CHAPTER- I

INTRODUCTION

Stroke or cerebral vascular accident is the sudden death of brain cells due to inadequate blood flow. The WHO clinically defines stroke as the rapid development of clinical signs and symptoms of a focal neurological disturbance lasting more than 24 hours or leading to death with no apparent cause other than vascular origin *(WHO 2005).*

Stroke is one of the leading causes of mortality and morbidity worldwide. Stroke increases with age. Indian studies have estimated that the prevalence rate of stroke increases from 21/100,000 for the age group 20-40 to 625/100,000 in the age group 60 and above. However in India, the prevalence of stroke in younger individuals is high compared with high-income countries. Stroke is a global health care problem that is both serious and disabling. In high income countries , stroke is the main cause of acquired cause of death and is the main cause of acquired adult impairment .As most patient with stroke survive with initial injury , the best effect on patient and families is usually through long term impairment .It has been shown that about 40% of people who survive a stroke still have significance impaired function in this affected arm after 3 months, whereas 40% have middle to moderate impairment and only 20% have entirely normal function *(Vafader et al .,2014).*

Stroke is a clinical syndrome divided into two broad categories that is ischemic and haemorrhagic. Ischemic type is caused either cerebral thrombosis or embolism and account for 50%-85% of all strokes worldwide. Haemorrhage strokes are caused by subarachnoid haemorrhage or intracerebral haemorrhage and account for 1%-7% and 7%-27% respectively.The effects of a stroke are determined by the extent

and site of brain injury, but the clinical symptoms of stroke do not accurately predict its underlying cause. Classic Stroke symptoms include the acute onset of unilateral paralysis, loss of vision, speech impairment, memory loss, impaired reasoning ability, coma or death .They are most commonly experience the subluxed shoulder when the arm significantly paralyzed. The subluxation is not painful, but the shoulder can be traumatized easily ,if it is not carefully handled and positioned at all times. When muscle tone and active movement in the rotator cuff muscle returns the correct alignment of the joint can be maintained. Physiotheraphy there for aims at correcting the posture of the shoulder girdle and stimulating activity in the stabilizing muscle around the shoulder. The recovery rate of upper limb function after stroke is poor when compared with independent walking. Therefore, effective methods are warranted for upper limb rehabilitation. Functional electrical stimulation is the use of electrical stimulation to produce muscle contraction that have a functional purpose *(Peckham 1987).*

Electrical stimulation of the peripheral nerve or motor points is associated with concomitant physiological changes in the brain including activation of primary sensory and motor areas and the supplementary motor area, reduction of intra cortical inhibition and increased amplitude of motor-evoked potentials. 3 weeks of neuromuscular electrical stimulation to the experimental group of affected upper extremity of patients with stroke improves motor recovery. After 2 weeks of treatment all patients showed significant improvement in upper limb function ($p<0.05$),and at least some of the improvement persisted for the entire 6 months in every case .Specific training along with electrical stimulation and neuroprosthesis in stroke   patients. After intervention, they exhibited action research arm test and fugl-meyer assessment score increases (+2.85 and +2.2), motor activity log (+0.97).post intervention functional magnetic

resonance imaging revealed significant increase in cortical activation .Higher and lower dose of electrical stimulation for 60min and 30min for 4weeks to extensor digitorum communies, extensor carpi radials,flexor digitorum communies, supraspinatus,and the posterior deltoid.They concluded higher and lower dose of neuromuscular electrical stimulation lead to similar improvements in motor function *(Shushuyan et al.,2010).*

The term " plasticity " refers ,in general to the capacity of the central nervous system to adapt to functional demand and therefore to the system capacity to reorganize mechanism of brain plasticity include the capacity for neurochemical ,neuroceptive and neuronal structural changes .Brain organization appear to play an impotent role in the brain's capacity for flexibility and adaptation. Extensive intracortical axonal collaterals provides input to many different movement representation of a given body part and their patterns of recruitment may determine the execution of complex movement patterns .Central motor neuroplasticity support the use of active repetitive training of the paretic limb to maximize motor recovery after stroke. A recent study suggests that after local damage to the motor cortex, active repetitive training of the hemiparetic limb shapes subsequent functional reorganization in the adjacent intact cortex and that the undamaged motor cortex plays an important role in motor recovery *(Chae et al.,1998).*

Proprioceptive neuromuscular facilitation technique (PNF) is a philosophy and a method of treatment. It was started by Dr,Herman Kabat in the 1940 s .Dr.kabat and Margaret (Maggie) Knott continued to expand and develop the treatment techniques and procedure after their move to Vallejo ,California in1947 .It deals with making use of the proprioceptor o modify the action of the motor system. Development in the PNF concept are closely followed through tout the world .It is now possible to

take reorganized training courses in many countries given by qualified PNF instructors *(Kabat* The proprioceptive neuromuscular facilitation   is a method used in post stroke treatment where the process of gradual restitution of patients motor abilities. It is a method of neuromuscular dysfunction treatment by means of facilitation flow of information mainly by the stimulation of proprioceptors *(Kabat and Knott 1967).*

The possible machanisms behind this was, autogenic inhibition and reciprocal inhibition .Its has been accepted as the neurophysiological explanations for the superior range of motion gains that PNF stretching achieves over static and ballistic alternatively. Autogenic inhibition reflex is a sudden relaxation of muscle upon development of high tension. It is a self-induced, inhibitory, negative feedback lengthening reaction that protects against muscle tear. Golgi tendon organs are receptors for the reflex. Autogenic inhibition (historically known as the inverse myotatic reflex or autogenetic inhibition) refers to a reduction in excitability of a contracting or stretched muscle that in the past has been solely attributed to the increased inhibitory input arising from Golgi tendon organs (GTOs) within the same muscle. The reduced efferent (motor) drive to the muscle by way of autogenic inhibition is a factor believed to assist target muscle elongation. Reciprocal inhibition describes the process of muscles on one side of a joint relaxing to accommodate contraction on the other side of that joint. Joints are controlled by two opposing sets of muscles, extensors and flexors, which must work in synchrony for smooth movement. When a muscle spindle is stretched and the stretch reflex is activated, the opposing muscle group must be inhibited to prevent it from working against the resulting contraction of the homonymous muscle. This inhibition is accomplished by the actions of an inhibitory interneuron in the spinal cord *(Adler et al., 2007).*

The afferent of the muscle spindle bifurcates in the spinal cord. One branch innervates the alpha motor neuron that causes the homonymous muscle to contract, producing the reflex. The other branch innervates the inhibitory interneuron, which in turn innervates the alpha motor neuron that synapses onto the opposing muscle. Because the interneuron is inhibitory, it prevents the opposing alpha motor neuron from firing, thereby reducing the contraction of the opposing muscle. Without this reciprocal inhibition, both groups of muscles might contract simultaneously and work against each other. If opposing muscles were to contract at the same time, a muscle tear can occur. This may occur during physical activities, such as running, during which muscles that oppose each other are engaged and disengaged sequentially to produce coordinated movement. Reciprocal inhibition facilitates ease of movement and is a safeguard against injury. However, if a "misfiring" of motor neurons occurs, causing simultaneous contraction of opposing muscles, a tear can occur *(Voss et al., 1987)*.

Patterns of facilitation is composed of mass movement patterns of the limbs and the synergistic trunk muscle. The motor cortex generates and organized these movement patterns, the individual cannot voluntarily leave a muscle out of the movement patterns to which it belongs. PNF patteren combine motion in all three plane. spiral and sagittal stretch and resistance reinforce the effectiveness of the patterns,as shown by an increased activity in the muscle and restoration of normal movement based on movement patterns, basic principle and technique of PNF directed towards normalization of muscle tone among stroke patients in wrist and hand function by PNF technique was in first one year *(Nakaten et al.,1997).*

The mirror box therapy based on mirror neuron present in the premotor cortex. This neuron were discovered in 1990's by the scientist of university of parma in Italy. Mirror therapy has been employed with some success in treating stroke patients.

Clinical studies that have combined mirror therapy and conventional rehabilitation to achieve the most positive outcomes. Mirror therapy is act based on the reflective illusion or artificial visual feed back to brain which stimulate motor neurons in brain [20% of mirror neuron in all our human body].It has a capacity to differentiate right and left side .If right side limb paralysis left mirror neuron connect with left hemiparesis, which stimulate motor performance by visual feed back and proprioception . Mirror therapy increase spinal and cortical neuron excitation *(Chen et al.,1995).*

Mirror visual feedback (MVF) was initially utilized by Ramachandran and Rogers-Ramachandran in 1996 to alleviate pain and paralysis in amputees. MVF is designed to trick the patient's brain while directly, and eventually, transforming their mind. When patients with chronic pain issues anticipate movements to be painful, mirrors help deceive them into thinking that they are not experiencing pain via dynamic feedback to their brains. "Mirrors and vision are inextricably linked, and the reflected image appears strikingly believable even if deliberately distorted." Using observation of the uninvolved limb helps to "drive proprioception" in the involved limb, thereby normalizing the "movement process." Simply put, the use of the mirror gives the patient the "impression of having two normal limbs." The concept behind this "visual input" modality is that it helps patients re-educate, re-introduce to their altered higher processing neural networking, a normal relationship between a physical movement and the sensory feedback it provides *(McCabe 1996).*

MVF is based on several theories. The first involves reconstructing, or rewiring, the tangled higher motor and sensory circuitry. Another basis suggests that continuous attention to the painful limb helps patients improve their perceived control of that limb. Yet another theory is based on the idea that it addresses kinesiophobia, meaning that a patient can break the connection between the fear of moving the limb

and the associated pain. Lastly, MVF is considered to be a form of basic distraction therapy. It is well known that patients who suffer from debilitating pain disorders—such as Chronic Regional Pain Syndrome (CRPS), phantom limb, focal dystonia, or strokes - undergo changes in the brain's topographical map. The sensorimotor portion of the cortex, corresponding to the painful limb, becomes less active. As pain increases, so does the disorganization of the higher cortices. Considering hand therapy as an example, if a patient with CRPS wants to make a fist, what he or she expects to feel doesn't match the actual sensory input, thus creating conflict. However with tools such as MVF, therapists can aid patients in reducing their pain, thereby reversing the damaging cortical changes *(Blasis et al.,1998).*

1.1 Statement of the study

A study on the effectiveness of Mirror box therapy and proprioceptive neuromuscular facilitation technique in management of upper limb function among stroke patients.

1.2 Need of the study

The reason of the study is to introduce mirror box therapy and proprioceptive neuromuscular facilitation techniques as a useful intervention method to improve wrist and hand function, improve frequency and quality of upper limb movement in stroke.

The studies also create awareness on physiotherapy and patients that mirror box therapy and proprioceptive neuromuscular facilitation techniques can be used to improve wrist and hand function, frequency and quality of upper limb movement in stroke.

1.3 Objective of the study

- To find out the effectiveness of mirror box therapy on wrist and hand function, frequency and quality of upper limb movement among stroke patients.
- To find out the effectiveness of proprioceptive neuromuscular facilitation on wrist and hand function, frequency and quality of upper limb movement among stroke patients.
- To compare the effect of mirror box therapy and proprioceptive neuromuscular facilitation on wrist and hand function, frequency and quality of upper limb movement among stroke patients.

1.4 Hypothesis

- It is hypothesized that there may be significant different in wrist and hand function, frequency and quality of upper limb movement following Mirror Box Therapy among stroke patients.

- It is hypothesized that there may be significant different in wrist and hand function, frequency and quality of upper limb movement following proprioceptive neuromuscular facilitation techniques among stroke patients.

- It is hypothesized that there may not be significant difference between mirror box therapy and proprioceptive neuromuscular facilition techniques in the management of wrist and hand function, frequency and quality of upper limb movement among stroke patients.

1.5 Operational Definitions

Stroke

Stroke is defined as a cerebrovascular accident as the result of circulatory defect in which the symptoms have continued for more than 24 hours. An attack lasts for less than the 24 hours is known as transient ischemic attack. Stroke is due to a lesion affecting the opposite side of the cerebrum *(WHO 2005).*

Muscle function

The important function of the muscle is its ability to develop tension and to exact a force on the bony lever. Tension can be either active or passive, and the total tension that a muscle can develop including both active and passive component (*Macdon 1998).*

Mirror Box Therapy

Mirror Box Therapy is a simple ,inexpensive and most importantly ,patient directed treatment that may improve that range of motion (ROM) ,speed, hand

dexterity and accuracy of hand and wrist movement in upper -extremity function by congruent visual feedback from the moving non paretic hand *(Ramachandran 1996).*

Proprioceptive neuromuscular facilitation techniques

The technique of proprioceptive neuromuscular facilitation relies mainly on stimulation of the proprioceptors for increasing the demand on the neuromuscular mechanism to obtain and facilitate its response *(Kabat 1940).*

Fugl- Meyer's scale

The Fugl -Meyer Scale (FMS), a motor performance test consisting of 33 tasks performed by the affected upper limb , evaluates the ability to make movement outside of a synergistic pattern.. Performance on each task is rated 0, 1, or 2, with higher ratings representing better performance .The FMS measure used in this study was the sum of the 33 ratings (possible range 0 to 66 *) (Michaelsen et al.,1996).*

Motor activity log

This instrument is a structured interview intended to examine how much and how well the subject uses their more-affected arm outside of the laboratory setting. Participants are asked standardized questions about the amount of use of their more affected arm (Amount Scale or AS) and the quality of their movement (How Well Scale or HW) during the functional activities indicated. The scales are printed on separate sheets of paper and are placed in front of the participant during test administration. Participants should be told that they can give half scores (i.e., 0.5, 1.5, 2.5, 3.5, 4.5) if this is reflective of their ratings *(Vander et al., 1991).*

CHAPTER – II

REVIEW OF LITERATURE

Section A: General aspects of stroke.

Section B: Studies on effects of PNF technique on the upper limb function among stroke patients.

Section C: Studies on effects of Mirror Box Therapy on the upper limb function among stroke patients.

Section D: Studies on the reliability and validity of Fugl -Mayer's scale in assessing wrist and hand function.

Section E: Studies on the reliability and validity of Motor Activity log in assessing frequency and quality of upper limb movement.

Section A: General aspects of stroke.

 Dohle et al., (2009) organized a study " Effectiveness of increased intensity of rehabilitation in post stroke patients ". 36 patients with severe hemiparesis due to first ever ischemic stroke in the territory of the middle cerebral artery were enrolled, no more than 8 weeks after the stroke. They completed a protocol of weeks of additional therapy (30 minutes a day ,5 days a week),with random assignment to either mirror therapy (MT) or an equivalent control therapy (CT).The primary outcome measures were the fugl- meyer's sub score for upper extremity ,(arm, hand, and finger function) were evaluated before and after treatment. There were no significant differences in the mean FM sub scores of any of the FM sub scores at the end of treatment .In the sub group of 25 patients with distal plegia at the beginning of the therapy ,Mirror therapy

(MT) patients regained more distal function then Control therapy (CT) patients. furthermore ,across all patients ,MT improved recovery of surface sensibility.

Mchielsen et al., (2002) conducted a study on "Mirror therapy for improving motor function after stroke ".40 chronic stroke patients (mean of 3.9 years post onset) were randomly assigned to the mirror group (n = 20) or the control group (n=20) and then participated in a 6 - week training program, led by physiotherapist at the rehabilitation center and practiced at home 1 hour daily,5 times a week. The primary outcome measure was the fugl-meyer's motor assessment (FMA).The grip force, spasticity ,pain , dexterity, hand-use in daily life ,and quality of life at baseline post treatment and at 6 months were all measured by a blinded assessor. Patients in the mirror group achieved more gains in FAM points compared with those in the control group, although they did not persist at follow-up .There were significant differences on mirroe therapy group outcomes at either the end of treatment.

Rames et al., (2007) conducted a study on " Effect of training programme and exercise in stroke patients''. 66 patients were participated in this study. They were grouped into two, 33 subjects in one group who received motor training programme and 33 subjects in second group who received PNF and conventional exercise. The Fugl –Meyer's scale used as a outcome measure.The result showed significant improvement in both groups as 20% value increased. This study reveals the effect motor training and exercise programme have value in stroke rehabilitation.

Yavuer et al.,(2008) studied "Effectiveness of conventional stroke rehabilitation programme among stroke patients ".40 inpatients all within one - year of stroke were randomized to a program of either 30 minutes of mirror therapy (n=20) a day consisting of wrist and finger flexion and extension movements (n=20) in addition to conventional stroke rehabilitation program ,5 days a week ,2 to 5 hours a day ,four 4

weeks . Outcomes including the Modified Ashworth Scale (MAS) and the Brunnstrom stages of motor recovery were assessed before and after treatment and at 6 months. The scores of the Brunnstrom stages for the hand and upper extremity and the FIM self care score improved more in the mirror group than in the control group after 4 weeks of treatment (by 0.83, 0.89, and 4.10, respectively; all P < 05).There were significant differences in changes scores between the groups at either the end of treatment or at follow - up .

Section B : Studies on effects of PNF technique on the upper limb function among stroke patients.

Jette et al., (1995) conducted a study ''Physical therapy intervention for patients with stroke in inpatients rehabilitation center ''. Dates were collected from 972 patients with stroke who receiving physical therapy service at 6 rehabilitation center in the united state. All subject were randomly assigned into 2 group with 486 patients in each .one group received proprioceptive neuromuscular facilitation (PNF) techniques as intervention and second group received exercise as intervention. Fugl- meyer's scal (FMS) used as outcome measure. The result suggested that who received PNF as intervention had high level of improvement > 20% then the second group .So they concluded PNF is very effective in improving motor function among stroke patients .

Seo et al., (1749) organized study on " The effect of proprioceptive neuromuscular facilitation (PNF) - upper extremity pattern in improving motor performance with chronic stroke patients ''. 30 stroke patients participated in this study they were assigned randomly and equally to an experimental group and a control group .The experimental group received active exercise for 30 min and control group received upper extremity PNF pattern for 30 min. This intervention were conducted in 30 min session ,three time per week for eight week .The subjects were assessed with fugl-

meyer's scale and both group compared .The result suggested after the intervention with PNF , motor performance value had significantly increase. They concluded that PNF as a good outcome measure for improving motor recovery among stroke patients.

Smedes et al., (2002) carried a study on topic " Is there support for proprioceptive neuromuscular facilitation (PNF) concept on stroke? " . Review of literature for the last 16 years was collected through pub med, Pedro and academic search elite. we found 42 publication with 1288 patient with stroke who receive PNF technique to improve motor performance .we had to categorize these publication in groups because of the different fields of studied topics. The group is again sub categorized in publication design .This review concluded that the PNF concept can be beneficial within the physical therapy provided for a wide range of indication.

Winter et al.,(2011) oversighted a study on " Hands on therapy intervention for upper limb motor dysfunction following stroke " . 86 subjects with stroke involving in this study who met all the selection criteria. The intervention included PNF, Bobath techniques and exclude pharmacological psychological techniques .Fugl –meyer's scale and action reach arm test used as outcome measure. They measured pre and post value of motor performance before and after intervention .the result suggest significant improvement of >25% among pre and post test measures. Hands on therapy having high value of intervention to improve motor performance among stroke patients.

Section C: Studies on effects of Mirror Box Therapy on the upper limb function among stroke patients.

Altschler et al.,(1999) conducted a study on "Rehabilitation of arm function after stroke " .9 subjects with stroke onset of > 6 months were randomly assigned to spend the first 8 weeks using either a mirror or transparent plastic then crossed over to the other treatment for the next 8 weeks. Patients practiced for 15 min 2/ day 6 days a

week ,moving the paretic hand as much as they were able while watching the unaffected arm in the mirror or the paretic arm through the plastic.2 Neurologists assessed change from baseline in movement ability in terms of range of motion ,speed and accuracy ,using a -3 to + 3 scale . Both raters agreed that 7/9 patients in the control group did not improve .Two patients in the control group improved by 0.5 or 1 point. In the mirror group, at least one of the raters reported that every patient had improved by at least 0.5 points.

Blasis et al., (2007) studied ''Mirror therapy in hand rehabilitation ''. This randomized controlled study was conducted to compare the effectiveness on pain and upper limb function of mirror therapy on CRPS 1 of upper limb in patients with acute stroke.208 patients with first episode of the affected upper limb were enrolled in a randomized controlled study, with a 6 month follow -up, and assigned to either a mirror therapy group or placebo control group .The secondary end points significantly improved in the mirror group. No statistically significant improvement was observed in any of the control group value .Moreover ,statistically significant differences after treatment and at the 6 month follow -up were found between the 2 groups ,The result indicate that mirror therapy effectively reduces pain and enhances upper limb motor function in stroke patents.

Jannink et al., (2004) carried a study on " The role of mirror therapy in the improvement of upper limb function in post stroke patients " This reviews gives overview of the current state of research regarding the effectiveness of mirror therapy in upper extremity function. A systematic literature search was performed to identify studies concerning mirror therapy in upper extremity. The included journal articles were reviewed according to a structured diagram and the methodological quality was assessed. Fifteen studies were identified and reviewed. Five different patient categories

were studied ;two studied focused on mirror box therapy after an amputation of the upper limb, five studies focused on mirror therapy after stroke ,five studies focused on mirror therapy with complex regional pain syndrome type 1 (CRPS 1) patients, one study on mirror therapy with complex regional pain syndrome 2 (CRPS 2).The present review showed a trend that mirror therapy is effective in upper limb treatment of stroke patients and patients with CRPS .Whereas the effectiveness in other patient groups has yet to be determined.

Nakaten et al., (2009) oversighted a study titled " Effects and adherence of mirror therapy in people with chronic upper limb hemi paresis ''. Rehabilitation of the severely affected paretic arm after stroke represents a major challenge, especially in the presence of sensory impairment. To evaluate the effect of a mirror therapy that includes use of a mirror to stimulate the affected upper extremity with the unaffected upper extremity early after stroke .36 patients with severe hemi paresis because of a first ever ischemic stroke in the territory of the middle cerebral artery were enrolled, no more than 8 weeks after the stroke .They completed a protocol of 6 weeks of additional therapy (30 minutes a day ,5 days a week) ,with random assignment to either Mirror Box (MT) or an equivalent control therapy (CT) . There were the Fugl- Meyer's sub scores for the upper extremity, evaluated by independent raters through video tape .Patients also underwent functional and neurophysiologic testing. In the subgroup of 25 patients with hemilplegia at the beginning of the therapy .Mirror Box Therapy patients regained more distal function then equivalent control therapy (CT) patients.Furthermore, across all patients, Mirror Box Therapy improved recovery of surface sensibility. Neither of these effects depended on the side of the lesion .Mirror Therapy stimulated recovery from hemi neglect .Mirror Box Therapy after stroke is a

promising method to improve sensory and attention deficits and to support motor recovery in a hemiplegic limb.

Section D: Studies on the reliability and validity of Fugl -Mayer's scale in assessing wrist and hand function.

Gladston et al.,(2002) conducted a study on " The fugl – meyer's assessment of motor recovery after stroke ; a critical review of its measurement properties ". 60 in patients with stroke were randomly selected , they are under went various training programme .Their level of motor performance were assessed by using fugl - meyer 's assessment scale during before and after intervention .The result suggest that post score increase > 25% then the pre score measure . Based on the available evidence, the fugl- meyer's scale is recommended highly as a clinical and research tool for evaluating changes in motor impairment following stroke.

Michaelsen et al.,(2011) conducted a study on "Translation adaptation and inter rater reliability of the administration manual for the fugl- meyer's assessment ". 18 subject with chronic stroke patients took part in this study .9 patients participated in the first group of the study and 9 in the second group. After intervention the inter rater reliability assessed by using interclass correlation coefficient (ICC). Result suggest that the reliability of the fugl - meyer's score (FMS) based on the adapted version of the of the total motor score for the upper limbs (ICC= 0.98). This study showed that the application of the FMA based on the adapted version of the application manual for brazilin Portuguese presented adequate inter rater reliability.

Sanford et al., (1993) over sighted a study titled ''Reliability of the fugl – meyer's assessment for testing motor performance in patients following stroke " . 12 patients aged 49 to 86 years who had stroked participated in the study. They are level of motor performance were assessed by using fugl meyer's scale among stroke patients .

In a result over all reliability was high (R = 96) they concluded that the fugal –meyer's scale as a research tool versus a clinical assessment for stroke.

　　Tucak et al., (2010) studied " Relationships between initial motor assessment scale score and length of stay mobility at discharge and discharge destination after stroke" The date base included 239 individuals admitted to a stroke rehabilitation unit between June 2001 and January 2007.Admission score and discharge score are assessed by using fugl- meyer's scale as an outcome measure .Result suggest that poor mobility and lower motor assessment score (MAS) on admission . After the intervention motor assessment scale score increased > 57.4 % during discharge from rehabilitation unit .This study provides further evidence for the utility of motor assessment score to predict some outcome in stroke survivor.

Section E: Studies on the reliability and validity of Motor Activity log in assessing frequency and quality of upper limb movement.

　　Natalia et al.,(2012) Studied " Reliability and relationship with motor impairment in individual with chronic stroke ".The aim of the study is to assess the inter-rater and test-retest reliability of the MAL .The inter - rater and test-retest reliability was evaluated by comparing the result of two examiner ,repeated one –week apart with 30 individual with chronic hemiparesis.The result suggest that the inter-rater (0.988 for the AOU and OQM) and test –retest reliability (0.99) for   both scale. The study reveals that MAL was reliable to evaluate the spontaneous use of the most affected upper limb after stroke.

　　Stewart et al.,(2013) conducted a study on " Patients reported measure provide unique insight into motor function after stroke". This study included 46 participants had mild disability, moderate motor deficit and mild cognitive and language deficit.all subjects was assessed by SIS and MAL scale. The result of the

study suggest that 20 patients reported outcome measure SIS were sensitive to the presence of motor deficit .26 patients classified as having minimal or difficult with hand movement by reduced arm use by MAL score. Finally this study reveals those motor deficits were evaluated in a majority of patients classified by MAL scale.

Thompson et al.,(2006) did a study " Usefulness of MAL in assessing quantity and quality measure of arm and hand function among srtoke patients".The study is a parallel cluster randomized controlled trail with patients(n=48).After written consent form patients randomly assignsed to treat and 6 month later standardized outcome measure used before and after intervention .The quality of arm and hand use are measured by MAL scale .The result suggest that 30 > post test score increased then pre test score measure .This evidence support the MAL is reliable & valid in individuals with sub acute stroke.

Vander et al.,(1991) did a study on " motor activity log for assessment of arm use in hemiparetic patients" . Assess the use of hemiparatic arm and hand (amount of use (AOU) and (quality of movement (QOM) on 56 subjects during activity of daily living. Two base line measurement 2 weeka apart and 1 follow up measurement immediately after 2 weeks of intensive exercise therapy either withor without immobilization the arm were performed in 56 chronic stroke patient.The result showed internal consistency was high (AOU= 0.88: QOM = 0.91) .The limits of agreement -0.70 to 0.85 and -0.61 to 0.71 for AOU and QOM respectively .The responsiveness ratio was 1.99 (AOU) AND 2.0 (QOM) . This study concluded that MAL is internally consistent and relatively stable in assessing quantity and quality of arm and hand function in chronic stroke patients., concurrent validity and responsive of the patients after stroke with minimal to moderate arm and hand function .

CHAPTER III

METHODOLOGY

3.1. Study Setting

The study was conducted in outpatient department Sri Kumarn Multi specialty hospital, Tirupur.

3.2. Selection of subjects

20 subjects were randomly selected who fulfilled the inclusion and exclusion criteria and divided into 2 groups.

- Group A- Mirror Box Therapy
- Group B- Proprioceptive Neuromuscular Facilitation technique

3.3. Variables

3.3.1. Dependent variables

- Wrist and hand function
- Frequency of upper limb movement
- Quality of upper limb movement

3.3.2. Independent variable

- Mirror box therapy
- Proprioceptive neuromuscular facilitation technique

3.4. Measurement tools

Variables	Tools
Wrist and hand function	Fugl meyer's scale
Frequency of upper limb movement	Motor Activity Log [How often scale or Amount scale]
Quality of upper limb movement	Motor Activity Log [How well scale]

3.5. Study design

The study design was pre and post-test experimental design.

3.6. Inclusion criteria

- Clinically diagnosed anterior cerebral artery stroke patients.

- Brunstrom's stages 3 and 4.

- Subjects of age group between 40 to 55 years.

- Subjects who are able to understand and follow verbal instructions.

- Medically stable.

3.7. Exclusion criteria

- Perceptual and cognitive deficits.

- Subject with visual impairment

- Subjects with recurrent episodes of stroke

- Subjects with shoulder hand syndrome

- Subjects with tumors and fracture

3.8. Orientation of the subjects

Before the collection of data, subjects were explained about the purpose of the study. The investigators have given a detailed orientation about the various test procedures. Such as Fugl Meyer's scale to measure the wrist and hand function and Motor Activity Log (How often or Amount scale) to measure frequency of upper limb movement and Motor Activiyt Log (How well scale) to measure quality of upper limb movement. The consent and full co-operation of each participant was sought after complete explanation of condition and demonstration of the procedures involved in the study.

3.9. Test Administration

Wrist and hand function assessment by Fugl- Meyer's scale (FMS)

The Fugl -Meyer Scale (FMS), a motor performance test consisting of 33 tasks performed by the affected upper extermity,it evaluates the ability to make movement outside of a synergistic pattern. Patients were asked to perform 33 task .Based on their ability of completing task .Performance on each task is rated 0,1,or 2, with higher ratings representing better performance .The FMS measure used in this study was the sum of the 33 ratings (possible range 0 to 66).

Upper limb movement assessment by Motor activity log (MAL)

The Motor activity log instrument is a structured interview intended to examine how much and how well the subject uses their more-affected arm outside of the laboratory setting. Participants are asked standardized questions about the amount of use of their more-affected arm (Amount Scale or AS) and the quality of their movement (How Well Scale or HW) during the functional activities indicated. During the visit, patients were asked to perform the 30 activity of daily living. Performance was

conducted according to standardized procedure descried in the testing manual. After completing of each task their level of motor performance on both MAL scale are scored on six points ,ranging from 0 to 5 were noted in separate sheets of paper and are placed in front of the participant during test administration. Participants should be told that they can give half scores (i.e., 0.5, 1.5, 2.5, 3.5, 4.5) if this is reflective of their ratings is a structured interview intended to examine how much and how well.

3.10. Treatment procedure

Group A- Mirror Box Therapy

Patient position: sitting position

Therapist position: sitting opposite to the patient.

Treatment procedure

- ➢ During Mirror Box Therapy, patients were seated close to a table on which a mirror (35x35 cm) was placed vertically.
- ➢ The involved hand was placed behind mirror that is, the non reflective side and the non - paretic hand in front of the reflective side of the mirror.
- ➢ The practice consisted wrist flexion and extension movements followed by finger flexion and extension movements on non- paretic hand, while subjects looked into the mirror watching the image of their non-involved hand, thus seeing the reflection of the hand movements projected over the involved hand.
- ➢ Subjects could see only the non-involved hand in the mirror. During the session patients were asked to try to do the same movements with paretic hand while they were moving the non-paretic hand.

- The effect of mirror visual illusion on brain activity showed increased excitability of primary motor cortex (MI) of the hand behind the mirror.

- Mirror neurons are bimodal visuomotor neurons that are active during action observation, mental stimulation (imagery) and action execution.

- Mirror neurons are now gerenerly understood to be the system underlying the learning of new skills by visual inspection of the skill.

- Treatment with a mirror gives an illusion of function in a non functioning hand. The method is based on the concept that the central representation of body image can change rapidly, and has been described in the treatment of stroke.

- During an 8 week training program, patients were asked to try to match the movement of the unseen involved hand, with the displayed hand movements.

- After the training period an increased activity in MI corresponding with the affected limb was found using functional magnetic resonance imaging.

Dose: Fifteen minutes two times per day, in six days a week for eight month.

Figure 1:   **Wrist flexion and extension of non paretic limb**

Figure 2:   **Hand flexion and extension of non paretic limb**

Group B - Proprioceptive Neuromuscular Facilitation Techniques

Patient position: Lying position.

Therapist position: Walk standing position at side of patient.

Treatment procedure

- ➢ The patients lying on the table and the therapist stand on side of the patient.

- ➢ The patient were instructed to close the hand, wrist, and finger and pull the limb up and cross the face so that the shoulder is adducted and flexed, with the elbow extended.

- ➢ The therapist should apply matched resistance (matched to the strength of the patient's contraction) to this UE DIF pattern.

- ➢ When the patient's UE is positioned near the end of its range. He or she is instructed to change direction into the UE DIE pattern. The patient is asked to open the hand and extend the fingers and wrist, with the shoulder internally rotated pushing down and out.

- ➢ The shoulder should now be in abduction and extension .The therapist should apply matched resistance to this UE DIE pattern.

- ➢ When these PNF patterns are reversed, movement should be smooth and continuous without relaxation and resistance maintained from one pattern into the opposite pattern.

- ➢ The ability to maintain the wrist in a neutral or extended position to allow for grasp and pretension patterns (described below) is required. For example, maintenance of the wrist in an extended position (approximately

20 to 30 degree of wrist extension) is required to grasp a milk container and pour the liquid into a glass.

Dose: Thirty minutes per day, three times a week for eight week.

PNF Patterns:

Figure3: Upper extremity DI Flexion PNF Pattern

Figure 4: Upper extremity D1 Extension Pattern

3.11. Collection of data

The selected 20 stroke subjects were divided into 2 groups.

Group A - Mirror Box Therapy

Group B - Proprioceptive neuromuscular facilitation techniques

Both the experimental groups were given treatment for continues 4-8week. Before and after the completion of 4-8 week treatment intervention, wrist and hand function was evaluated by Fugl Meyer's scale , frequency of upper limb movement was evaluated by Motor Activity Log [How often or Amount scale] and quality of upper limb movement was evaluated by Motor Activiyt Log [How well scale] was recorded.

3.12. Statistical technique

The collected data were analysed by paired't' test to find out significance difference between pre and post test values of experimental groups and further unpaired 't' test was applied to find out the difference between groups.

CHAPTER IV

DATA ANALYSIS AND RESULTS

4.1. Data analysis

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

a) Paired 't' test

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

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

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

Where,

d – Difference between pre test and post test values

$\bar{d} = \frac{\Sigma d}{n}$ 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, mean difference, standard deviation and paired't' value between pre and post test scores of wrist and hand function for group A.

Measurement	Mean	Mean Difference	Standard Deviation	Paired 't' Value
Pre-test	40.8	6.3	5.55	3.87*
Post- test	47.1			

* 0.005 level of significance

In Group A for wrist and hand function the calculated paired't' value is 3.87 and't' table value is 3.250 at 0.005 level. Since the calculated't' value is more than 't' table value above value shows that there is significant difference in wrist and hand function following mirror box therapy among stroke subjects.
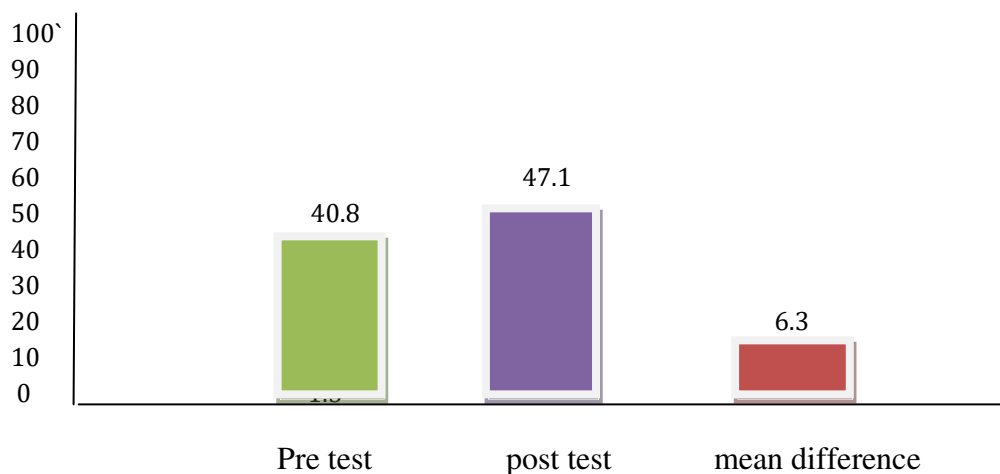

Figure: 5 – Shows the pre test mean, post test mean and mean difference of wrist and hand function for Group A.

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Table 2

The table shows mean value, mean difference, standard deviation and paired't' value between pre and post test scores of wrist and hand function for group B.

Measurement	Mean	Mean Difference	Standard Deviation	Paired 't' Value
Pre-test	43.6	10.4	2.68	12.85*
Post- test	54			

* 0.005 level of significance

In Group B for wrist and hand function the calculated paired't' value is 12.85 and't' table value is 3.250 at 0.005 level. Since the calculated't' value is more than 't' table value above value that there is significant difference in wrist and hand function following proprioceptive neuromuscular facilitation technique among stroke subjects.
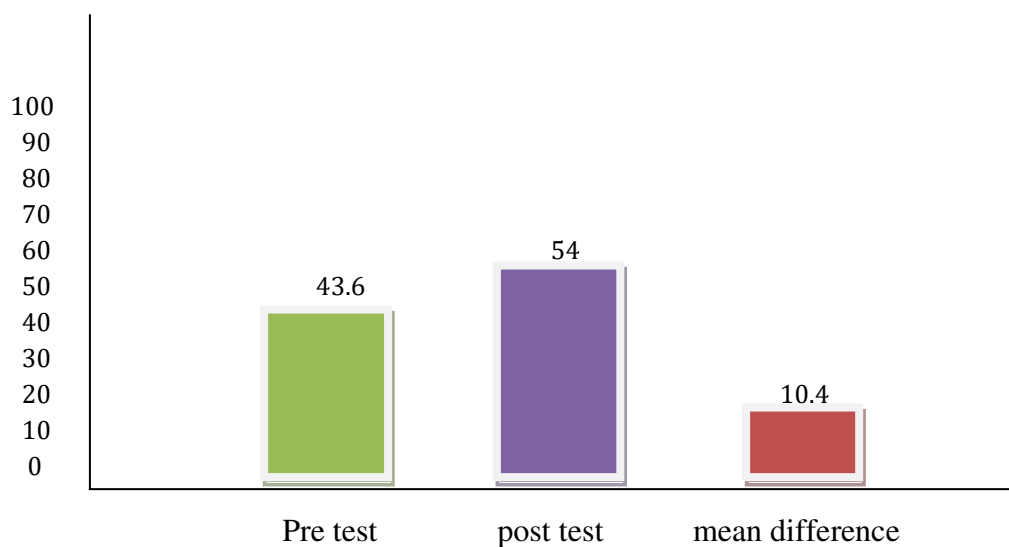

Figure: 6 – Shows the pre test mean, post test mean and mean difference of wrist and hand function for Group B.

Table 3

The table shows the group A mean, group B mean, standard deviation and unpaired 't' value for wrist and hand function .

Sl. No	Variable pain	Mean Difference	Standard Deviation	Unpaired 't' value
1.	Group A	6.3	4.1	4.09
2.	Group B	10.4		

.

* 0.005 level of significance

In Group A and B for wrist and hand function the calculated unpaired't' value is 4.09 and't' table value is 3.250 at 0.005 level. Since the calculated't' value is more than 't' table value above value shows that there is significant difference between mirror box therapy   and proprioceptive neuromuscular facilitation techniques in improving wrist and hand function among stroke patients.
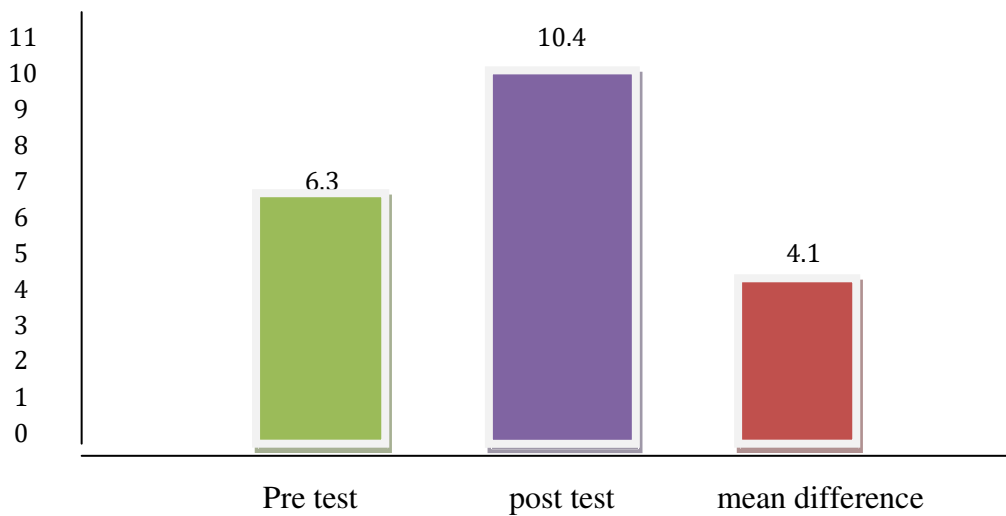

Figure: 7 – Shows the group A mean, group B mean and mean difference for hand and wrist function.

Table 4

The table shows mean value, mean difference, standard deviation and paired 't' value   between pre test mean, post test scores of frequency of upper limb movement for group A.

Measurement	Mean	Mean Difference	Standard Deviation	Paired 't' value
Pre – test	1.6			
Post test	2.9	1.3	0.24	17.11*

 * 0.005 level of significance

In Group A for frequency of upper limb movement the calculated paired 't' value is 17.11 and 't' table value is 3.250 at 0.005 level. Since the calculated 't' value is more than 't' table value above value shows that there is significant frequency of upper limb movement following mirror box therapy among stroke subjects.
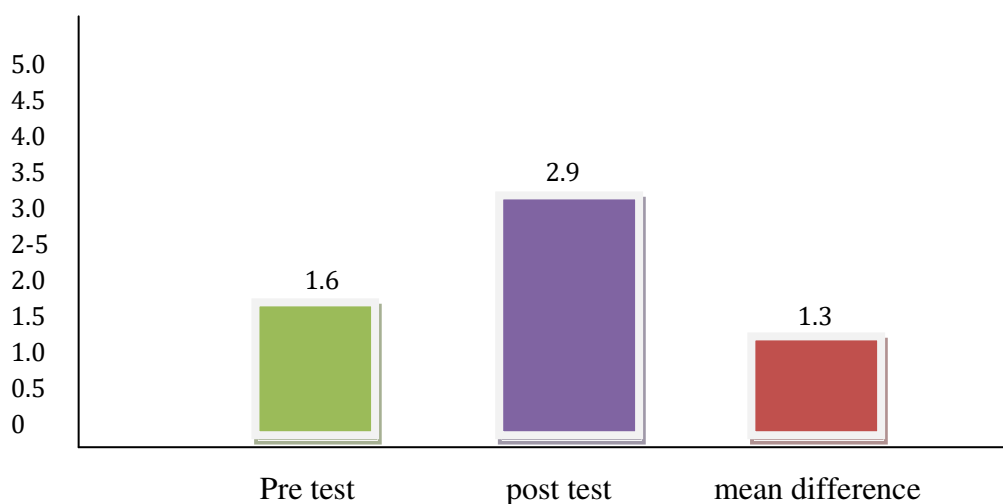

Figure: 8 - Shows the pre test mean, post test mean and mean difference of frequency of upper limb movement for group A.

Table 5

The table shows mean value, mean difference, standard deviation and paired 't' value pre test and post test score of frequency of upper limb movement for group B.

Measurement	Mean	Mean Difference	Standard Deviation	Paired 't' value
Pre – test	1.5			
		1.2	0.56	6.77*
Post - test	2.7			

* 0.005 level of significance

In Group B for frequency of upper limb movement the calculated paired't' table value is 6.77 and't' 3.250 at 0.005 level. Since the calculated't' value is more than 't' table value above value shows that there is significant difference in frequency of upper limb movement following proprioceptive neuromuscular facilitation techniques among stroke subjects.
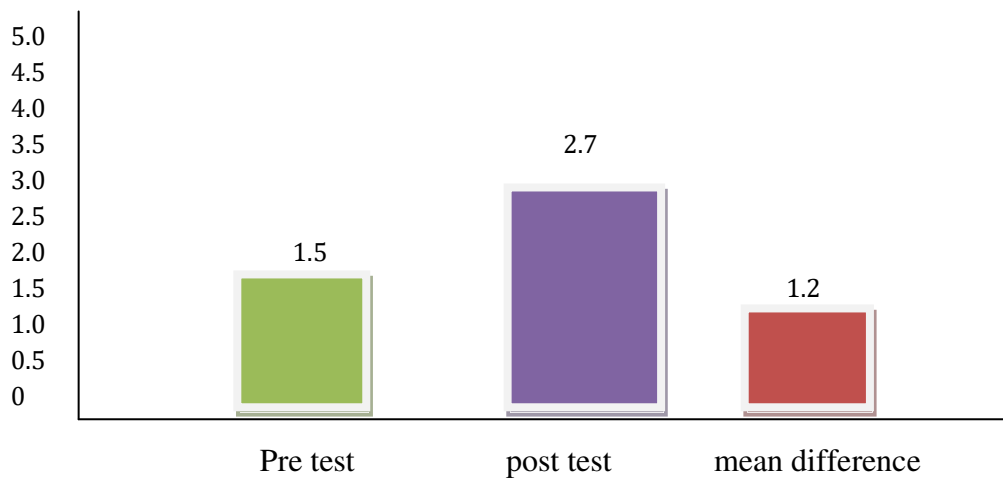

Figure: 9 – Shows the pre test mean, post test mean and mean difference of frequency of upper limb movement for group B.

Table 6

The table shows group A mean, group B mean, standard deviation and unpaired 't' value for frequency of upper limb movement .

Sl. No	Variable Knee function	Mean Difference	Standard Deviation	Unpaired 't' value
1.	Group A	1.3		
2.	Group B	1.2	0.24	9.31

* 0.005 level of significance

In Group A and B for frequency of upper limb movement the calculated unpaired't' value is 9.31 and and't' table value is 3.250 at 0.005 level. Since the calculated't' value is more than 't' table value above value shows that there is significant difference between mirror box therapy and proprioceptive neuromuscular facilitation techniques in the management of frequency of upper limb function among stroke patients.
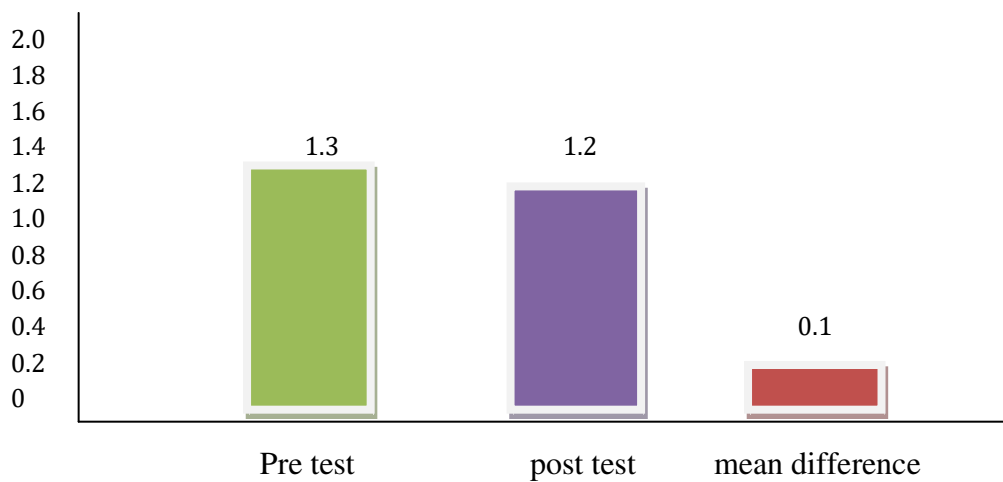
Figure: 10 – Shows the group A mean, group B mean and mean difference for frequency of upper limb movement .

Table 7

The table shows mean value, mean difference, standard deviation and paired 't' value   between pre test mean, post test scores of quality of upper limb movement for group A.

Measurement	Mean	Mean Difference	Standard Deviation	Paired 't' value
Pre – test	1.6			
		1.3	0.26	14.58*
Post test	2.9			

 * 0.05 level of significance

In Group A for quality of upper limb movement the calculated paired't' value is 14.58 and't' table value is 3.250 at 0.005 level. Since the calculated't' value is more than 't' table value above value shows that there is significant difference in quality of upper limb movement following mirror box therapy among stroke subjects.

Figure: 11 - Shows the pre test mean, post test mean and mean difference of Quality of upper limb movement for group A.

Table 8

The table shows mean value, mean difference, standard deviation and 't'

Value pre test and post test score of quality of upper limb function for group B.

Measurement	Mean	Mean Difference	Standard Deviation	Paired 't' value
Pre – test	1.4			
		1.2	0.33	10.5*
Post test	2.6			

* 0.005 level of significance

In Group B for quality of upper limb movement the calculated paired 't' table value is 10.5 and 't' 3.250 at 0.005 level. Since the calculated 't' value is more than 't' table value above value shows that there is significant difference in quality of upper limb movement following proprioceptive neuromuscular facilitation techniques among stroke subjects.
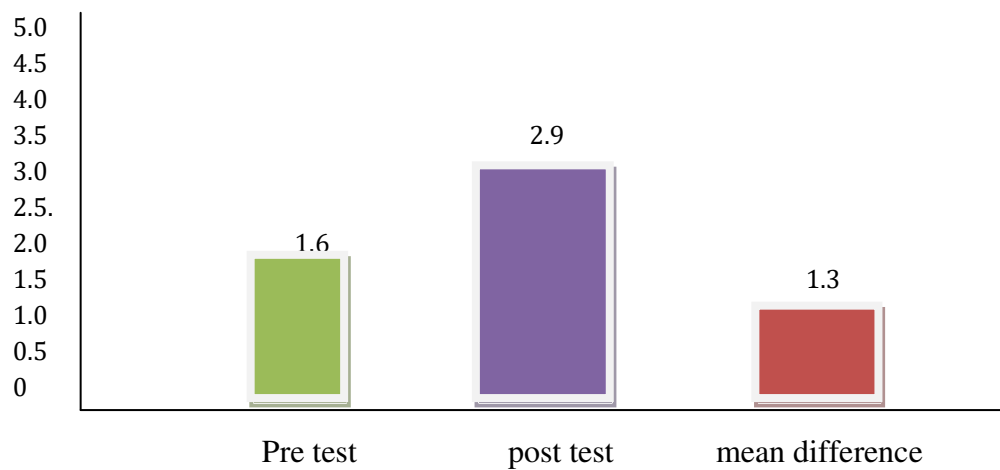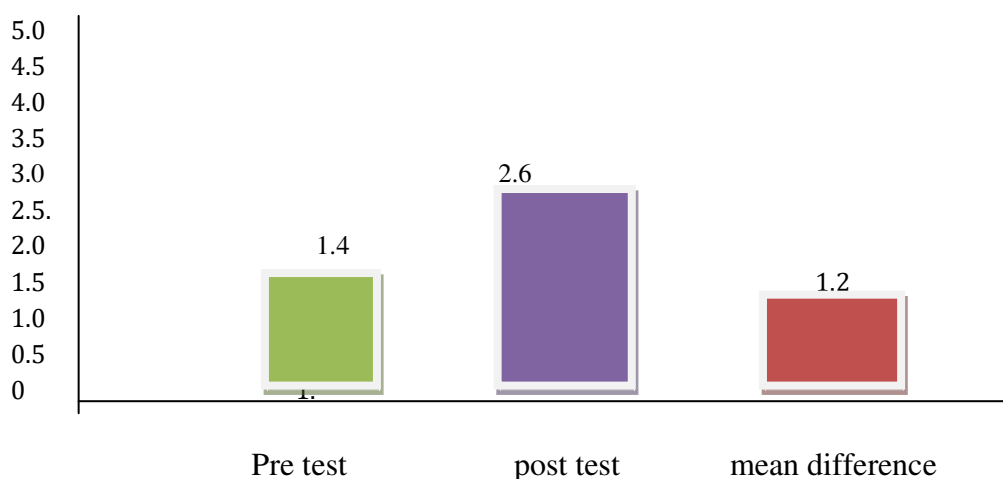

Figure: 12 – Shows the pre test mean, post test mean and mean difference of quality of upper limb movement for group B.

Table 9

The table shows group A mean, group B mean, standard deviation and unpaired't' value for quality of upper limb movement.

Sl. No	Variable Knee function	Mean Difference	Standard Deviation	Unpaired 't' value
1.	Group A	1.3		
2.	Group B	1.2	0.3	7.46

* 0.005 level of significance

In Group A and B for quality of upper limb function the calculated unpaired't' value is 7.46 and and't' table value is 3.250 at 0.005 level. Since the calculated't' value is more than 't' table value above value shows that there is significant difference between mirror box therapy and proprioceptive neuromuscular facilition techniques in the management of quality of upper limb among stroke patients.
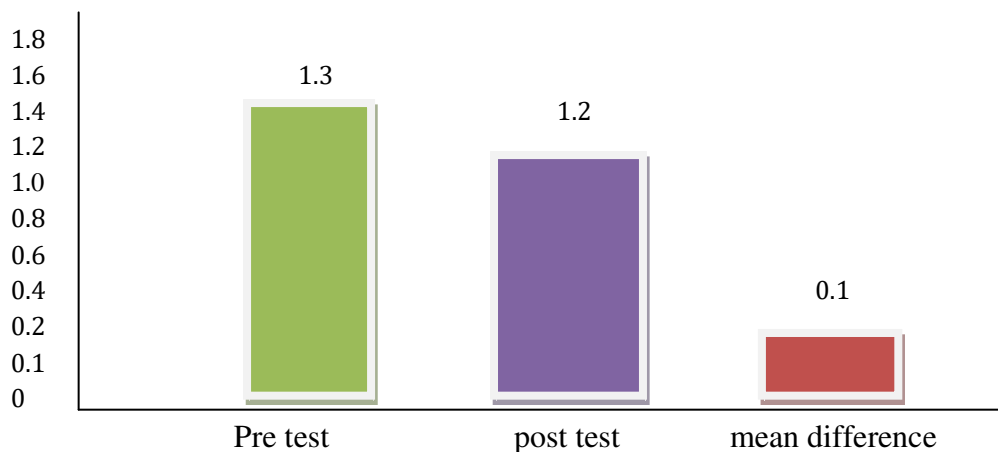
Figure: 13 – Shows the group A mean, group B mean and mean difference for quality of upper limb movement.

4.2 Results

20 stroke subjects were selected for the study. The subjects were randomly divided into two groups.

Group A was treated with Mirror Box Therapy

Group B was treated with Proprioceptive neuromuscular facilitation techniques

The patient was treated for one session a day like that 8 weeks. Before starting the treatment, wrist and hand function was graded by Fugl Meyer's scale and frequency of upper limb movement was graded by motor activity log (how often scale or amount scale). Quality of upper limb movement was graded by motor activity log (how well scale). The measurement was repeated at the end of the study duration.

Analysis of Dependent Variable wrist and hand function in Group A: The calculated paired 't' value is 3.87 and the 't' table 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 wrist and hand function following mirror box therapy among stroke subjects.

Analysis of Dependent variable wrist and hand hand function in Group B: The calculated paired 't' value is 12.85 and the table 't' value is 3.250 at 0.005 level of significant. Hence, the calculated 't' value is greater than the table 't' value there is significant difference in wrist and hand function following proprioceptive neuromuscular facilitation techniques in stroke subjects.

**Analysis of Dependent variable wrist and hand function between Group A and Group B:** The calculated unpaired 't' value is 4.09 and table 't' value is 2.878 at

0.05 level of significance. Hence, the calculated 't' value is greater than table 't' value there is significant difference between mirror box therapy and proprioceptive neuromuscular facilitation techniques in stroke subjects.

When comparing the mean values of Group A and B, Group A subjects treated with mirror box therapy showed more difference than Group B. Hence it is concluded that mirror box therapy is more effective than proprioceptive neuromuscular facilitation techniques in improving wrist and hand function among stroke subjects.

Analysis of Dependent variable frequency of upper limb movement in Group A: The calculated paired 't' value is 17.11 and the paired table 't' value is 3.25 at 0.00 5evel of significance. Hence, the calculated 't' value is greater than the table 't' value there is significant difference in frequency of upper limb movement following mirroe box therapy in stroke subject.

Analysis of Dependent variable frequency of upper limb movement in Group B: The calculated paired 't' value is 6.77 and the paired table 't' value is 3.250at 0.05evel of significance. Hence, the calculated 't' value is greater than the table 't' value there is significant difference in frequency of upper limb movement following proprioceptive neuromuscular facilitation techniques in stroke subjects.

Analysis of Dependent variable frequency of upper limb movement between Group A and Group B: The calculated unpaired 't' value is 9.31 and the unpaired table 't' value is 2.878 at 0.01 level of significance. Hence, the calculated 't' value is greater than table 't' value there is significant difference between mirror box therapy and proprioceptive neuromuscular facilitation techniques in stroke subjects.

When comparing the mean values of Group A and B, Group A subjects treated with mirror box therapy showed more difference than Group B. Hence it is concluded that

mirror box therapy   is more effective than proprioceptive neuromuscular facilition techniques in improving frequency of upper limb movement among stroke subjects.

Analysis of Dependent variable quality of upper limb movement in Group A: The calculated paired't' value is 14.58 and the paired table't' value is 3.250at 0.05evel of significance. Hence, the calculated't' value is greater than the table 't' value there is significant difference in quality of upper limb movement following mirror box therapy in stroke subjects.

Analysis of Dependent variable quality of upper limb movement in Group B: The calculated paired't' value is 10.5 and the paired table't' value is 3.250at 0.05evel of significance. Hence, the calculated't' value is greater than the table 't' value there is significant difference in quality of upper limb movement following proprioceptive neuromuscular facilitation techniques in stroke subjects

Analysis of Dependent variable quality of upper limb movement between Group A and Group B: The calculated unpaired't' value is 7.46 and the unpaired table't' value is 2.878 at 0.01 level of significance. Hence, the calculated't' value is greater than table 't' value there is significant difference between mirror box therapy and proprioceptive neuromuscular facilitation techniques in stroke subjects.

When comparing the mean values of Group A and B, Group A subjects treated with mirror box therapy showed more difference than Group B. Hence it is concluded that mirror box therapy   is more effective than proprioceptive neuromuscular facilitation techniques in improving quality of upper limb movement among stroke subjects

CHAPTER V

DISCUSSION

The study was conducted on 20 subjects. The subjects were divided into two groups, Group A and Group B.

Group A received mirror box therapy for unaffected upper limb

Group B received proprioceptive neuromuscular facilitation techniques for affected upper limb.

The aim of the study was to find out effect and compare the effectiveness of mirror box therapy and proprioceptive neuromuscular facilitation techniques on wrist and hand function and frequency and quality of upper limb movement in stroke subjects.

The result of study shows that wrist and hand function ,frequency and quality of upper limb movement was improved significantly following mirror box therapy in stroke subjects. Mirror therapy is act based on the reflective illusion or artificial visual feed back to brain which stimulate motor neurons in brain (20% of mirror neuron in all our human body).It has a capacity to differentiate right and left side .If right side limb paralysis left mirror neuron connect with left hemiparesis , which stimulate motor performance by visual feedback and proprioception . Mirror therapy increase spinal and cortical neuron excitation.

This result is supported by Mchielson et al.,(2002) in his study "the effect of mirror box therapy on stroke" mirror box therapy was effective treatment in increasing wrist and hand function in stroke patients. Mirror visual feedback (MVF)

studies ,have shown the mirror box therapy help to improve wrist and hand function in patients with stroke.

Chen et al.,(1995)mentioned that mirror box therapy is act on the mirror neuron in premotor cortex of the brain, That will increase spinal and cortical neuron by creating mirror visual field which will stimulate the motor performance .

Mirror box therapy is designed to trick the patient's brain while directly, and eventually, transforming their mind. When patients with chronic pain issues anticipate movements to be painful, mirrors help deceive them into thinking that they are not experiencing pain via dynamic feedback to their brains. "Mirrors and vision are inextricably linked, and the reflected image appears strikingly believable even if deliberately distorted." Using observation of the uninvolved limb helps to "drive proprioception" in the involved limb, thereby normalizing the "movement process." Simply put, the use of the mirror gives the patient the "impression of having two normal limbs."

The finding of the study also shows that wrist and hand function, frequency and quality of upper limb movement were improved significantly with proprioceptive neuromuscular facilitation technique in stroke subjects. The possible mechanisms behind this was, autogenic inhibition and reciprocal inhibition .Its has been accepted as the neurophysiological explanations for the superior range of motion gains that PNF stretching achieves over static and ballistic alternatively. Autogenic inhibition reflex is a sudden relaxation of muscle upon development of high tension. It is a self-induced, inhibitory, negative feedback lengthening reaction that protects against muscle tear. Golgi tendon organs are receptors for the reflex.

Reciprocal inhibition describes the process of muscles on one side of a joint relaxing to accommodate contraction on the other side of that joint. Joints are controlled by two opposing sets of muscles, extensors and flexors, which must work in synchrony for smooth movement. When a muscle spindle is stretched and the stretch reflex is activated, the opposing muscle group must be inhibited to prevent it from working against the resulting contraction of the homonymous muscle. This inhibition is accomplished by the actions of an inhibitory interneuron in the spinal cord.The afferent of the muscle spindle bifurcates in the spinal cord. One branch innervates the alpha motor neuron that causes the homonymous muscle to contract, producing the reflex.

This result is supported by Hugo *et al.,* (2008) his study reveals that effects of proprioceptive neuromuscular facilitation techniques of wrist and hand function, frequency and quality of upper limb movement endured after eight weeks. It was a randomized, controlled trial three sessions of manual therapy to the upper limb results in significantly greater improvement in wrist and hand function, frequency and quality of upper limb movement and the ability to use upper limb in people with stroke are performed at the end range of upper limb use was assessed to found that proprioceptive neuromuscular facilitation technique for the stroke in improving upper limb function are extremely helpful. Seo et al., (1983) proprioceptive neuromuscular facilitation techniques are performed to assess the activity of daily life become easier. They found that proprioceptive neuromuscular facilitation technique is more effective in improving wrist and hand function and frequency, quality of upper limb movement. Proprioceptive neuromuscular facilitation technique significantly improve wrist and hand motor function and result in improvement motor function immediately after the end of the treatment period.

Patterns of facilitation is composed of mass movement patterns of the limbs and the synergistic trunk muscle .The motor cortex generates and organized these movement patterns ,the individual cannot voluntarily leave a muscle out of the movement patterns to which it belongs. PNFpatteren combine motion in all three plane. spiral and sagittal stretch and resistance reinforce the effectiveness of the patterns ,as shown by an increased activity in the muscle .

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

CHAPTER VI

CONCLUSION

An experimental study was conducted to investigate the effectiveness of mirror therapy and proprioception neuromuscular facilitation techniques in the management of stroke.

20 patients with stroke were included in this study and randomly divided into two groups A and B each group consist of 10 subjects. Group A was treated with mirror box therapy. Group B was treated with proprioceptive neuromuscular facilitation techniques. Wrist and hand function, frequency and quality of upper limb movement were assessed before and after intervention by Fugl Meyer's Scale and Motor Activity Log (how often and how well scale).

The statistical result shows that there is improvement in both the groups. But when comparing both it was found that mirror box therapy is more effective than proprioceptive neuromuscular facilitation techniques.

5.1 Limitations

- This study was limited to age group between 35-45 yrs only.
- The study sample size was small.

5.2 Recommendation

- A study can also be done for the other age groups.
- A study can also be done using large population.

- A study can also be done with other form of exercise combination to know the effect of combined treatment.

- A study can be done with different variables.

- Number of subject can be increase.

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ANNEXURES

ANNEUXURE - 1

ASSESSMENT CHART

Physical Therapy assessment chart

Subjective assessment:

Name

Age

Sex

Occupation

Chief Complaints

Medical history

a)Past medical history:

b)Present illness:

Family/Social Therapy

Associated problems

Vital signs

Temperature	Pulse rate	Respiratory rate	Blood pressure

Objective assessment

On observation

      Built

      Posture

      Attitude of limbs

      Muscle wasting

      Edema

      Involuntary movement

      Gait

      Deformity

On Palpation

      Tenderness

      Swelling

      Muscle tightness

      Warmth

      Other if any

Pain assessment

      Side

      Site

      Duration

      Nature

      Aggravation factor

      Relieving factor

      Other if any

On examination

Higher function

- Conciousness

- Cognition

- Orientation

- Attention span

- Memory

- Abstract thinking

- Insight, judgment, planning

- Spatial

- Perception.

Speech

- Sound production

- Articulation

- Understanding & expressing words

Hearing

Cranial nerves

- Olfactory

- Optic

- Occulomotor, Trochlear, Abducement

- Trigeminal

- Facial nrve

- Vestibule cochlear

- Glossopharyngeal

- Vagus

- Accessory

- Hypoglossal

Musculoskeletal system

- Fracture

- Muscle contracture

- Joint stiffness

- Joint subluxation

- osteoporosis

Reflexes

- Superficial

- Deep

- Primitive

- Pathological

Co ordination

- Equilibrium assessment

- Non equilibrium assessment

Balance

- Static

- Sitting

- Standing

- Balance reaction

Hand function

- Power and precision grip

- Reaching

- Grasping

- Releasing

Functional Assessment

- ADL

- Functional status (Disease specific scales)

Diagnosis

Problem list

Short term & long term goals.

Fugl meyer's scale score for wrist and hand function

Table 10: Pre and post values of group A for wrist and hand function.

SL.NO	PRE TEST	POST TEST
1	40	50
2	38	45
3	40	47
4	42	48
5	43	51
6	44	50
7	39	43
8	37	42
9	42	47
10	43	48

Table 11: Pre and post test value of group B for wrist and hand function.

SL.NO	PRE TSET	POST TEST
1	40	55
2	38	49
3	44	52
4	43	50
5	45	57
6	40	53
7	42	56
8	48	54
9	50	60
10	46	54

Motor activity log (How often or amount scale)

Table 12: The pre and post test value of group A for frequency of upper limb movement

SL.NO	PRE TEST	POST TEST
1	1.5	3
2	1	2
3	1.5	3
4	2	3
5	1	2.5
6	2	3
7	2	3
8	1.5	3
9	1.5	3
10	2	2.5

Table 13: The pre and post test values of group B for frequency of upper limb movement

SL.NO	PRE TEST	POST TEST
1	1.5	2.5
2	1	2
3	1.5	2.5
4	1.5	3
5	2	3
6	1.5	3
7	1.5	3
8	2	3
9	1	3
10	1.5	2.5

Motor activity log (How well scale) score for quality of upper limb movement

Table 14: Pre and post values of group A for quality of upper limb movement

SL.NO	PRE TEST	POST TEST
1	1	2
2	1.5	3
3	1.5	2.5
4	1.5	3
5	2	3
6	2	3.5
7	1.5	3
8	1.5	3
9	2	3
10	2	3

Table 15: Pre and post test value of group B for quality of upper limb movement

SL.NO	PRE TSET	POST TEST
1	1.5	2
2	1	2.5
3	2	3
4	1	2
5	1.5	3
6	1.5	2.5
7	1.5	3
8	1.5	2
9	1.5	3
10	1.5	2.5

ANNUXTURE III

Fugl meyer assessment

The FM consists of a 33-item upper-extremity subscale (UE-FM) and a 17-item lower-extremity subscale.

The UE-FM items are related to movements of the proximal and distal parts of the upper extremities and include reflex testing, movement observation, grasp testing and assessment of coordination.

The items of the FM are mainly scored on a 3-point scale from 0 to 2.

Scoring ranges from 0 to a maximum of 66 for the UE-FM.

Higher scores indicate a higher level function (i.e. a lower level of impairment) (Deakin, et al., 2009)

UE-FM Scoring (points):

0 Unable to perform

1 Able to perform in part

2   Able to perform.

Manual for the fugl Meyer's assessment

1.Shoulder / elbow/forearm

1.1 Reflex activity - Biceps /triceps and finger flexors

- No activity present   0

- Reflex activity present   2

1.2 Flexor synergy

Touch your ear with weaker hand. The patient may be asked to repeat the movement up to three times to enable observation.

- Cannot performed   0
- Detail partly performed   1
- Detail is performed faultlessly   2

1.3 Extensor synergy

Starting position is the full flexor synergy .The patient may be helped to achieve the starting position. Move your hand from ear to your opposite knee. The patient may be asked to repeat the movement up to three times to enable observation.

- Cannot performed   0
- Detail partly performed   1
- Detail is performed faultlessly   2

1.4 Volitional movement mixing synergies

1.4.1 Hand on the lumbar spine

Put your hand on your back .The patient has to move forward on the chair for this item may be given some support for balance. Score as previously, for a score of 2 the patient's hand must go higher than the anterior superior iliac spine.

1.4.2 Shoulder flexion 0- 90°

Lift your arm straight up, keep your thumb pointing up . Score as previously ,the elbow must remain fully extended for a score of 2 .

1.4.3 Forearm supination / pronation

Turn your palm face up and face down. Starting position elbow actively held at 90°.

Elbow and shoulder position must be maintained to score 1 or 2.

1.5 Volitional movement without synergy

1.5.1 Shoulder abduction 0-90°.

Lift your arm out to the side. Score as previously, elbow must be extended and forearm pronated to score 2.

1.5.2 Shoulder flexion 90° -180°

Examiner may help the patient to achieve the starting position. Lift your hand towards the ceiling, keep your elbow straight and thumb pointing up. Score as previously.

1.5.3 Forearm pronation/supination

Shoulder should be between 30° and 90° of flexion. Turn your palm face up and face down, with your elbow straight. Score as previously**.**

1.6 Normal reflex activity

Test only if full markers given in section 5.Test the three reflex as in section 1.1.

- 2 or 3 markedly hyperactive   0
- 2 lively or 1 hyperactive   1
- 1 or no lively reflexes   2

2. Wrist

2.1 wrist stability (elbow 90°)

Apply resistance at 15° dorsiflexion .The elbow may be supported if needed. Lift your hand up and hold it there, keep your elbow bent**.**

- 15° dorsiflexion cannot be performed   0
- Dorsiflexion performed but not against resistance   1
- Position can be maintained against slight resistance   2

2.2 wrist flexion/extension(elbow90°)

The elbow may be supported if needed. Lift your hand up and down, keep your elbow bent.

- No voluntary movement   0
- Voluntary movement but no through total passive range   1
- Movement through total passive movement   2

2.3 wrist stability (elbow 90°)

Apply resistance at 15° dorsiflexion .

The elbow may be supported if needed.

Lift your hand up and hold the position there with your arm straight .

- 15° dorsiflexion cannot be performed   0
- Dorsiflexion performed but not against resistance   1
- Position can be maintained against slight resistance   2

2.4 wrist flexion/extension(elbow90°)

The elbow may be supported if needed. Lift your hand up and down ,keep your arm straight .

- No voluntary movement   0
- Voluntary movement but no through total passive range   1
- Movement through total passive movement   2

2.5 wrist circumduction

Move your hand around; keep your elbow bent and your arm still.

- Movement cannot be performed   0
- Jerky motion or incomplete circumduction   1
- Detail performed fully and adequately   2

3. Hand

For all the items the examiner may support the patient's elbow at 90°

3.1 Mass flexion

Make a fist.

- No flexion   0
- Some but not full active finger flexion   1
- Full active flexion (compared to unaffected hand) 2

3.2 Mass extension

Stretch out your hand .

- No extension occur   0
- Can release mass flexion grasp   1
- Full active extension (compared to unaffected hand) 2

3.3 Distal finger grasp

Grip my finger –hold it.

- Required position cannot be achieved   0
- Grasp is weak   1
- Grasp maintained against resistance   2

3.4 Thumb adduction grasp

Grip the paper between your thumb and hand.

- Function cannot be performed   0
- Paper held between thumb and index metacarpal

  can be in place but not against a tug   1
- Paper is held well againt a tug   2

3.5 thumb to index finger grasp

Hold the pencil-keep it there.

- Pencil cannot be held   0
- Pencil can be held but not against a tug   1
- Pencil can held against a tug   2

3.6 Cylinder grasp

Plastic mug diameter 8 cm .Hold the ball-keep it there.

- Mug cannot be held   0
- Mug can be held but not against a tug   1
- Mug is held against a tug   2

3.7 spherical grasp

Tennis ball. Hold the ball –keep it there.

- Ball cannot be held   0
- Ball can be held but not against a tug   1
- Ball is held against a tug   2

4. Co-ordination and speed

Finger to nose test: the patient is blind folded. He first performs the test with the non paretic side then the paretic side. Each test is timed. Touch your finger to your nose five times as quickly as you can.

4.1 Tremor

- No tremor   2
- Slight tremor   1
- Marked tremor   0

4.2 Dysmetria

(Error in endpoint destination)

- No dysmetria   2

- Slight   dysmetria   1

- Marked dysmetria   0

4.3 Speed

- Lass then 2 seconds difference between sides   2

- 2-5 seconds difference   1

- At least 6 seconds difference   0

ANNEXTURE IV

Upper Extremity Motor Activity Log
(UE MAL)

1. General

This instrument is a structured interview intended to examine how much and how well the subject uses their more-affected arm outside of the laboratory setting. Participants are asked standardized questions about the amount of use of their more-affected arm (Amount Scale or AS) and the quality of their movement (How Well Scale or HW) during the functional activities indicated. The scales are printed on separate sheets of paper and are placed in front of the participant during test administration. participants should be told that they can give half scores (i.e., 0.5,1.5,2.5,3.5,4.5) if this is reflective of their ratings is a structured interview intended to examine how much and how well .

2. Rating Scales

Both the AS and HW scales are used during all test administrations, except for the periodic

Administration of the MAL during treatment, when only the HW scale is used. In all administrations except those done during treatment, begin with the AS scale and ask participants to rate all tasks using the AS scale first. (See Comment 1at the end of the manual) The tester then describes to the participant the difference between the AS and HW scales (as suggested in the instructions) and the UE MAL Video are shown. The participant then rates all tasks performed with the HW scale. The UE MAL Demonstration Video is not shown at the screening administration (first administration) or for administrations during treatment,but it is shown again during post-treatment administration. (See Comment 5c) The tester should not ask the participant to rate the

more-affected UE on the HW scale if they have already rated the more-affected UE a s a 0 for the AS.

Amount Scale

0 - Did not use my weaker arm (not used).

.5

1 - Occasionally used my weakerarm but only very rarely (very rarely).

1.5

2 - Sometimes used my weaker arm but did the activity most of the timewith my stronger arm (rarely).

2.5

3 - Used my weaker arm about half as much as before the stroke (half pre-stroke).

3.5

4 - Used my weaker arm almost as much as before the stroke (3/4 pre-stroke).

4.5

5 - Used my weaker arm as often as before the stroke (same as pre-stroke).

How Well Scale

0 - My weaker arm was not usedat all for that activity (not used).

.5

1 - My weaker arm was moved during that activity but was not helpful (very poor).

1.5

2 - My weaker arm was of some use during that activity but needed some help from the stronge , moved very slowly, or with difficulty (poor).

2.5

3 - My weaker arm was used for that activity but the movements were slow or were made only withsome effort (fair).

3.5

4 - The movements made by my weaker arm for thatactivity were almost normal but not quite as fast or accurate as normal (almost normal).

4.5

5 - The ability to use my weaker arm for thatactivity was as good as before the stroke (normal)

ANNEXURE - V

PATIENT CONSENT FORM

I . . . . Voluntarily consent to participate in the research named on **"A STUDY ON THE EFFECTIVENESS OF MIRROR BOX THERAPY AND PROPRIOCEPTIVE NEUROMUSCULAR FACILITION TECHNIQUE IN MANAGEMENT OF UPPER LIMB FUNCTION AMONG 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

Date :

Place :