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A STUDY TO ASSESS THE EFFECTIVENESS OF MIRROR THERAPY TO IMPROVE UPPER EXTREMITY MOTOR FUNCTION IN STROKE PATIENTS AT PSG HOSPITALS, COIMBATORE

By

GOKILA.S

A dissertation submitted to **The Tamil Nadu Dr. M G R Medical University,**
Chennai in partial fulfillment of requirement of the degree of

Master of Science in Nursing

Branch I Medical Surgical Nursing

2016

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2016

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ABSTRACT

A study to assess the effectiveness of mirror therapy to improve upper extremity motor function in stroke patients at PSG Hospitals, Coimbatore

Background of the study: Stroke is a global health problem. It is the second commonest cause of death and fourth leading cause of disability worldwide. Mirror therapy is a relatively new approach in rehabilitation used in different neurological disorders including stroke. In mirror therapy, a mirror is placed beside the unaffected limb, blocking the view of the affected limb. This creates the illusion that both limbs are functioning properly. Evidence suggests that damaged areas of the brain's motor cortex may improve by viewing movements of intact, functioning limbs.

Objective: The main objective of the study was to evaluate the effectiveness of mirror therapy on motor function of upper extremity in intervention group and sham therapy in comparison group.

Methods: The research design adopted was True experimental pre test post test design. The sample size was 30 stroke patients with impaired upper extremity motor function in PSG hospitals. Purposive sampling technique was used in this study. Patients were randomly assigned into 15 in the intervention group and 15 in the comparison group. Brunnstrom motor recovery scale III and IV stage patients were selected for this study. Fugl- Meyer Assessment tool were used to assess upper extremity motor performance, sensory function, passive joint motion and joint pain. Pre test data were collected on the first day of intervention in both groups using Fugl-Meyer Assessment. Post test I and post test II data were collected at the 7^{th} and 14^{th} day of intervention in both groups using Fugl-Meyer Assessment. Mirror therapy was administered 30 minutes/ day and 7 times a week for minimum 2 weeks and maximum till the discharge for intervention group. Sham therapy was administered 30 minutes/ day and 7 times a week for minimum 2 weeks and maximum till the discharge for comparison group.

Major findings of the study: There was a significant improvement of motor performance in intervention group than comparison group in patients with stroke ($t=10.05$, $p<0.05$). There was a significant improvement of sensory function in intervention group than comparison group in patients with stroke ($t=8.67$, $p<0.05$). There was a statistically significant improvement of passive joint motion in intervention group than comparison group in patients with stroke ($t=8.50$, $p<0.05$). There was a significant improvement of joint pain in intervention group than comparison group in patients with stroke ($t=10.83$, $p<0.05$).

Conclusion: Mirror therapy was an effective, inexpensive and non pharmacological measure for improving upper extremity motor function. The study result showed that there was a significant improvement in upper extremity motor function involving motor performance, sensory function, passive joint motion and joint pain among stroke patients in intervention group compared with sham therapy group.

Key words:

Stroke, Mirror therapy, Sham therapy, Brunnstrom motor recovery scale, Fugl-Meyer Assessment.

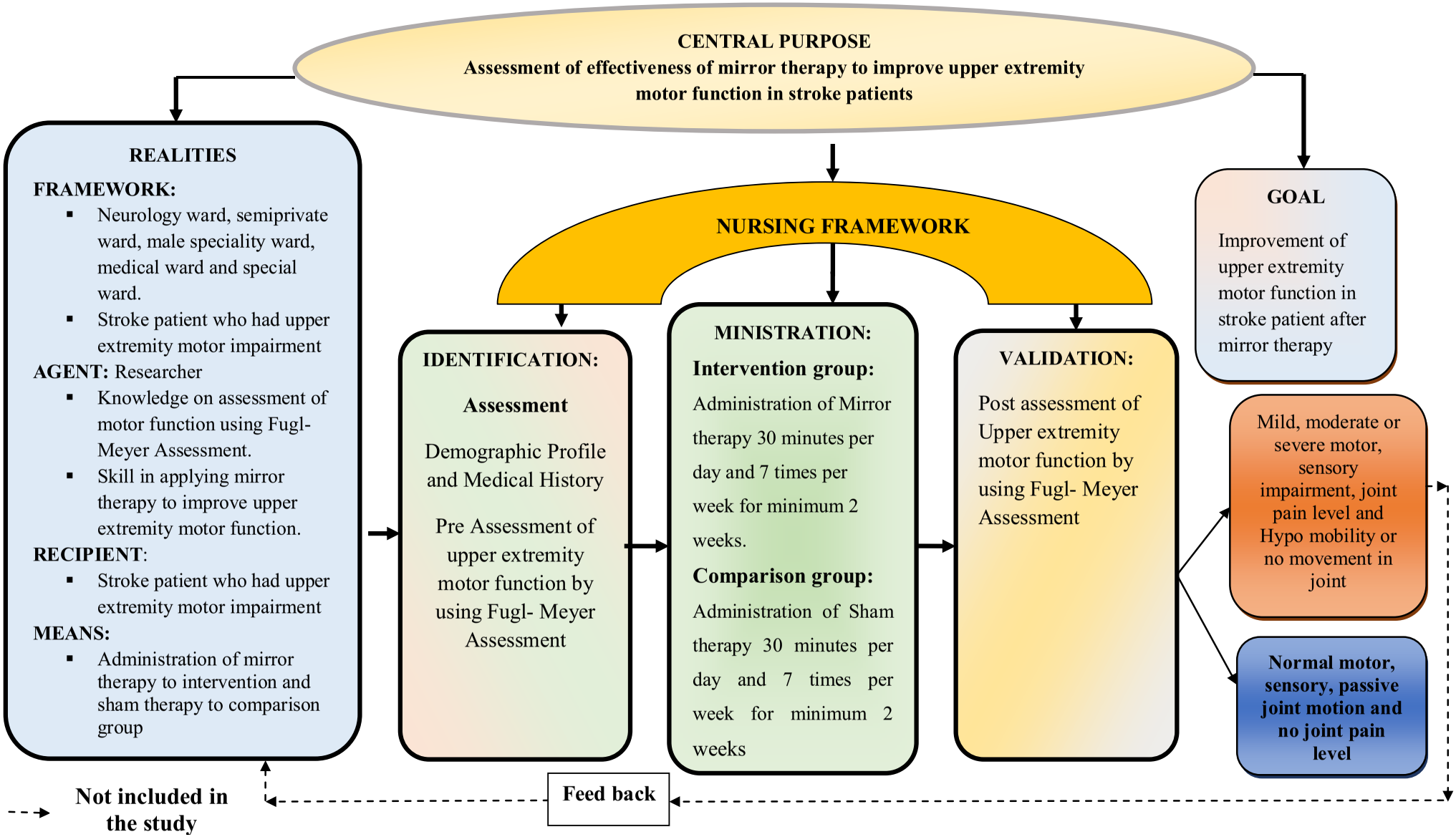

Figure 1.1 Modified Wiedenbach's prescriptive Theory to assess the effectiveness of mirror therapy to improve upper extremity motor function in stroke patients.

CHAPTER-I

INTRODUCTION

"A healthy man is a successful man"

1.1 Background of the study

Health is a dynamic process and it is always changing. All have times of good health, times of sickness, and maybe even times of serious illness. Health is the level of functional and (or) metabolic efficiency of a living being. Health is the general condition of a person in the mind, body and spirit, usually meaning to be free from illness, injury or pain. An impairment of the normal state of a human being that interrupts or modifies its vital functions is known as disease. **(Bradshaz Y, et al., 2011)**

India is a country with almost 1.2 billion peoples. India is the second most populous country of the world and has changing socio-political demographic and morbidity patterns. Despite several growths orientated policies adopted by the government, the widening economic, regional and gender disparities are posing challenges for the health sector. Communicable diseases such as typhoid, infectious hepatitis, measles, malaria, tuberculosis, whooping cough, pneumonia and reproductive tract infections dominate the morbidity pattern, especially in rural areas. However, non-communicable diseases such as stroke, cancer, blindness, mental illness, hypertension, diabetes, HIV/AIDS, accidents and injuries are also on the rise. India, like other developing countries, is in the midst of a stroke epidemic. There is a huge burden of strokes with significant regional variations. **(Somasundaram, et al., 2015)**

According to a recent study published in the Journal of stroke, the prevalence rate of strokes is 84 to 262 per 100,000 populations in rural India and 334 to 424 out of 100,000 populations in cities. **(Jeyaraj Durai Pandian, 2015)**

Stroke is becoming an important cause of premature death and disability in low-income and middle-income countries like India, largely driven by demographic

changes and enhanced by the increasing prevalence of the key modifiable risk factors. As a result developing countries are exposed to a double burden of both communicable and non-communicable diseases. The poor are increasingly affected by stroke, because of both the changing population exposures to risk factors and, most tragically, not being able to afford the high cost for stroke care. Majority of stroke survivors continue to live with disabilities, and the costs of on-going rehabilitation and long term-care are largely undertaken by family members, which impoverish their families. **(Anand, et al., 2001)**

A stroke, sometimes called a brain attack, occurs when a clot blocks the blood supply to the brain or when a blood vessel in the brain bursts. Stroke can be caused by either too little blood to the brain, a ischemic stroke, or too much blood in the skull, a hemorrhagic stroke. Damage to the brain cause by a stroke may lead to problems with speech as well as movement in a leg or arm. The area that suffers damage and the extent of that damage will depend on which area of the brain was damaged and how badly. Studies show that both physical and mental therapy techniques can be used to improve the patient's responses, and various types of stroke rehabilitation are encouraged to help regain speech and motor functions. **(Zafer, et al., 2014)**

Stroke rehabilitation typically includes both mental and physical therapy techniques. Patients are encouraged to continue with both in order to combat the damage that has been present in the brain. As well as regular exercise and therapy techniques that can also be considered for those areas of the body that have been affected by the effects of stroke. **(Gaziham, et al., 2010)**

Rehabilitation is an active participatory process to minimize the neurological impairment resulting from stroke. The main goal of the rehabilitation is to return the patient to home and maximize recovery by providing safe, progressive regimen suited to the individual patient. Proper rehabilitation of stroke patients includes early physical, occupational and speech therapy. Proper rehabilitation therapies results in better motor recovery and reverse the disabilities caused by stroke. **(Torgier Brunn, 2014)**

Mirror therapy is a relatively new approach in rehabilitation used in different neurological disorders including stroke. Mirror therapy was originally developed for the relief of phantom limb pain, but has been extended in the treatment of stroke rehabilitation, and complex regional pain syndrome, as well as for hand and foot rehabilitation following an injury or surgery. **(Tinson D.J, 2010)**

Mirror therapy was first described by V.S. Ramachandran, Director of the centre for brain and cognition and professor with the psychology department and the neurosciences program at the university of California, san Diego.Mirror therapy is a drug free treatment and has been described in medical literature to be of benefit to 80% of users – some even report numbers as high as 95% and that rehabilitation can be dramatically improved by integrating physical and mental practice. By utilizing mirrors to trick patients' brains into thinking that they were moving their hand or limb. **(Kynan, 2007)**

In mirror therapy, patient places the affected limb inside the mirror box and their unaffected limb in front of the mirror. Seeing the reflection of the unaffected limb, the patient thus receives visual feedback from a virtual image of their affected limb appearing as if it is normal. While scanning the brain using a Magnetic Resonance Imaging (MRI) has shown that by using a mirror box as often and as long as comfortable the neuro network within the brain can start to rewire itself to map its new profile and compensate for the damaged or missing limb, improving the patients quality of life. **(Solodkin, 2007)**

1.2 Need for the study

Strokes can cause much neurological impairment, which may lead to a reduction in the performance of activities of daily living. In most strokes, upper extremity was affected more than lower extremity. Lack of movement especially if the dominant arm is affected, can be frightening and frustrating for the patient, since the hand performs so many functions than the leg. The reason why the upper limb is more affected is the cortical representation of the hand is high and the lesion picks up more

fibers supplying the hand than the rest of the body, especially the fine motor movement. **(Susan, 2008)**

Current rehabilitation techniques focus on occupational and physical therapy, using guided limb manipulation and task-oriented training. These exercises combine passive and active movement in an attempt to rebuild neuronal connections damaged by the stroke. Adding mirror therapy to traditional therapy enlists visual stimulation showing improvement in motor function. **(Lalit Kalra, 2012)**

In mirror therapy, a mirror is placed beside the unaffected limb, blocking the view of the affected limb. This creates the illusion that both limbs are functioning properly. Mirror therapy is based on evidence that action observation activates the same motor areas of the brain as action execution. Observed actions lead to the generation of intended actions, engaging motor planning and execution. Further, evidence suggests that damaged areas of the brain's motor cortex may improve by viewing movements of intact, functioning limbs. **(Sutbeyz, 2007)**

Mirror therapy is effective in improving upper limb function like ROM, speed, accuracy of arm movement in hemiparetic stroke patients than without. The true experimental study was conducted to find out the effectiveness of mirror therapy to improve hand function among sub acute stroke patient. The study concluded that two weeks of intense mirror therapy in chronic stroke patients resulted in significant recovery of grip strength and hand movement of paretic arm. (**Sathian, et al., 2013)**

Mirror therapy is simple, inexpensive and has no side effect. So it can use for old age stroke patients those who having difficulty to perform other type of exercise. Research studies suggests that mirror therapy will improve motor activity, gait pattern and reduction in spasticity. **(Altschuler E.L, et al., 2008)**

Mirror neurons play a major explanatory role in understanding of a number of human features, from imitation to empathy, mind reading and language learning. In humans they have been found mirror neurons in broca's area and inferior parietal cortex of brain. Visual stimuli enhance neuroplastic changes within brain in evidence

of cortical reorganization of primary somatosenory cortex by visual feedback. **(Hofner, et al., 2003)**

Mirror therapy has been shown to increase cortical and spinal motor excitability, possibly through the effect on the mirror neuron system. Mirror neurons accounts for about 20% of all the neurons present in a human brain. These mirror neurons are responsible for laterality reconstruction that was ability to differentiate between the left and the right side. When using the mirror box, these mirror neurons gets activated and helps in the recovery of affected parts. This system was thought to use the observation of movement to stimulate the motor processes which would be involved in that movement. Similarities have been drawn with motor imagery where by the individual will mentally imagine movements rather than observing the reflection of a movement in a mirror. **(Yavuzer .G, et al., 2008)**

Sham therapy (placebo therapy) is a faked intervention or treatment that omits the step thought to be therapeutically necessary. In some studies, placebo or sham therapy was used to identify the effectiveness of mirror therapy. In sham therapy reflecting side of the mirror was covered or in the other form patient looked at bilateral arm training, just the same training as the patients in the mirror therapy group did but without the mirror. **(Thieme, 2014)**

Mirror therapy is a relatively new therapeutic intervention which focuses on use of unimpaired limb to train affected limb which has been suggested to enhance the capability of impaired limb. In the recent years there has been extensive research about the various therapeutic measures that have been used for recovery of upper limb function. But very few studies have been done to evaluate effectiveness of mirror therapy. So the purpose of the present study was to analyze the effectiveness of mirror therapy to improving upper extremity motor function among stroke patient.

1.3 Statement of the problem:

A study to assess the effectiveness of mirror therapy to improve upper extremity motor function in stroke patients at PSG hospitals, Coimbatore

1.4 Objectives:

- To assess the motor function of upper extremity in stroke patients.
- To evaluate the effectiveness of mirror therapy on motor function of upper extremity in intervention group and sham therapy in comparison group.
- To associate the motor function of upper extremity in stroke patient with demographic variables.

1.5 Assumption

- Patients after stroke may have decreased motor function in upper extremity.
- Mirror therapy improves the motor function of the affected upper extremity.
- Mirror therapy is more effective in improving the upper extremity motor function in stroke patients than sham therapy.

1.6 Hypothesis:

- **H_1**: There will be a significant difference between motor function of upper extremity in stroke patient before and after administration of mirror therapy between intervention and comparison group.
- **H_2:** There will be association between pre test upper extremity motor function and selected demographic variables of the stroke patients.

1.7 Delimitation of the study:

- The study is delimited to only upper extremity motor function is measured using Fugl-Meyer Assessment.

1.8 Operational definition:

Effectiveness:

Effectiveness refers to the outcome of mirror therapy among stroke patient in terms of improving upper extremity motor function as measured by Fugl-Meyer Assessment.

Mirror therapy:

Mirror therapy refers to a special form of therapy designed for stroke patient, and the therapy is given with the help of mirror box, which is triangular in shape, with one side mirror. Mirror therapy is administered for 30 minutes daily and 7 days per week for minimum 2 weeks.

Motor function:

Motor function refers to movement to achieve normal motor performance, sensation, passive joint motion and reduction of joint pain among stroke patients measured by Fugl-Meyer Assessment.

Stroke patient:

In this study, it refers to the patient with Cerebro Vascular Accident who had impaired upper extremity Motor function and stage III and IV Brunnstrom motor recovery scale.

Sham therapy:

Sham therapy refers to a fake treatment, which intended to mimic the mirror therapy, in which non reflective side of mirror was used. Sham therapy is administered for 30 minutes daily and 7 days per week for minimum 2 weeks.

1.9 Projected outcome:

Stroke patients will improve in motor function of upper extremity after administration of mirror therapy.

1.10 Conceptual framework

Modified Wiedenbach's helping art of clinical nursing theory:

The conceptual frame work for this study was derived from modified Wiedenbach's helping art of clinical nursing theory (Fawcett, 1997). This study was based on the concept that mirror therapy helps to improve the upper extremity motor functions in stroke patients. The investigator adopted the modified Wiedenbach's helping art of clinical nursing theory as a base for developing the conceptual framework. Ernestine Wiedenbach's proposed a prescriptive theory for nursing, which is described as conceiving of a decide solution and the ways to attain it. It directs action towards an explicit goal. This theory has three factors.

1. Central purpose
2. Prescription
3. Realities

Central purpose: It refers to what the nurse wants to accomplish. It is the overall goal towards which a nurse strives. In this study the main central purpose is the assessment of mirror therapy to improve upper extremity motor function in stroke patients.

Realities: It refers to the physical, physiological, emotional and spiritual factors that involves in nursing actions. In this theory there are four realities. They are as follows:

Frame work: It refers to the place in which it is practised. Here it refers to the stroke patients who had upper extremity motor impairment. This study was conducted in Neuro ward, semiprivate ward, male speciality ward, medical ward and special ward.

Agent: One who directs all action towards the goal and has capacities, capabilities, commitment and competence to provide care. In this study agent is the researcher who directs all the action towards the goal.

Recipient: One who is vulnerable and dependent and receives all attention. Here the entire stroke patients admitted with upper extremity impairment is the recipient of the mirror therapy.

Means: This refers to the activities or devices used to achieve the goal. In this study it refers to administration of mirror therapy to the intervention group and sham therapy for comparison group.

Goals: It refers to the desired outcome of the action. Improvement in the level of upper extremity motor function was considered as the goal of the study.

Wiedenbach's nursing practice consists of identification, Ministration and validation.

Identification: It refers to the viewing the individual's unique experiences and perceptions. In this study the client's condition was assessed by using demographic data and Fugl-Meyer Assessment.

Ministration: This step involves provision of required help for the identified need. The mirror therapy is administered 30 minutes per day and 7 times per week for minimum 2 weeks to the intervention group and sham therapy is administered 30 minutes per day and 7 times per week for minimum 2 weeks to the comparison group.

Validation: It refers to the restoration of functional ability through the identification of need and implementation of action. Here it is the post assessment of upper extremity motor function using Fugl-Meyer Assessment after administration of mirror therapy and sham therapy.

CHAPTER-II

REVIEW OF LITERATURE

The term review of literature refers to the activities involved in identifying and searching for information on the topic to develop an understanding of the state of knowledge of the topic. (Burns N, Grove, 2001). A review of relevant literature was collected to generate an extensive review on the search topic in order to gain deeper insight into the problem and collect maximum relevant information for mirror therapy. The literatures gathered and were depicted under the following headings:

2.1 Literature related to stroke

2.2 Literature related to mirror therapy.

2.3 Literature related to mirror therapy improves upper extremity motor function.

2.1 Literature related to stroke

A randomized control study was conducted in Geriatric clinic, Sweden. The objective of the study was to describe the spasticity occurrence and association with motor impairments and activity limitation. Ninety-five patients with first-ever stroke were examined initially (mean, 5.4 days) and 3 months after stroke. Out of the 95 patients studied, 71 were hemiparetic, 18 were spastic, 6 reported muscle stiffness, and 18 had increased tendon reflexes 3 months after stroke. Patients who were nonspastic (n=77) had statistically significant ($p<0.001$) better motor and activity scores (FM scores 35) than spastic patients (n=18) activity scores (FM scores 20). Muscle tone and disability scores were low and severe disabilities were seen in spastic patients. The study concluded that spasticity seems to contribute the disabilities after stroke. **(Bipin, et al., 2010)**

An experimental study was conducted in Auckland, New Zealand to identify the recovery of motor function after stroke. A total of 680 patients were participated. Out of 680 patients, 88% presented with a hemiparaesis. 71% of the patients were had hemiparaesis at 1 month of onset of stroke and 62% of the patients were had

hemiparaesis at 6 months after the onset of the stroke. Recovery of motor function was associated with the stroke severity but not with age or sex. Patients with a mild motor deficit at onset were 10 times more likely to recover their motor function (95% confidence interval (CI) 12.6 to 13.7) than those with a severe stroke (CI 3.3 to 3.5). The study results confirmed that the recovery of motor function is improved to patients whose motor deficit at onset is either mild or moderate deficit. **(Ruth Bonita, 2013).**

A cohort study was conducted in rehabilitation centre at Netherland. The purpose of the study was assessing the long-term motor and functional recovery of arm function after stroke. Fifty-four patients with a first episode of stroke were selected. Fugl-Meyer Motor Assessment (FMA), Action Research Arm Test (ARA) and Ashworth Scale were used to measure the outcome. Most of the improvement occurred during the first 16 weeks after stroke and improvement was continued after 16 weeks in 10 (18.5%) patients (FMA score 20). In 13 (24%) patients the recovery of arm function only started after 16 weeks (ARA score 25). After 4 years a fair to good recovery of arm motor function was found in 31 (57%) patients (AS score 4). The study results investigate that after 4 years, a fair to good recovery of arm motor function was found among stroke patients. (**J. G. Broeks, et al., 2009**)

A prospective study was conducted in Copenhagen, Denmark. The objective of the study was to determine the time course of both neurological and functional recovery from stroke. Totally 1,197 patients with acute stroke were included in this study. Main outcome measured by Scandinavian Neurological Stroke Scale and Barthel Index. The study results showed that functional recovery was completed within 12.5 weeks (95% confidence interval (CI) 11.6 to 13.4) from stroke onset. However, 80% of the patients had reached their best Activity of Daily Living function within 6 weeks (CI 5.3 to 6.7) from onset. The study concluded that a reliable prognosis of all stroke patients is made within 12 weeks from onset. Even in patients with severe and very severe strokes, neurological and functional recovery should not be expected after the first 5 months. **(Henrik Jorgensen, 2010**).

A prospective study was conducted in the Greater Cincinnati, Ohio to assess the current public knowledge of stroke warning signs and risk factor. Telephone calls were made to 17634 households, which yielded 2642 demographically eligible individuals. Interviews were completed by 1880 respondents. A total of 1066 respondents were (57%) correctly listed at least 1 of the 5 established stroke warning signs, and 1274 respondents were (68%) correctly listed at least 1 of the established stroke risk factors. Compared with those younger than 75 years, respondents 75 years or older were less likely to correctly list at least 1 stroke warning sign (60% vs 47%, respectively; $p<.001$) and were less likely to list at least 1 stroke risk factor (72% vs 56%, respectively; $p<.001$). The result of the study showed that Considerable education is needed to increase the public's awareness of the warning signs and risk factors for stroke. **(Pancioli, 2008)**

A prospective study was conducted in neuro rehabilitation hospital, Korea regarding the patients' awareness of stroke signs, symptoms, and risk factors. Totally, 174 patients were included in this study. Out of the 174 eligible patients, 163 patients were able to respond to the interview questions. Of these 163 patients, 39% (63) did not know a single sign or symptom of stroke. Patients aged ≥65 years were less likely to know a sign or symptom of stroke than those aged <65 years (percentage not knowing a single sign or symptom, 47% versus 28%, $p=0.001$). Similarly, 43% of patients did not know a single risk factor for stroke. The elderly were less likely to know a risk factor than their younger patients. The result of the study showed that Almost 40% of patients admitted with a possible stroke did not know the signs, symptoms, or risk factor of a stroke. **(Rashmi Kothari, 2014)**

A descriptive study was conducted in Newcastle urban area in Australia. The aim of the study was to assess baseline knowledge regarding stroke risk factors, symptoms, treatment, and information resources. A total of 1278 potential participants were selected at random from an electronic telephone directory. A total of 822 participants completed the telephone interview. Six hundred three participants (73.4%) correctly identified the brain as the affected organ in stroke. A total of 626 (76.2%) respondents correctly listed ≥1 established stroke risk factor, but only 409 (49.8%)

respondents correctly listed ≥1 warning sign (76.2% vs. 49.8%, p<0.001). The result showed that level of knowledge in the community about stroke risk factors, warning signs, and treatment was inadequate. **(Sung Sug Yoon, 2013)**

A community-based longitudinal study on stroke was conducted in India. Totally 20717 subjects, out of 20842 people from a cluster of 12 villages were surveyed. Altogether 128 first ever stroke cases were detected over 5 years showing an average annual incidence rate of 123.57 per 100,000 populations. First 30 days mortality recorded was 18% with men suffering twice than women. Follow-up after one year revealed speech improvement in 47%, residual spasticity in 46% and independency in activities daily living in 62% of cases. Age and sex matched case control study has shown that hypertension (OR- 2.79), heart disease (OR - 6.20) and smoking (OR - 3.92) are significant risk factors. This study had indicated a higher age, hypertension, heart disease and smoking are important risk factors for stroke**. (Bhattacharya .S, 2011)**

2.2 Literature related to mirror therapy

A case study was showed that the effectiveness of mirror therapy in patients with causalgia (Complex Regional Pain Syndrome Type II) following peripheral nerve injury. The study subjects are two patients with complex regional pain syndrome type II. Pain was measured with a visual analogue scale. The first case had developed a severe burning and constant pain in the hand (VAS score 8). In this patient, a strong reduction in pain was found during and immediately after mirror therapy (VAS score 5). As a result, the patient was able to perform active exercises that were previously too painful. The second patient also had severe burning pain (VAS score 7). In this patient, repeated mirror therapy for a 3-month period strongly decreased pain level (VAS score 4). The presented cases demonstrate that the use of mirror therapy in patients with causalgia was reduced the pain level. **(Selles Ruud .W, et al., 2013)**

A randomized controlled study was conducted in Newcastle, Australia to assess the effectiveness of mirror therapy for phantom limb pain. Randomly assigned 22 patients to one of three groups: one that viewed a reflected image of their intact

foot in a mirror (mirror group), one that viewed a covered mirror (sham group), and one that was trained in mental visualization. Phantom Limb Pain was measured by 100-mm Visual-Analogue Scale. After 4 weeks of treatment, 100% of patients in the mirror group reported a decrease in pain. In contrast, in the covered-mirror group, only one patient (17%) reported a decrease in pain, whereas three patients (50%) reported worsening pain. In the mental-visualization group, two patients (33%) reported a decrease in pain, whereas four patients (67%) reported worsening pain. The study findings showed that mirror therapy reduced phantom limb pain in patients who had undergone amputation of lower limbs. **(Engl J, 2009)**

A randomized controlled study was conducted in Boissezon hospital in Korea to compare the effectiveness of mirror therapy to reduce pain and improve upper limb motor function among complex regional pain syndrome type I and acute stroke patients. 208 patients with first episode of unilateral stroke and 48 patients with Complex regional pain syndrome type 1 of the affected upper limb were enrolled, and assigned to either a mirror therapy group or placebo control group. The primary end points were a reduction of pain measured by visual analogue scale score. The secondary end points were improvement in motor function as assessed by the Wolf Motor Function Test and Motor Activity Log. The mean scores of both the primary and secondary end points significantly improved in the mirror group ($p < 0.001$). The results of the study indicate that mirror therapy effectively reduces pain among complex regional pain syndrome type I patients and enhances upper limb motor function in stroke patients. **(Angelo Cacchio, et al., 2012)**

A pilot study was conducted in Centre Hospital University, Switzerland to assess the effectiveness of home-based self-delivered mirror therapy for phantom pain. Forty community-dwelling adults with unilateral amputation and phantom pain were included. Participants received the mirror therapy and were asked to self-treat for 25 minutes daily. A significant reduction in mean phantom pain intensity was found at month 1 ($n = 31$, $p=0.002$) and at month 2 ($n = 26$, $p = 0.002$). The overall median percentage reduction at month 2 was 15.4%. These findings support the feasibility and efficacy of home-based self-delivered mirror therapy. **(Darnall, et al., 2012)**

A randomized control study was conducted in India to assess the effectiveness of mirror therapy on lower extremity motor recovery, balance and mobility in patients with acute stroke. Totally 22 patients were included, equal number of patients participated in mirror group (n=11) and control group (n=11). Mirror therapy group performed 30 minutes of functional synergy movements of non-paretic lower extremity (SD 0.66; 95% CI 0.05 to 1.50; p = 0.01), whereas control group underwent sham therapy with similar duration (SD 0.66; 95% CI 0.05 to 0.50; p = 0.01). Outcome measured by lower extremity motor subscale of Fugl Meyer Assessment (FMA), Brunnel Balance Assessment (BBA) and Functional Ambulation Categories (FAC). The study concluded that administration of mirror therapy early after stroke was help to improve lower limb motor recovery and balance, except for improvement in mobility. **(Uthra Mohan, et al., 2013)**

A randomized control study was conducted in India to assess the mirror therapy in unilateral neglect after stroke. Forty-eight stroke patients with thalamic and parietal lobe lesions with unilateral neglect were included. Patients were randomized to the mirror therapy group or the sham mirror therapy group, and both the groups received limb activation. Patients received treatment for1–2 hours a day 5 days a week for 4 weeks. Outcome measured by using the star cancellation test, the line bisection test, and a picture identification task at 1, 3, and 6 months. The study results showed that improvement in scores on the star cancellation test over 6 months was greater in the mirror therapy group (mean difference 23). Similarly, improvement in the mirror therapy group was observed in the scores on the picture identification task (mean difference 3.2) and line bisection test (mean difference 8.6). The study concluded that a patient with stroke, mirror therapy is simple treatments that improve unilateral neglect**. (Jeyaraj D. Pandian et al., 2015)**

An experimental study was conducted in Canton city in Switzerland to assess the effects of mirror therapy on the gait of sub acute stroke patients. Thirty-four patients with stroke were randomly assigned to two groups: a mirror therapy group (experimental) and a control group. The stroke patients in the experimental group underwent comprehensive rehabilitation therapy and mirror therapy for the lower

limbs. The stroke patients in the control group underwent sham therapy and comprehensive rehabilitation therapy. Participants in both groups received therapy five days per week for four weeks. Outcome measured by Temporo spatial gait characteristics, such as single stance, stance phase, step length, stride, swing phase, velocity, and cadence. The result of the study showed that a significant difference was observed in post-training gains for the single stance step length and stride length between the experimental group and the control group ($p<0.05$). The study concluded that mirror therapy may be beneficial in improving the effects of stroke on gait ability. **(Sang Gu Ji, et al., 2014).**

A prospective study was conducted in Alabama at Birmingham about visual feedback and brain function. The objective of the study was to find out the use of visual feedback, in restoring brain function. They collected 18 clinical studies of mirror therapy. According to that they suggested that mirror visual feedback [mirror therapy] can accelerate recovery of motor function from wide range of neurological disorder such as phantom pain, hemiparesis from stroke or other brain injury or lesion, complex regional pain syndrome, even in peripheral nerve injury. In this review 4 studies are stroke related and they suggest that mirror therapy stimulate the mirror neurons which are found in frontal lobe as well as the parietal lobe (MD 0.23; 95% CI 0.25 to 0.60; $p = 0.01$). Mirror neuron provides visual input to revive motor neurons. The study concluded that mirror therapy was help to restore brain function. **(V.S Ramchandran, Eric Altsculer, et al., 2009)**.

2.3 Literature related to mirror therapy improve upper extremity motor function

A randomized control study was conducted at a neurological clinic in Tuzla to evaluate the effectiveness of mirror therapy for improving motor function, activities of daily living, pain and visuospatial neglect in patients after stroke. Totally 567 participants were included in this study. Mirror therapy may have a significant effect on motor function than other intervention. Additionally, mirror therapy may improve activities of daily living (SD 0.33; 95% CI 0.05 to 1.60; $p = 0.02$) and pain, visuospatial neglect (SD 1.22; 95% CI 0.24 to 0.29; $p = 0.01$). The study result

showed that mirror therapy help to improving motor function, activities of daily living, pain and visuospatial neglect in patients after stroke. **(Holm Thieme, 2012)**

An experimental study was conducted in neuro clinic, Taiwan to evaluate the effects of mirror therapy on upper-extremity motor recovery, spasticity, and hand-related functioning of patients with sub acute stroke. A total of 40 in patients with stroke were participated. The Brunnstrom stages of motor recovery, spasticity assessed by the Modified Ashworth Scale (MAS), and Functional independence measures were used to measure the outcome. The scores of the Brunnstrom stages for the upper extremity and the Functional independence measures 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 $p<0.01$) and at the 6-month follow-up (by 0.16, 0.43, and 2.34, respectively; all $p<0.05$). The study result showed that mirror therapy help to improve the hand function compared to other interventions. **(Mesut .B, et al., 2007)**

A randomized study was conducted stroke rehabilitation centre, America to evaluate the effects of mirror therapy on upper extremity motor recovery, spasticity, and hand related functioning of patient with sub acute stroke patient. Totally 40 patients were selected. Thirty minutes of mirror therapy program a day consisting of wrist and fingers flexion and extension movement was given. The Brunnstrom stages of motor recovery, Modified Ashworth Scale for spasticity were used. The scores of the Brunnstrom stages for the hand and upper extremity and the Functional Independent Measure self-care score improved more in the mirror group than in the control group after 4 weeks of treatment(CI 0.98, 0.67, and 8.30, respectively; $p<0.01$). So the study concluded that group of sub acute stroke patients, hand functioning improved more after mirror therapy. **(Yavuzerg, et al., 2007)**

A comparative study was conducted to assess the task specific exercise and mirror therapy to improve upper limb function in sub acute stroke patients. Participants were recruited from the Neuro-physiotherapy department, Pravara Institute of Medical Sciences Ahmednagar, Maharashtra State, India. Totally 37 stroke patients were divided into 3 groups. Group A received task specific exercise, group B

received mirror therapy, group C received both mirror therapy and task specific exercise. Action Research Arm Test, Fugl-Meyer Assessment and Voluntary Control Grading were used. Task specific exercises (TSE) mean difference in pre- and post-intervention scores was 4.5 ± 3.06 ($p<0.01$). There was 7.89% improvement. Mirror therapy (MT) mean difference in pre and post intervention scores were 2.25 ± 1.60 ($p<0.01$). There was 3.93% improvement. Combined intervention of task specific exercises and mirror therapy mean difference in pre- and post-intervention scores was 7.23 ± 1.79 ($p<0.01$). All 3 groups showed statistically significant improvement on outcome measures but Group C improved more than the other 2 groups. The study concluded that task specific exercise and mirror therapy interventions should be combined altogether in the treatment of sub-acute stroke patients to improved upper extremity motor function**. (Sneha S. Khandare, 2009)**

A randomized controlled study was conducted in selected hospitals at Tehran, Iran to identify the effectiveness of mirror therapy to improve hand function among sub acute stroke patients. Forty patients with severe hemiparaesis were selected. The mirror therapy group showed a statistically significant improvement in motor recovery. The mean change of Brunnstrom stages for the hand at six months from baseline was 1.5 (95% confidence interval 1.1 -1.9) compared to 0.4 (95%confidence interval 0.1-0.8) change in the control group ($p=0.001$). The mean change in Brunnstrom stages for the upper extremity at six months from baseline was1.6 (95% confidence interval 1.3-1.9) compared to 0.3(95% confidence interval 0.1-0.6) change in the control group ($p=0.001$). The conclusion of the study showed that mirror therapy improved hand function in patients with severe hemi paresis. **(Serap Sutbeyaz, 2014)**

An experimental study was conducted in Seoul, Korea to identify the effectiveness of mirror therapy to improve motor function of the affected arm after stroke. A total of 37 participants in the chronic stage after stroke were randomly allocated to the action observation or control observation (CO) group. Participants in the action observation group observed mirrored video tapes of reaching movements performed by their unaffected arm(SD 1.34; 95% CI 2.33 to 3.669; $p = 0.01$), whereas

participants in the control observation group observed static photographs of landscapes(SD 1.22; 95% CI 0.24 to 0.29; p = 0.01). The present study showed that a mirror therapy–based action observation helps to improve motor function after stroke. (**Wouter J. Harmsen, et al., 2013**)

A descriptive study was conducted in District general hospital, south of England to assess the effectiveness of combined mirror therapy (MT) and mesh glove (MG) afferent stimulation in reducing motor impairment after stroke. Forty-three chronic stroke patients with mild to moderate upper extremity impairment were randomly assigned to receive mirror therapy and mesh glove afferent stimulation for 1.5 hours/day, 5 days/week for 4 weeks. Outcome measured by the Fugl-Meyer Assessment (FMA), Box and Block Test (BBT) and 10-Meter Walk Test (10 MWT) for motor function. FMA total scores were significantly higher in the mirror therapy and mesh glove afferent stimulation groups (95% CI 0.24 to 2.19; p = 0.01) compared with the control group. The study showed that mirror therapy and mesh glove afferent stimulation improved manual dexterity and ambulation. **(Ching-yi Wu, 2014)**

A systematic literature gave an overview that the effectiveness of mirror therapy in upper extremity functions after stroke. Fifteen studies were identified and reviewed. Five different patient categories were studied: two studies focused on mirror therapy after an amputation of the upper limb, five studies focused on mirror therapy after stroke (MD 1.33; 95% CI 1.05 to 2.60; p = 0.05), five studies focused on mirror therapy with Complex Regional Pain Syndrome type 1 (CRPS1) patients(MD 0.33; 95% CI 0.25 to 1.60 ; p = 0.05), one study on mirror therapy with Complex Regional Pain Syndrome type 2 (CRPS2) patients (MD 0.33; 95% CI 0.35 to 1.60 ; p = 0.05) and two studies focused on mirror therapy after hand surgery other than amputation(MD 0.33; 95% CI 1.05 to 1.60 ;(p = 0.01). The result of the review showed that mirror therapy is effective in upper limb treatment of stroke patients and patients with complex regional pain syndrome. **(Danielle Ezendam, 2011)**

A randomized control study was conducted in medical centre, America to identify the motor recovery after mirror therapy in chronic stroke patients. A total of

40 chronic stroke patients were randomly assigned to the mirror group (n=20) and the control group (n=20). Both groups trained once a week under supervision of a physiotherapist at the rehabilitation center and practiced at home 1 hour daily, 5 times a week. The primary outcome measured by Fugl-Meyer Motor assessment (FMA). The result showed that the Fugl-Meyer Motor assessment improved more in the mirror therapy group (95% CI 0.25 to 0.60; p = 0.02) than in the control group. The study concluded that mirror therapy showed effectiveness in motor function among chronic stroke patients (**Marian E. Michelson et al., 2010).**

A perspective study was conducted in selected hospital, Bangladesh to evaluate the effectiveness of Neuro-restorative therapies to improve the recovery after stroke by promoting brain repair and function. Study subjects included 20 patients with chronic stroke. Fugl Meyer and modified Barthel Index were used to measure the outcomes. The mirror therapy was given via laptop system integrated with web camera, mirroring the movement of the unaffected hand. This therapy was administered for 5 days in a week for 60-90 min for 8 weeks. The study results showed that all the patients showed statistical significant improvement in Fugl Meyer and modified Barthel Index ($p<0.05$). The study concluded that mirror therapy simulated the "action-observation" hypothesis exhibiting recovery in patients with chronic stroke. Therapy induced cortical reorganization was also observed from this study. **(Ashu Bhasin**, **et al., 2012**)

A randomized control study was conducted in medical center in Seattle, Washington to evaluate the effectiveness of mirror therapy to improve the motor recovery in severe hemiparesis. Thirty-six patients with severe hemiparaesis were selected and randomly assigned to either mirror therapy or control therapy. The main outcome measured by Fugl-Meyer assessment. The results of the study showed that mirror therapy patients regained more distal function (SD 4.33; 95% CI 4.05 to 5.60; p = 0.05) than control therapy patients (SD 3.53; 95% CI 3.05 to 3.60; p = 0.05). Furthermore, across all patients, mirror therapy improved recovery of surface sensibility. Mirror therapy stimulated recovery from hemi neglect. The study concluded that mirror therapy early after stroke is a promising method to improve

sensory and attention deficits and to support motor recovery in a distal plegic limb. **(Christian Dohle, et al., 2008)**

An experimental study was conducted in selected hospital, Bangalore to find out the effectiveness of mirror therapy as a home program in rehabilitation of hand function in sub-acute stroke patients. Totally 30 stroke patient with impaired hand function were randomly allocated. They grouped as 15 subjects were into the mirror therapy and 15 subjects were into the sham mirror therapy group. Subjects were asked to review once in a week and follow the treatment at home for 4 weeks. Hand functions were measured using Chedoke Arm and Hand Activities Inventory-9 Scale before and after 4 weeks of intervention. The result of the study showed that the mirror therapy as a home program with conventional exercises significantly found effective (SD 0.28; 95% CI 0.05 to 1.20; $p < 0.01$) than sham mirror therapy (SD 0.23; 95% CI 0.15 to 0.20; $p < 0.02$) in improving hand functions among sub-acute stroke. **(Femy Mol Baby, et al., 2014).**

An experimental study was conducted in medical center in Peoria to examine the effects of mirror therapy on upper extremity motor function and activities of daily living in chronic stroke patients. Fifteen subjects were assigned to a mirror therapy group and a sham therapy group. The Fugl-Meyer Motor Function Assessment and Box and Block Test were performed to compare paretic upper-extremity function and hand coordination abilities. Paretic upper-extremity function and hand coordination abilities were significantly different between the mirror therapy (SD 1.33; 95% CI 0.05 to 3.39 ;($p < 0.01$) and sham therapy group (SD 0.73; 95% CI 0.35 to 0.40; $p < 0.02$). The study concluded that mirror therapy is effective in improving paretic upper-extremity function and activities of daily living in chronic stroke patients. **(Jin- Young park, et al., 2015)**

Summary

Literatures related to mirror therapy helped to identify the objectives and procedure protocol of mirror therapy. The literatures laid the foundation for the present study which briefly describes procedure protocol, selection criteria and method

of analysis. These reviews gave an idea regarding selection of Fugl-Meyer Assessment as a tool. Twenty nine studies which included survey study, epidemiological study, and comparison study, randomized and experimental study were reviewed deeply for the present study. There is wide knowledge gap on the importance of mirror therapy among nurses and physical therapists. In conclusion reviews evaluated the effects of mirror therapy for stroke survivors. This literature review confirmed that upper extremity motor function was improved by mirror therapy. But very few studies have been done to evaluate effectiveness of mirror therapy to improve upper extremity motor function involving motor performance, sensation, passive joint motion and joint pain. Also literatures had not adequately explained about mirror therapy exercises and description of sham therapy. So the present study will be planned to analyze the effectiveness of mirror therapy for improving upper extremity motor function involving motor performance, sensation, passive joint motion and joint pain among stroke patient.

CHAPTER-III

MATERIALS AND METHODS

Research design is the blueprint for conducting a study. It maximizes control over factors that could interfere with the validity of the study findings (Susan k. Grove.et.al, 2013). The present study is designed to find out effectiveness of mirror therapy to improve upper extremity motor function in stroke patients. The methodology of the study constitutes of research design, setting, selection of population and sampling, criteria for selecting samples, instruments and tools for data collection and method of data analysis.

3.1 Research approach:

In this study, true experimental research approach was adopted. In this study intervention group of patients received the mirror therapy and also comparison group of patients received the sham therapy as intervention. There was a randomization adopted in assigning patients to intervention and comparison group. Hence the study adopted true intervention research approach.

Study Design:

Pre test-posttest control group design.

The research design selected for the study was pre test – posttest control group design. In this study subjects are randomly assigned to either the intervention or comparison group. Fugl- Meyer Assessment was used to assess the upper extremity motor function among stroke patients before and after administration of mirror therapy for intervention group and sham therapy for comparison group.

Intervention group O1 → X1 → O2 → O3

Comparison group O1 → X2 → O2 → O3

O_1: Pre test data were collected to assess the upper extremity motor performance, sensation, passive joint motion, and joint pain in intervention and comparison group

using Fugl-Meyer Assessment. Pre test data were collected on the first day of intervention in both groups.

X_1: Mirror therapy was administered to the intervention group for 30 minutes per day and 7 times per week for minimum 2 weeks and maximum till the patient gets discharge. The patients also received routine physiotherapy exercises along with mirror therapy.

X_2: In comparison group, Sham therapy administered for 30 minutes per day and 7 times per week for minimum 2 weeks and maximum till the patient gets discharge. The patients also received routine physiotherapy exercises along with sham therapy.

O_2: Post test I data was collected at the end of the 7^{th} day of intervention in both intervention and comparison group using Fugl-Meyer Assessment.

O_3: Post test II data were collected at the end of the 14^{th} day of intervention in both intervention and comparison group using Fugl-Meyer Assessment. All the patients are available till the end of 14^{th} day in both groups.

3.2 Variables of the study:

3.2.1 Independent variable: The independent variables within the study were Mirror therapy and sham therapy.

3.2.2 Dependent variable: The dependent variable in the study was Upper extremity motor function in stroke patients.

3.3 Setting of the study:

This study was conducted in Neuro ward, Male specialty ward, Medical ward, Semi-private ward, special ward at PSG Hospitals, Peelamedu, Coimbatore. The Hospital is a multi specialty hospital and research centre with bed strength of 1315 which caters multi lingual patients from various parts of the country. The PSG Hospitals has an outpatient facility whereby around 1000 patients take medical advice every day. This is the first teaching hospital in Tamilnadu and the third teaching hospital in India to get certified by National Accredited Board for Hospitals and

Health Care Providers (NABH). The study was conducted in the Neuro inpatient department of this hospital. The neurology patients also got admitted in semiprivate ward, male speciality ward, medical ward and special ward.

The Study was conducted in the Neurology ward, semiprivate ward, male speciality ward, medical ward and special ward. Bed strength of the neuro ward was 20. Speciality ward bed strength was 30 and the medical ward bed strength was 42. The speciality ward and medical ward consists of patients from respiratory, cardiology and neurology unit. The semiprivate ward consists of four beds in each room. Here eight beds are allotted for neurological patients. The special ward consists of single room for each patient. The Neurology unit of special ward is present in fifth floor. The physical rehabilitation centre renders services for inpatients and outpatient follows up exercises. The total numbers of patients admitted with first episode of stroke per month in neurology inpatient department were 13 patients. Approximately 3-4 patients with first episode of stroke were admitted in neurology inpatient department per day.

3.4 population and sampling

The population composed of patients with stroke who had upper extremity motor impairment at PSG hospitals, Coimbatore. The total numbers of patients admitted with first episode of stroke from 2014 to 2015 were 162 patients. Sample size was calculated by using allowable error method.

3.4.1 sampling technique and sample size

The sampling technique used in this study was Purposive sampling technique. The calculated sample size was 30 patients. The stroke patients who met the inclusion criteria were selected for this study. Total samples were 37 stroke patients and grouped as 19 in the intervention group and 18 in the comparison group. Among them 4patients in intervention group and 3 patients in comparison group were drop out from the study, because they got discharged after the first post test. So 15 patients in intervention group and 15 patients in comparison group received mirror therapy and sham therapy respectively.

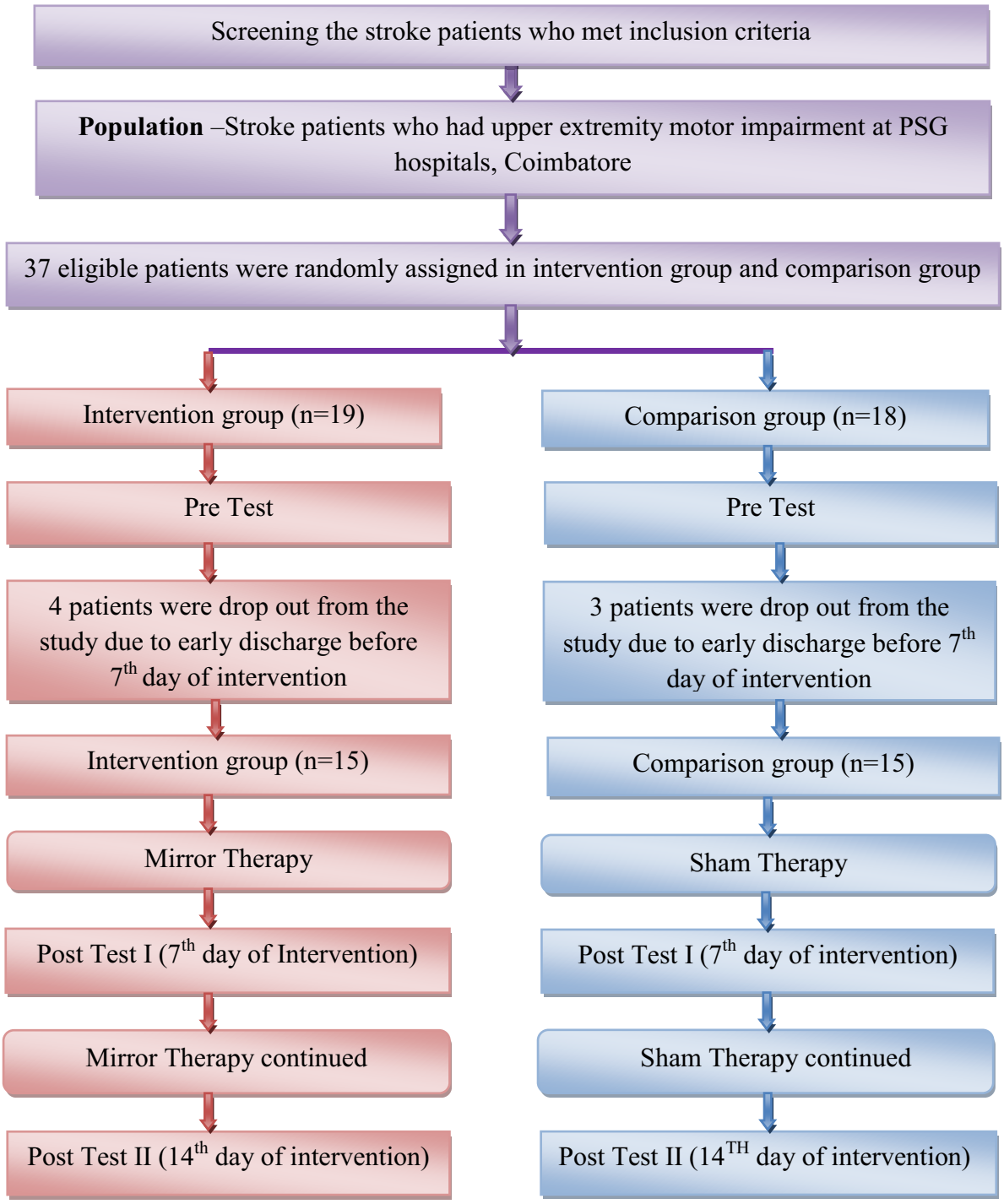

Figure 3.1: Schematic representation of sampling technique

Sample size calculation:

Allowable Error Method

$$n = \frac{4\,pq}{L^2}$$

n = number of samples

Where, p = (mean/total population in a year) x100

p=8.3

q=100-p

q=91.7

L=allowable error

n= (4x8.3x91.7)/10x10

n=30

Estimated sample size is 30.

3.4.2 Sampling criteria:

Inclusion criteria:

- Patients with first episode of stroke.
- Patients who had upper extremity motor impairment.
- Patients who had stroke for less than 1year.
- Patients who are able to understand and obeys commands.
- Patients who were in stage III and IV in Brunnstrom motor recovery scale.
- Patients who knows Tamil or English.
- Patients who were on treatment for two weeks duration in hospital.

Exclusion criteria:

- Patients who had poor cognitive function.
- Patients with visual deficit and perceptual deficit.
- Contracture in the affected limb.
- Patients who had fracture on stroke affected extremities.

3.5 INSTRUMENTS AND TOOL FOR DATA COLLECTION

3.5.1 Selection tool:

The Brunn Strom Motor Recovery Scale is a standardized tool and it was developed in the year of 1960 by Signe Brunnstrom, an occupational and physical therapist from Sweden. It emphasizes the synergic pattern of movement which develops during recovery from hemiplegia. The Brunn strom motor recovery scale has seven proposed stages of sequential motor recovery after a stroke. The established reliability of the Brunn strom motor recovery scale is 0.90. **(Uncan P.W, 2007)**. Patients who were in stage III and IV in Brunnstrom motor recovery scale was selected for this study. (Annexure-V)

3.5.2 Data collection tool:

The tool used to collect data from patients consisted of three parts.

SECTION A: Demographic data: It includes age, sex and education of the patients with stroke. (Annexure-V)

SECTION B: Medical history: It includes duration of stroke, stroke affected side, dominant side, associated illness. (Annexure-V)

SECTION C: Fugl-Meyer Assessment:

Fugl-Meyer Assessment (FMA) is a standardized scale and widely used to assess physical recovery after stroke. It was developed by Fugl-Meyer AR, Jaasko L, Leyman I in 1975 and it was the first quantitative instrument for measuring sensory-motor recovery after stroke. The established reliability of the Fugl-Meyer Assessment is 0.95. **(Richard, 2008)**. The FMA characterized as a cumulative numerical score system that evaluates four aspects of the physical performance: motor performance, sensation, passive joint motion and joint pain. The test takes 30 minutes duration. Motor performance scores ranges from 0 to 66, Sensation scores ranges from 0 to 24, Passive joint motion scores ranges from 0 to 24, Joint pain scores ranges from 0 to 24. (Annexure-V)

3.5.3 Training for assessing the tool:

The investigator had undergone a special training regarding assessment of Brunnstrom motor recovery scale and Fugl-Meyer Assessment from the Physiotherapy department, PSG hospitals, Coimbatore. The investigator underwent training for 45 minutes for one day. The training was given by physiotherapist. The trainer used lecture cum demonstration method to teach the assessment tool. The investigator redemonstrated it infront of the HOD of the physiotherapy department and got certificate. (Annexure-II).

3.5.4 Validity and reliability of the tool:

Validity of the tool:

Validity of the tool had been determined by expert's opinion from the different fields. The experts gave their opinion, clarity and appropriateness of the tool.

Reliability of the tool:

Reliability of the Brunn strom motor recovery scale was identified using both split half method and inter rater reliability method. Reliability of the Brunn strom motor recovery scale was identified using split half method. It was computed using spearman brown correlation coefficient method. The reliability of the tool was found to be 0.82.Reliability of the Brunn strom motor recovery scale was identified using inter rater reliability method. It was computed using spearman rank coefficient method. The reliability of the tool was found to be 0.86. The tool was found to be reliable for the study.

Reliability of the Fugl-Meyer Assessment was identified using both split half method and inter rater reliability method. Reliability of the Fugl-Meyer Assessment was identified using split half method. It was computed using spearman brown correlation coefficient method. The reliability of the tool was found to be 0.88.Reliability of the Fugl-Meyer scale was identified using inter rater reliability method. It was computed using spearman rank coefficient method. The reliability of the tool was found to be 0.92. The tool was found to be reliable for the study.

3.5.5 Ethical Approval:

The Institutional Human Ethics Committee (IHEC) (Annexure-III), PSG Institute of Medical Science and Research reviewed the proposal on in its full board meeting and approved the study to conduct. The Institutional Human Ethics Committee (IHEC) consists of fifteen members of different areas of expertise. After getting ethical clearance from Institutional Human Ethics Committee (IHEC) data collection was done.

3.5.6 Techniques of data collection:

Demographic data and medical history were collected through interview method and observed from medical records. Upper extremity motor performance, sensation, passive joint motion, and joint pain were assessed using Fugl-Meyer Assessment through observation method.

3.5.7 Intervention package:

Steps of mirror therapy procedure:

- During mirror therapy subjects were seated on a chair close to the table on which a mirror box was placed vertically and advised to place both the hands on the table.
- The involved hand was placed behind the mirror and the noninvolved hand was placed in front of the mirror.
- The subjects were advised not to look on the affected hand and focus towards the mirror. Keep the unaffected hand flat on the table.
- The investigator demonstrated the each exercise such as wrist flexion and extension, finger flexion and extension, fanning out the hand, finger and thumb abduction, makes a fist and release, prehension, pad to pad, pad to side, pad to pad grip, grasping objects, single finger movement, thumb opposition and simultaneously the patients performed the same exercise using the non-paretic hand in front of mirror.
- During the session, subjects were asked to try to do the same movements in the paretic hand while they were moving the non-paretic hand. Subject was

instructed to observe the reflection of the non affected hand while doing exercise of both hands.

- Mirror therapies administered for 30 minutes per day and 7 times per week for minimum of two weeks and maximum till the patient get discharged.

Steps of Sham therapy procedure:

- Sham therapy was administered to comparison group.
- During sham therapy subjects were seated on a chair close to the table on which a non reflective plastic material side was placed vertically and advised to place both the hands on the table.
- The involved hand was placed behind the non reflective plastic material side and the noninvolved hand was placed in front of the non reflective plastic material side.
- The subjects were advised not to look on the affected hand. Keep the unaffected hand flat on the table.
- The investigator demonstrated the each exercise such as wrist flexion and extension, finger flexion and extension, fanning out the hand, finger and thumb abduction, makes a fist and release, prehension, pad to pad, pad to side, pad to pad grip, grasping objects, single finger movement, thumb opposition and simultaneously the patients performed the same exercise using non-paretic hand in front of the non reflective plastic material side.
- During the session, subjects were asked to try to do the same movements in the paretic hand while they were moving the non-paretic hand.
- Sham therapy administered for 30 minutes per day and 7 times per week for minimum of two weeks. Sham therapy was continued till the patients get discharged.

3.5.8 Data Collection procedure:

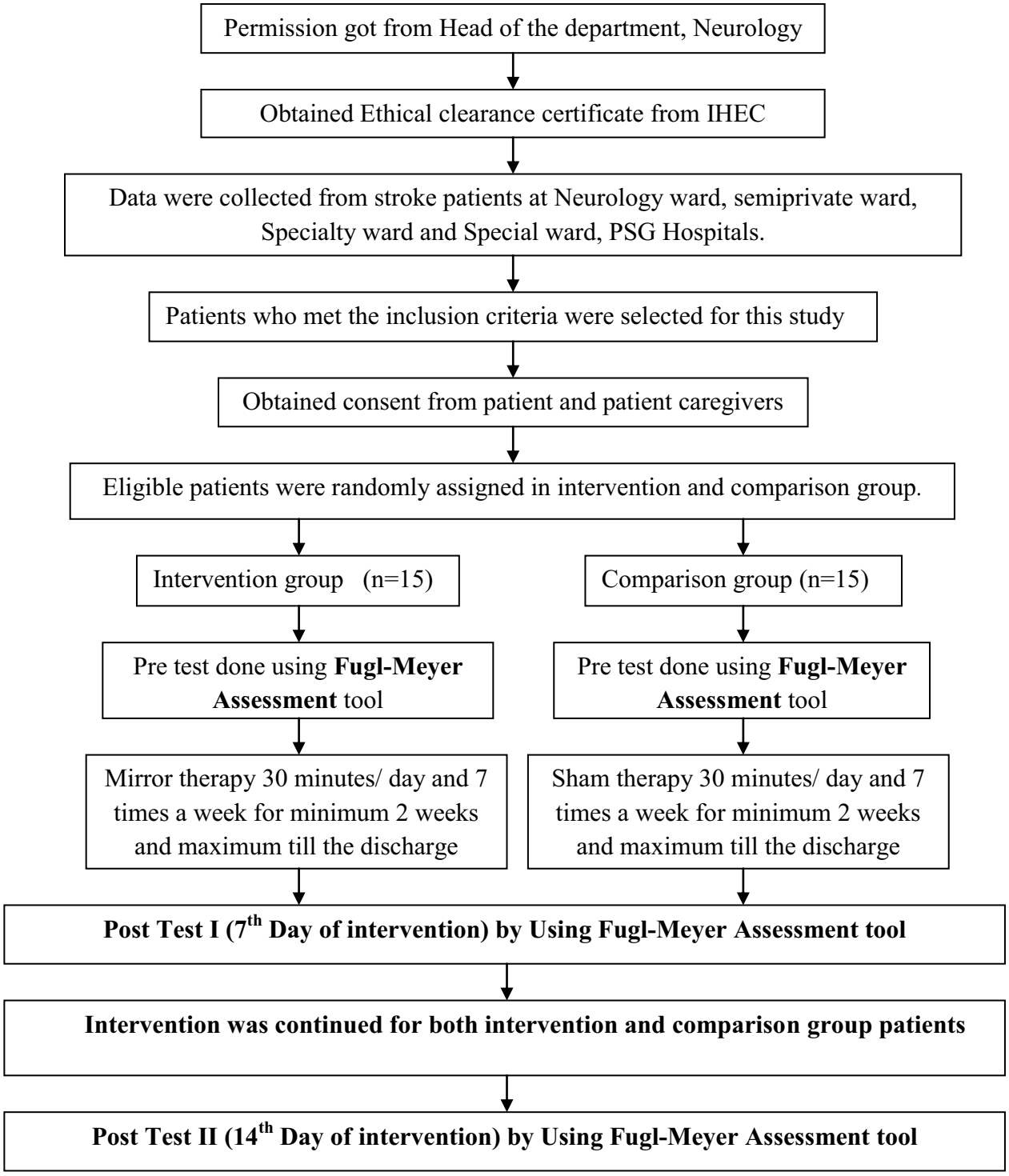

Figure 3.2: Schematic representation of data collection procedure

Permission was obtained from the Head of the Department, Neurology (Annexure-I) as well as from Institutional Human Ethics Committee (IHEC), PSG Institute of Medical Science and Research (Annexure-III). After that the stroke patients who met the inclusion criteria were selected for this study (Annexure-V). Informed consent was obtained from patients or care giver (Annexure-IV). Patients were randomly assigned to Intervention and comparison group by using lottery method. Demographic data and medical history were collected through interview method and observed from medical records.

Pre test data were collected regarding upper extremity motor performance, sensation, passive joint motion, and joint pain to all thirty patients using Fugl-Meyer Assessment. Mirror therapy was administered for 30 minutes per day and 7 times a week for minimum two weeks and maximum till the patient get discharged in intervention group (Annexure-VI). In the comparison group, sham therapy was administered for 30 minutes per day and 7 times a week for minimum two weeks and maximum till the patient get discharged (Annexure-VI). After intervention post assessment I data were collected regarding upper extremity motor performance, sensation, passive joint motion, and joint pain to all thirty patients using Fugl-Meyer Assessment at the end of 7^{th} day of intervention and Post assessment II data were collected at the end of 14^{th} day of intervention to the intervention and comparison groups. Among 15 patients in intervention group, 14 of them left after two weeks of mirror therapy and only one patient hospitalized till 18^{th} day, mirror therapy was continued till 18^{th} day. In the comparison group out of 15 patients, only one patient was hospitalized till 17^{th} day, sham therapy was continued. Post test III, data were collected on the day of discharge using Fugl-Meyer Assessment among both group of patients.

3.6 Report of the pilot study:

Pilot study was conducted for a period of 3 weeks to test the validity, practicability of the tool and feasibility of conducting the main study. Pilot study was conducted with 10 samples. The samples who met the inclusion were selected for the study. After selection of patients, demographic data and medical history were

collected through interview method and observed from medical records. Patients were divided into intervention and comparison group using lottery method. Pre test data were collected in both intervention and comparison groups. Mirror therapy was given to the intervention group, 7days/week, and 30 minutes /day for 2 weeks. Sham therapy was given to the comparison group, 7days/week, and 30 minutes/day for 2 weeks. Two post test data were collected at 7^{th} and 14^{th} day of intervention for both the groups. Through the pilot study, the reliability and practicability of the tool and feasibility of the study has been found.

3.7 Data analysis plan:

The data will be analyzed using descriptive and inferential statistics.

1. Descriptive Statistics:

- Frequency and percentage distribution of samples to assess the demographic variables.
- Frequency distribution, mean, standard deviation will be used to describe the motor function of upper extremity before and after administration of mirror therapy in intervention group and sham therapy in comparison therapy.

2. Inferential Statistics:

- Paired t- test will be used to find out the difference between the motor function of upper extremity between the pretest and posttest score.
- Independent t- test will be used to find out the difference in pre test, post test level of motor function of upper extremity among intervention and comparison group.
- Chi-square test will be used to find out the association between motor function of upper extremity in stroke patient and their demographical variables.

CHAPTRER-IV

DATA ANALYSIS AND INTERPRETATION

Data analysis is the systematic organization and synthesis of research data and in quantitative studies, the testing of hypotheses using those data. Interpretation is the process of making sense of study results and of examining their implications (Polit and Beck, 2008). This chapter deals with the analysis of the data collected from the patient and the interpretation of the results help in making sense of the result study. The data was collected to assess the effectiveness of mirror therapy to improve upper extremity motor function among stroke patients. The data was collected, analyzed and tested for the significance.

The data analysis was organized and presented in table under the following sections:

SECTION

I. Frequency and percentage distribution of patients according to demographic profile and medical condition.

II. Frequency and percentage distribution of stroke patients upper extremity motor function among Intervention and comparison group in pre test and post test.

III. Comparison of Mean and Standard deviation of Upper Extremity Motor Function between Pre Test and Post Test scores among Intervention and Comparison Group patient using paired ‘t’ Test.

IV. Effectiveness of mirror therapy and sham therapy of stroke patients with upper extremity motor function using Independent‘t’ test.

V. Association between demographic variables and pre test level of motor impairment among patients with upper extremity motor function.

SECTION I: Frequency and percentage distribution of patients according to demographic profile and medical condition.

Table 4.1: Frequency and percentage distribution of patients with stroke according to their demographic profile

n=30

S.No	Baseline details	Number of patients with stroke				Total number of patients	%
		Intervention group		Comparison group			
		f	%	f	%		
1.	**Age**						
	20-30years	1	6.67	1	6.67	2	6.67
	31-40years	1	6.67	1	6.67	2	6.67
	41-50years	5	33.33	2	13.33	7	23.33
	51-60years	4	26.67	4	26.67	8	26.67
	61-70years	3	20	5	33.33	8	26.66
	71-80years	1	6.67	2	13.33	3	10
2.	**Sex**						
	Male	10	66.67	11	73.33	21	70
	Female	5	33.33	4	26.67	9	30
3.	**Education**						
	Illiterate	0	0	1	6.67	1	3.34
	Primary	6	40	5	33.33	11	36.66
	High school	6	40	3	20	9	30
	Higher secondary	1	6.67	2	13.33	3	10
	Graduate	2	13.33	3	20	5	16.66
	Post graduate	0	0	1	6.67	1	3.34

Age of the patients with stroke:

Table 4.1 shows that among 30 patients, majority of the patients (26.67%) were in the age group between 51-60 years this comprised of 4 patients in Intervention group and 4 patients in comparison group. 8 patients (26.67%) were in the age group of 61-70 years, this comprised of 3 patients in Intervention group and 5 patients in comparison group.

Sex of the patients with stroke:

Tables 4.1 reveals that majority of the patients were male (70%) comprising 10 patients in Intervention group and 11 patients in comparison group.

Education qualification of patients with stroke:

Table 4.1 shows that among 30 patients, 11 patients (36.66 %) belongs to primary education comprising 6 patients in Intervention group and 5 patients in comparison group. There were nine (30%) patients belongs to high school education comprising of 6 patients in Intervention group and three patients in comparison group.

Table 4.2: Frequency and percentage distribution of patients with stroke according to their medical conditions

n=30

S.No	Baseline details	Number of patients with stroke				Total number of patients	%
		Intervention group		Comparison group			
		f	%	f	%		
1.	**Duration of stroke patient**						
	1-30days	15	100	11	73.33	26	86.67
	31-60days	0	0	2	13.34	2	6.67
	61-90days	0	0	2	13.33	2	6.67
2.	**Stroke affected side**						
	Right side	8	53.33	5	33.33	13	43.33
	Left side	7	46.67	10	66.67	17	56.67
3.	**Dominant side**						
	Right side	14	93.33	13	86.67	27	90
	Left side	1	6.67	2	13.33	3	10
4.	**Associated illness**						
	Nil	9	60	4	26.67	13	43.34
	Hyper tension	4	26.67	8	53.33	12	40
	Diabetes mellitus	1	6.67	3	20	4	13.33
	Ischemic heart disease	1	6.67	0	0	1	3.33

Duration of stroke:

Table 4.2 shows that majority of the patients (86.67%) had duration of stroke between 1-30 days, comprising 15 patients in the Intervention group, 11 patients in the comparison group. Two patients (6.67%) had duration between 31-60 days comprising 2 patients in the Intervention group and no one in the comparison group.

Stroke affected side:

The number of the patients with right side stroke was 13 (43.33%), comprising 8 patients in Intervention group and 5 patients in comparison group. The remaining 17 patients (56.67%) were affected with left side stroke comprising 7 patients in Intervention group and 10 patients in comparison group.

Dominant side:

Among 30 patients, most of the patients (90%) were right hand dominant comprising 14 patients in Intervention group and 13 patients in comparison group.

Associated illness:

The table 4.2 shows that 17 patients (56.66) had associated illness. Half of the patients not having any associated illness. Nearly half of the patients (40%) had history of hypertension comprising 4 patients in Intervention group and 8 patients in comparison group. There were 4 patients (13.33%) had diabetes mellitus comprising one patient in Intervention group and 3 patients in comparison group.

SECTION II: Frequency and percentage distribution of stroke patients upper extremity motor function among intervention and comparison group in pre test and post test

Table 4.3: Frequency and percentage distribution of stroke patients level of motor performance among intervention and comparison group in pre test and post test

n=30

S. No	Level of motor performance	Intervention Group								Comparison group							
		Pre test		Post test I (7th day)		Post test II (14th day)		Post test III		Pre test		Post test I (7th day)		Post test II (14th day)		Post test III	
		f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%
1.	Mild motor impairment	0	0	0	0	12	80	1	6.6	0	0	0	0	0	0	0	0
2.	Moderate motor impairment	3	20	4	26.6	3	20	0	0	0	0	0	100	5	33.34	1	6.6
3.	Severe motor impairment	12	80	11	73.4	0	0	0	0	15	100	15	100	10	66.66	0	0

The results showed that in intervention group 3(20%) patients had moderate motor impairment and 12 (80%) patients had severe motor impairment during pre test, whereas on post test I (7^{th} day), 4(26.66%) patients had moderate motor impairment and 11(73.4%) patients had severe motor impairment, in post test II (14^{th} day) 12(80%) patients motor function was improved to mild motor impairment level and 3(20%) patients had moderate motor impairment after mirror therapy. Among 15 patients, 14 of them get discharged after Post test II. Only One patient has been hospitalized till 18^{th} day. Mirror therapy was continued, during the post test III (18^{th} day) the patient motor function had improved from moderate to mild motor impairment level. In the comparison group, 15(100%) patients had severe motor impairment during pre test, whereas on post test I (7^{th} day) all the 15(100%) patients had severe motor impairment and in post test II (14^{th} day) 5 patients had moderate motor impairment and 10 (66.66%) patients had severe motor impairment after sham therapy. No one had improved to mild motor impairment level on 7^{th} and 14^{th} day of assessment. Among 15 patients, 14 of them get discharged after Post test II. Only One patient has been hospitalized till 17^{th} day. Sham therapy was continued, during the post test III (17^{th} day) the patient motor function was not improved from moderate motor impairment level.

Table 4.4: Frequency and percentage distribution of stroke patients level of sensory function among intervention and comparison group in pre test and post test

n=30

S. No	Level of Sensation	Intervention Group								Comparison group							
		Pre test		Post test I (7th day)		Post test II (14th day)		Post test III		Pre test		Post test I (7th day)		Post test II (14th day)		Post test III	
		f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%
1.	Normal Sensation	0	0	7	46.6	15	100	1	6.67	0	0	2	13.3	6	40	0	0
2.	Mild sensory Impairment	2	13.3	2	13.3	0	0	0	0	3	20	1	6.67	3	20	0	0
3.	Moderate sensory impairment	12	80	6	40	0	0	0	0	11	73.3	12	80	6	40	1	6.67
4.	Severe sensory impairment	1	6.67	0	0	0	0	0	0	1	6.67	0	0	0	0	0	0

The result showed that in Intervention group 12(80%) patients had moderate sensory impairment during pre test, while on post test I (7^{th} day) 7 (46.6%) patients attained normal sensory function, whereas in post test II (14^{th} day) all the 15(100%) patients attained normal sensory function after mirror therapy. Among 15 patients, 14 of them get discharged after Post test II. Only One patient has been hospitalized till 18^{th} day. Mirror therapy was continued, during the post test III (18^{th} day) the patient was in normal sensory function. In comparison group, 11 (73.3%) patients had moderate sensory impairment during pre test, whereas post test I (7^{th} day) 12 (80%) patients had moderate impairment, while post test II (14^{th} day) only 6 (40%) patients attained normal sensory function, 3(20%) patients had moderate sensory impairment and 6 (40%) patients had severe sensory impairment. Among 15 patients, 14 of them get discharged after Post test II. Only One patient has been hospitalized till 17^{th} day. Sham therapy was continued, during the post test III (17^{th} day) the patient remains in moderate sensory impairment level.

Table 4.5: Frequency and percentage distribution of stroke patients level of passive joint motion among Intervention and comparison group in pre test and post test.

n=30

S. No	Level of Passive Joint Motion	Intervention Group								Comparison group							
		Pre test		Post test I (7th day)		Post test II (14th day)		Post test III		Pre test		Post test I (7th day)		Post test II (14th day)		Post test III	
		f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%
1.	Normal	0	0	5	33.4	15	100	1	6.67	0	0	0	0	1	6.67	0	0
2.	Hypo mobility	2	13.33	5	33.4	0	0	0	0	1	6.67	6	40	9	60	1	6.67
3.	No movement	13	86.67	5	33.4	0	0	0	0	14	93.3	9	60	5	33.33	0	0

The results showed that in Intervention group, 2(13.33%) patients had hypo mobility and 13(86.67%) patients had no movement during pre test whereas on post test I (7^{th} day), 5(33.4%) patients attained normal passive motion and in post test II (14^{th} day) all 15(100%) patients had improved to normal passive joint motion level after administration of mirror therapy. Among 15 patients, 14 of them get discharged after Post test II. Only One patient has been hospitalized till 18^{th} day. Mirror therapy was continued, during the post test III (18^{th} day) the patient was in normal passive joint motion. In comparison group, 14(93.3%) patients had no movement during pre test, whereas post test I (7^{th} day), 6(40%) patients had hypo mobility and 9(60%) patients had no movement and in post test II (14^{th} day), 9(60%) patients had hypo mobility and 5(33.33%) patient had no movement after providing sham therapy. Among 15 patients, 14 of them get discharged after Post test II. Only One patient has been hospitalized till 17^{th} day. Sham therapy was continued, during the post test III (17^{th} day) the patient remains in hypo mobility level.

Table 4.6: Frequency and percentage distribution of stroke patients level of joint pain among Intervention and comparison group in pre test and post test.

n=30

S. No	Level of pain	Intervention Group								Comparison group							
		Pre test		Post test I (7th day)		Post test II (14th day)		Post test III		Pre test		Post test I (7th day)		Post test II (14th day)		Post test III	
		f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%
1.	No Pain	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.	Mild Pain	0	0	1	6.67	15	100	1	6.67	0	0	0	0	0	0	0	0
3.	Moderate Pain	1	6.67	4	26.67	0	0	0	0	2	13.33	3	20	8	53.33	1	6.67
4.	Severe Pain	14	93.33	10	66.67	0	0	0	0	13	86.67	12	80	7	46.67	0	0

The results showed that in Intervention group, 14(93.33%) patients had severe pain during pre test, whereas on the post test I (7th day) 4(26.67%) patients had moderate pain and 10(66.67%) patients had severe pain, while on post test II (14th day) all the 15(100%) patients had mild pain after mirror therapy. Among 15 patients, 14 of them get discharged after Post test II. Only One patient has been hospitalized till 18^{th} day. Mirror therapy was continued, during the post test III (18^{th} day) the patient had mild pain. In comparison group, 13(86.67%) patients had severe pain during pre test. Whereas on post test I (7th day), 12(80%) patients had severe pain level and 3(20%) patients had moderate pain level, while on the post test II (14^{th} day) 7(46.67%) patients had severe pain after sham therapy. Among 15 patients, 14 of them get discharged after Post test II. Only One patient has been hospitalized till 17^{th} day. Sham therapy was continued, during the post test III (17^{th} day) the patient remains in moderate pain level.

SECTION III: Comparison of Mean and Standard deviation of Upper Extremity Motor Function between Pre Test and Post Test scores among Intervention and Comparison Group patient using paired‘t’ Test

Null Hypothesis (H_{o1}): There will not be a significant difference between pre test and post test scores of motor function in stroke patients with upper extremity motor impairment among Intervention and Comparison Group.

Table 4.7: Comparison of Mean and Standard deviation of Upper Extremity Motor Function between Pre Test and Post Test I scores among Intervention and Comparison Group patient using paired ‘t’ Test

n=30

S.NO	Motor Function	Pre Test		Post Test- I		Calculated ‘t’ Value	Tabulated Value
		Mean	SD	Mean	SD		
1.	**Intervention Group**						
	Motor Performance	17.86	10.20	29.73	8.85	9.55*	4.14
	Sensation	5.80	1.32	8.80	2.67	4.74*	4.14
	Passive Joint Motion	11.46	2.16	15.93	4.11	4.80*	4.14
	Joint Pain	20.0	3.46	15.40	4.37	5.56*	4.14
2.	**Comparison Group**						
	Motor Performance	20.46	7.56	21.73	6.76	0.95 (NS)	4.14
	Sensation	6.20	1.42	6.80	1.82	1.38 (NS)	4.14
	Passive Joint Motion	12.13	2.66	12.13	2.19	0 (NS)	4.14
	Joint Pain	17.60	3.24	16.53	2.52	1.94 (NS)	4.14

* $p<0.001$ statistically significant N.S - Not Significant

Table 4.7 describes that in Intervention group the calculated ‘t’ value was significant at $p<0.001$ level. So null hypothesis was rejected and research hypothesis was accepted. This showed that there was a significant difference between pre test and post test I mean score of motor performance, sensory function, passive joint motion and joint pain among stroke patients who received mirror therapy. Hence it was concluded that the mirror therapy was significantly helps to improve motor function of the upper extremity.

In comparison group the calculated ‘t’ value was not significant at $p<0.001$ level. So null hypothesis was accepted and research hypothesis was rejected. This showed that there was no significant difference between pre test and post test I mean score of motor performance, sensory function, passive joint motion and joint pain among stroke patients who received sham therapy. Hence it was concluded that the sham therapy was not significantly helps to improve motor function of the upper extremity.

Table 4.8 Comparison of Mean and Standard deviation of Upper Extremity Motor Function between Pre Test and Post Test II scores among Intervention and Comparison Group patient using paired 't' Test

n=30

S.NO	Motor Function	Pre Test		Post Test- II		Calculated 't' Value	Tabulated Value
		Mean	SD	Mean	SD		
1.	**Intervention Group**						
	Motor Performance	17.86	10.20	55.40	3.29	15.34*	4.14
	Sensation	5.80	1.32	12.0	0	4.74*	4.14
	Passive Joint Motion	11.46	2.16	22.60	1.12	23.53*	4.14
	Joint Pain	20.0	3.46	3.80	1.93	19.53*	4.14
2.	**Comparison Group**						
	Motor Performance	20.46	7.56	27.0	10.43	4.85*	4.14
	Sensation	6.20	1.42	7.53	1.99	2.32 (NS)	4.14
	Passive Joint Motion	12.13	2.66	14.40	3.56	2.32 (NS)	4.14
	Joint Pain	17.60	2.52	15.53	3.71	2.55 (NS)	4.14

* $p<0.001$ statistically significant N.S - Not Significant

Table 4.8 describes that in Intervention group the calculated 't' value was significant at $p<0.001$ level. So null hypothesis was rejected and research hypothesis was accepted. This showed that there was a significant difference between pre test and post test II mean score of motor performance, sensory function, passive joint motion and joint pain among stroke patients who received mirror therapy. Hence it was concluded that the mirror therapy was significantly helps to improve motor function of the upper extremity.

In comparison group the calculated ‘t’ value was not significant at $p<0.001$ level. So null hypothesis was accepted and research hypothesis was rejected. This showed that there was no significant difference between pre test and post test II mean score of sensory function, passive joint motion and joint pain except motor performance among stroke patients who received sham therapy. Hence it was concluded that the sham therapy was not significantly helps to improve sensory function, passive joint motion and joint pain but it significantly helps to improve motor performance of the upper extremity.

Table 4.9 Comparison of Mean and Standard deviation of Upper Extremity Motor Function between Post Test I and Post Test II scores among Intervention and Comparison Group patient using paired 't' Test

n=30

S.NO	Motor Function	Post Test I		Post Test- II		Calculated 't' Value	Tabulated Value
		Mean	SD	Mean	SD		
1.	**Intervention Group**						
	Motor Performance	29.73	8.85	55.40	3.29	12.02*	4.14
	Sensation	8.80	2.67	12.0	0	4.62*	4.14
	Passive Joint Motion	15.93	4.11	22.60	1.21	6.87*	4.14
	Joint Pain	15.40	4.37	3.80	1.93	11.04*	4.14
2.	**Comparison Group**						
	Motor Performance	21.73	6.76	27.0	10.43	3.45 (NS)	4.14
	Sensation	6.80	1.82	7.53	1.99	2.44 (NS)	4.14
	Passive Joint Motion	12.13	2.19	14.40	3.56	2.48 (NS)	4.14
	Joint Pain	16.53	3.24	15.53	3.71	2.84 (NS)	4.14

* $p<0.001$ statistically significant N.S - Not Significant

Table 4.9 describes that in Intervention group the calculated 't' value was significant at $p<0.001$ level. So null hypothesis was rejected and research hypothesis was accepted. This showed that there was a significant difference between post test I and post test II mean score of motor performance, sensory function, passive joint motion and joint pain among stroke patients who received mirror therapy. Hence it was concluded that the mirror therapy was significantly helps to improve motor function of the upper extremity.

In comparison group the calculated ‘t’ value was not significant at $p<0.001$ level. So null hypothesis was accepted and research hypothesis was rejected. This showed that there was no significant difference between post test I and post test II mean score of motor performance, sensory function, passive joint motion and joint pain among stroke patients who received sham therapy. Hence it was concluded that the sham therapy was not significantly helps to improve motor function of the upper extremity.

SECTION IV: Effectiveness of mirror therapy and sham therapy of stroke patients with upper extremity motor impairment using independent 't' test.

Null Hypothesis (H_{o2}): There will not be a significant difference in pre test, post test I and post test II scores of upper extremity motor function between intervention and comparison group among patients with upper extremity motor impairment

Table 4.10 Comparison of Mean and Standard deviation of Upper Extremity Motor Function between Pre Test, Post Test I and Post Test II scores among Intervention and Comparison Group patients using independent 't' Test

n=30

S.NO	Motor Function	Intervention Group		Comparison Group		Calculated 't' Value	Tabulated Value
		Mean	SD	Mean	SD		
1.	**Pre Test** Motor Performance	17.86	10.20	20.46	7.56	0.79 (NS)	2.05
	Sensory Function	5.80	1.32	6.20	1.42	0.79 (NS)	2.05
	Passive Joint Motion	11.46	2.16	12.13	2.66	0.75 (NS)	2.05
	Joint Pain	20.0	3.46	17.60	2.52	2.00 (NS)	2.05
2.	**Post Test I** Motor Performance	29.73	8.85	21.73	6.76	2.77*	2.05
	Sensory Function	8.80	2.67	6.80	1.82	2.39*	2.05
	Passive Joint Motion	15.93	4.11	12.13	2.19	3.15*	2.05
	Joint Pain	15.4	4.37	16.53	3.24	0.80 (NS)	2.05
3.	**Post Test II** Motor Performance	55.40	3.29	27.00	10.43	10.05*	2.05
	Sensory Function	12.0	0	7.53	1.99	8.67*	2.05
	Passive Joint Motion	22.6	1.12	14.4	3.56	8.50*	2.05
	Joint Pain	3.80	1.93	15.53	3.71	10.83*	2.05

* $p<0.05$ statistically significant N.S - Not Significant

Table 4.10 describes that the pre test calculated ‘t’ value was less than the tabulated ‘t’ value. So null hypothesis was accepted and research hypothesis was rejected. There was no significant difference in the mean score of motor performance, sensory function, passive joint motion and joint pain of the affected upper extremity before administration of mirror therapy in the intervention group and sham therapy in the comparison group.

Post test I calculated ‘t’ value was more than the tabulated ‘t’ value in motor performance, sensory function and passive joint motion. So null hypothesis was rejected and research hypothesis was accepted. There was a significant difference in the mean score of motor performance, sensory function and passive joint motion of the affected upper extremity after administration of mirror therapy in the intervention group and sham therapy in the comparison group. But post test I calculated ‘t’ value was less than the tabulated ‘t’ value in joint pain. So null hypothesis was accepted and research hypothesis was rejected. Hence there was no significant difference in the mean score of joint pain of the affected upper extremity after administration of mirror therapy in the intervention group and sham therapy in the comparison group.

Post test II calculated ‘t’ value was greater than the tabulated ‘t’ value. So null hypothesis was rejected and research hypothesis was accepted. There was a significant difference in the mean score of motor performance, sensory function, passive joint motion and joint pain of the affected upper extremity after administration of mirror therapy in the intervention group and sham therapy in the comparison group. That implies that mirror therapy helps to improve the upper extremity motor function among stroke patients.

SECTION V: Association between demographic variables and pre test level of motor function among stroke patients with upper extremity motor impairment.

Null Hypothesis (H_{03}): There will not be an association between demographic variables and motor function among stroke patients with upper extremity motor impairment.

Table 4.11: Association of between pre test level of motor performance and demographic variables among stroke patients

n=30

S.No	Demographic variables	Motor performance		χ^2	Degree of freedom	Table value
		Moderate motor impairment	Severe motor impairment			
1.	**Age in years**					
	20-30	0	2			
	31-40	0	2			
	41-50	1	6	1.032	5	11.070
	51-60	1	7	(N.S)		
	61-70	1	7			
	71-80	0	3			
2.	**Gender**					
	Male	2	19	0.018	1	3.841
	Female	1	8	(N.S)		
3.	**Education**					
	Illiterate	0	1			
	Primary	2	9	1.942	5	11.070
	High school	1	8	(N.S)		
	Higher secondary	0	3			
	Graduate	0	5			
	Post graduate	0	1			
4.	**Duration of stroke**					
	1-30 days	3	23			
	31-60 days	0	2	0.513	2	5.991
	61-90 days	0	2	(N.S)		
5.	**Stroke affected side**					
	Right	2	11	0.739	1	3.841
	Left	1	16	(N.S)		
6.	**Dominant side**					
	Right	3	24	0.37	1	3.841
	Left	0	3	(N.S)		
7.	**Associated illness**					
	No associated illness	3	10			
	Hypertension	0	12	4.359	3	7.815
	Diabetes Mellitus	0	4	(N.S)		
	Ischemic heart Disease	0	1			

* $p<0.05$ statistically significant N.S - Not Significant

The table shows that there was no association between the demographic variables of the patient such as age, sex, education, duration of stroke, stroke affected side, dominant side, associated illness and motor performance. So null hypothesis was accepted and research hypothesis was rejected. This indicates that these demographic variables had not influenced the motor performance of the stroke patients.

Table 4.12: Association of between pre test level of sensory function and demographic variables among stroke patients

n=30

S. No	Demographic variables	Sensory function			χ^2	Degree of freedom	Table value
		Mild sensory impairment	Moderate sensory impairment	Severe sensory impairment			
1.	**Age in years**						
	20-30	0	2	0			
	31-40	0	2	0			
	41-50	1	6	0	3.967	10	18.307
	51-60	2	5	1	(N.S)		
	61-70	1	6	1			
	71-80	1	2	0			
2.	**Gender**						
	Male	4	15	2	1.346	2	5.991
	Female	1	8	0	(N.S)		
3.	**Education**						
	Illiterate	0	0	1			
	Primary	3	4	2	7.738	10	18.307
	High school	1	3	2	(N.S)		
	Higher secondary	1	0	2			
	Graduate	0	1	2			
	Post graduate	0	0	1			
4.	**Duration of stroke**						
	1-30 days	5	19	2	1.405		9.488
	31-60 days	0	2	0	(N.S)	4	
	61-90 days	0	2	0			
5.	**Stroke affected side**						
	Right	3	10	0	2.095	2	5.991
	Left	2	13	2	(N.S)		
6.	**Dominant side**						
	Right	5	21	1	4.155	2	5.991
	Left	0	2	1	(N.S)		
7.	**Associated illness**						
	No associated illness	3	9	1			
	Hypertension	2	9	1	2.011	3	7.815
	Diabetes Mellitus	0	4	0	(N.S)		
	Ischemic heart Disease	0	1	0			

* $p<0.05$ statistically significant N.S - Not Significant

The table shows that there was no association between the demographic variables of the patient such as age, sex, education, duration of stroke, stroke affected side, dominant side, associated illness and sensory function. So null hypothesis was accepted and research hypothesis was rejected. This indicates that these demographic variables had not influenced the sensory function of the stroke patients.

Table 4.13: Association of between pre test level of passive joint motion and demographic variables among stroke patients

n=30

S. No	Demographic variables	Passive joint motion		χ^2	Degree of freedom	Table value
		Hypo mobility	No movement			
1.	**Age in years**					
	20-30	0	2			
	31-40	0	2			
	41-50	1	6	1.032	10	18.307
	51-60	1	7	(N.S)		
	61-70	1	7			
	71-80	0	3			
2.	**Gender**					
	Male	2	19	0.018	1	3.841
	Female	1	8	(N.S)		
3.	**Education**					
	Illiterate	0	1			
	Primary	2	9	2.929	5	11.070
	High school	0	9	(N.S)		
	Higher secondary	0	3			
	Graduate	1	4			
	Post graduate	0	1			
4.	**Duration of stroke**					
	1-30 days	3	23			
	31-60 days	0	2	0.513	2	5.991
	61-90 days	0	2	(N.S)		
5.	**Stroke affected side**					
	Right	2	11	0.739	1	3.841
	Left	1	16	(N.S)		
6.	**Dominant side**					
	Right	2	25	2.016	1	3.841
	Left	1	2	(N.S)		
7.	**Associated illness**					
	No associated illness	3	10			
	Hypertension	0	12	4.359	3	7.815
	Diabetes Mellitus	0	4	(N.S)		
	Ischemic heart Disease	0	1			

* $p<0.05$ statistically significant N.S - Not Significant

The table shows that there was no association between the demographic variables of the patient such as age, sex, education, duration of stroke, stroke affected side, dominant side and associated illness and passive joint motion. So null hypothesis was accepted and research hypothesis was rejected. This indicates that these demographic variables had not influenced the passive joint motion of the stroke patients.

Table 4.14: Association of between pre test level of joint pain and demographic variables among stroke patients

n=30

S. No	Demographic variables	Level of joint pain		χ^2	Degree of freedom	Table value
		Moderate pain	Severe pain			
1.	**Age in years**					
	20-30	0	2			
	31-40	1	1			
	41-50	0	7	7.778	5	11.070
	51-60	2	6	(N.S)		
	61-70	0	8			
	71-80	0	3			
2.	**Gender**					
	Male	0	21	7.778*	1	3.841
	Female	3	6			
3.	**Education**					
	Illiterate	0	1			
	Primary	2	9			
	High school	1	8	1.942	5	11.070
	Higher secondary	0	3	(N.S)		
	Graduate	0	5			
	Post graduate	0	1			
4.	**Duration of stroke**					
	1-30 days	2	24			
	31-60 days	1	1	3.932	2	5.991
	61-90 days	0	2	(N.S)		
5.	**Stroke affected side**					
	Right	2	11	0.739	1	3.841
	Left	1	16	(N.S)		
6.s	**Dominant side**					
	Right	3	24	0.370	1	3.841
	Left	0	3	(N.S)		
7.	**Associated illness**					
	No associated illness	2	11			
	Hypertension	0	12	2.863	3	7.815
	Diabetes Mellitus	1	3	(N.S)		
	Ischemic heart	0	1			
	Disease					

* $p<0.05$ statistically significant N.S - Not Significant

The table shows that there was no association between the demographic variables of the patient such as age, education, and stroke affected side, duration of stroke, dominant side, associated illness and joint pain. So null hypothesis was accepted and research hypothesis was rejected .This indicates that these demographic variables had not influenced the joint pain among stroke patients. There was an association between sex and joint pain. Present study showed that male patients were experienced severe pain than female patients.

CHAPTER V

RESULTS AND DISCUSSION

This chapter deals with the discussion of the study findings and the results. The discussion brings the right report to closure. This is the most important section of any research report. Stroke is a leading cause of acquired disability in adults. It is estimated that there will be 23 million new incidence strokes and 7·8 million stroke deaths in 2030.

Mirror therapy helps to improve the motor performance, sensory function, passive joint motion and reduce the joint pain in patients with stroke. The main objective of the study is to assess the effectiveness of mirror therapy to improve upper extremity motor function in stroke patients.

5.1 Frequency and percentage distribution of patients with stroke according to their demographic profile

Age of the stroke patients ranged from a minimum of 20 years to a maximum of 80 years. Most of the patients (26.67%) were in the age group between 51-60 years. Eight patients (26.66%) were in the age group of 61-70 years. This finding was supported by another study which showed that majority of patients with stroke was above 65 years of age and increase in age was one of the risk factor associated with stroke. (PSC Secretariat, 2015)

Regarding the sex of patients, most of the patients were male (70%) and only 5 patients (30%) were females. The results are consistent with the result of another study showed that male to female ratio of stroke was 2:1. (Nagaraja, et al., 2008). Another study found similar findings that among 25 patients with stroke, 14 were males and 11 females. (Yang, et al., 2007). Contradictory results showed in other study females were more prone to get stroke than males. (Bhattacharya, 2011).

Regarding the educational qualification of the patients, most of the patients (36.66%) belongs to primary education. One third of the patients (30%) belong to high school education. This finding was contradictory with studies stated that half of the stroke subjects were illiterate (n=535, 46%). (Nagaraja et al., 2008).

5.2 Frequency and percentage distribution of patients with stroke according to their medical conditions

In this study more than one half of the patients (56.67%) were diagnosed as left side stroke and thirteen patients were diagnosed as right side stroke. The present study results are in consistent with findings of another study showed that among 25 patients, sixteen were right sided stroke and nine were diagnosed as left sided stroke. (Yang, et al., 2007) In a similar study found that among 1174 patients, 513 were affected with right sided stroke and 499 patients were affected with left sided stroke. (Nagaraja, et al., 2008)

There were nearly half of the stroke patients (40%) had history of hypertension. There were 4 stroke patients (13.33%) had diabetes mellitus. Another study revealed that out of 91 patients with stroke, 51 were suffering from hypertension. (Jehangir Khan, et al., 2006). The result was supported by another study showed that hypertension and diabetes mellitus are the important risk factors for stroke. (Chin-Yi Wu, 2014)

5.3 Frequency and percentage distribution of stroke patients level of motor performance among intervention and comparison group in pre test and post test

In this present study, 12 (80%) patients had severe motor impairment during pre test, whereas on post test I (7^{th} day), 4 (26.66%) patients had moderate motor impairment and 11 (73.4%) patients had severe motor impairment, post test II (14^{th} day), 12 (80%) patients motor function was improved to mild motor impairment level after mirror therapy in intervention group. But in comparison group, 15(100%) patients had severe motor impairment, whereas on post test I (7^{th} day) all the 15(100%) patients had severe motor impairment and post test II (14^{th} day), 10(66.66%) patients had severe motor impairment after sham therapy. This finding was supported by

another study showed that upper limb motor performance was improved more in the experimental group after mirror therapy (FIM score shoulder/elbow/forearm items, 9.54 vs. 4.61; wrist items, 2.76 vs. 1.07; hand items, 4.43 vs. 1.46) than in the control group. (Lee, et al., 2012)

5.4 Frequency and percentage distribution of stroke patients level of sensory function among intervention and comparison group in pre test and post test

Regarding sensory function, 12(80%) patient had moderate sensory impairment during pre test, while on post test I (7^{th} day) 7(46.6%) patients attained normal sensory function, whereas post test II (14^{th} day) all the 15(100%) patients attained normal sensory function after mirror therapy in intervention group. In comparison group, 11(73.3%) patients had moderate sensory impairment during pre test, whereas post test I (7^{th} day) 12(80%) patients had moderate impairment, while post test II (14^{th} day) 6(40%) patients attained normal sensory function. In a similar study the result suggested that mirror therapy group showed significant and large effects on sensory function among stroke patients compared with the improvement (Mean score of 3.72, p=0.01) in control group. (Altschuler E.L, et al., 2008)

5.5 Frequency and percentage distribution of stroke patients level of passive joint motion among intervention and comparison group in pre test and post test.

The result of the present study shows that, 13(86.67%) patients had no movement during pre test whereas on post test I (7^{th} day), 5(33.4%) patients attained normal passive motion and post test II (14^{th} day) all 15(100%) patients improved to normal passive joint motion level after administration of mirror therapy in intervention group. In comparison group, 14(93.3%) patients had no movement during pre test, whereas post test I (7^{th} day), 9(60%) patients had no movement and post test II (14^{th} day), 5(33.33%) patient had no movement after administration of sham therapy. Another study found similar findings that majority of the patients passive joint motion was improved after mirror therapy (Score of BAS- 0.83, MAS- 0.89, and FIM- 4.10, respectively; all $p<0.01$) compared with (Score of BAS - 0.16, MAS - 0.43, and FIM- 2.34, respectively; all $p<0.05$) control group. (Ruud Selles, et al., 2012)

5.6 Frequency and percentage distribution of stroke patients level of joint pain among intervention and comparison group in pre test and post test.

The finding of the study stated that, 14(93.33%) patients had severe pain during pre test, whereas on the post test I (7^{th} day) 4(26.67%) patients had moderate pain and 10(66.67%) patients had severe pain, while on post test II (14^{th} day) all the 15(100%) patients had mild pain level after mirror therapy. In comparison group, 13(86.67%) patients had severe pain during pre test. Whereas on post test I (7^{th} day), 12(80%) patients had severe pain level while on the post test II (14^{th} day) 7(46.67%) patients had severe pain after sham therapy.

An interventional study clearly stated that mirror therapy has a significant effect on pain reduction for patients after stroke (SMD -1.10; 95% CI -2.10 to -0.09; p=0.03) compared with all other interventions. (Mehrholz. J, et al., 2012)

5.7 Comparison of Mean and Standard deviation of Upper Extremity Motor Function between Pre Test and Post Test scores among Intervention and Comparison Group patient using paired 't' Test

Comparison of pre test and post test scores of intervention group showed that calculated 't' value was significant at $p<0.001$ level. This showed that there was a significant difference between pre test and post test mean score of motor performance, sensory function, passive joint motion and joint pain among stroke patients who received mirror therapy. Hence it was concluded that the mirror therapy was significantly helps to improve motor function of the upper extremity.

This similar result found in another study showed that the mirror therapy was significantly helps to improve motor performance, sensory function, passive joint motion and joint pain of the upper extremity. (N Engl J, 2009) This study finding was consistent with the result of another study showed that mirror therapy after stroke was a promising method to improve sensory function, passive joint motion in a hemiparaesis hand. (Antje Nakaten, 2014) This result supported by another study showed that mirror therapy help to reduce the joint pain compared to other interventions. (Mesut .B, et al., 2007)

5.8 Comparison of Mean and Standard deviation of Upper Extremity Motor Function between Pre Test, Post Test I and Post Test II scores among Intervention and Comparison Group patients using independent 't' Test

Comparison of pre test and Post test calculated 't' value is greater than the tabulated 't' value. There was a significant difference in the mean score of motor performance, sensory function, passive joint motion and joint pain of the affected upper extremity after administration of mirror therapy in the intervention group and sham therapy in the comparison group. That implies that mirror therapy helps to improve the upper extremity motor function among stroke patients. Winstein CJ, et al., reported that patients of the mirror therapy group had greater improvement in motor function (FMA score from 2.66 to 9.60) compared to (FMA score of 2.81 to 4.93 points) sham therapy group.

5.9 Association between demographic variables and motor performance, sensory function, passive joint motion and joint pain of patient with stroke.

The result of the present study showed that there was no association between the demographic variables of the patient such as age, sex, education, duration of stroke, stroke affected side, dominant side, associated illness and motor function of patients with stroke in both intervention and comparison group. A study results contradicted that age is the important factor in motor functional differences among post stroke patients. (Sasaki, et al., 2014)

There was an association between sex and joint pain. Male patients had severe joint pain than female patients. A study results contradicted with another study result showed that female patient experienced more joint pain than male patients with stroke. (Jonsson, et al., 2006)

There was no association between duration of stroke, sensory function and passive joint motion. A study results contradicted with another study result showed that sensory impairment and no motor movements were noticed during the first 4 weeks of stroke. (Bard and Hirshberg, 2014)

CHAPTER-VI

SUMMARY AND CONCLUSION

Hand function is of great importance in the many daily activities that require well-coordinated hand and arm movements. The present study is a study to assess the effectiveness of mirror therapy to improve upper extremity motor function in stroke patients at PSG hospitals, Coimbatore. The main objective is to find the effectiveness of mirror therapy among intervention group. The reviews evaluated the effects of mirror therapy interventions for stroke survivors and summarized the available evidence on the mirror therapy intervention. The wide literature search also helped in selection of appropriate conceptual planning, developing framework and research plan.

The research design used in this study was true experimental approach, pre test - posttest control group design. The study was conducted in neurology ward, male specialty ward, semiprivate ward, medical ward and special ward of PSG Hospitals, Peelamedu, Coimbatore. The sampling technique used in this study was purposive sampling technique. Using allowable error method the sample size calculated as 30, 15 patients belonged to each intervention and comparison group. According to selection criteria, patients were selected for the study. Standardized tool was used to assess the upper extremity motor function was Fugl-Meyer Assessment. The data were collected after ethical approval from 29.6.2015 to 9.8.2015. The pre test level of motor performance, sensory function, passive joint motion and joint pain were assessed using Fugl-Meyer Assessment and the intervention was provided. Mirror therapy was given for 30 minutes per day and 7 days per week. Mirror therapy was given for 2 weeks minimum. The post test was done at 7^{th} and 14^{th} day of intervention.

The patients willingly and interestingly participated in mirror therapy. The data were collected through interview and observation for all patients of both intervention and comparison group. Both descriptive and inferential statistics were used to analyses of the data. Student and Independent ‘t’ test was used to evaluate the effectiveness of mirror therapy and sham therapy. Chi-square test is used to find out the association

between motor function of upper extremity in stroke patient and their demographical variables.

6.1 Major findings of the study:

1. Among 30 stroke patients, most of the patients (26.67%) were in the age group between 51-60 years and also 8 patients (26.67%) were in the age group of 61-70 years.

2. Most of the stroke patients were male (70%). The remaining (30%) were female patients.

3. Among 30 patients, 11 patients (36.66%) had primary education only and nine (30%) patients had high school education.

4. Majority of the patients (86.67%) had duration of stroke between 1-30 days.

5. Most of the patients (56.67%) were affected with left sided stroke.

6. Most of the patients had associated illness. Nearly half of the patients (40%) had history of hypertension. There were 4 patients (13.33%) had diabetes mellitus.

7. There was a significant improvement in the mean score of motor performance in patient with stroke after mirror therapy ($t=15.349$, $p<0.001$).

8. There was a significant improvement in the mean score of sensory function in patient with stroke after mirror therapy ($t=4.743$, $p<0.001$).

9. There was a significant improvement in the mean score of passive joint motion in patient with stroke after mirror therapy ($t=23.532$, $p<0.001$).

10. There was a significant improvement in the mean score of joint pain in patient with stroke after mirror therapy ($t=19.536$, $p<0.001$).

11. There was a significant improvement of motor performance in intervention group than comparison group in patients with stroke ($t=10.054$, $p<0.05$).

12. There was a significant improvement of sensory function in intervention group than comparison group in patients with stroke ($t=8.670$, $p<0.05$).

13. There was a significant improvement of passive joint motion in intervention group than comparison group in patients with stroke ($t=8.505$, $p<0.05$).

14. There was a significant improvement of joint pain in intervention group than comparison group in patients with stroke ($t=10.838$, $p<0.05$).

6.2 Conclusion:

Mirror therapy was an effective, inexpensive and non pharmacological measure for improving upper extremity motor function. This study was intended to assess the effectiveness of mirror therapy to improve upper extremity motor function in stroke patients at PSG hospitals, Coimbatore. The report of this study was found that there was a significant improvement in upper extremity motor function involving motor performance, sensory function, passive joint motion and joint pain among stroke patients in intervention group compared with sham therapy group.

6.3 Nursing implications:

The present study has implications for nursing practice, nursing education, nursing administration and nursing research.

6.3.1 Nursing practice:

1. Nurses can implement the practice of mirror therapy to improve upper extremity motor function among stroke patients in clinical and community settings.
2. Nurses should assess the upper extremity motor function of patients with stroke by using Fugl-Meyer Assessment on daily basis.

3. Nurses also involve in educating stroke survivors and their families on the importance of mirror therapy in improvement of upper extremity motor function.
4. Nurses should provide support and motivation for stroke patients to continue mirror therapy regimens for permanent incorporation into a daily routine.

6.3.2 Nursing education:

1. Mirror therapy can be included in the literature on improving upper extremity motor function in stroke patients.
2. Mirror therapy training program can be included into the nursing curriculum to improve the upper extremity motor function among stroke patients.
3. Continuous education among staff nurses will help to promote and update their knowledge on administration of mirror therapy for improving upper extremity motor function among stroke patients

6.3.3 Nursing administration:

1. Provision should be made for staff working in neuro ward to get training in mirror therapy and various therapies.
2. Protocol for the procedure of mirror therapy can be developed based on the study findings.
3. Nursing administrators can motivate nurses to use mirror therapy in their clinical practice.

6.3.4 Nursing research:

1. Nurse researchers can conduct studies to verify the scientific rationale or physiology behind the effect of mirror therapy to improve upper extremity motor function among stroke patients.
2. Randomized clinical trials could be under taken so that the validity of the results can be increased and it can be incorporated into the evidence based nursing practice.

6.4 Limitations:

1. The participants were also under physiotherapy treatment.

6.5 Recommendations for further study:

1. A similar study could be conducted in rehabilitation centers and community setting.
2. A comparative study to assess the effectiveness of mirror therapy to improve the upper and lower extremity motor function among patients with stroke.
3. The similar study can be conducted in larger group of population.
4. A study to assess the effectiveness of mirror therapy to reduce the pain in patient with complex regional pain syndrome and phantom pain.

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ANNEXURE-I

PERMISSION LETTER

From

Ms. S. Gokila,
I Year M. Sc Nursing,
PSG College of Nursing,
Peelamedu,
Coimbatore - 4

To

Dr. K. Ramadoss, MD, DM.
Professor and HOD of Neurology,
PSG Hospitals,
Coimbatore - 4

Through : The Principal, PSG College of Nursing

6/2/15

Respected Sir,

Sub: Seeking permission to carry out the study in PSG Hospitals, Coimbatore.

I Ms. S. Gokila, I year M.Sc. Nursing student is interested in doing this study. "**A Study to assess the Effectiveness of Mirror Therapy to Improve Upper Extremity Motor Function in Stroke Patients at PSG Hospitals, Coimbatore**". Kindly grant me permission to carry out the study.

Thanking You,

Date: 09-02-15
Place: PEELAMEDU

Yours sincerely

S.GOKILA,
I year M.Sc Nursing.

Signature of Neurology HOD:

Dr.K.Ramadoss, MD.,DM
Reg. No: 43816
Department of Neurology

PERMISSION LETTER

From

Ms. S. Gokila,
I Year M. Sc Nursing,
PSG College of Nursing,
Peelamedu,
Coimbatore - 4

To

Dr. Vimal Kumar Govindan.
Medical Director,
PSG Hospitals,
Coimbatore - 4

Through : The Principal, PSG College of Nursing

Respected Sir,

Sub: Seeking permission to carry out the study in PSG Hospitals, Coimbatore.

I Ms. S. Gokila, I year M.Sc. Nursing student is interested in doing this study. "**A Study to assess the Effectiveness of Mirror Therapy to Improve Upper Extremity Motor Function in Stroke Patients at PSG Hospitals, Coimbatore**". Kindly grant me permission to carry out the study.

Thanking You,

Date: 09.02.15
Place: PEELAMEDU

Yours sincerely

S.GOKILA,
I year M.Sc Nursing.

Signature of Medical Director:

Dr.Vimal Kumar Govindan,MS,FRCSed.,
Medical Director
PSG Hospitals
Peelamedu,
Coimbatore - 641 004.

ANNEXURE-II

PSG HOSPITALS
AVINASHI ROAD • PEELAMEDU • COIMBATORE 641 004. INDIA

Phone : 91-422-2570170 (6 Lines) & 2598822
Fax : 91-422-2594400
E-mail : psghospitals@yahoo.co.in

TO WHOMSO EVER IT MAY CONCERN

This is to certify that Ms. Gokila.S, Studying M.Sc(Nursing) at PSG College of Nursing has been trained in assessing the two scales named "Fugl- Meyer Assessment and Brunnstorm Motor Recovery Scale" and is considered eligible to assess the same scale in a clinical setup.

14/01/15

DR V RAMAMOORTHY MD.,
PROF & HOD

Dr.V.RAMAMOORTHY, DNB(PMR)
Prof & Head Dept. of PM&R
PSG Hospitals
PSG Institute of Medical Sciences & Research
Coimbatore - 641 004.
Regd. No. 45391.

PSG HOSPITALS
COIMBATORE-641 004.

ANNEXURE-III

PSG Institute of Medical Sciences & Research
Institutional Human Ethics Committee
Recognized by The Strategic Initiative for Developing Capacity in Ethical Review (SIDCER)
POST BOX NO. 1674, PEELAMEDU, COIMBATORE 641 004, TAMIL NADU, INDIA
Phone : 91 422 - 2598822, 2570170, Fax : 91 422 - 2594400, Email : ihec@psgimsr.ac.in

To
Ms S Gokila
I M Sc Nursing
PSG College of Nursing
Coimbatore

Ref: Project No.15/086

Date: March 18, 2015

Dear Ms Gokila,

Institutional Human Ethics Committee, PSG IMS&R reviewed and discussed your application dated 18.02.2015 to conduct the research study entitled *"A study to assess the effectiveness of mirror therapy to improve upper extremity motor function in stroke patients at PSG Hospitals, Coimbatore"* during the IHEC meeting held on 27.02.2015.

The following documents were reviewed and approved:

1. Project Submission form
2. Study protocol
3. Informed consent forms
4. Data collection tool
5. Permission letter from concerned Head of the Departmetn
6. Current CVs of Principal investigator, Co-investigator
7. Budget

The following members of the Institutional Human Ethics Committee (IHEC) were present at the meeting held on 27.02.2015 at IHEC Secretariat, PSG IMS & R between 10.00 am and 11.00 am:

Sl. No.	Name of the Member of IHEC	Qualification	Area of Expertise	Gender	Affiliation to the Institution Yes/No	Present at the meeting Yes/No
1	Dr. P. Sathyan (Chairperson, IHEC)	DO, DNB	Clinician (Ophthalmology)	Male	No	Yes
2	Dr. S. Bhuvaneshwari (Member-Secretary, IHEC)	MD	Clinical Pharmacology	Female	Yes	Yes
3	Dr. S.Shanthakumari	MD	Pathology, Ethicist	Female	Yes	Yes
4	Dr. D. Vijaya	M Sc, Ph D	Basic Medical Sciences (Biochemistry)	Female	Yes	Yes

The study is approved in its presented form. The decision was arrived at through consensus. Neither PI nor any of proposed study team members were present during the decision making of the IHEC. The IHEC functions in accordance with the ICH-GCP/ICMR/Schedule Y guidelines. The approval is valid until one year from the date of sanction. You may make a written request for renewal / extension of the validity, along with the submission of status report as decided by the IHEC.

PSG Institute of Medical Sciences & Research
Institutional Human Ethics Committee
Recognized by The Strategic Initiative for Developing Capacity in Ethical Review (SIDCER)
POST BOX NO. 1674, PEELAMEDU, COIMBATORE 641 004, TAMIL NADU, INDIA
Phone : 91 422 - 2598822, 2570170, Fax : 91 422 - 2594400, Email : ihec@psgimsr.ac.in

Following points must be noted:

1. IHEC should be informed of the date of initiation of the study
2. Status report of the study should be submitted to the IHEC every 12 months
3. PI and other investigators should co-operate fully with IHEC, who will monitor the trial from time to time
4. At the time of PI's retirement/intention to leave the institute, study responsibility should be transferred to a colleague after obtaining clearance from HOD, Status report, including accounts details should be submitted to IHEC and extramural sponsors
5. In case of any new information or any SAE, which could affect any study, must be informed to IHEC and sponsors. The PI should report SAEs occurred for IHEC approved studies within 7 days of the occurrence of the SAE. If the SAE is 'Death', the IHEC Secretariat will receive the SAE reporting form within 24 hours of the occurrence
6. In the event of any protocol amendments, IHEC must be informed and the amendments should be highlighted in clear terms as follows:
   a. The exact alteration/amendment should be specified and indicated where the amendment occurred in the original project. (Page no. Clause no. etc.)
   b. Alteration in the budgetary status should be clearly indicated and the revised budget form should be submitted
   c. If the amendments require a change in the consent form, the copy of revised Consent Form should be submitted to Ethics Committee for approval
   d. If the amendment demands a re-look at the toxicity or side effects to patients, the same should be documented
   e. If there are any amendments in the trial design, these must be incorporated in the protocol, and other study documents. These revised documents should be submitted for approval of the IHEC and only then can they be implemented
   f. Any deviation-Violation/waiver in the protocol must be informed to the IHEC within the stipulated period for review
7. Final report along with summary of findings and presentations/publications if any on closure of the study should be submitted to IHEC

Kindly note this approval is subject to ratification in the forthcoming full board review meeting of the IHEC.

Thanking You,

Yours Sincerely,

SECRETARY
PSG IMS&R
COIMBATORE-641004.
INSTITUTIONAL HUMAN ETHICS COMMITTEE

Dr S Bhuvaneshwari
Member - Secretary
Institutional Human Ethics Committee

ANNEXURE-IV

PSG Institute of Medical Science and Research, Coimbatore
Institutional Human Ethics Committee
INFORM CONSENT FORMAT FOR RESEARCH PROJECTS
PATIENT INFORMATION SHEET

I, S.Gokila, am carrying out a study on the topic: "A STUDY TO ASSESS THE EFFECTIVENESS OF MIRROR THERAPY TO IMPROVE UPPER EXTREMITY MOTOR FUNCTION IN STROKE PATIENTS AT PSG HOSPITALS, COIMBATORE", as part of my research project being carried out under the aegis of the Department of: Nursing

My research guide is: Prof. Tamilselvi.A, HOD of Medical-surgical nursing department, PSG College of Nursing. / Dr.G.Malarvizhi, Vice principal, PSG College of nursing

The justification for this study : Mirror therapy is a relatively new therapeutic intervention for stroke patient. Working mechanism behind mirror therapy is activation of mirror neuron system. By undergoing mirror therapy patients upper extremity motor function will be improved

The objectives of this study are:

Primary Objective: To assess the motor function of upper extremity in stroke patients.

Secondary Objective: To evaluate the effectiveness of mirror therapy on motor function of upper extremity in experimental group and sham therapy in control group.
Sample size: 30.

Study volunteers / participants are (specify population group & age group): stroke patients.

Location: PSG Hospitals, Coimbatore

Data collected will be stored for a period of 5 years.

Benefits from this study: Mirror therapy improves the motor function of the affected upper extremity among stroke patients.

Projected outcome:

Stroke patients will improve in motor function of upper extremity after administration of mirror therapy.

Signature / Left thumb impression of the Study Volunteer / Legal Representative:

Signature of the Interviewer with date: Witness:

Contact number of PI: 9626718969
Contact number of Ethics Committee Office: 0422 2570170 Extn: 5818

INFORMED CONSENT FOR PATIENT

The above information regarding the study, has been read by me/ read to me, and has been explained to me by the investigator. Having understood the same, I hereby give my consent to them to interview me. I am affixing my signature / left thumb impression to indicate my consent and willingness to participate in this study (i.e., willingly abide by the project requirements).

Date of assessment:

Signature / Left thumb impression of the Study Volunteer / Legal Representative:

Signature of the Interviewer with date: Witness:

Contact number of PI: 9626718969

Contact number of Ethics Committee Office: 0422 2570170 Extn.: 5818

தகவல்த்தாள் மற்றும் ஒப்புதல் படிவம்

தேதி :

கோகிலா .செ, ஆகிய நான், பி. எஸ். ஜி. மருத்துவக் கல்லூரியின், செவிலியர் துறையின் கீழ் **"கண்ணாடியின் முன் கைப்பயிற்சி செய்வதின் மூலம் பக்கவாத நோயாளிகளுடைய கையின் செயல்பாடு மேம்படும் திறனைமதிப்பீடு செய்தல்"** என்ற தலைப்பில் ஆய்வு மேற்கொள்ள உள்ளேன்.

என் ஆய்வு வழிகாட்டி: பேராசிரியை. தமிழ்ச்செல்வி

ஆய்வு மேற்கொள்வதற்கான அடிப்படை:

- பக்கவாதத்தால் கைகள் பாதிக்கப்பட்ட நோயாளிக**ளுக்கு கண்**ணாடியின் முன் கைப்பயிற்சி செய்வது ஒரு புதிய மற்றும் அத்தியாவசிய சிகிச்சை முறை ஆகும். இது நரம்பு செல்லை ஊக்குவித்து செயல்பாட்டை மேம்படுத்தும் முறையை பின்பற்றுகிறது. இதனால் கைகளின் செயல்பாடுகள் மேம்படும்.

ஆய்வின் நோக்கம்:

- பக்கவாதத்தால் பாதிக்கப்பட்ட நோயாளிகளுடைய கையின் செயல்பாட்டுத் திறனை கண்டறிதல்.
- கண்ணாடியின் முன் கைப்பயிற்சி செய்வதின் மூலம் பக்கவாத நோயாளிகளுடைய கையின் செயல்பாட்டுத் திறனை ஆய்வுக் குழுவிற்கும் மற்றும் சாம் சிகிச்சையின் திறனை ஆய்விற்கு உட்படுத்தாத குழுவிற்கும் மதிப்பிடல்.
- பக்கவாத நோயாளிகளுடைய கையின் செயல்பாட்டுத் திறனை அடிப்படை தகவலோடு இணைத்தல்.

ஆய்வில் பங்கு பெறும் நபர்களின் எண்ணிக்கை: 30

ஆய்வு மேற்கொள்ளும் இடம்: பி. எஸ். ஜி. மருத்துவமனை, கோயம்புத்தூர்.

ஆய்வின் பலன்கள்:

கண்ணாடியின் முன் கைப்பயிற்சி செய்வதின் மூலம் பக்கவாத நோயாளிகளுடைய கையின் செயல்பாட்டு திறனை முன்னேற்றம் அடைய செய்தல்.

ஆய்வினால் ஏற்படும் அசௌகரியங்கள் / பக்க விளைவுகள்: பக்க விளைவுகள் எதுவும் இல்லை.

இந்த ஆய்வில் கிடைக்கும் தகவல்கள் 5 வருடங்கள் பாதுகாக்கப்படும். இவை வேறு எந்த ஆய்விற்கும் பயன்படுத்தப்பட மாட்டாது. எந்த நிலையிலும் உங்களைப் பற்றிய தகவல்கள் யாருக்கும் தெரிவிக்கப்படமாட்டாது. அவை இரகசியமாக வைக்கப்படும்.

எந்த நேரத்தில் வேண்டுமானாலும் ஆய்விலிருந்து விலகிக்கொள்ளும் உரிமை உங்களுக்கு உண்டு. ஆய்விலிருந்து விலகிக்கொள்வதால் உங்களுக்கு அளிக்கப்படும் சிகிச்சையில் எந்த வித மாற்றமும் இருக்காது.

இந்த ஆராய்ச்சிக்காக உங்களிடம் சில கேள்விகள் கேட்கப்படும்.

மேலும், இந்த ஆய்வில் பங்கு கொள்வது உங்கள் சொந்த விருப்பம். இதில் எந்த விதக் கட்டாயமும் இல்லை. நீங்கள் விருப்பப் பட்டால், இந்த ஆய்வின் முடிவுகள் உங்களுக்குத் தெரியப் படுத்தப்படும்.

ஆய்வாளரின் கையொப்பம் :

தேதி :

ஆய்வுக்குட்படுபவரின் ஒப்புதல் படிவம்

நான் இந்த ஆராய்ச்சியின் நோக்கம் மற்றும் அதன் பயன்பாட்டினைப் பற்றி தெளிவாகவும், விளக்கமாகவும் தெரியப்படுத்தப் பட்டுள்ளேன். இந்த ஆராய்ச்சியில் பங்கு கொள்ளவும், இந்த ஆராய்ச்சியின் மருத்துவ ரீதியான குறிப்புகளை வரும் காலத்திலும் உபயோகப்படுத்திக் கொள்ளவும் முழு மனதுடன் சம்மதிக்கிறேன்.

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ANNEXURE-V

CRITERIA FOR SELECTING PATIENT

1. Is this first episode of stroke?
    a. Yes
    b. No
2. What was the duration of stroke?
    a. Less than 1 year
    b. More than 1 year
3. Do you have fracture in your stroke affected hand?
    a. Yes
    b. No
4. Contractures present

Left	Right
Yes	Yes
No	No

5. Able to identify the objects: Yes/ No

BRUNN STROM RECOVERY SCALE

Stage	Description
1	Immediately following a stroke there is a period of flaccidity whereby no movement of the limbs on the affected side occurs.
2	Recovery begins with developing spasticity, increased reflexes and synergic movement patterns termed obligatory synergies. These obligatory synergies may manifest with the inclusion of all or only part of the synergic movement pattern and they occur as a result of reactions to stimuli or minimal movement responses.
3	Spasticity becomes more pronounced and obligatory synergies become strong. The patient gains voluntary control through the synergy pattern, but may have a limited range within it.
4	Spasticity and the influence of synergy begin to decline and the patient is able to move with less restrictions. The ease of these movements progresses from difficult to easy within this stage.
5	Spasticity continues to decline, and there is a greater ability for the patient to move freely from the synergy pattern. Here the patient is also able to demonstrate isolated joint movements, and more complex movement combinations.
6	Spasticity is no longer apparent, allowing near-normal movement and coordination.
7	Last recovery stage, normal motor function is restored.

Section A: Demographic data

1. Sample number:

2. Age:

3. Sex:

4. Education:

5. Date of assessment:

Section B: Medical History

1. Date of admission:

2. Duration of stroke:

3. Stroke affected side:

4. Dominant side:

5. Associated illness:

Section C: **Fugl Meyer Assessment**

FUGL MEYER ASSESSMENT

A. UPPER EXTREMITY:

Position	Attained score/Maximum possible score	Test	Score criteria	
			None	Can be Elicited
Sitting	_/4	**REFLEX ACTIVITY** • Biceps	0	2
		• Triceps	0	2

Position	Attained score/Maximum possible score	Test	Score criteria		
			None	Partial	Full
Sitting	_/12	**VOLITIONAL MOVEMENT WITHIN SYNERGIES** (A). Flexor synergy • Elevation	0	1	2
		• Shoulder retraction	0	1	2
		• Abduction	0	1	2
		• External rotation	0	1	2
		• Elbow flexion	0	1	2
		• Forearm supination	0	1	2
	_/6	(B).Extensor synergy • Shoulder adduction/ internal rotation	0	1	2
		• Elbow extension	0	1	2
		• Forearm pronation	0	1	2
	_/6	**MOVEMENT COMBING SYNERGIES** • Hand to Lumbar spine	0	1	2
		• Shoulder flexion to 90◦ elbow at 0◦	0	1	2
		• Pronation /supination of forearm with elbow at 90◦ and shoulder at 0◦.	0	1	2
	_/6	**MOVEMENT OUT OF SYNERGY** • Shoulder abduction to 90◦ elbow at 0◦ and Forearm pronated	0	1	2
		• Shoulder flexion to 90◦ elbow at 0◦	0	1	2
		• Pronation /supination of forearm with elbow at 90◦ and shoulder at 0◦	0	1	2

	_/2	**NORMAL REFLEX ACTIVITY** • Biceps and or finger flexors and triceps (This component is included only if the patient has a score of 6 for component IV)	0	1	2
B. Wrist	_/10	• Stability at 15° dorsiflexion Elbow at 90°, Forearm Pronated, Shoulder at 0°	0	1	2
		• Flexion/ extension, elbow at 90◦, shoulder at 0°	0	1	2
		• Stability ,elbow at 0,shoulder shoulder at 30°	0	1	2
		• Flexion/ extension, elbow at 0°, shoulder at 30°	0	1	2
		• Circumduction	0	1	2
C. Hand	_/14	• Finger mass flexion	0	1	2
		• Finger mass Extension	0	1	2
		• Flexion	0	1	2
		• Thumb adduction	0	1	2
		• Opposition	0	1	2
		• Cylinder grip	0	1	2
		• Spherical grip	0	1	2
D. Coordination/ Speed	_/6	**Coordination/ speed-finger-to-nose** (five repetitions in rapid succession) • Tremor	0	1	2
		• Dysmetria	0	1	2
		• Speed	0	1	2

I.SENSATION

Position	Attained score/ Maximum possible score	Test	Scoring criteria		
			Anesthesia	Hyperaesthesia	Normal
Sitting	_/4	**I.** Light touch • Upper arm	0	1	2
		• Palm to hand	0	1	2
			Absence Less than ¾ correct	¾ correct considerable difference	Correct 100% little or no difference
Sitting	_/8	**II. Proprioception** • Shoulder	0	1	2
		• Elbow	0	1	2
		• Wrist	0	1	2
		• Thumb	0	1	2

II.PASSIVE JOINT MOTION

Position	Attained score/ Maximum possible score	Test	Scoring criteria		
			Only few degrees (less than 10 in shoulder)	Decreased	Normal
Sitting	_/24	**Shoulder** Flexion (0◦-180◦)	0	1	2
		Abduction(0◦-90◦)	0	1	2
		External rotation	0	1	2
		Internal rotation	0	1	2
		Elbow Flexion	0	1	2
		Extension	0	1	2
		Forearm Pronation	0	1	2
		Supination	0	1	2
		Wrist Flexion	0	1	2
		Extension	0	1	2
		Fingers Flexion	0	1	2
		Extension	0	1	2

III.JOINT PAIN

Position	Attained score/ Maximum possible score	Test	Scoring criteria		
			No pain	Some pain	pronounced constant pain during or at the end of movement
Sitting	_/24	**Shoulder** • Flexion(0◦-180◦)	0	1	2
		• Abduction (0◦-90◦)	0	1	2
		• External rotation	0	1	2
		• Internal rotation	0	1	2
		Elbow • Flexion	0	1	2
		• Extension	0	1	2
		Forearm • Pronation	0	1	2
		• Supination	0	1	2
		Wrist • Flexion	0	1	2
		• Extension	0	1	2
		Fingers • Flexion	0	1	2
		• Extension	0	1	2

A.	UPPER EXTREMITY	_/36
B.	WRIST	_/10
C.	HAND	_/14
D.	COORDINATION /SPEED	_/6
TOTAL A-D(MOTOR PERFORMANCE)		**_/66**

I.	SENSATION	_/12
II.	PASSIVE JOINT MOTION	_/24
III.	JOINT PAIN	_/24

INTERPRETATIONS:

Motor Performance

Normal motor function	: ≥63
Mild motor impairment	: 55-62
Moderate motor impairment	: 33-54
Severe motor impairment	: ≤ 32

Sensation

Normal Sensation	: ≥10
Mild sensory impairment	: 7-9
Moderate sensory impairment	: 4-6
Severe sensory impairment	: ≤3

Passive Joint Motion

Normal movement	: ≥19
Hypo mobility	: 13-18
No movement	: ≤12

Joint Pain

No pain	: 0
Mild pain	: 1- 8
Moderate pain	: 9-15
Severe pain	: ≥16

ANNEXURE-VI

A STUDY TO ASSESS THE EFFECTIVENESS OF MIRROR THERAPY TO IMPROVE UPPER EXTREMITY MOTOR FUNCTION IN STROKE PATIENTS AT PSG HOSPITALS, COIMBATORE

A brief introduction on mirror therapy will be given to the participants and relatives with adequate positive reinforcement. Mirror therapy is the training helps to improve motor function of upper extremity. Mirror therapy should be done for 30 minutes per day and 7 times for a week in 2 weeks.

Equipment needed:

- Mirror box
- Sham therapy box
- Chair
- Pen
- Bed side table
- Reflex hammer
- Ball

Description on mirror box:

Mirror therapy was given with the help of mirror box, which is triangular in shape. Size of the mirror box is 30×45 cm. It is made up of Perspex material. One side of the box had a reflective mirror, and other two sides are covered by non reflective plastic material. Adequate space is present in between the surfaces for placing hand.

Description on Sham therapy box:

Sham therapy was given with the help of sham therapy box, which is triangular in shape. Size of the sham therapy box is 30×45 cm. It is made up of Perspex material. All three sides of sham therapy box are covered by non reflective plastic material. Adequate space is present in between the surfaces for placing hand.

Steps of mirror therapy procedure:

- During mirror therapy subjects were seated on a chair close to the table on which a mirror box was placed vertically and advised to place both the hands on the table.
- The involved hand was placed behind the mirror and the noninvolved hand was placed in front of the mirror.
- The subjects were advised not to look on the affected hand and focus towards the mirror. Keep the unaffected hand flat on the table.
- The investigator demonstrated the each exercise such as wrist flexion and extension, finger flexion and extension, fanning out the hand, finger and thumb abduction, makes a fist and release, prehension, pad to pad, pad to side, pad to pad grip, grasping objects, single finger movement, thumb opposition and simultaneously the patients performed the same exercise using the non-paretic hand in front of mirror.
- During the session, subjects were asked to try to do the same movements in the paretic hand while they were moving the non-paretic hand. Subject was instructed to observe the reflection of the non affected hand while doing exercise of both hands.
- Mirror therapy administered for 30 minutes per day and 7 times per week for minimum of two weeks and maximum till the patient get discharged.

Steps of Sham therapy procedure:

- Sham therapy was administered to control group.
- During sham therapy subjects were seated on a chair close to the table on which a non reflective plastic material side was placed vertically and advised to place both the hands on the table.
- The involved hand was placed behind the non reflective plastic material side and the noninvolved hand was placed in front of the non reflective plastic material side.
- The subjects were advised not to look on the affected hand. Keep the unaffected hand flat on the table.
- The investigator demonstrated the each exercise such as wrist flexion and extension, finger flexion and extension, fanning out the hand, finger and thumb abduction, makes a fist and release, prehension, pad to pad, pad to side, pad to pad grip, grasping objects, single finger movement, thumb opposition and simultaneously the patients performed the same exercise using non-paretic hand in front of the non reflective plastic material side.

- During the session, subjects were asked to try to do the same movements in the paretic hand while they were moving the non-paretic hand.
- Sham therapy administered for 30 minutes per day and 7 times per week for minimum of two weeks. Sham therapy was continued till the patients get discharged.