COMPARING THE EFFICACY OF MOTOR RELEARNING PROGRAMME AND PROGRESSIVE RESISTENCE EXERCISE PROGRAMME IN IMPROVING UPPER LIMB FUNCTION FOLLOWING HEMIPARETIC PATIENTS

Dissertation submitted to The Tamil Nadu Dr. M.G.R. Medical University towards partial fulfilment of the requirements of **MASTER OF PHYSIOTHERAPY (Advanced PT in Neurology)** Degree programme.

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CERTIFICATE

This is to certify that research work entitled **"comparing the efficacy of motor relearning programme and Progressive resistance exercise programme in improving upper limb function following hemiparetic patients"** was carried out by the candidate bearing the Register No: **27091608**, KMCH College of Physiotherapy towards partial fulfillment of the requirements of the **Master of Physiotherapy (*Advanced PT in Neurology*)** of The Tamil Nadu Dr. M.G.R. Medical University, Chennai-32

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CONTENTS

ABSTRACT

Objective: To compare the effect of Motor relearning programme and Progressive resistance exercise is improving physical performance following stroke.

Design: The study design was pre – test and post – test experimental group study. Participants: 20 subjects aged 35-75 years with stroke were randomized into two groups, with 10 in each group. One group received Motor relearning programme and other group received progressive resistance exercise.

Outcome measure: Pre test- post test measurement using Upper extremity component of Fugal – Meyer assessment scale.

Results: Statistical analysis was done using 't' test . Both Groups show significant improvement in upper limb physical performance ; comparison of both groups shows significant improvement in Motor relearning programme group .

Conclusion: Motor relearning programme is more significant than progressive resistance exercise in improving upper limb physical performance following stroke.

1. INTRODUCTION

Stroke is an acute, event that is caused by an alteration in blood flow to the brain. The alteration in blood flow can be a deprivation of blood to the brain tissue or a hemorrhage into the brain tissue. Ischemic stroke account for about 85% of all strokes[18]

The most common neurological impairment caused by stroke is partial weakness, called paresis, reflecting a reduced ability to activate spinal motor neurons voluntarily. Around 80% of people with stroke experience acute hemiparesis, resulting in a diminished ability to use their affected extremities for purposeful movements (Granger et al, 1998. Gray et al). Only about 40% of such patients achieve full recovery (Jorg erson et al 1995, Reding & Potes 1988). The remaining 60% of stroke survivors have persistent motor and non motor impairments that significantly disrupt their ability to participate in home and community life.[18]

Although many stroke patients are able to recover some walking function during initial rehabilitation, the majority of stroke patients are unable to use their upper extremity in their activities of daily living after months of standard physiotherapy.

Hemiparesis stroke survivors may use altered movement strategies to perform functional arm and hand activities, which is considered compensatory. It is shows that non guided therapy may lead to the reinforcement of compensatory movements (Mindy F Levin et al., 2005)

The prevalence of stroke in India was estimated as 203 per 100,000 populations above 20 years, amounting to a total of about 1 million cases. The male to female ratio was 1.7. Around 12% of all stroke occurred in population below 40 years. The estimation of stroke mortality was limited by the method of classification of cause of death in the country. [41]

Stroke rehabilitation is a complex intervention, drawing on a huge range of therapy techniques. Neuro rehabilitation approaches and therapeutic techniques have evolved over the years from a major emphasis on muscle reeducation initially developed for patients with poliomyelitis in the 1940s to the neurophysiological/neurodevelopmental approaches first popularized in the 1950s and 1960s. These included Neurodevelopmental Treatment (NDT), Movement Therapy in Stroke – Brunnstrom approach, Proprioceptive Neuromuscular Facilitation (PNF) and sensory stimulation techniques. Currently there is emphasis on functional/task specific training using intense practice of

functional tasks along with behavioral shaping and environment enrichment. Compensatory training strategies are also used in some circumstances to promote resumption of function using the less involved extremities. Motor learning strategies provide a common base for all functional training.[40]

The motor relearning approach was developed by Australian physiotherapists Janet H. Carr and Roberta B. Shepherd based on motor learning theory. Carr and Shepherd proposed that training in motor control requires anticipatory actions and ongoing practice. To further enhance relearning, the motor tasks involved are practiced within a context that can be task or environment specific.

Progressive resisted exercises was developed by **Delorme and Watkins**

The maximum weight which can be lifted once only through a prescribed range is called the one repetition maximum (1RM) and the maximum weight can be lifted 10 times at natural speed without rest between lifts is the ten repetition maximum (10 RM)[42]

Prior to the technique, warm up exercise are given, afterwards 50 % of the already calculated 10 RM is given, and asked to perform in their natural speed, then given rest for sufficient time and it is progressed to 75 % of 10 RM which is

again followed by adequate rest period , and it is progressed into 100 % of 10 RM . At the end of the technique there is a rest period is given.

Thus the necessity to examine and compare the effect of motor relearning programme and progressive strengthening exercises on upper limb function in hemiparesis.

1.1 NEED FOR THE STUDY

The most common neurological impairment caused by stroke is partial weakness, called paresis. Around 60% of stroke survivors have persistent motor and non motor impairments that significantly disrupt their ability to participate in home and community life.

Although many stroke patients are able to regain some amount of walking function during the initial phases of rehabilitation, but most of the patients are left with upper limb impairments even with conventional physiotherapy.

Motor relearning programme is based on the assumption that the impaired learn in the same way as that of the unimpaired. These are thought to further enhance relearning of the motor tasks.

The progressive resistance training on the other hand was thought to improve the muscle strength of the paretic limb. Most of the studies concentrated on the lower limb functions and gait.

Thus the absolute need for this study is to find out the changes that occur with the motor relearning programme and progressive resistance training on improving the upper limb functions.

So this study was done, in order to know, which of these namely the motor relearning programme and the progressive resistance training along with the conventional physical therapy had a greater impact in improving the upper extremity function.

2. REVIEW OF LITERATURE

According to WHO defines stroke as ,'' Stroke is acute onset of neurological deficient occur due to abnormalities in cerebral circulation with resultant signs and symptoms that correspond to involvement of focal area of the brain lasting for more than 24 hours.[10]

2.1 ANATOMICAL CONSIDERATIONS

The brain receives rich supply of blood through four major arteries, two vertebral arterie , and two internal carotid arteries

The four major arteries branch intracranially to form the main artery branches of the brain (circle of Willis). Two vertebral arteries unit to form basilar artery, which divided into two posterior cerebral arteries.

The internal carotid artery give rise to following branches, anterior cerebral artery, middle cerebral artery, posterior communicating artery, anterior choroidal branches and superior hypopyseal arteries.

2.2 CLINICAL CONSIDERATIONS:

RISK FACTORS

- Hypertension
- Cardiac disease
- Diabetes
- Hereditary
- Smoking
- Increased serum lipid
- Oral contraceptives
- Age
- Physical inactivity
- Obesity and diet
- Psychological factor
- Race
- High blood hemoglobin concentration

2.3 CAUSES OF STROKE

- Atherothromboembolism of cerebral arterial supply - 50%
- Intracranial small vessel disease -25%
- Embolism from the heart -20%
- Miscellaneous and rare disorders -5%

Stroke incidence rises rapidly between the age group of 45-65 years with similar gender variability and increases rapidly after 65 with increasing variability found in males than females but the stroke incidence varies between 45-85 years of age.

2.4 CLASIFICATION OF STROKE

The pathological processes that result from a cerebero vascular accident can be divided into three groups

- Thrombotic
- Embolic
- Hemorrhagic

According to Rolack and Rockey accounted that thrombotic strokes are most common type accounting for an estimated 60% of all cases.

On the basis of duration according to Julien , in his book recovery of stroke. Stroke can be classified as

i. Acute stroke (0-4) weeks
ii. Sub- acute stroke (5-26) weeks
iii. Chronic stroke (<26) weeks

2.5 CLINICAL MANIFESTATION

SIGNS AND SYMPTOMS	**STRUCTURES INVOLVED**
Paresis of contralateral face, arm and leg (leg is least affected)	Primary motor cortex and internal capsule
Sensory impairments over the contralateral face, arm, leg(pain, touch,temperature,vibration,position,two point discrimination,stereognosis)	Primary sensory cortex and internal capsule
Motor speech disorder (expressive-	Broca's cortical area in the

aphasia-telegraphic halting speech)	dominant hemisphere
Wernicke's or receptive aphasia (fluent but often jargon speech, poor comprehension	Wernicke's cortical area in the dominant hemisphere
Perceptual problem such as unilateral neglect, apraxias, depth perception problems, spatial relation difficulties	Parietal sensory association cortex
Homonymous hemianopia	Optic radiation in the internal capsule
Loss of conjugate gaze to the opposite side	Frontal eye field or their descending tracts
Ataxia of the contralateral limbs(sensory ataxia)	Parietal lobe

2.6 Causes of ischemic stroke

1. **Cardiac origin**

1. *Arterial fibrillation* and other arrhythmias (with rheumatic, atherosclerotic, congenital or systemic heart diseases.

2. Myocardial infarction with mural thrombus

3. Acute and sub acute bacterial endocarditis

4. Heart diseases without arrhythmias or mural thrombus (mitral stenosis, myocarditis etc)

5. Complication of cardiac surgery

6. Valve prosthesis

7. Prolapsed mitral valve

8. Paradoxical embolism with congenital heart diseases

Non Cardiac Origin

Atherosclerosis of aorta and carotid arteries (mural thrombus, atheromatous material)

From sites of cerebral artery thrombosis (basilar, vertebral, middle cerebral)

2.7 MEDICAL MANAGEMENT OF STROKE :

Acute Ischemic Stroke :

Thrombus in pulmonary veins

Fat, tumor or air

Complication of neck and thoracic surgery.

This is approached in four different ways ;

I General measures aimed at prevention and treatment of comlications.

II Reperfusion strategies directed at arterial recanalisation.

III Cyto protective strategies aimed at cellular and metabolic targets.

IV Promotes the inhibition of the inflammatory process associated with cerebral ischemia.

Heparin therapy reduces the rate of progression of cerebral infarction. Thrombolytic therapy is able to recanalise acute intracranial occlusions. Treatment with intravenous tissue plasminogen activatore with in 3 hours of onset of ischemic stroke improves clinical outcome at 3 months.[43]

The effect of medical treatment in stroke patients such as immediately applied pharmacological interventions (eg: thrombolytic, antigoagulants, vasodilators and other drugs) aimed at restoring cerebral heamodynamics and metabolism after ischemic stroke are disappointing.

Possible effects of medical treatment are constrained by the narrow time window for pharmocological treatment effects. Reduced penetration of drugs into parts of the brain with impaired blood circulation.

The risk of systemic hypertention resulting in reduced perfusion of the ichemic zone over colateral arteries. Agitation and hallucination caused by some neuroprotectants. (wahlgren, 1997)

2.8 SURGICAL MANAGEMENT

A carotid endarterectomy for stenosis of the internal carotid artery is an operation carried out in the expectation that it will prevent a subsquent stroke. This surgery has a risk of myocardial infarction post operatively.

The advent of angioplasty and stinting has led to thr treatment of symptomatic internal carotid artery stenosis in placed of carotid endarterectomy.[44]

2.9 PHYSIOTHERAPY MANAGEMENT OF STROKE

I MOTOR RELEARNING PROGRAMME FOR STROKE

The approach developed by Carr and Shepherd first published in 1980. They looked into the literature on behavioral science and biomechanics when developing their programme is basically a framework for retraining movement.

AIM :

The aim of the frame work is to enable person to learn. Emphasis is placed on; utilizing theories of learning and knowledge of biomechanics for analyzing movements and performance of task.

Basis of practice:

It is based on the assumption that the impaired learn in the same way as the unimpaired. Motor control of posture and movement are interrelated and that appropriate sensory input will help modulate the motor response to a task

Programme is based on four factors

1. Elimination of unnecessary muscle activity
2. Feed back
3. Practice
4. Link between postural adjustment and movement.

TREATMENT:

Movement analysis and training form the critical part of framework. Treatment follows four steps.

Step 1: analysis of task- observation, comparison and analysis.

Step 2: practice of missing components- explanation, instruction, practice and verbal and visual feedback and manual guidance.

Step 3: practice of task - explanation, instruction, practice and verbal and visual feedback and manual guidance, re evaluation and encourage flexibility.

Step 4: transference of training – opportunity to practice in context. Consistency of practice, organization of self monitored practice, structured learning environment, involvement of relatives and staff.

Motor relearning programme to improve upper limb function

To improve upper limb function

Common problems of upper limb and compensatory strategies are analyzed. Isolated muscle action is elicited and practice and extended to meaningful tasks. Unnecessary movement must be eliminated consciously by the patient. Muscle activity is elicited and training motor control for reaching and pointing.

Patient lifts arm and support it in forward flexion and attempts to reach up towards ceiling. Therapists lift patients hand and asking to take hand to head and above the pillow.

Arm made to move in all direction and asking the patient to control the movement. To maintain length of the muscle patient sits with his affected limb flat on bed.

Motor relearning programme given other areas following stroke

1. To improve sitting balance
2. To improve sitting up over the side of the bed:
3. To improve sitting down and standing up
4. Balance standing :
5. Gait
6. Spasticity
7. Sensory problems

II PROGRESSIVE RESISTANCE EXERCISES :

Delorme Technique:

The maximum weight which can be lifted once only through a prescribed range is called the one repetition maximum (1RM) and the maximum weight can

be lifted 10 times at natural speed without rest between lifts is the ten repetition maximum (10 RM)[42]

Prior to the technique warm up exercise are given, afterwards 50 % of the already calculated 10 RM is given, and asked to perform their natural speed, then given rest for sufficient time and it is progressed to 75 % of 10 RM which is again followed by adequate rest period , and it is progressed into 100 % of 10 RM . At the end of the technique there is a rest period is given. [42]

2.10 SCALES FOR ASSESSING UPPER LIMB FUNCTION

1. FUGL – MEYER ASSESSMENT SCALE

Test items are organized into 5 sequential recovery stages. A 3 – point ordinal scale is used to measure impairments of volitional movement with grades ranging from 0 to 2. It includes upper extremity function, balance, sensation, range of movement and pain.[2]

Leyman et al., 1975

The Fugl Meyer assessment can be a potential method for evaluation of the physical performance as a whole in post stroke hemiplegic patient.

Platz T et al., 2005

The Fugl Meyer assessment of upper extremity(FMA-UE) is the most widely used clinical assessment of post stroke upper extremity impairment.

Platz T et al., 2005 & Woodbury M L et al., 2007

The Fugl Meyer assessment of upper extremity showed a very high inter rater and test retest reliability.

2.11 UPPER LIMB ACTIVITIES IN STROKE

Cathreine E Lang et al., (2007)

They study about the use of upper extremity early after stroke with healthy individuals. They analyzed the time of upper limb usage in inpatient stay and analyses the impairments and activity limitation in early stroke.

Three clinical scales: action reach arm test , wolf motor function test and functional independent measure and motor assessment scale were used to assess activity limitation of upper limb extremity, they quantified activity limitation and functional performance respectively. Upper extremity use revealed a positive correlation with the out come measures.[18]

Wade et al ., (1983)

Recovery of hand function after stroke is often poor, despite rehabilitation, in his study he also found that only 14 % of those initially had paralyzed arm eventually regained normal arm function and a further 25 % made a partial recovery.[36]

Burridge et al., (2009)

The study was conducted to investigate the upper limb impairment and activity limitation. Here spasticity, motor control, muscle activation pattern during tracking, stiffness, ROM and isometric muscle power strength were analyzed. The outcome was assessed with ARAT and MAS, showed a positive relation to the spasticity and negative relation to the other upper motor neuron symptoms.[37]

2.12 UPPER LIMB RECOVERY AND FUNCTION:

Christopher and Gray et al .,(1989)

A study on 157 patients admitted in hospital with a clinical diagnosis of acute stoke was examined daily for up to 28 days. The pattern recovery of limb tone, power and reflexes all depend on the functional use of that lim

Hilde et al., (1998)

Grasping an object, holding an object and manipulating objects, which requires the recruitment and complex integration of muscle activity from shoulder to finger are included in functional recovery of arm. In contrast to this, a minimal amount of recovery of the hemiplegic leg mat be sufficient to obtain functional ambulation.[39]

Pang MY et al.(2006)

Conducted a study on 63 subjects to assess the effects of a community-based exercises program on motor recovery and functional abilities of the paretic upper extremity in persons with chronic stroke. The exercise programme was a circuit training which included shoulder exercises; range of motion, weight bearing activities and elbow/wrist exercises; hand activities and functional training for the experimental group and the control group underwent cardiorespiratory fitness and mobility; mobility and balance; lower extremity muscle strength. They found

that community-based exercises program can improve upper extremity function in persons with chronic stroke.[47]

Kwakkel et al.(1999)

Found the effects of different intensities of arm and leg rehabilitation training on the functional recovery of ADL, walking ability and dexterity of the paretic arm, in a single blinded randomized controlled trial. They found that greater intensity of rehabilitation of legs improves the functional recovery and health-related functional status, whereas greater intensity of arm rehabilitation results in small improvement in dexterity, providing further evidence that exercise therapy primarily induces treatment effects on the abilities at which training is specifically aimed.[48]

Pesi Katrak et al ., (1998)

A study was made to predict the early shoulder and hand movement after stroke for subsequent hand movement and function in recovery. A consecutive sample of 71 patients was assessed for upper limb function. The parameter were ability to shrug and abduct the shoulder, thumb and finger movement hand function test result in , light touch, sensory inattention and proprioception in the hemiplegic upper limb. The function are assessed at 1,2,and 3 months after stroke and

reveals that earlier function in the upper limb been predictor of the later recovery.

2.13 Motor relearning programme training:

Morris JH et al.(2008)

This study shows a study to compare effects of bilateral task training with unilateral task training on upper limb outcomes in early poststroke rehabilitation on 106 subjects for 6 weeks. They concluded that bilateral training was no more effective than unilateral training, and in terms of overall improvement in dexterity, the bilateral training group improved significantly less. Timing of intervention, task characteristics, dose and intensity of training may have influenced the results and are therefore areas for future investigation.[49]

Yang YR et al.(2006)

This study shows a study to examine the effectiveness of task oriented progressive resistance strength training on lower extremity strength and functional performance in 48 chronic stroke subjects and found that task oriented progressive resistance strength training programme could improve lower

extremity muscle strength in individuals with chronic stroke and could carry over into improvement in functional abilities.[50]

Thielman GT et al.(2004)

This study Evaluated the effectiveness of 2 rehabilitative approaches [Task-Related Training (TRT) versus Progressive Resistive Exercise (PRE)] for improving paretic limb reaching on 12 chronic stroke subjects. Based on findings from the kinematic analysis performance on the Rivermead Motor Assessment, TRT for severely impaired subjects appears most effective in promoting functional improvement in reaching. PRE for less impaired subjects appears to enhance the actual recovery of reaching, as reflected by improved arm control at the difficult target ipsilateral to the impaired limb.[29]

Blennerhasett and Dite(2004)

This study to investigate whether additional practice of either upper limb or mobility tasks improved functional outcome during inpatient stroke rehabilitation on 30 subjects. They found that larger gains were observed in both groups that were specific to the type of additional practice received.[51]

NM Salbach et al.(2004)

Conducted a study to evaluate the efficacy of a task-oriented intervention in enhancing competence in walking in people with stroke on 91 subjects. The experimental intervention included 10 functional tasks designed to strengthen the lower limbs and enhance walking balance, speed and distance. The intervention involved the practicising of the upper extremity activities. They found that the study findings support the efficacy of a task-oriented intervention in enhancing walking distance and speed in the first year post stroke, particularly in people with moderate walking deficits.[52]

Dean et al.(2000)

This study conducted a randomized controlled pilot study to investigate the feasibility and efficacy of an exercise class aimed at improving performance of loco motor-related tasks in post stroke individuals. The class focused on improving the functional task which involve performance and endurance of the lower extremities (sit-to-stand, walking, reaching in sitting and standing, walking, and stair ascent and descent). They found out that there is a significant improvement in the walking speed and endurance, force production through the affected le during sit to stand and number of repetitions of the step test.[53]

2.14 Progressive resistance training (PRT):

Michelle M. Ouelette et al.(2004)

Evaluated the efficacy of supervised high-intensity progressive resistance training (PRT) on lower extremity strength, function, and disability in older, long-term stroke survivors. They concluded that long-term stroke survivors have the capacity to safely improve lower extremity musculoskeletal strength in both the paretic and non paretic limbs with a program of PRT, and that these improvements lead to reductions in self-reported functional limitations and disability.[54]

Ulla-Britt flansbjer et al.(2008)

This study conducted a randomized controlled trial to evaluate the effects of progressive resistance training on muscle strength, muscle tone, gait performance and perceived participation after stroke on 24 subjects. They concluded that progressive resistance training is an effective intervention to improve muscle strength in chronic stroke. There appears to be long-term benefit, but further

studies are needed to clarify the effects, specifically of progressive resistance training on gait performance and participation.[55]

Langhammer B et al.(2007)

Conducted this study to find out if there were any differences in improvement and maintenance of motor function, activity of daily living and grip strength between patients with first-ever stroke receiving two different strategies of physical exercise during the first year after stroke. The intensive exercise group received functional exercise programme with emphasis on high intensity of endurance, strength, balance. The regular exercise group did not receive any specific treatment. They found out that the motor function, activities of daily living functions and grip strength improved initially and was maintained during the first year after stroke in all patients irrespective of exercise regime. This study indicates the importance of motivation for regular exercise in the first year following stroke, achieved by regular check-ups.[56]

Ada et al.(2006)

This study shows a systematic review to find out whether strength training is effective after stroke, whether it increases the spasticity and whether it improves activity. They concluded that strengthening intervention increases strength, improves activity, and do not increase spasticity. These findings suggest that strengthening programs should be a part of rehabilitation after stroke.[57]

Winstein CJ et al. (2004)

This study to evaluate immediate and long term effects of 2 upper extremity rehabilitation approaches applied in the acute phase, one emphasized functional task and the other strength and motor control in 64 subjects and concluded that task specificity and stroke severities are important factor for rehabilitation of arm use in acute stroke. 24 hours of therapy specific to upper extremity over 4 to 6 weeks significantly affected functional outcome. The immediate benefit of a functional task approach were similar to those of a resistance-strength approach, however, the former was more beneficial in the long term.[58]

Morris SL et al. (2004)

Conducted a systematic review to determine whether progressive resistance strength training reduces impairments, activity limitation and participation restriction after stroke. They concluded that there is preliminary evidence that progressive resistance strength training programmes reduce musculoskeletal impairments after stroke, whether strengthening exercises enhances the performance of functional activities or participation in societal roles remains unknown.[59]

Badics E et al.(2002)

Studied the effects of strength building exercises on muscle tone and on the gain in muscle strength achieved with them on 56 subjects. They found out that the extent of strength gain was positively correlated with the intensity and the number of exercising units. Muscle tone, abnormalities which was high at baseline, did not further increase in any one case. The results showed that targeted strength training significantly increased muscle power in patients with muscle weakness of central origin without any negative effects on spasticity.[60]

2.15 Arm ability training(AAT):

Platz et al. (2001)

Conducted a single-blinded, randomized controlled trial to test the efficacy of the arm ability training(AAT) on patients with central arm paresis after traumatic brain injury(TBI) or stroke on 60 subjects in which 45 were stroke and 15 TBI. They concluded that AAT reduces focal disability among stroke and TBI patients with mild central arm paresis. The results suggest that central arm paresis is amenable to specific therapeutic intervention when the training specifically addresses relevant functional limitation.

2.16 Motor relearning programme rehabilitation:

DYL Chan et al.(2006)

Did a randomized controlled trial to investigate the effect of using a sequential function-based task strategy in a six-week motor relearning programme for improving the balance function and functional performance of a group of post stroke patients. They concluded that the motor relearning programme was found to be effective for enhancing functional recovery of patients who had a stroke. In rehabilitation of motor relearning for stroke patients, both 'sequential' and 'function based' concepts are important.[63]

Langhammer B, Stanghelle J. (2000)

Compared the effect of 2 different physiotherapy concepts/methods in the rehabilitation of 61 acute stroke subjects. They found that physiotherapy with task-oriented strategies (represented by the motor relearning programme (MRP)) was preferable to physiotherapy with facilitation/inhibition strategies such as the Bobath programme.[59]

P M Van Vliet et al. (2005)

Compared Bobath based physiotherapy with movement science based physiotherapy intervention for stroke in 120 subjects and found no significant differences in the ability of movement or functional independence between patients receiving Bobath based or movement science based intervention in stroke patients.[62]

2. AIM AND OBJECTIVES

3.1 AIM:

To examine the effect of motor relearning programme with Progressive resistance exercise on upper limb function in hemiparetic patients.

3.2 OBJECTIVES:

- To examine the effect of motor relearning programme on upper limb function in hemiparetic patients.
- To examine the effect of Progressive resistance exercises on upper limb function in hemiparetic patients.
- To compare the effect of motor relearning programme with Progressive resistance exercises on upper limb function in hemiparetic patients.

3. MATERIALS AND METHODOLOGY

Methodology

4.1 STUDY DESIGN:

Experimental study

4.2 SAMPLE TECHNIQUE:

Simple Random sampling

4.3 STUDY SETTING:

- Department of Physical Medicine Rehabilitation

  KMCH, Coimbatore

- Home setting

4.4 SAMPLE SIZE:

10 – 10 Ischemic stroke patients

4.5 STUDY DURATION:

One month

4.6 CRITERIA

INCLUSION CRITERIA:

1. First onset of stroke
2. Hemiparetic stroke patients: ischemic and hemorrhagic.
3. Medically stable patients
4. Subjects with upper limb involvement
5. Age 35 – 75 years
6. Sex : Both male and female
7. Motor assessment scale score 2 - 3

EXCLUSION CRITERIA:

1. Sensory involvement
2. Cognitive disorders and perceptual disorders
3. Shoulder hand syndrome
4. Shoulder pain or subluxation
5. Musculoskeletal disorders
6. Severe cardiac diseases
7. Progressive neurological disorder

4.7 HYPOTHESIS

Null hypothesis:

HO1:

There is no significant difference with motor relearning programme in improving upper limb function in hemiparetic patients.

HO2:

There is no significant difference with Progressive resistance exercises in improving upper limb function in hemiparetic patients.

HO3:

There is no significant difference between motor relearning programme and Progressive resistance exercises in improving upper limb function in hemiparetic patients.

Alternate hypothesis:

HA1:

There is a significant difference with motor relearning programme in improving upper limb function in hemiparetic patients.

HA2:

There is a significant difference with Progressive resistance exercises in improving upper limb function in hemiparetic patients.

HA3:

There is a significant difference between motor relearning programme and Progressive resistance exercises in improving upper limb function in hemiparetic patients.

4.8 PROCEDURE:

A written consent was taken from patients who fulfilled the inclusion criteria. Subjects were randomly allocated to 2 groups.

Group 1- Motor relearning programme and conventional therapy

Group 2- Progressive resistance exercise and conventional therapy

Group 1:

Subjects were asked to sit on a chair with hip and knee in 90° and the feet placed on the ground. The affected hand was placed on the table, where the objects were also placed, and the unaffected hand placed on the lap. The tasks like reaching in uni-direction and multi-direction, grasping and placing the objects on a target was analyzed to find out the missing components. The identified missing component was practiced. Then the corrected missing component was incorporated into the task and the task was practiced. Later the following exercises were given.

Stretching:

- long finger flexors, wrist flexors, thumb adductors: brief stretch with hand on wall or table top, manually
- forearm pronators: brief manual stretch with forearm on table top
- adductors and internal rotators of GH joint: brief manual stretch in sitting/supine with hands behind the head

Active exercises:

Sitting:-

With arm on table:

- lifting and lowering a glass which held by the palm and the fingers
- lifting glass from table by radial deviation at wrist, forearm in mid rotation, placing it to left and right by wrist flexion and extension
- tapping table top with all fingers
- holding a ruler, supinating and touching the end of ruler to table
- holding a cup filled with water, transfer to other hand and place it on target
- slide glass forward in different direction to touch targets keeping forearm in mid rotation

- slide glass backward and forward to touch the target by extending & flexing the elbow
- shoulder placed at 90° flexion, reaching and pointing within controllable range above 90°, gradually increasing range in forward and sideways direction
- reaching forward, sideways and backwards to pick up an object and transport it to another place
- scooping seeds or coins from table top & transfer it to other hand
- With forearm supported on the lap: shoulder shrugging
- Lifting hands to comb the hair

Treatment was given for 1 hr /day for 5 days a week for 4 weeks

MOTOR RELEARNING PROGRAMME TRAINING

Group 2:

Subject was asked to sit on the edge of the bed or a chair without backrest. Treatment protocol includes-

Brief period of warm up and cool down (5 minutes) which include

Upper limb stretches

- long finger flexors, wrist flexors, thumb adductors: brief stretch with hand on wall or table top, manually
- forearm pronators: brief manual stretch with forearm on table top
- adductors and internal rotators of GH joint: brief manual stretch in sitting/supine with hands behind the head
- active and self active assisted ROM exercises

Regime used for progressive resistance exercises is De Lorme & Watkins which is as follows:

- 10 lifts with ½ 10 R.M.
- 10 lifts with ¾ 10 R.M.
- 10 lifts with 10 R.M.

Strengthening exercises consisted of

- shoulder flexion and extension and
- shoulder abduction and adduction
- shoulder external and internal rotation
- elbow flexion and extension
- wrist flexion and extension

Exercises were given as 3 sets of 8-12 repetitions, 5 days/ week for 6 weeks. Weight cuffs are used.

PROGRESSIVE RESISTED EXERCISE TRAININ

The outcome measures used were:-

- Upper extremity component of Fugl – Meyer assessment of physical performance

2.3. STATISTICAL ANALYSIS:

INDEPENDENT `t' TEST (between groups)

$$t = \frac{\overline{X1} - \overline{X2}}{S} \sqrt{\frac{n_1 n_2}{(n_1 + n_2)}}$$

Where,

$$S = \sqrt{\frac{\sum d_1^2 + \sum d_2^2}{n_1 + n_2 - 2}}$$

PAIRED `t' TEST (within groups)

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

Where,

$$S = \sqrt{\frac{\sum d^2 - [\bar{d}]^2 \times n}{n-1}}$$

S=combined standard deviation

$d_1 \& d_2$ =difference between initial & final readings in group 1 &group 2 respectively.

n_1 & n_2=number of patients in group 1 & group 2 respectively.

$\overline{X_1} \& \overline{X_2}$ =Mean of group 1 & group 2 respectively.

4. DATA PRESENTATION AND RESULTS
5.1 TABULATION

(i) Comparison of pre test and post test value using paired 't' test (FMA)

[A] Motor relearning programme GROUP

	Pre test	Post test
Mean value	30.5	52.9
't' value	8.44	
Level of significance	P<0.05 and significant	

For 9 degrees of freedom and at 5% level of significance, the table value is 1.833 and the calculated 't' is 8.44 ,which is greater than the table value. Hence alternate hypothesis is accepted.

[B] Progressive resistance exercises

	Pre test	Post test
Mean value	31.6	44.6
't' value	12.33	
Level of significance	P<0.05 and significant	

For 9 degrees of freedom and at 5% level of significance, the table value is 1.833, the calculated 't' value is 12.33, which I greater than the table value. Hence alternate hypothesis is accepted.

(ii) Comparison of pre test values of Motor relearning programme and Progressive resistance exercises group using independent 't' test.

Pre test	MRP group	PRE group
Mean value	30.5	31.6
't' value	0.487	
Level of significance	P<0.05 and significant	

The mean value of pre test value is 30.5 and 31.6 respectively. For 18 degrees of freedom and at 5% level of significance the table value is1.734. The calculated value is 0.487. Since the calculated value is less than the table value, its states that there exists no significant difference between the two groups.

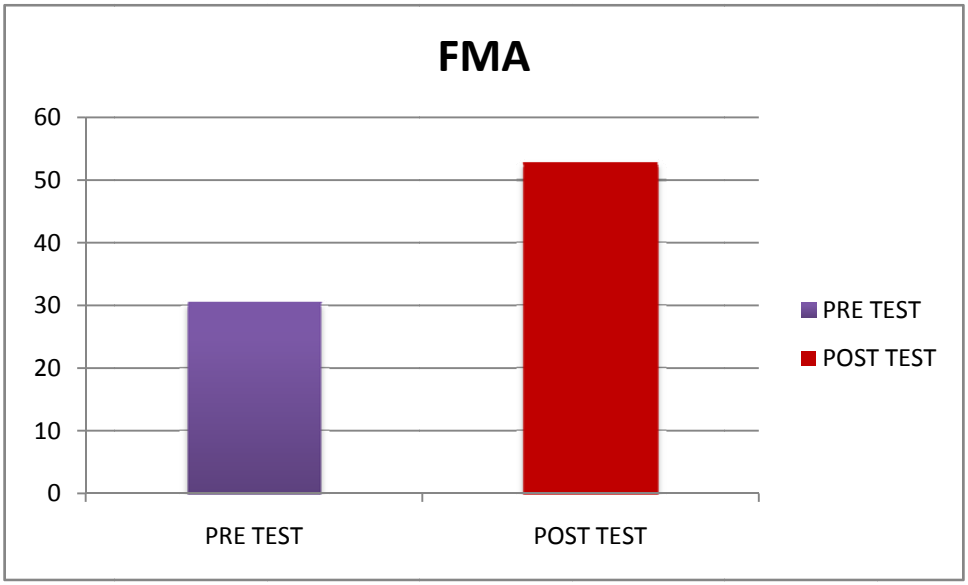
Comparison of post test values of Motor relearning programme and Progressive resistance exercises group using independent 't' test.

Post test	MRP group	PRE group
Mean value	52.9	44.6
't' value	1.80	
Level of significance	P<0.05 and significant	

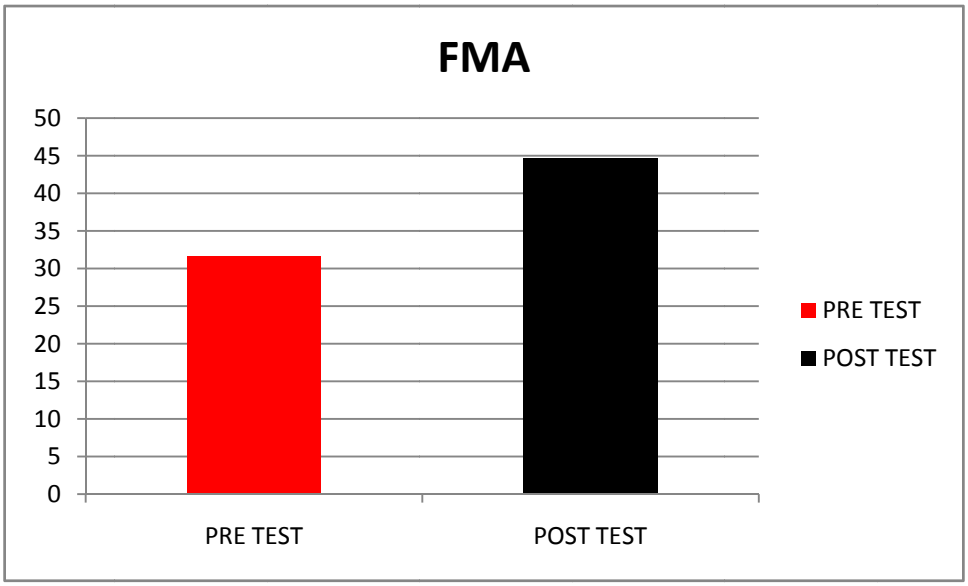
The mean value of post test value of is 52.9 and 44.6. For 18 degrees of freedom and at 5% level of significance the table value is1.734.The calculated value is 1.80. Since the alternate hypothesis is accepted.

5.2 . GRAPHICAL REPRESENTATION

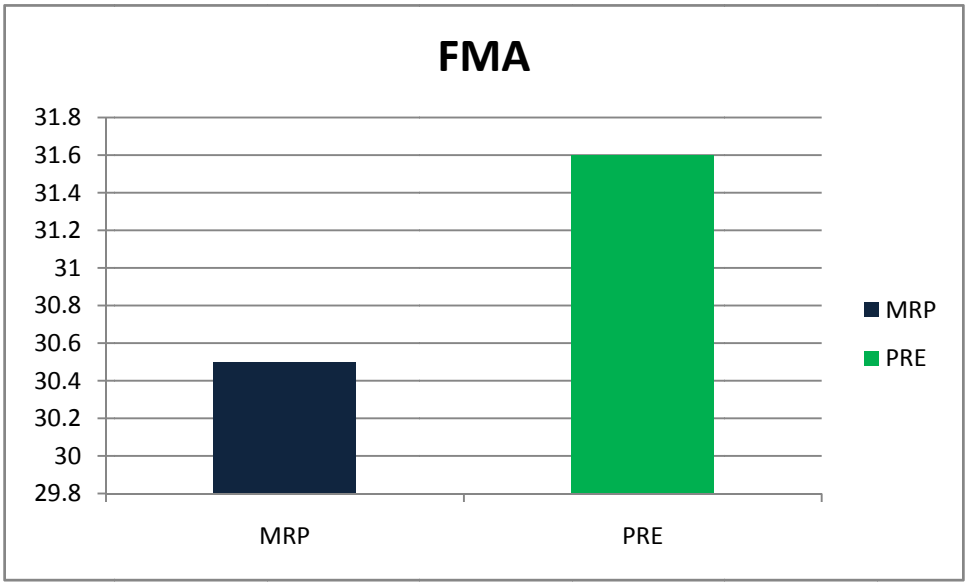
Comparison of Pre test and Post test mean values in FMA scale for Group1.



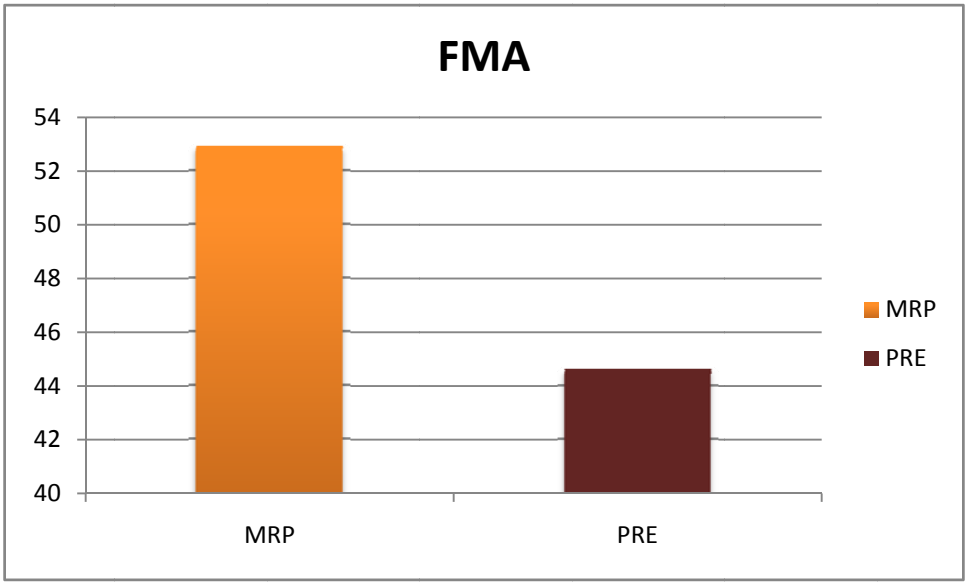
Comparison of Pre test and Post test mean values in FMA scale for Group2.



Comparison of Pre test mean values in FMA scale between Group1 and Group2.



Comparison of Post test mean values in FMA scale between Group1 and Group2.



5.3. DATA ANALYSIS AND RESULTS

The changes within the motor relearning programme group and

Progressive resistance exercise group are analyzed using paired‘t’ test. The difference between the groups were analyzed using independent‘t’ test.

FUGL MEYER ASSESSMENT SCALE :

Group-A : Motor relearning programme group – Paired ‘t’ test value between day 1 and end of week 4.

For 9 degrees of freedom and at 5% level of significance, the table value is 1.833 and the calculated ‘t’ value between pre test and post test value is 8.44 ,which is greater than the table value. Hence this states that there is significant effect on Motor relearning programme in improving in upper limb function of stroke patients.

Group- B : Progressive resistance exercise group – Paired ‘t’ test value between day 1 and end of week 4.

For 9 degrees of freedom and at 5% level of significance, the table value is 1.833, the calculated ‘t’ value is 12.33, which I greater than the table value. Hence this states that there is significant effect of Progressive resistance exercise is improving upper limb function of stroke patients.

INDEPENDENT‘T’ TEST

FUGL MEYER ASSESSMENT SCALE :

The mean value of pre test value of motor relearning programme group and Progressive resistance exercise group is 30.5 and 31.6 respectively. For 18 degrees of freedom and at 5% level of significance the table value is1.734. The calculated value is 0.487. Since the calculated ‘t’ value is less than the table ‘t’ value, its states that there exists no significant difference between the two groups.

FUGL MEYER ASSESSMENT SCALE :

The mean value of post test value of Motor relearning programme group is 52.9 and Progressive resistance exercise group is 44.6. For 18 degrees of freedom and at 5% level of significance the table value is1.734.The calculated value is 1.80. Since the calculated ‘t’ value is greater than the table ‘t’ value the null hypothesis is rejected.

This states that there is significant difference between motor relearning programme group and Progressive resistance exercise group in improving upper limb function of stroke patients.

6. DISCUSSION

Stroke is one of the major causes of human morbidity and mortality. It range as the sixth leading cause of disability-adjusted years in 1990 and is projected to rank fourth by the year 2020. It has been noted that stroke incidence may considerably vary from country to country, furthermore in some areas or within some racial and ethnic groups, stroke incidence may be unusually very high.

According to WHO stroke is an acute onset of neurological deficient occur due to abnormalities in cerebral circulation with resultant signs and symptoms that corresponding involvement of focal areas of the brain lasting for more then 24 hours. [10]

Stroke is a common neurological disorder with a complex recovery. Survivors of stroke are often left with disabilities. It leads to depression and stress among caregivers and family members. Rehabilitation helps in promoting natural recovery preventing complication due to disabilities. A well planned co-ordinate strategy towards stroke rehabilitation is bound to yield good results.

The study consisted of 20 subjects irrespective of the age and gender. The subjects were randomly allocated into 2 groups, with subjects selected on the basis of inclusion and exclusion criteria. The treatment protocol for 2 groups was (1) motor relearning program and conventional treatment; (2) Task oriented progressive resistance exercise and conventional treatment. The treatment intervention was given for 4 weeks. One outcome measures used were Fugl-meyer assessment of physical performance whose pretest and posttest value were taken.

This study aims to compare the effectiveness of motor relearning programme and Progressive resistance exercise in improving upper limb function following stroke. 20 ischemic stroke patients were selected and assigned to two groups. 10 patients were treated using motor relearning program and other group using Task oriented progressive resistance exercise. The patients were assessed before and after the study using Fugl – Meyer assessment scale. Results were analyzed using paired‘t’ test for subjects within each group and with indepented‘t’ test for subjects between groups. The study shows both groups improved in upper limb performance and comparatively groups which received motor relearning programme showed much improvement than the Progressive resistance exercise group.

Morris et al (2004) shows that there is evidence that PRE reduces the musculoskeletal impairments after stroke, but whether there is an improvement in the functional status was unknown.[30]

Yang YR et al concluded that task oriented PRE could improve lower extremity muscle strength in chronic stroke subjects and could carry over into improvement in functional activities.[50]

Thielman GT et al (2004) concluded that task related training is effective for improving reaching in severely impaired subjects and PRE is effective in for less impaired subjects.[29]

The motor relearning programme group improves upper limb function because it involves repetition of task and trying to achieve an objective task. Since this is implemented early after stroke the potential for neuroplasticity is greater thus the motor learning.

In stroke rehabilitation, specific training or repetitive training are also know to increase corticospinal excitability and improve function in the hemiparetic upper limb.[34]

In the progressive resisted training group there is no significant improvement in the upper limb function as it involved only strengthening of muscles without incorporating any functional activities. Although there is some improvement in the functional activities significant improvement is found in strengthening of the muscles. So this might not have a significant effect on the neuroplasticity.

So it is learnt that in progressive resisted training more of the improvement is seen in strengthening of the muscles, whereas in motor relearning program greater improvement in the functional activities is seen. So it is recommended that motor relearning program can be included in the rehabilitation of stroke patients.

7. SUMMARY AND CONCLUSION

The study was conducted in an effort to compare the effect of motor relearning programme and Progressive resistance exercise are improving upper limb function of stroke patients. 20 stroke patients were selected and assigned into two groups, one group receiving motor relearning programme and the other group receiving Progressive resistance exercise.

The study was pre test and post test experimental design. The results were analyzed using ‘t’ test. The results show significant improvement in group received motor relearning programme treatment than Progressive resistance exercise.

From this study it may be concluded that motor relearning programme is more significant than Progressive resistance exercise in improving upper limb functional performance in stroke patients.

8. LIMITATION AND SUGGESTIONS

- This study has been done with smaller sample size; Further study can be done with larger sample size.
- Consistency of patients with training was not reliable in home setting. Supervised programme in home setting.
- The study was a short term study; it is there fore necessary to do along term study to make the result more valid.
- This study was done only on MCA ischemic stroke ,the study can be done other type of stroke patients
- Less fine motor training was incorporated. Fine motor components can be incorporated
- Follow up was not done. But follow up should be done.
- No specific conventional treatment has been given. But compare with conventional treatment.
- The study can be compared with other neurophysiological approaches like Roods, Brunnstroms Bobath and Johnstons approaches.

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APPENDIX I

ASSESSMENT FORM

Name:

Age:

Sex:

Occupation:

Date of admission:

Date of assessment:

IP/OP Number:

Address:

Inclusion criteria

Motor assessment scale score (2-3)

Outcome measures

SCALES	PRE TEST	POST TEST
FUGL-MEYER ASSESSMENT (UPPER EXTREMITY		

APPENDIX II

CONSENT FORM

I voluntarily consent to participate in a research study named “comparing the efficacy of motor relearning programme and task oriented progressive resistence exercise programme in improving upper limb function following hemiparetic patients”

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

Signature of the reseacher

Signature of the participant

Signature of the witness

Place:

Date:

APPENDIX III

MOTOR ASSESSMENT SCALE

Upper Arm Function

1. Supine: Therapist places affected arm in 90 degrees shoulder flexion and holds elbow in extension – hand toward ceiling.

The patient protracts the affected shoulder actively.

2. Supine: Therapist places affected arm in above position. The patient must maintain the position for 2 seconds with some

external rotation and with the elbow in at least 20 degrees of full extension.

3. Supine: Patient assumes above position and brings hand to forehead and extends the arm again. (flexion & extension of

elbow) Therapist may assist with supination of forearm.

4. Sitting: Therapist places affected arm in 90 degrees of forward flexion. Patient must hold the affected arm in position for 2

seconds with some shoulder external rotation and forearm supination. No excessive shoulder elevation or pronation.

5. Sitting: Patient lifts affected arm to 90 degrees forward flexion - holds it there for 10 seconds and then lowers it with some

shoulder external rotation and forearm supination. No pronation.

6. Standing: Have patient's affected arm abducted to 90 degrees with palm flat against wall. Patient must maintain arm position

while turning body toward the wall.

APPENDIX IV

THE FUGL MEYER ASSESSMENT-UPPER LIMB SECTION

Test	Scoring criteria	Maximum possible score	Attained score
I.Reflexes a. biceps b. triceps	0-No reflex activity can be elicited 2-Reflex activity can be elicited	4	
II.Flexor Synergy Elevation Shoulder retraction Abduction(at least 90^0) External rotation Elbow flexion Forearm supination	0-Cannot be performed at all 1-Performed partially 2-Performed faultlessly	12	
III.Extensor Synergy Shoulder adduction/internal rotation Elbow extension Forearm pronation	0-Cannot be performed at all 1-Performed partially 2-Performed faultlessly	6	
IV.Movement Combining Synergy a. Hand to lumbar spine b. Shoulder flexion to 90^0 elbow at 0^0 c. Pronation/supination of forearm with elbow at 90^0 and shoulder at 0^0	a. 0-No specific action performed 1-hand must pass ASIS 2-action performed faultlessly b. 0-Arm is immediately abducted or elbow flexes at start of motion. 1-abduction or elbow flexion in later phase of		

	motion 2-Faultless motion c. 0-correct positon of shoulder and elbow cannot be attained, and/or pronation or supination cannot be performed 1-active pronation/supination can be performed even within a limited ROM. And at the same time the shoulder and elbow are correctly positioned. 2-complete pronation supination with correct positions at shoulder and elbow	6	
V.Movement Out of Synergy a. Shoulder abduction to 90^0 elbow at0^0 and forearm pronated b. Shoulder flexion, 90-180^0 and forearm in mid position c. Pronation/supination of forearm elbow at 0^0 and shoulder between 30-90^0 of flexion	a. 0-initial elbow flexion occurs or any deviation from pronated forearm occurs 1-motion can be performed partly, during motion elbow is flexed or forearm deviates 2-Faultless motion b. 0-initial elbow flexion or shoulder abduction 1-elbow flexion or shoulder abduction, occurs during shoulder flexion 2-Faultless motion c. 0-supination and pronation cannot be performed at all/or elbow and shoulder position can be attained 1-elbow and shoulder properly positioned and	6	

	motion performed in limited range 2-Faultless motion		
VI.Normal reflex activity Biceps and/or finger flexors and triceps	0-atleast 2 of 3 phasic reflexes are markedly hyper active 1-one reflex is hyper active or at least 2 reflexes are lively 2-no more than one reflex is lively and none are hyper active	2	
VII. Wrist a. Stability, elbow at 90^0 shoulder at 0^0 b. Flexion/extension, elbow at 90^0, shoulder at 0^0 c. Stability, elbow at0^0 shoulder at 30^0 d. Flexion/extension elbow at 0^0 shoulder at 30^0 e. Circumduction	a. 0-cannot dorsiflex wrist to 15^0 1-dorsiflexion is accomplished no resistance taken 2-can be maintained with some resistance b. 0-volitional movement does not occur 1-cannot move wrist actively throughout ROM 2- faultless smooth movement c. Same as a. d. Same as b. e. 0-cannot be performed 1-jerky/incomplete 2-complete motion	10	
VIII. Hand a. Finger mass flexion b. Finger mass extension c. Grasp 1 MP's extended, IP's flexed d. Grasp 2 thumb adduction with first CMC and IP at 0^0 e. Grasp 3 oppose thumb pad against index pad	a. 0-no motion 1-partial motion 2-complete motion b. Same as a. c. 0-required position cannot be acquired 1-weak grasp 2-grasp can be maintained against resistance d. 0-cannot be performed	14	

f. Grasp 4 holding a cylindrical object g. Grasp 5 a spherical grasp.	1-scrap of paper inter posed , but not against a slight tug 2-paper is held firmly against a tug e. Same as d. f. Same as d. e. g. Same as d. e. f.		
IX.Hand Coordination/speed finger to nose (5 repetitions in rapid succession). 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 systemic 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 score		66	

APPENDIX V

DATA PRESENTATION

1. MOTOR RELEARNING PROGRAM

S.NO	FUGL MEYER ASESSMENT	
	PRE TEST	POST TEST
1.	30	40
2.	26	38
3.	37	53
4.	34	58
5.	27	54
6.	24	59
7.	43	60
8.	31	54
9.	23	52
10.	30	61

2. PROGRESSIVE RESISTANCE EXERCISE

S.NO	FUGL MEYER ASESSMENT	
	PRE TEST	POST TEST
1.	26	34
2.	31	49
3.	35	46
4.	29	43
5.	34	50
6.	35	45
7.	37	49
8.	28	42
9.	29	39
10.	32	49