EFFECTS OF SUPERVISED AND UNSUPERVISED CONSTRAINT INDUCED MOVEMENT THERAPY IN THE MANAGEMENT OF MOTOR FUNCTIONS AMONG HEMIPARETIC STROKE PATIENTS

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

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INTERNAL EXAMINER

EXTERNAL EXAMINER

A dissertation submitted in the partial fulfillment of the requirement for the degree of **Masters of Physiotherapy- May 2018** to The Tamilnadu Dr. M.G.R. medical university, Chennai.

CERTIFICATE

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I, Thank ***GOD*** for providing me the wisdom and knowledge to complete the study successfully.

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MOHAMMED SALIH. P

DECLARATION

I hereby declare and present my project work **"EFFECTS OF SUPERVISED AND UNSUPERVISED CONSTRAINT INDUCED MOVEMENT THERAPY IN THE MANAGEMENT OF MOTOR FUNCTIONS AMONG HEMIPARETIC STROKE PATIENTS".** The outcome of the original research work undertaken and carried out by me, under the guidance of ***Dr. R. Nagarani, MPT, MA, PhD,*** Principal R.V.S College of physiotherapy, Sulur, Coimbatore, Tamil Nadu.

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

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I. INTRODUCTION

Stroke is a rapidly developing clinical signs of focal or global disturbance of cerebral functions with symptoms lasting for 24 hours or longer or lasting to death with no other apparent cause of vascular origin.It is a major health issue not only because it is the third major cause of death but also because it leaves patients with several residual disabilities like physical dependence, in-coordination, cognitive decline, dementia and depression **(Sullivian 2007).**

Around 15 million people worldwide suffer stroke every year. Nearly 6 million die and another five million are left presently disabled. 10% of stroke victims recover almost completely, 25% recover with minor impairments, 40% experience moderate to severe impairment requiring special care. 10% stroke requires care in a nursing home or other long term care facility. The incidence of stroke is about 1.25 times greater in males than females. Etiology of stroke includes atherosclerosis, cerebral thrombus, and cerebral embolus, embolism from the heart, intracranial hemorrhage, subarachnoid hemorrhage and intracranial small vessel disease common. Risk factors of stroke are hypertension, cardiac disease, diabetes, obesity, abnormal blood lipid, cigarette smoking, excessive alcohol consumption, drug use and physical inactivity. There are different types of stroke based on the cause and onset of stroke. They are namely: 1) Ischemic stroke which occurs as a result of thrombus, embolism or conditions that produce low systemic perfusion pressures. 2) Hemorrhagic stroke which results from abnormal bleeding into extra-vascular areas of brain as a result of rupture of a cerebral vessel or trauma. Hemorrhagic stroke is further sub-divided into a) Intra-cerebral hemorrhage is caused by rupture of cerebral blood vessel with subsequent bleeding into brain. b) Subarachnoid stroke occurs from bleeding into subarachnoid space typically

from a saccular or berry aneurysm affecting primarily large blood vessels **(Gillen 2004).**

Prevention depends upon the identification of risk factors and their correction. Increasing age is the strongest risk factor. Hypertension is the major factor in the development of thrombotic cerebral infarction and intracranial haemorrhage. Cardiac disease, diabetes, hereditary, cholesterol, smoking, obesity, race, oral contraceptives are all associated with an increased risk of stroke. Occlusion or rupture of a cerebral artery results in vascular syndromes. The clinical manifestation seen depends on the concerned artery. The vascular syndromes are namely anterior cerebral artery syndrome, middle cerebral artery syndrome, internal carotid artery syndrome, posterior cerebral artery syndrome, lacunar syndromes and vertebra basilar artery syndrome. Early warning signs of stroke are sudden numbness or weakness of the face, arm, or leg, especially on one side of the body, sudden confusion or trouble in speaking sudden trouble seeing in one or both eyes, sudden trouble in walking, dizziness, loss of coordination, sudden nausea, fever, vomiting, and brief loss of consciousness. The common clinical manifestations include contralateral hemiparesis, hemi sensory loss, speech deficits and perceptual deficit. Hemiparesis is one of the most disabling consequences of stroke because of its impact on activities of daily living. Upper extremity hemiparesis is considered as the primary impairment underlying stroke-induced disability and it is the impairment most frequently treated **(Sullivan 2000).**

Functional recovery of upper extremity function is more difficult than recovery of lower limb function mainly because the patient with stroke and unilateral upper extremity dysfunction may progressively avoid using the more affected arm in favor of non-paretic extremity leading to learn no use. There are various treatment regimens for management of stroke. The conventional physiotherapy management consists of

various techniques such as proprioceptive neuromuscular facilitation (PNF), neuro developmental technique (NDT), motor relearning program, Roods approach etc. Traditional physiotherapy management includes range of motion exercises, resistance exercises, stretching, and functional training, gait and balance re-education regimens **(Sullivian 2014).**

Constraint induced movement therapy consists of three components 1.massing of repetitive, structured, practice-intensive therapy in use of the more affected arm, 2.restraint of the less-affected arm, 3.transfer program **(Taub 2006).**

1.1 Statement of the study

A study to find out and the effectiveness of supervised versus unsupervised constraint induced movement therapy in the management of motor functions among hemiparetic stroke patients.

1.2 Need of the study

This study aimed to provide awareness of people who are affected with stroke among the physiotherapist.

To provide awareness and popularize constraint induced movement therapy for the management of hemiparetic stroke patients.

1.3 Objectives of the study

- To evaluate the effectiveness of supervised constraint induced movement therapy on motor functions among hemiparetic stroke patients.
- To evaluate the effectiveness of unsupervised constraint induced movement therapy on motor functions among hemiparetic stroke patients.

- To compare the effectiveness of supervised constraint induced movement therapy and of unsupervised constraint induced movement therapy on motor functions among hemiparetic stroke patients.

1.4 Hypothesis

- It is hypothesized that there may be no significant difference in motor functions following supervised constraint induced movement therapy among hemiparetic stroke patients.
- It is hypothesized that there may be no significant difference in motor functions following unsupervised constraint induced movement therapy among hemiparetic stroke patients.
- It is hypothesized that there may be significant difference in motor functions between supervised constraint induced movement therapy and unsupervised constraint induced movement therapy among hemiparetic stroke patients.

1.5 Operational definitions

Supervised Constraint Induced Movement Therapy

Constraint induced movement therapy involves mass bed and intensive practice with more affected upper extremity and includes two components; use of unaffected extremity is restrained during 90% of waking hours and at the same time the more affected extremity uses repeated and extensive training for 6 hours or more a day **(Gordon 2005).**

Unsupervised Constraint Induced Movement Therapy

We all know prescribed home exercise is a key part of patient recovery and rehabilitation, so it can be pretty frustrating when patient do not correctly follow the prescribed program. Importance of home exercises is outside of physical therapist's

scope of practice to prescribe medication. But as movement specialists, we can recommend therapeutic exercise so that patient maintains active lifestyles.

One of the biggest components of success in physical therapy is the home exercise program, or home exercise. One could say the exercise is up to fifty percent of the reason you will achieve better outcomes: considering the average physical therapy visit ranges from 45-60 minutes, which may not be enough time to make the drastic change you need **(Johann 2016).**

Quality of Upper Extremity Skills Test (QUEST)

The quality of upper extremity skills test is an evaluative measure to assess specific changes in limb functions among individuals who sustained cortical damage resulting in hemiplegia. **(Lyle1981).**

II. REVIEW OF LITERATURE

Section A: Studies on the effect of supervised constraint induced movement therapy in hemiparetic stroke patients.

Section B: Studies on the effect of unsupervised constraint induced movement therapy in hemiparetic stroke patients.

Section C: Studies on reliability and validity of quality of upper extremity skills test.

Section A: Studies on the effect of supervised constraint induced movement therapy in hemiparetic stroke patients.

Nagarani *et al.,* (2012) compared the effectiveness of conventional therapy versus modified constraint induced movement therapy along with conventional therapy in improving upper extremity functions of stroke patients. Thirty subjects of age group 50 to 60 years were included in this group. The duration of the study was 3 to 9 month. The upper limb motor function of the stroke patients were assessed using box and block test and barthel index. This study concluded that modified constraint induced movement therapy is an effective exercise in improving motor performance of upper extremity.

Yue *et al.,* (2011) compared the effectiveness of constraint- induced movement therapy with traditional rehabilitation therapy in patients with upper-extremity dysfunction after stroke. This systematic review provided fairly strong evidence that constraint induced movement therapy could reduce the level of disability, improve the ability to use the paretic upper extremity, and enhance spontaneity during movement

time. Thirteen randomized control trials involving 278 patients were included. Meta-analysis showed that patients receiving Constraint Induced Movement Therapy showed higher scores for the Fugl Meyer Assessment, the Quality Of Upper Extremity Skills Test, and Motor Activity Log than traditional therapy.

Stephen *et al.,* (2008) compared the efficacy of a reimbursable, outpatient, constraint-induced therapy protocol (half-hour therapy sessions occurring 3 days per week in which subjects used the more affected arm combined with less affected arm restriction 5 days per week for 5 hours; both of these regimens were administered during a 10-week period) with that of a time-matched exercise program for the more affected arm or a no-treatment control regimen. The Quality of Upper Extremity Skills Test, Fugl-Meyer Assessment of Motor Recovery after Stroke, and Motor Activity Log were administered to the subjects. After intervention, significant differences were observed on Constraint Induced Movement Therapy on the Quality of Upper Extremity Skills Test and Motor Activity Log, Amount of Use and Quality of Movement scales, all in favor of the Constraint Induced Movement Therapy group.

Ching-yi *et al.,* (2007) examined the benefits of Constraint Induced Movement Therapy on motor function, daily function, and health-related quality of life in elderly stroke survivors. Twenty-six patients received either Constraint Induced Movement Therapy (restraint of the unaffected limb combined with intensive training of the affected limb) or traditional rehabilitation for a period of 3 weeks. Outcome measures included the Fugl-Meyer Assessment, Functional Independence Measure instrument, Motor Activity Log, and Stroke Impact Scale. The Constraint Induced Movement Therapy group exhibited significantly greater improvements in motor function, daily function than the traditional rehabilitation group. Patients in the Constraint Induced Movement Therapy group perceived significantly greater percent of recovery after

treatment than patients in the traditional rehabilitation group thus suggested Constraint Induced Movement Therapy as a promising intervention for improving motor function.

Stephen *et al.,* (2004) reviewed the evidences and discussed the theoretical bases of Constraint Induced Movement Therapy for stroke-induced hemiparesis. The objective was to make stroke practitioners aware of the Constraint Induced Movement Therapy theoretical bases as clinically practical, efficacious protocol to be practiced as an outpatient therapy. They concluded that Constraint Induced Movement Therapy is solidly grounded in motor learning principles, is practical and safe, and is effective. Constraint Induced Movement Therapy studies have shown efficacy using rigorous randomized controlled methods in both sub-acute and chronic stroke and have shown high effect sizes that have been independently confirmed.

Stephen *et al.,* (2002) determined the efficacy of a Constraint Induced Movement Therapy protocol administered to a patient with sub-acute stroke. Thirty minutes of structured physical therapy and 30 minutes of occupational therapy 3 times a week for 10 weeks, each session emphasizing affected arm use. During the same period, the unaffected arm and hand were restrained 5days/week during 5 hours initially identified as a time of frequent use. The main outcome measures were The Fugl-Meyer Assessment of Motor Recovery, Quality of Upper Extremity Skills Test, Wolf Motor Function Test, and Motor Activity Log. There was a substantial improvement on Constraint Induced Movement Therapy on the Fugl-Meyer Assessment of Motor Recovery and Quality of Upper Extremity Skills Test. There was improvement on the Wolf Motor Function Test in the ability to perform tasks and in the time taken to complete the tasks. Amount and quality of arm use also improved, as measured by the Motor Activity Log.

Section B: Studies on the effect of unsupervised constraint induced movement therapy in hemiparetic stroke patients.

Andreas *et al.,* (2011) evaluated the clinical aspects of unsupervised constraint induced movement therapy interventions after stroke, phantom limb pain and complex regional pain syndrome. A systematic literature search of the Cochrane Database of controlled trials was made by two investigators independently. For stroke there is a moderate quality of evidence that unsupervised constraint induced movement therapy as an additional intervention improves recovery of arm function.

Gunes *et al.,* (2008*)* evaluated the effects of unsupervised constraint induced movement therapy on upper-extremity motor recovery, spasticity, and hand-related functioning of inpatients with sub-acute stroke. Thirty minutes of unsupervised constraint induced movement therapy program a day consisting of wrist and finger flexion and extension movements in addition to conventional stroke rehabilitation program, 5 days a week, 2 to 5 hours a day, for 4 weeks. The Brunnstrom stages of motor recovery, spasticity assessed by the Modified Ashworth Scale and hand-related functioning (self-care items of the Functional Independence Measure instrument). The scores of the Brunnstrom stages for the hand and upper extremity and the Functional Independence Measure self-care score improved more in the unsupervised group than in the control group after 4 weeks of treatment and at the 6-month follow-up .No significant differences were found between the groups for the Modified Ashworth Scale.

Christian *et al.,* (2008) evaluated the effect of a therapy that includes use of home exercise to simulate the affected upper extremity with the unaffected upper extremity early after stroke. Thirty-six patients with severe hemiparesis because of a

first-ever ischemic stroke in the territory of the middle cerebral artery were enrolled. They completed a protocol of 6 weeks of additional therapy (30 minutes a day, 5 days a week), with random assignment to either unsupervised constraint induced movement therapy or an equivalent control therapy. The main outcome measures were the Fugl-Meyer sub scores for the upper extremity. In the subgroup of 25 patients with distal plegia at the beginning of the therapy, unsupervised constraint induced movement therapy patients regained more distal function than Control Therapy patients. Furthermore, across all patients, Unsupervised Constraint Induced Movement Therapy improved recovery of surface.

Section C: Studies on reliability and validity of Quality of Upper Extremity Skills Test.

Lang (1999) examined the responsiveness and validity of the Quality of Upper Extremity Skills Test in a population of subjects with mild to moderate hemiparesis. The Quality of Upper Extremity Skills Test is a responsive and valid measure of upper extremity functional limitation and therefore may be an appropriate measure for use in acute upper extremity rehabilitation trials.

Ching-Lin *et.al,* (1998) verified the inter-rater reliability and validity of the Quality of Upper Extremity Skills Test in stroke patients. Validity was assessed by comparing the patients' scores on the Quality of Upper Extremity Skills Test with those obtained for the other well-validated measurements evaluating upper extremity motor impairment and disability. The results of this study supported the value of the Quality of Upper Extremity Skills Test for measuring recovery of arm – hand function in stroke patients.

Hsieh (1998) verified the inter-rater reliability and validity of Quality of Upper Extremity Skills Test by assessing recovery of upper extremity function in stroke patients. 50 stroke patients participated and validity was assessed by comparing the patients score on the Quality of Upper Extremity Skills Test with those obtained for other well-validated measurements evaluating upper extremity motor impairment and disability. The preliminary results of this study support the value of the Quality of Upper Extremity Skills Test for measuring recovery of arm-hand function in stroke patients.

Van (1998) examined the reliability of the Quality of Upper Extremity Skills Test. The inter rater reliability was assessed by comparing the ratings of the videotaped measurements of 2 raters. The high intra and inter reliability of the Quality of Upper Extremity Skills Test was confirmed.

III. METHODOLOGY

3.1 Study setting

The study was conducted in physiotherapy outpatient department, RVS College of Physiotherapy, Sulur, Coimbatore.

3.2 Selection of subjects

20 subjects were randomly selected who fulfilled the inclusion and exclusion criteria and were divided into two groups.

Group A-Supervised Constraint Induced Movement Therapy

Group B-Unsupervised Constraint Induced Movement Therapy

3.3 Variables

3.3.1 Dependent variable

Motor functions

3.3.2 Independent variables

Supervised Constraint Induced Movement Therapy

Unsupervised Constraint Induced Movement Therapy

3.4 Measurement tool

Variable	Tool
Motor functions	Quality of upper extremity skills test

3.5 Study design

The study design adopted was pre test and posttest, experimental design.

3.6 Inclusion criteria

- Hemiparetic stroke patients
- Age: 50-60 years
- History of not more than one episode of stroke
- Patients who can make a simple communication.
- Patients who can maintain a sitting position for more than 30 minutes.
- No severe cognitive disorders**.**
- Those who are co-operative.

3.7 Exclusion criteria

- Associated psychological disorders
- Perceptual deficit.
- Significant visual & auditory impairment
- Cognitive and perceptual deficits

3.8 Orientation to the subjects

Before the collection of data, all the subjects were explained about the purpose of the study the investigator about the various test procedure. The consent and full cooperation of each participant was sort after complete explanation of the condition and demonstration of the procedure involved in the study.

3.9 Materials used

- Sling with Velcro strap
- Cloth
- Peg board

3.10 Test administration

Quality of upper extremity skills test (QUEST)

Quality of upper extremity skills test is a 34 activity items separated among four domains:

- Dissociated movements
- Grasp
- Protective extension
- Weight bearing

Three items for the tester to rate the hand function, spasticity and cooperativeness. Item activities require a variety of upper extremity movement. Item level score of one or two determined by quality of assessed position or movement;

One if movement quality is not achieved, two if movement quality achieved. Item scores are summed formulas are used to calculate percentages for each domain. Domain percentages are summed and divided by number of domains to obtain total score.

- Minimum score = 0
- Maximum score = 100

3.11 Procedure

All the patients of both group were asked to perform the below mentioned activities.

Supervised Constraint Induced Movement Therapy

Constraint Induced Movement Therapy was administered by restricting the non-paretic upper limb using a sling with velcro strap in the Physiotherapy outpatient

department under the supervision of physiotherapist. Patients were asked to perform the below mentioned activities in front of the therapist.

- Turning pages in a book
- Peg board-removing and placing different shapes of wooden pieces
- Picking up a cup and bringing in to mouth
- Opening container(lid of bottles)
- Holding a book
- Folding towels
- Picking up pin and placing in proper place
- Reach activities exercises of upper extremity- above and sides of shoulder and trunk.

Training details:

- Duration of 1 session – 3 hours
- Daily 1 session
- Weekly 5 session
- Total duration of the study was 4 weeks

Figure 1: Shows removing and placing different shapes of wooden pieces- peg board

Figure 2: Shows picking up and placing in order

Unsupervised Constraint Induced Movement Therapy

Constraint Induced Movement Therapy was administered by restricting the non-paretic upper limb using a sling with velcro strap in the home after giving proper demonstration. Patients were asked to perform the below mentioned activities in the home.

- Turning pages in a book
- Peg board-removing and placing different shapes of wooden pieces
- Picking up a cup and bringing in to mouth
- Opening container(lid of bottles)
- Holding a book
- Folding towels
- Picking up pin and placing in proper place
- Reach activities exercises of upper extremity- above and sides of shoulder and trunk.

  Training details
- Duration of 1 session – 3 hours
- Total duration of the study was 4 weeks

3.12 Collection of data

10 stroke subjects were selected and divided into 2 groups for the study. The group A received Constraint induced movement therapy and group B received home program. Both the experimental groups were given treatment for 2 months. Before and after 2 months of treatment intervention the upper extremity was evaluated by quality of upper extremity skills test and recorded.

3.13 Statistical technique

Collection of data were analyzed by paired ‘t’ test to find out significance difference between pre and post-test value for experimental groups and further unpaired ‘t’ test was applied to find out difference between group.

IV. DATA ANALYSIS AND RESULTS

4.1Data analysis

This chapter deals with the systematic presentation of the analyzed data followed by the interpretation of the data.

a) Paired 't' test

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

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

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

Where,

d – Difference between pre-test and post-test values

$\bar{d} = \frac{\sum d}{n}$ – Mean of difference between pre-test and post-test values

n – Total number of subjects

s – Standard deviation

b) Un paired t' test

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

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

Where,

S = Standard deviation

n_1 = Number of subjects in Group A

n_2= Number of subjects in Group B

$\bar{x}_1$ = Mean of the difference in values between pre-test and post-test in Group-A

$\bar{x}_2$= Mean of the difference in values between pre-test and post-test in Group-B

TABLE 1:

The table shows the comparative mean value, means difference, standard deviation and paired 't' value between pre and post-test values of motor functions among Group A.

Measurement	Mean	Mean Difference	Standard Deviation	Paired 't' value
Pre-test	18.58	10.07	1.30	24.47*
Post-test	28.65			

*0.005 level of significance.

In group A for motor functions the calculated paired 't' value is 24.47 and 't' table value is 3.250 at 0.005 level. Since the calculated 't' value is more than 't' table value, it shows that there is significant difference in motor functions following supervised constraint induced movement therapy among hemiparetic stroke patients.

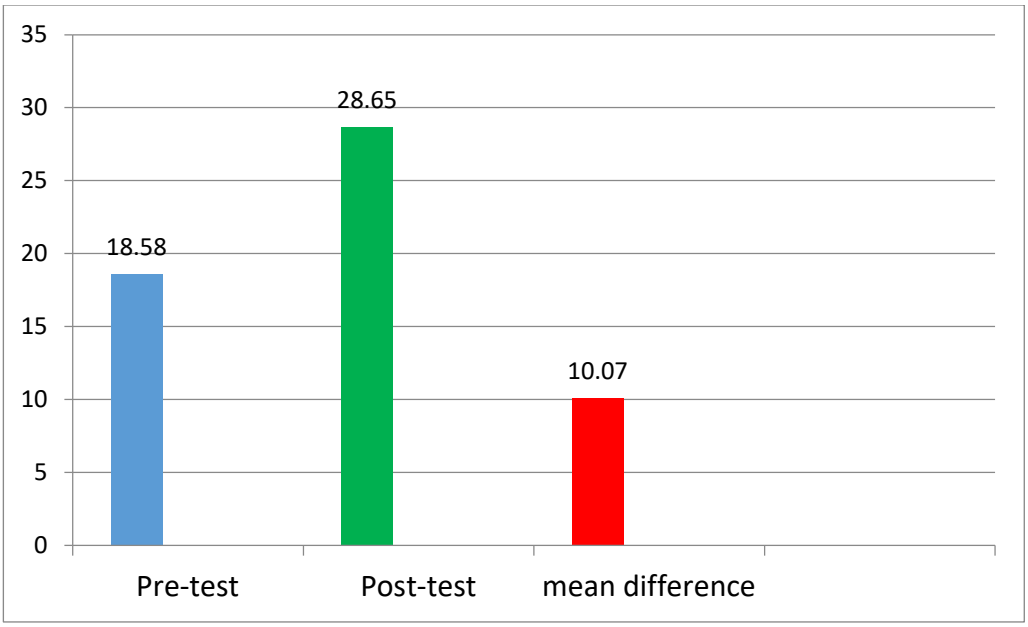

Figure 3: Shows the graphical representation of pre and post-test values of motor functions in Group A.

Table 2: Shows the comparative mean value, mean difference, standard deviation and paired 't' value between pre and post-test values of upper motor functions among Group B.

Measurement	Mean	Mean Difference	Standard Deviation	Paired 't' value
Pre-test	30.20	30.40	6.17	15.58*
Post-test	60.61			

*0.005 level of significance.

In group B for motor functions the calculated paired 't' value is 15.58 and 't' table value is 3.250 at 0.005 level. Since the calculated 't' value is more than 't' table value, it shows that there is significant difference in motor functions following unsupervised constraint induced movement therapy among hemiparetic stroke patients.

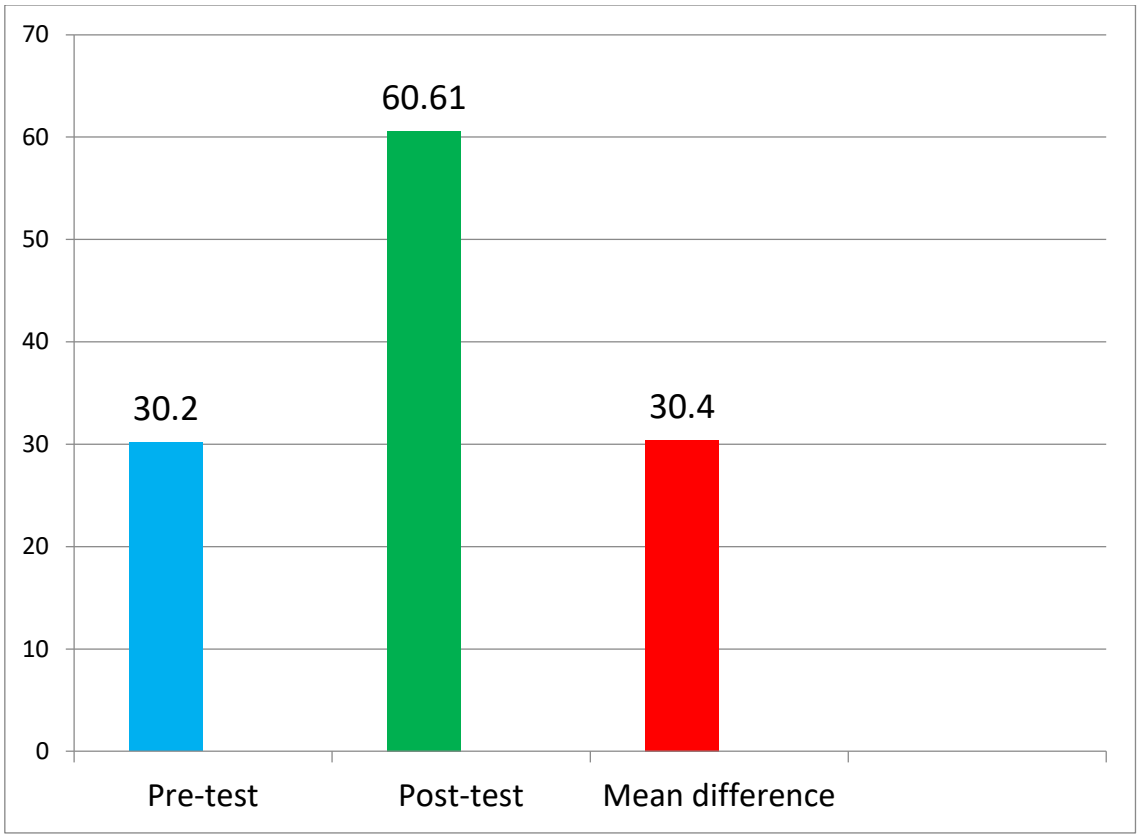

Figure 4: Shows the graphical representation of pre and post-test values of motor functions in Group B.

Table 3: Shows the comparative mean value, mean difference, standard deviation and unpaired 't' values of motor functions between Group A and Group B.

Sl.No	Groups	Improvement		Standard deviation	Unpaired "t" test
		Mean	**Mean difference**		
1	**Group-A**	10.07	19.96	4.57	9.88*
2	**Group-B**	30.03			

*0.005 level of significance

In group A and B for motor functions the calculated paired 't' value is 9.88 and 't' table value is 2.87 at 0.005 level. Since the calculated 't' value is more than 't' table value, it shows that there is significant difference between supervised constraint induced movement therapy and unsupervised constraint induced movement therapy in motor functions among hemiparetic stroke patients.

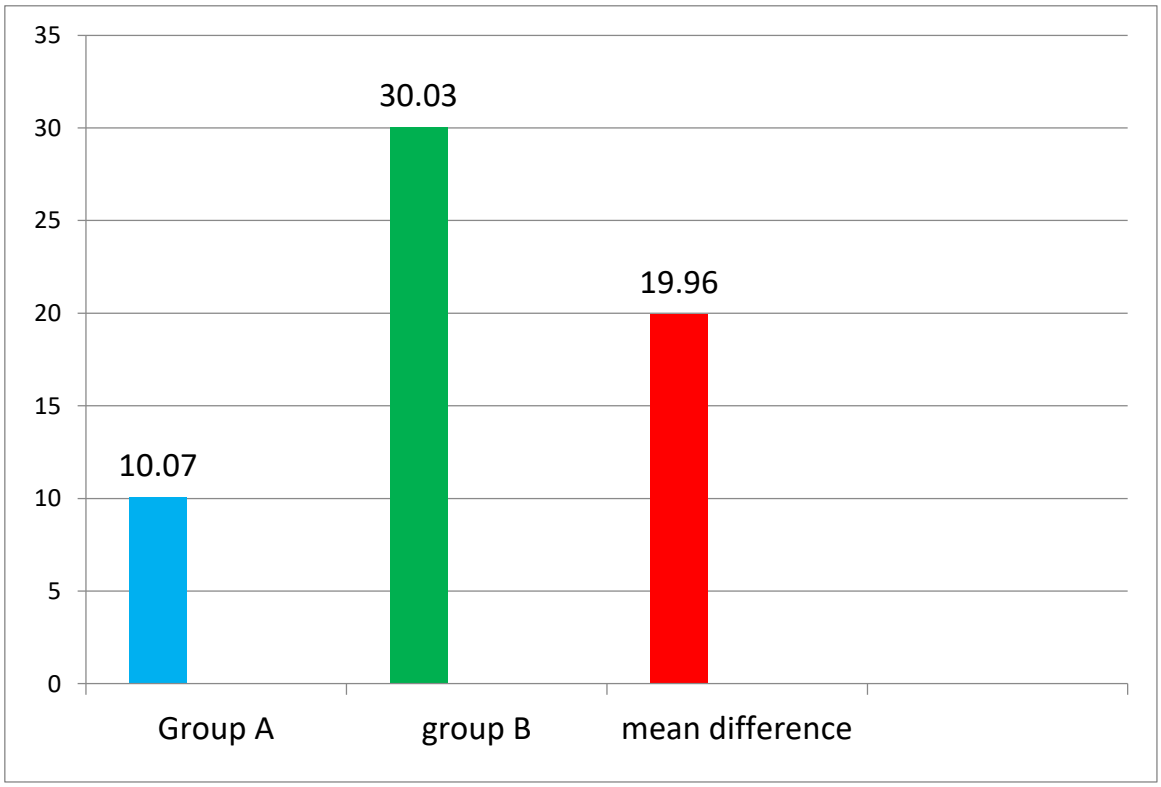

Figure 5: Shows the graphical representation of mean values of motor functions in Group A and Group B.

4.2 Results

Group A was treated with supervised constraint induced movement therapy and Group B was treated with unsupervised constraint induced movement therapy.

Analysis of dependent variable motor functions in Group A: The calculated paired ‘t’ value is 24.47 and the table ‘t’ value is 3.250 at 0.005 level of significance. Hence, the calculated ‘t’ value is greater than the table ‘t’ value there is significant difference in motor functions with supervised constraint induced movement therapy among hemiparetic stroke patients .

Analysis of dependent variable motor functions in Group B: The calculated paired ‘t’ value is 15.58 and the table ‘t’ value is 3.250 at 0.005 level of significance. Hence, the calculated ‘t’ value is greater than the table ‘t’ value there is significant difference in motor functions with unsupervised constraint induced movement therapy among hemiparetic stroke patients .

Analysis of dependent variable motor functions between Group A and Group B: The calculated unpaired ’t’ value is 2.88 and the table ‘t’ value is 2.878 at 0.005 level of significance. Hence, the calculated ‘t’ value is greater than table ‘t’ value there is significant difference between supervised constraint induced movement therapy and unsupervised constraint induced movement therapy in improving motor functions among hemiparetic stroke patients .

When comparing the mean value of Group A and Group B, group a subject treated with supervised constraint induced movement therapy shows more different in score of motor function than in group B subjects treated with unsupervised constraint induced movement therapy. Hence its concluded that supervised constraint movement

therapy more effective than unsupervised constraint induced movement therapy in improving motor functions among hemiparetic stroke patiens.

V. DISCUSSION

In stroke patients the upper extremity motor abilities and functional activities are affected adversely.

The aim of the study was to compare the effectiveness of improving motor functions using supervised constraint induced movement therapy and unsupervised constraint induced movement therapy among hemiparetic stroke patients. The 20 stroke subjects divided into two groups, group A and B, each group consist of 10 subjects. Group A was treated with supervised constraint induced movement therapy and group B was treated with unsupervised constraint movement therapy.

Results of the present study shows that there is significant difference in upper extremity skills following supervised Constraint Induced Movement Therapy. It is supported by Stephen Page *et al.,* (2008) compared the efficacy of a reimbursable, outpatient, supervised constraint-induced therapy protocol (half-hour therapy sessions occurring 3 days per week in which subjects used the more affected arm combined with less affected arm restriction 5 days per week for 5 hours; both of these regimens were administered during a 10-week period) with that of a time-matched exercise program for the more affected arm or a no-treatment control regimen. The Quality of Upper Extremity Skills Test, Fugl-Meyer Assessment of Motor Recovery after Stroke, and Motor Activity Log were administered to the subjects. After intervention, significant differences were observed on Supervised Constraint Induced Movement Therapy on the Quality of Upper Extremity Skills Test and Motor Activity Log, Amount of Use and Quality of Movement scales, all in favour of the Supervised Constraint Induced Movement Therapy group. Fleet *et al.,* (2014) conducted systematic review; study results were reviewed to assess the effectiveness of supervised Constraint Induced

Movement Therapy for extremity recovery. Among 473 students identified, 15 utilized supervised constraint induced movement therapy. Study results indicated that participants receiving supervised constraint induced movement therapy experienced clinically significant improvements in upper extremity impairment and activity level attributes. The study concluded that the supervised constraint induced movement therapy protocol is effective intervention for recovery of improving upper extremity motor functions among hemiparetic stroke patients.

Results of the present study shows that there is significant difference in upper extremity skills following unsupervised constraint induced movement therapy. It is supported by Thieme *et al.,* (2012) summarized the effectiveness of unsupervised constraint induced movement therapy for improving motor function, activities of daily living and pain in patients after stroke. They included randomized controlled trials and randomized cross-over trials comparing unsupervised constraint induced movement therapy with any control intervention for patients after stroke. They included 14 studies with a total of 567 participants that compared unsupervised constraint induced movement therapy with other interventions. The results indicated evidence for the effectiveness of unsupervised constraint induced movement therapy for improving upper extremity motor function, activities of daily living and pain, at least as an adjunct to normal rehabilitation for patients after stroke. Christian Dohle *et. al,* (2008) evaluated the effect of a therapy that includes use of a home exercise program to simulate the affected upper extremity with the unaffected upper extremity early after stroke. Thirty-six patients with severe hemiparesis because of a first-ever ischemic stroke in the territory of the middle cerebral artery were enrolled. They completed a protocol of 6 weeks of additional therapy with random assignment to either unsupervised constraint induced movement therapy or an equivalent control therapy.

The main outcome measures were the Fugl-Meyer sub scores for the upper extremity. In the subgroup of 25 patients with distal plegia at the beginning of the therapy, unsupervised constraint induced movement Therapy patients regained more distal function than Control Therapy patients. Furthermore, across all patients, unsupervised constraint induced movement Therapy improved recovery of surface.

Both the techniques, supervised constraint induced movement therapy and unsupervised constraint induced movement therapy clinically shows improvement in upper extremity skills but statistically there is significant improvement following supervised constraint induced movement therapy in improving upper extremity skills among hemiparetic stroke patients.

Hence the hypothesis first and second are rejected third is accepted.

VI. CONCLUSION

20 hemiparetic stroke patients were included in this study and randomly divided into two groups and each group consisted of 10 subjects. Group A was treated with supervised Constraint Induced Movement Therapy. Group B was treated with Unsupervised Constraint Induced Movement Therapy. After three weeks of intervention upper extremity skills improved significantly.

The statistical result shows that there is improvement in both the groups. When comparing both, supervised constraint induced movement therapy showed more significant improvement in motor functions than unsupervised constraint induced movement therapy among hemiparetic stroke patients.

6.1 Limitations

- Isolation of selected functional tasks is difficult.
- Limited sample size.
- Social factor.
- Short duration study.
- Age group between 50 to 60 was only selected.
- Right hemiparetic patients of middle cerebral artery stroke were only considered.

6.2 Suggestions

- Number of subjects can be increased.
- Further study can be done in hemiplegic patients with other vascular territory ischaemic or haemorrhagic stroke.

- Long term follow-up is needed to evaluate the difference in the condition of the patient from current status.
- Further study is suggested with more specified cortical and sub cortical strokes.

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ANNEXURES

ANNEXURE I

ASSESSMENT CHART

I. Subjective Examination

Name :

Age :

Sex :

Dominance :

Occupation :

Address :

Chief complaints :

History of present illness :

Past medical history :

Previous treatment history :

Drug history :

Family history :

Social history :

Personal history :

Occupational history :

General examination :

Vital sign :

II Objective examination

A) On observation

Built of patient :

Gait :

Posture :

Attitude of limb :

Atrophy :

Colour of skin :

Contour of joints :

Deformities :

External appliances :

Fasciculation :

Involuntary movements :

Mode of ventilation :

Oedema :

B) On palpation

Tenderness :

Warmth :

Tone :

Oedema :

Spasm :

C) On examination

I Higher Functions

a) Level of consciousness

Glasgow coma scale

II Sensory assessment scale

Superficial senses :

Deep senses :

Combined cortical :

IV Motor examination

a) Muscle power : Upper extremity

b) Tone

Assess hyper tonicity and hypo tonicity

c) Girth measurement

d) Deep tendon reflexes

e) Superficial reflexes

f) Primitive reflexes

g) Range of motion

V Co-ordination

Equilibrium test

Non – equilibrium test

VI Functional assessment

ANNEXURE II

QUALITY OF UPPER EXTREMITY SKILLS TEST

A. DISSOCIATED MOVEMENTS
Shoulder Items

Start Position: sitting in chair no table hands on lap

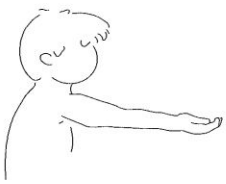
ITEM "SHOULDER"	SCORE L <90	SCORE L ≥90	SCORE R <90	SCORE R ≥90	CRITERIA
1. Flexion 	☐	☐	☐	☐	elbow: complete extension wrist: neutral to extension
2. Flexion with Fingers Extended 	☐	☐	☐	☐	elbow: complete extension wrist: neutral to extension
3. Abduction 	☐	☐	☐	☐	elbow: complete extension wrist: neutral to extension
4. Abduction with Fingers Extended 	☐	☐	☐	☐	elbow: complete extension wrist: neutral to extension

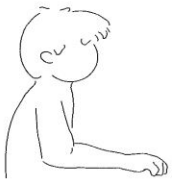
✔ ☐ ✘ ☐ NT ☐ 2.

A. DISSOCIATED MOVEMENTS continued
Elbow Items

Start Position: sitting in chair no table hands on lap

ITEM "ELBOW"	SCORE L half <range	SCORE L half ≥range	SCORE R half <range	SCORE R half ≥range	CRITERIA
1. Flexion	☐	☐	☐	☐	forearm: complete supination
2. Extension	☐	☐	☐	☐	forearm: complete supination
3. Flexion	☐	☐	☐	☐	forearm: complete pronation
4. Extension	☐	☐	☐	☐	forearm: complete pronation

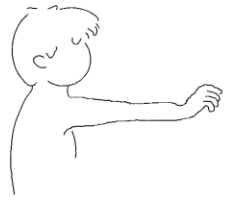




✔ ☐ ✘ ☐ NT ☐ 3.

A. DISSOCIATED MOVEMENTS continued
Wrist Items

Start Position: sitting at table forearms may be on table

ITEM "WRIST"	SCORE L half <range	SCORE L half ≥range	SCORE R half <range	SCORE R half ≥range	CRITERIA
1. Extension 	☐	☐	☐	☐	elbow: complete extension* **see manual for definition of complete extension*
2. Extension 	☐	☐	☐	☐	elbow: at least 10° flexion
3. Extension 	☐	☐	☐	☐	forearm: complete pronation
4. Extension 	☐	☐	☐	☐	forearm: complete supination
5. Flexion 	☐	☐	☐	☐	forearm: complete supination

✔ ☐ ✘ ☐ NT ☐ 4.

A. DISSOCIATED MOVEMENTS continued
Finger Items

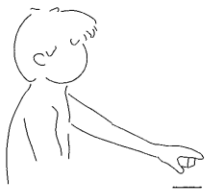
Start Position: sitting at table forearms must rest on table

ITEM	SCORE L	SCORE R	CRITERIA
1. Independent Finger Wiggling 	☐	☐	dissociation of all fingers no associated reactions
2. Independent Thumb Movement 	☐	☐	no associated reactions

Grasp of 1" Cube

Start Position: sitting at table cube at distance requiring elbow extension

Note: If Item 1 is performed, then Item 2 should also be scored YES

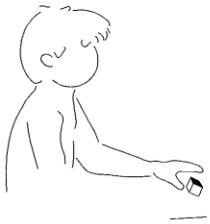
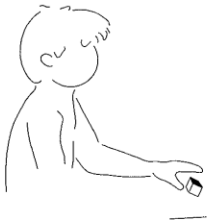
ITEM	SCORE L	SCORE R	CRITERIA
1. Grasp Using Thumb 	☐	☐	shoulder: neutral elbow: extension wrist: neutral to extension
2. Grasp Using Palm 	☐	☐	shoulder: neutral elbow: extension wrist: neutral to extension

✔ ☐ ✘ ☐ NT ☐ 5.

A. DISSOCIATED MOVEMENTS continued
Release of 1" Cube

Start Position: **sitting at table** **cube in child's hand ***

*** Allowable to put cube in child's hand if he/she can't actively grasp**
Note: If Item 1 is performed, then Item 2 should also be scored YES

ITEM	SCORE L	SCORE R	CRITERIA
1. Release from Thumb and Fingers 	☐	☐	shoulder: neutral elbow: extension wrist: neutral to extension
2. Release from Palm 	☐	☐	shoulder: neutral elbow: extension wrist: neutral to extension

✔ ☐ ✘ ☐ NT ☐

Scoring for Part A: DISSOCIATED MOVEMENTS *(pages 2-6)*

Total ✔ : ☐ = a

Total ✘ : ☐ = b

Total NT : ☐ = c

TRANSFER TO QUEST SCORING SHEET ON PAGE i

6.

B. GRASPS

Sitting Posture *during grasps*

Note: Observations for scoring this item should be made while administering the grasp items in the following section.

ITEM	SCORE	
	NORMAL	**ATYPICAL**
Head	☐	☐ Left ☐ Right ☐ Flexion ☐ Extension *circle atypical posture*
Trunk	☐	☐ Forward ☐ Lateral *check off position*
Shoulders	☐	☐ Retracted ☐ Elevated *check off position*

Scoring for Part B1: GRASPS - Sitting Posture *(page 7 only)*

Total Normal (max. = 3) : ☐ = d

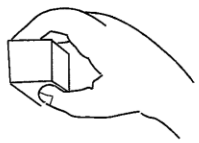
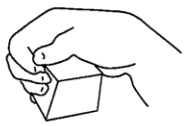
Total Atypical (max. = 5) : ☐ = e

TRANSFER TO QUEST SCORING SHEET ON PAGE **ii**

B. GRASPS continued
Grasp of 1" Cube

Start Position: **sitting at table** **cube on table within comfortable reach**

Note: **Once a grasp has been performed, give a YES score for all those below it. If grasp observed is not listed, then score NO in all boxes and describe it under "Other" below.**

ITEM	SCORE L	SCORE R	CRITERIA
1. Radial Digital	☐	☐	wrist: neutral to extension
			
2. Radial Palmar	☐	☐	wrist: neutral to extension
			
3. Palmar	☐	☐	
			

Other:

_____

_____

✔ ☐ ✘ ☐ NT ☐ 8.

B. GRASPS continued
Grasp of Cereal

Start Position: sitting at table

Note: Once a grasp has been performed, give a YES score for all those below it. If grasp observed is not listed, then score NO in all boxes and describe it under "Other" below.

ITEM	SCORE L	SCORE R	CRITERIA
1. Fine Pincer 	☐	☐	wrist: neutral to extension
2. Pincer 	☐	☐	wrist: neutral to extension
3. Inferior Pincer 	☐	☐	
4. Scissor 	☐	☐	
5. Inferior Scissor 	☐	☐	

Other:

_____

_____

✔ ☐ ✘ ☐ NT ☐ 9.

B. GRASPS continued
Grasp of Pencil or Crayon

Start Position: **sitting at table** **pencil placed midline vertical with point facing child**

Note: **Child must pick up pencil on his/her own.**
Once a grasp has been performed, give a YES score for all those below it.

Circle one of:	**L** Dominance	**R** Dominance	**L** Preference	**R** Preference
Circle one of:	grasp of **Pencil**	grasp of **Crayon**		

ITEM	**SCORE** L	**SCORE** R	
1. Dynamic Tripod (pencil, grasped distally - precise opposition of thumb, index & middle finger)	☐	☐	
2. Static Tripod (pencil grasped proximally - crude approximation of thumb, index & middle finger)	☐	☐	
3. Digital Pronate	☐	☐	
4. Palmar Supinate	☐	☐	

Other: _____

✔ ☐ ✘ ☐ NT ☐

Scoring for Part B: GRASPS *(pages 8-10)*

Total ✔ : ☐ = f

Total ✘ : ☐ = g

Total NT : ☐ = h

TRANSFER TO QUEST SCORING SHEET ON PAGE **ii**

10.

C. WEIGHT BEARING

Start Position: **prone** *or* **4 point**

Note: Once a position is scored, give a YES score for all those below it

ITEM	SCORE L	SCORE R	CRITERIA
Circle test position: prone 4 point			
1. Weight Bearing			
a) elbow extended, hand open	☐	☐	Thumb must be out of palm for all weight bearing items or they are scored "NO".
b) elbow extended, fingers flexed	☐	☐	
c) elbow extended, hand fisted	☐	☐	
d) elbow flexed, hand open	☐	☐	
e) elbow flexed, fingers flexed	☐	☐	
f) elbow flexed, hand fisted	☐	☐	

ITEM	SCORE
2. Weight Bearing with Reach	
a) Bears weight on **LEFT** hand with **LEFT** elbow completely extended and reaches with other arm.	☐
b) Bears weight on **RIGHT** hand with **RIGHT** elbow completely extended and reaches with other arm.	☐

✔ ☐ ✘ ☐ NT ☐ 11.

C: WEIGHT BEARING continued
Sitting

Start position: **sitting on floor** **preferably cross-legged**

ITEM	SCORE L	SCORE R	CRITERIA
1. **Hands forward** - circle test position: cross-legged ring other _____			
 a) elbow extended, hand open	☐	☐	Thumb must be out of palm for all items.
b) elbow extended, fingers flexed	☐	☐	
c) elbow extended, hand fisted	☐	☐	
d) elbow flexed, hand open	☐	☐	
e) elbow flexed, fingers flexed	☐	☐	
f) elbow flexed, hand fisted	☐	☐	
2. **Hands by side** - circle test position: cross-legged ring other _____			
 a) elbow extended, hand open	☐	☐	Thumb must be out of palm for all items.
b) elbow extended, fingers flexed	☐	☐	
c) elbow extended, hand fisted	☐	☐	
d) elbow flexed, hand open	☐	☐	
e) elbow flexed, fingers flexed	☐	☐	
f) elbow flexed, hand fisted	☐	☐	
3. **Hands behind** - circle test position: cross-legged ring other _____			
 a) elbow extended, hand open	☐	☐	Thumb must be out of palm for all items.
b) elbow extended, fingers flexed	☐	☐	
c) elbow extended, hand fisted	☐	☐	
d) elbow flexed, hand open	☐	☐	
e) elbow flexed, fingers flexed	☐	☐	
f) elbow flexed, hand fisted	☐	☐	

✔ ☐ ✘ ☐ NT ☐

Scoring for Part C: WEIGHT BEARING *(pages 11-12)*

Total ✔ : ☐ = i

Total ✘ : ☐ = j

Total NT : ☐ = k

TRANSFER TO QUEST SCORING SHEET ON PAGE **iii**

12.

D: PROTECTIVE EXTENSION

Start position: **preferably ring sitting** *or* **kneeling**

Note: Once a position is scored, give a YES score for all those below it.

ITEM	SCORE L	SCORE R
1. **Protective Extension - Forward** - circle start position: ring sit kneeling other _____		
a) elbow extended, hand open	☐	☐
b) elbow extended, fingers flexed	☐	☐
c) elbow extended, hand fisted	☐	☐
d) elbow flexed, hand open	☐	☐
e) elbow flexed, fingers flexed	☐	☐
f) elbow flexed, hand fisted	☐	☐
2. **Protective Extension - Side** - circle start position: ring sit kneeling other _____		
a) elbow extended, hand open	☐	☐
b) elbow extended, fingers flexed	☐	☐
c) elbow extended, hand fisted	☐	☐
d) elbow flexed, hand open	☐	☐
e) elbow flexed, fingers flexed	☐	☐
f) elbow flexed, hand fisted	☐	☐
3. **Protective Extension - Backward** - circle start position: ring sit kneeling other _____		
a) elbow extended, hand open	☐	☐
b) elbow extended, fingers flexed	☐	☐
c) elbow extended, hand fisted	☐	☐
d) elbow flexed, hand open	☐	☐
e) elbow flexed, fingers flexed	☐	☐
f) elbow flexed, hand fisted	☐	☐

✔ ☐ ✘ ☐ NT ☐

Scoring for Part D: PROTECTIVE EXTENSION *(page 13 only)*

Total ✔ : ☐ = l

Total ✘ : ☐ = m

Total NT : ☐ = n

TRANSFER TO QUEST SCORING SHEET ON PAGE **iv**

13.

E: HAND FUNCTION RATING

Please rate this child's hand function (circle a number)

Guidelines for scoring hand function:

POOR: minimal independent hand grasps, no active release, unable to combine reach and grasp
GOOD: spontaneous reach, grasp and release, good eye-hand coordination

	POOR										GOOD
Left Hand	0	1	2	3	4	5	6	7	8	9	10
Right Hand	0	1	2	3	4	5	6	7	8	9	10
Bilateral	0	1	2	3	4	5	6	7	8	9	10

F: SPASTICITY RATING

Please rate this child's spasticity

Guidelines for scoring spasticity:

MILD: good spontaneous movement, normal tone at rest, associated reactions present
MODERATE: tone interferes with spontaneous movement, may be present at rest
SEVERE: minimal spontaneous movement, stiff limbs, tone present at rest

	NONE	MILD	MODERATE	SEVERE
Left Hand	☐	☐	☐	☐
Right Hand	☐	☐	☐	☐

G: COOPERATIVENESS RATING

Please rate this child's level of cooperation during this assessment.

NOT cooperative	SOMEWHAT cooperative	VERY cooperative
☐	☐	☐

QUEST *Scoring Sheet*

A. DISSOCIATED MOVEMENTS

1. Transfer score information from page 6 of QUEST.

Total ✔ = ☐ = a

Total ✘ = ☐ = b

Total NT = ☐ x 2 = c

2. Calculate unstandardized score.

$$\text{Score A} = \frac{2(a) + b}{128 - c} \times 100$$

c **a** is multiplied by 2 because each ✔ scores 2 points.

$$\text{Score A} = \frac{2(\quad) + (\quad)}{128 - (\quad)} \times 100$$

c The **128 - c** calculation adjusts the score for any items not tested.

Score A = ☐

c Round to two decimal points.

3. Obtain a standardized score ranging from zero to 100.

(Score A - 50) x 2 = (- 50) x 2 = ☐

This is the dissociated movements score and can be transferred to the front page of the QUEST.

i.

B. GRASP

1. Transfer score information on sitting posture from page 7.

Total Normal = ☐ x 2 = d

Total Atypical = ☐ x (-1) = e

Score B1 = d + e = ☐

2. Transfer score information on grasps from page 10.

Total ✔ = ☐ = f

Total ✘ = ☐ = g

Total NT = ☐ x 2 = h

3. Calculate unstandardized score.

$$\text{Score B} = \frac{\text{Score B1} + 2(\text{f}) + \text{g}}{54 - \text{h}} \times 100$$

c The **54 - h** calculation adjusts the score for any items not tested.

$$\text{Score B} = \frac{(\quad) + 2(\quad) + (\quad)}{54 - (\quad)} \times 100$$

Score B = ☐

c Round to two decimal points.

4. Obtain a standardized score ranging from below zero (if a child scores ✘ on all items and has atypical posture) to 100.

(Score B - 50) x 2 = (- 50) x 2 = ☐

This is the grasps score and can be transferred to the front page of the QUEST.

ii.

C. WEIGHT BEARING

1. Transfer score information from page 12 of QUEST.

Total ✔	= [ ]		= i
Total ✘	= [ ]		= j
Total NT	= [ ]	x 2	= k

2. Calculate unstandardized score.

$$\text{Score C} = \frac{2(i) + j}{100 - k} \times 100$$

c The **100 - k** calculation adjusts the score for any items not tested.

$$\text{Score C} = \frac{2(\quad) + (\quad)}{100 - (\quad)} \times 100$$

Score C = [ ]

c Round to two decimal points.

3. Obtain a standardized score ranging from zero to 100.

(Score C - 50) x 2 = (- 50) x 2 = [ ]

This is the weight bearing score and can be transferred to the front page of the QUEST.

D. PROTECTIVE EXTENSION

1. Transfer score information from page 13 of QUEST.

Total ✔	= ☐		= l
Total ✘	= ☐		= m
Total NT	= ☐	x 2	= n

2. Calculate unstandardized score.

$$\text{Score D} = \frac{2(l) + m}{72 - n} \times 100$$

c The **72 - n** calculation adjusts the score for any items not tested.

$$\text{Score D} = \frac{2(\quad) + (\quad)}{72 - (\quad)} \times 100$$

Score D = ☐

c Round to two decimal points.

3. Obtain a standardized score ranging from zero to 100.

(Score D - 50) x 2 = (- 50) x 2 = ☐

This is the protective extension score and can be transferred to the front page of the QUEST.

ANNEXURE III

Table 5: Pre and post-test values of motor functions of group A.

Sr. No.	Pre test	Post test
1.	20.18	33.08
2.	19.11	30.72
3.	18.12	28.01
4.	22.12	30.82
5.	16.82	25.99
6.	17.62	27.82
7.	14.88	24.02
8.	16.91	26.17
9.	20.32	30.77
10.	19.72	29.11

Table 6: Pre and post-test values of motor functions of group B.

Sr. No.	Pre test	Post test
1.	24.94	46.23
2.	35.54	53.89
3.	33.57	62.39
4.	28.79	59.36
5.	35.76	71.25
6.	27.84	61.00
7.	30.04	63.69
8.	29.08	64.05
9.	28.03	65.28
10.	28.50	58.99

ANNEXURE- IV

PATIENT CONSENT FORM

I…….Voluntarily consent to participate in the research named on "**EFFECTS OF SUPERVISED AND UNSUPERVISED CONSTRAINT INDUCED MOVEMENT THERAPY IN THE MANAGEMENT OF MOTOR FUNCTIONS AMONG HEMIPARETIC STROKE PATIENTS".**

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

Signature of patient **Signature of researcher**

Signature of witness