n_1+n_2}}$$

Where,

S = Standard deviation

n_1 = Number of subject in group-I

n_2 = Number of subject in group-II

$\bar{x}_1$ = Average of the difference in value between pre-test and post test in group-I

$\bar{x}_2$ = Average of the difference in value between pre-test and post test in group-II

Table: 1 HAND FUNCTION

Intervention	Mean	Mean different	SD	Paired t value
Pretest	4.9	3.8	0.78	15.23
post test	8.7			

Table: 1 shows mean value, mean difference, standard deviation and paired‘t’ value between pre and post test scores hand function in constraint induced movement therapy among Group A.

Figure: 1

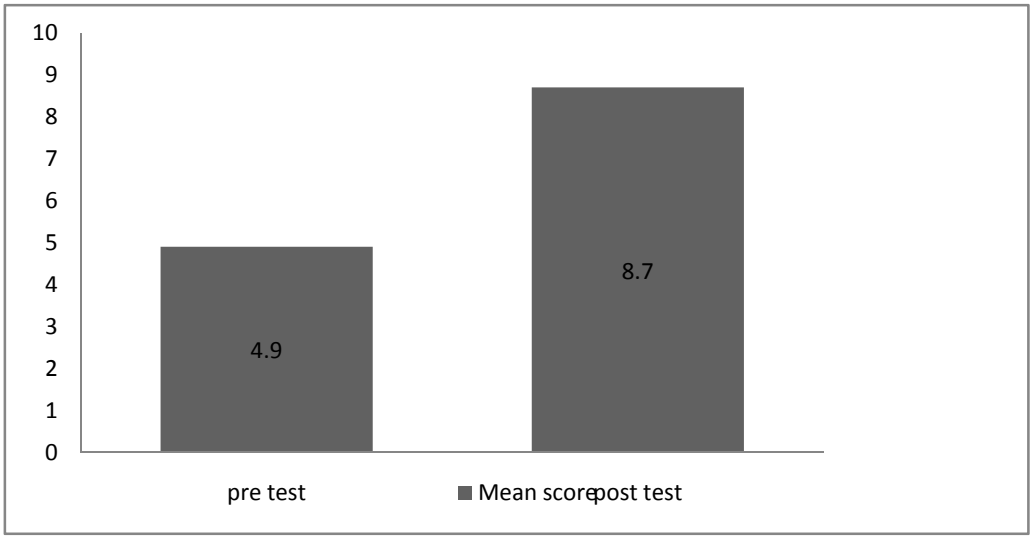

Figure: 1 shows the pre and post value of Fugl-meyer scale in Group A

Table: 2

Intervention	mean	Mean different	SD	Paired t value
Pre test	5.1	1.3	0.67	6.09
Post test	6.4			

Table: 2 shows mean value, mean difference, standard deviation, and paired‘t’ value between pre and post test score of hand function in conventional physiotherapy among Group B.

Figure: 2

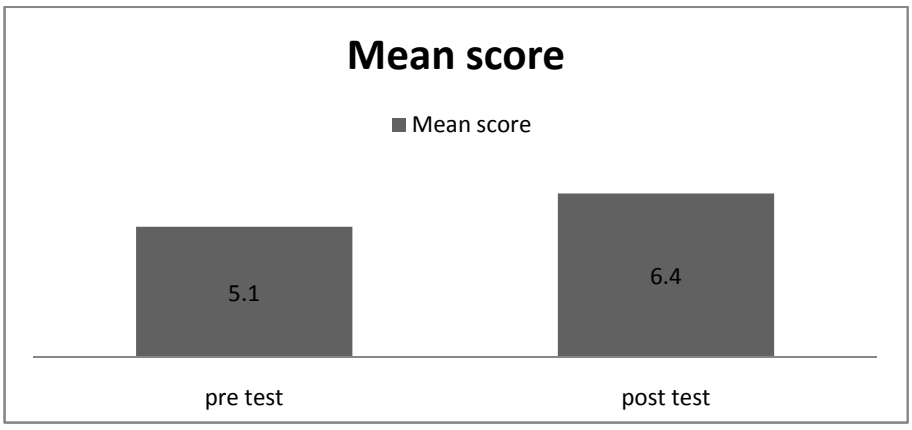

Figure: 2 shows pre and post test value of Fugl-meyer scale in Group-B

Table: 3

S.NO	VARIABLES	IMPROVEMENT		STANDARD DEVIATION	UNPAIRED "t" TEST
		Mean	Mean difference		
1	GROUP-A	3.8	2.5	0.734	7.61
2	GROUP-B	1.3			

Table: 3 shows the comparative mean value, mean difference, standard deviation, and unpaired't' Value scores between group A and Group B

Figure: 3

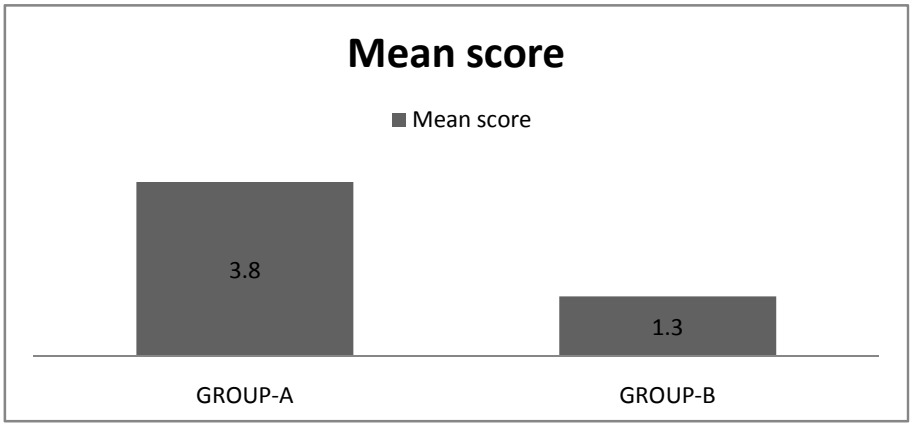

Figure: 3 shows pre and posttest value of Fugl-meyer scale in Group-A and Group-B

Table: 4 WRIST FUNCTION

Intervention	Mean	Mean different	SD	Paired t value
Pretest	2.3	3.9	0.67	18.28
post test	6.2			

Table: 4 shows mean value, mean difference, standard deviation and paired‘t’ value between pre and post test scores wrist function in constraint induced movement therapy among Group A.

Figure: 4

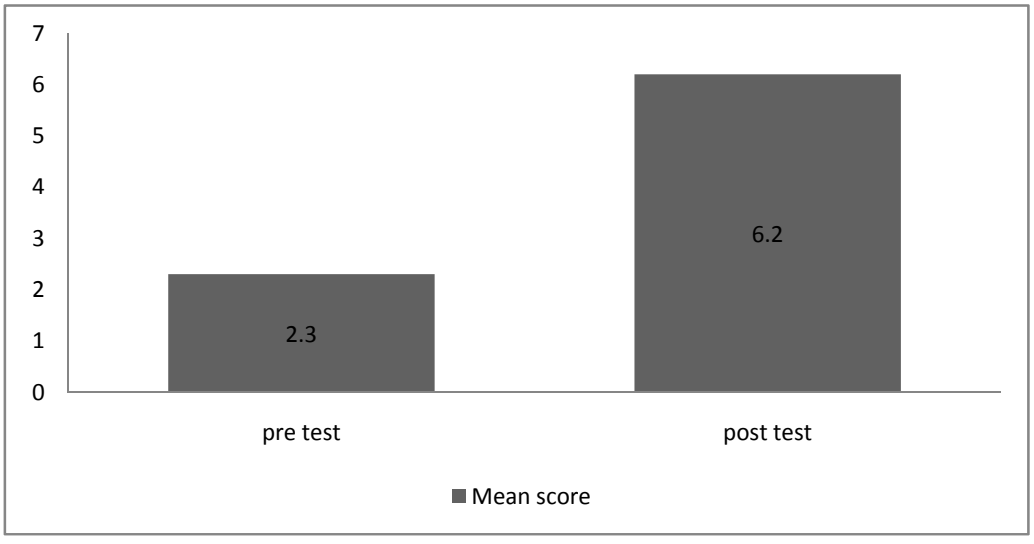

Figure: 4 shows the pre and post value of Fugl-meyer scale in Group -A

Table: 5

Intervention	mean	Mean different	SD	Paired t value
Pre test Post test	2.2 4.0	1.8	0.61	9.26

Table: 5 shows mean value, mean difference, standard deviation, and paired‘t’ value between pre and post test score of wrist function in conventional physiotherapy among Group B.

Figure: 5

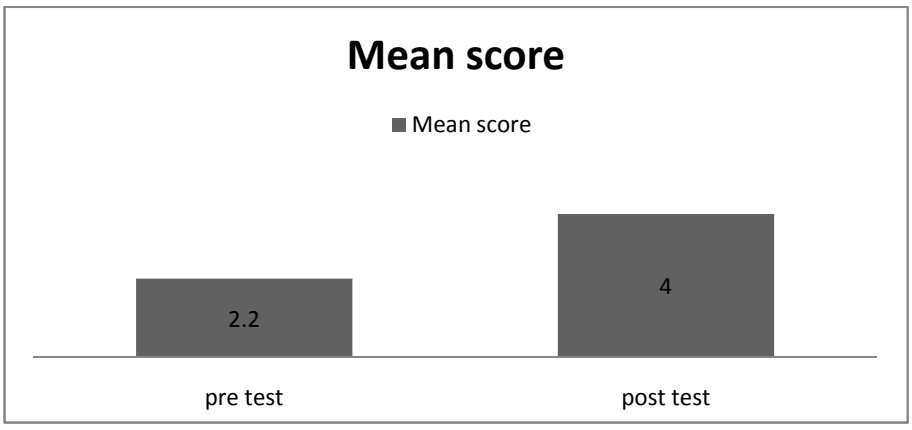

Figure: 5 shows pre and post test value of Fugl-meyer scale in Group-B

Table: 6

S.NO	VARIABLES	IMPROVEMENT		STANDARD DEVIATION	UNPAIRED "t" TEST
		mean	Mean difference		
1	GROUP-A	3.9	2.1	0.763	6.13
2	GROUP-B	1.8			

Table: 6 shows the comparative mean value, mean difference, standard deviation, and unpaired't' Value scores between group A and Group B

Figure: 6

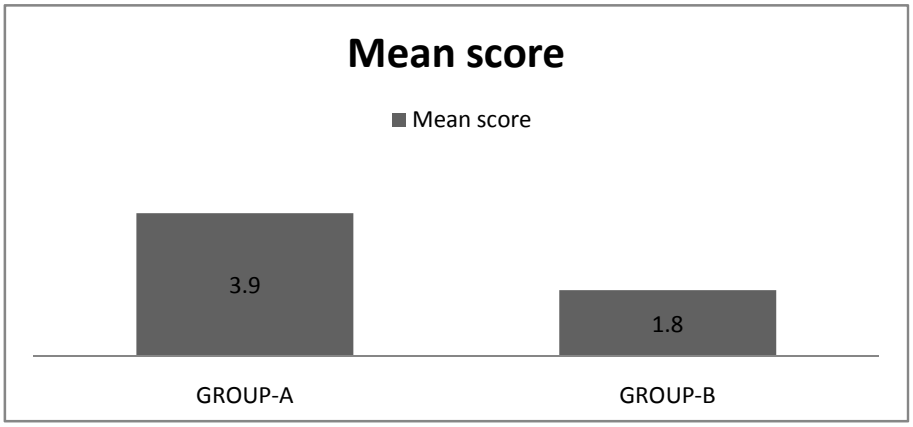

Figure: 6 shows pre and posttest value of Fugl-meyer scale in Group-A and Group-B

4.2 Results

The number of subjects for the study was 20(n=20).The subjects were divided into two groups , Group ‘A’ and Group ‘B’, each group consists of 10 persons. Treatment program was given for a period of (14 days) 2 weeks as 6 hours of training per week day of affected extremity. Before starting the treatment group-A was involved for pretest assessment by Fugl-meyer scale. The measurements were repeated after the treatment.

For Group ‘A’, Constraint induced movement therapy were given. Group ‘B’ received Conventional physiotherapy.

Regarding the dependent variable Hand function in Group-A, the calculated paired ‘t’ value is 15.23 at 0.05 level. The ‘t’ table value is 3.25 at 0.78 at 0.05 level. Hence the calculated ‘t’ value is more than ‘t’ table value. The above value shows that there is significant difference in Hand function following Constraint induced movement therapy. In Group-B, the calculated ‘t’ value is 6.09 at 0.05 level. The ‘t’ table value is 3.25 at 0.67 at 0.05 level. Hence the calculated ‘t’ value is more than ‘t’ table value. The above value shows that there is significant difference in Hand function following Conventional physiotherapy.

When analyzing Group ‘A’ and Group ‘B’ by unpaired‘t’ test, the calculated t’ value is 7.61 and the table ‘t’ value is 2.87 at 0.05 level. Hence the calculated ‘t’ value is more than ‘t’ table value. The above value shows that, there is significant difference between Constraint induced movement therapy and Conventional physiotherapy in improving Hand function among hemi paretic stroke patients. Hence we accept Alternate hypothesis H_{A1} and reject null hypothesis H_{o1}.

Regarding the dependent variable Wrist function in Group-A, the calculated paired ‘t’ value is 18.28 at 0.05 level. The ‘t’ table value is 3.25 at 0.67 at 0.05 level. the calculated ‘t’ value is more than ‘t’ table value. The above value shows that there is significant difference in Wrist function following Constraint induced movement therapy. In Group-B, the calculated paired ‘t’ value is 9.26 at 0.05 level. The ‘t’ table value is 3.25 at 0.61 at 0.05 level. Hence the calculated ‘t’ value is more than ‘t’ table value. The above value shows that there is significant difference in Wrist function following Conventional physiotherapy.

When analyzing Group ‘A’ and Group ‘B’ by unpaired‘t’ test, the calculated ‘t’ value is 6.13 and the table ‘t’ value is 2.87 at 0.05 level. Hence the calculated ‘t’ value is more than ‘t’ table value. The above value shows that there is significant difference between Constraint induced movement therapy and Conventional physiotherapy in improving Wrist function among hemi paretic stroke patients.

Hence we accept Alternate hypothesis H_{A2} and reject null hypothesis H_{o2}.

V. CONCLUSION

An experimental study was conducted to investigate the effectiveness of constraint induced movement therapy and conventional physiotherapy in improving hand and wrist function in the hemi paretic stroke patients.

20 patients with hemi paretic stroke were included in this study and randomly divided into two groups A and B each group consist of 10 subjects.

Group A was treated with Constraint induced movement therapy. Group B was treated with Conventional physiotherapy. Wrist and hand functions were assessed before and after intervention by Fugl-meyer scale.

The statistical result shows that there is improvement in both the groups. But when comparing both it was found that Constraint induced movement therapy is more effective than conventional physiotherapy

.

Limitations

- Number of subjects is small,
- Age and sex,
- Right (dominant) side Hemi paretic stroke patients.

Recommendation

- Number of subjects may be increased,
- More research in both interventions with consistent outcome measures,
- Study can be done with different variables.

VI .BIBLIOGRAPHY

1)Functional MRI evidence of cortical reorganization in upper-limb stroke hemiplegia treated with constraint-induced movement therapy.Am J Phys Med Rehabil 2001; 80: 4-12.

2)Kunkel A, Kopp B, Muller G, Villringer K, Villringer A, Taub E, Flor H. Constraint-induced movement therapy for motor recovery in chronic stroke patients. Arch Phys Med Rehabil 1999; 80: 624-8.

3)Morris D, Crago JE, DeLuca SC, Pidikiti RD, Taub E. Constraint-induced movement therapy for motor recovery after stroke. Neurorehabilitation 1997; 9: 29-43.

4) Liepert J, Miltner WHR, Bauder H, Sommer M, Dettmers C, Taub E, et al. Motor cortex plasticity during constraint-induced movement therapy in stroke patients. Neurosci Lett 1998; 250: 5-8.

5) Liepert J, Bauder H, Wolfgang HR, Miltner WH, Taub E, Weiller C. Treatment-induced cortical reorganization for stroke in humans. Stroke 2000; 31: 1210-6.

6) Miltner WHR, Bauder H, Sommer M, Dettmers C, Taub E. Effects of constraint-induced movement therapy on patients with chronic motor deficits after stroke: a replication. Stroke 1999; 30: 586-92.

7) Taub E. New discovery equals change in clinical practice

[guest editorial]. J Rehabil Res Dev 1999; 36: vii-viii.
8)Oujamaa L, Relave I, Froger J, Mottet D, Pelissier JY. Rehabilitation of arm function after stroke. Literature review. Annals of Physical and Rehabilitation Medicine. 52 (2009) 269–293

9)Andrews AW, Bohannon RW. Short-Term Recovery of Limb Muscle Strength After Acute Stroke. Arch Phys Med Rehabil. 2003; Vol 84, 125 130.

10)Mangold S, Schuster C, Keller T, Zimmermann-Schlatter A, Ettlin T. Motor Training of Upper Extremity With Functional Electrical Stimulation in Early Stroke Rehabilitation. Neurorehabilitation and Neural Repair. 2009; Vol 23(2): 184-190.

11)Ada L, Dorsch S, Canning CG. Strengthening interventions increase strength and improve activity after stroke: a systematic review. Australian Journal of Physiotherapy. 2006; 52: 241-248.

12)Duncan P, Studenski S, Richards L, Gollub S, Lai SM, Reker D, Perera S, Yates J, Koch V, Rigler S and Johnson D. Randomized Clinical Trial of Therapeutic Exercise in Subacute Stroke. Stroke 2003; 34:2173-2180.

13)Saunders DH, Greig CA, Mead GE, Young A. Physical fitness training for stroke patients (Review). Cochrane Library. 2009; 4.

14)Winstein CJ, Rose DK, Tan SM, Lewthwaite R, Chui HC, Azen SP. A Randomized Controlled Comparison of Upper-Extremity Rehabilitation Strategies in Acute Stroke: A Pilot Study of Immediate and Long-Term Outcomes. Arch Phys Med Rehabil 2004; 85: 620-628.

15)Wolf SL, Thompson PA, Morris DM, Rose DK, Winstein CJ, Taub E, Giuliani C, Pearson SL. The EXCITE Trial: Attributes of the Wolf Motor Function Test in Patients with Subacute Stroke. Neurorehabil Neural Repair 2005;19:194–205.

ANNEXURE-1

ASSESSMENT CHART

Physical therapy assessment chart

Name

Age

Sex

Occupation

Chief complaints

Medical history

Past

Present

Family/social history

Associated problems

Vital signs

temperature	Pulse rate	Respiratory rate	Blood pressure

On observation

Built

Posture

Attitude of limbs

Muscle wasting

Oedema

Involuntary movement

Gait

Deformity

On palpation

Tenderness

Swelling

Muscle tightness

Warmth

Other if any

Pain assessment

Side

Site

Duration

Nature

Aggravating factor

Relieving factor

Other if any

On examination

Higher functions

- ❖ Conciousness
- ❖ Cognition
- ❖ Orientation
- ❖ Attention span
- ❖ Memory
- ❖ Abstract thinking
- ❖ Insight,judgement,planning

- ❖ Spatial
- ❖ Perception

Speech

- ❖ Sound production
- ❖ Articulation
- ❖ Understanding& expressing words

Hearing

Cranial nerves

- ❖ Olfactory
- ❖ Optic
- ❖ Occulomotor.Trochlear,Abducent
- ❖ Trigeminal
- ❖ Facial nerve
- ❖ Vestibule cochlear
- ❖ Glossophayngeal
- ❖ Vagus
- ❖ Accessory
- ❖ Hypoglossal

Musculoskeletal system

- ❖ Fracture
- ❖ Muscle contracture
- ❖ Joint stiffness
- ❖ Joint subluxation
- ❖ Osteoporosis

Functional assessment

- ❖ ADL
- ❖ Functional status(disease specific scales)

Diagnosis

Problem list

Short term & long term goals

Reflexes

- ❖ Superficial
- ❖ Deep
- ❖ Primitive
- ❖ Pathological

Coordination

- ❖ Equilibilibrium assessment
- ❖ Non equilibrium assessment

Balance

static

- ❖ Sitting
- ❖ Standing
- ❖ Balance reactions

Hand function

- ❖ Power and precition grip
- ❖ Reaching
- ❖ Grasping
- ❖ Releasing

ANNEXURE-2

Table: 7

Pre and posttest Fugl-meyer scale value hand function in constraint induced movement therapy among Group A.

SL. No	Pretest	Post test	D
1	5	9	4
2	4	7	3
3	6	9	3
4	5	8	3
5	3	7	4
6	4	8	4
7	7	10	3
8	6	10	4
9	4	9	5
10	5	10	5

Table: 8

Pre and post test Fugl-meyer scale value hand function in conventional physiotherapy among Group B.

SL. No	Pretest	Post test	D
1	3	5	2
2	5	5	0
3	6	8	2
4	4	5	1
5	7	8	1
6	5	7	2
7	4	6	2
8	6	7	1
9	4	5	1
10	7	8	1

Table: 9

Pre and post test Fugl-meyer scale value wrist function in constraint induced movement therapy among Group A.

SI.No	Pretest	Post test	D
1	2	6	4
2	3	6	3
3	4	7	3
4	3	8	5
5	2	6	4
6	2	5	3
7	1	6	5
8	3	7	4
9	1	5	4
10	2	6	4

Table: 10

Pre and post test Fugl-meyer scale value wrist function in conventional physiotherapy among Group B.

SI.No	Pretest	Post test	D
1	3	5	2
2	2	3	1
3	1	4	3
4	3	5	2
5	1	4	3
6	2	4	2
7	4	6	2
8	3	4	1
9	2	3	1
10	1	2	1

ANNEXURE-3

EXERCISES GIVEN FOR CONSTRAINT INDUCED MOVEMENT THERAPY.

1) Putting pegs in a pegboard and taking them out.

2) Cards over.

3) Practice writing.

4) Pinch clothespins

5) Assemble nuts and bolts.

6) String beads.

7) Play checkers.

8) Put together puzzles.

9) Play the piano.

10) Practice typing.

11)Pick up small objects like buttons, coins, etc.

12) Crumple a sheet of paper into a ball. Try to spread it back out into a flat piece of paper using only the affected hand.

13) Pick up empty cans and then put them back down.

14) Roll a pencil between the thumb and fingers.

15) Place your hand on the table, and try to lift each finger one at a time off of the table.

16) Practice buttoning.

17) Pick up toothpicks with tweezers.

18) Wring out washcloths.

19) Fill a bowl with rice and place objects in the rice. Try to find the objects with your hand without looking.

20) Paint.

EXERCISES GIVEN FOR CONVENTIONAL PHYSIOTHERAPY.

- Conventional physiotherapy ,which consisted ,

1) Strength by elastic band, spring resisted gripping device, and putty. 2) Balance by sitting, standing and reaching objects.

3) Manual dexterity exercises (e.g. grasp release, tapping tasks, hand cupping tasks etc.)

4) Stretching/weight-bearing by the affected arm.

ANNEXURE-4

FUGL-MEYER SCALE

AREA	TEST	SCORING CRITERIA	MAXIMUM POSSIBLE SCORE	ATTAINED SCORE
UPPER EXTREMITY	1) Normal reflex activity Biceps and/or finger flexors and triceps	0- atleast 2 or 3 reflexes are markedly hyperactive 1- one reflex markedly hyperactive or atleast 2 reflexes are lively 2- no more than one reflex is lively and none are hyperactive	2	
WRIST	2) a). Stability,elbow at 90 degree ,shoulder at 0 degree b) Flexion/extension,elbow at 90 degree ,shoulder at 0 degree c) Stability ,elbow at 0 degree ,shoulder at 30 degree d) Flexion/extension,elbow at 0 degree ,shoulder at 30 degree e) Circumduction	a)0- cannot dorsiflex wrist to 15 degree. 1- dorsiflexed,no resistance 2- position maintained with some resistance b)0- no movement 1- cannot actively move the wrist 2-faultless smooth movement c)scoring same as for item a d)scoring same as for item b e)0-cannot be performed 1-jerky or incomplete 2-complete motion with smoothlessness	10	

HAND	3) a)Finger mass flexion b)Finger mass extension c)Grasp#1-MP joints extended and PIPS&DIPS are flexed.Grasp tested against resistance d) Grasp#2-instructed to adduct the thumb,1st carpometacarpophalangeal and IP joint at 0 degree e) Grasp#3-opposes the thumb pad against the pad of index finger.A pencil is interposed f) Grasp#4-should grasp a cylinder shaped object,the volar surface of the 1st and 2nd finger against each other . g) Grasp#5-A spherical grasp	a)0-no flexion 1-some flexion not full motion 2-complete active flexion b)0-no extension 1-can release on active mass flexion grasp 2-complete active extension c)0-required position cannot be acquired 1-grasp is weak 2-grasp can be maintained against relatively great resistance d)0-function cannot be performed 1-scrap of paper interposed between thumb and index finger can be kept in place but not against a slight tug. 2-paper is held firmly against a tug e)scoring are same as for Grasp#2 f)scoring are same as for Grasp#2 and #3 g) scoring are same as for Grasp#2, #3 and #4	14	

HAND	4) Coordination/speed-Finger to nose a.Tremor b.Dysmetria c.Speed	 a)0-marked tremor 1-slight tremor 2-no tremor b).0-pronounced or unsystematic dysmetria 1-slight or systematic dysmetria 2-no dysmetria c).0-activity is more than 6 sec longer than unaffected hand 1-2 to 5 sec longer than unaffected hand 2-less than 2 sec difference	 6	
	Total maximum upper extremity score		32	

ANNEXURE-5

PATIENT CONSENT FORM

I ……. Voluntarily consent to participate in the research named on "**A COMPARATIVE STUDY TO ASSESS THE EFFECTIVENESS OF CONSTRAINT INDUCED MOVEMENT THERAPY AND CONVENTIONAL PHYSIOTHERAPY IN IMPROVING HAND AND WRIST FUNCTION IN THE HEMIPARETIC STROKE PATIENTS"**

The researcher has explained me the treatment approach in brief, risk of participation and has answered the question to the study to my satisfaction.

Signature of patient **signature of researcher**

Signature of witness