

Effectiveness of Mirror Therapy on hand function improvement among patients with chronic stroke

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Bachelor of Science in Physiotherapy (B. Sc. PT)

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We the undersigned certify that we have carefully read and recommended to the Faculty of Medicine, University of Dhaka, for the acceptance of this dissertation entitled

“Effectiveness of Mirror Therapy on hand function improvement among patients with chronic stroke”

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DECLARATION

I declare that the work presented here is my own. All sources used have been cited appropriately. Any mistakes or inaccuracies are my own. I also decline that for any publication, presentation or dissemination of information of the study. I would be bound to take written consent of my supervisor.

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CONTENTS

Topic	Page No.
Acknowledgement	I
Acronyms	II
List of tables	III-IV
Abstract	V
CHAPTER 1: INTRODUCTION	1-8
1.1 Background	1-3
1.2 Rationale	4
1.3 Aim	5
1.4 Study Objective	5
1.5 Hypothesis	6
1.6 Operational Definition	7
1.7 List of Variable	8
CHAPTER 2: LITERATURE REVIEW	9-14
CHAPTER 3: METHODOLOGY	15-26
3.1 Study design	15-16
3.2 Study Site	17
3.3 Study Area	17
3.4 Study Population and Sample Population	17
3.5 Sampling Technique	17-18
3.6 Randomization	18
3.7 Selection Criteria	19
3.7.1 Inclusion criteria	19
3.7.2 Exclusion criteria	19

3.8 Treatment Regime	20-21
3.9 Sample Size	22
3.10 Data Processing	22
3.10.1 Measurement tools	22
3.10.2 Data collection procedure	22
3.11 Data management and analysis plan	23-25
3.11.1 Statistical Test	23-24
3.11.2 Level of Significance	25
3.12 Informed consent	25
3.13 Ethical considerations	25-26
CHAPTER 4: RESULTS	27-60
CHAPTER 5: DISCUSSION	61-62
Limitation	63
CHAPTER 6: CONCLUSION AND RECOMMENDATIONS	64-65
REFERENCES	66-68
APPENDIX	69-81

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Acronyms

BHPI	Bangladesh Health Professions Institute
CRP	Centre for the Rehabilitation of the Paralysed
BMRC	Bangladesh Medical Research Council
MT	Mirror Therapy
HS	Hemorrhagic Stroke
IS	Ischemic Stroke
DF	Dorsiflexion
df	Degree of Freedom
t	T-value
Sig	Significance
NSAID's	Non-Steroidal Anti-inflammatory Drugs
PT	Physiotherapy
mvt.	Movement
mobi.	Mobilization
RCT	Randomized Controlled Trial
ROM	Range of Movement
WHO	World Health Organization

List of Tables

Table No.	Description	Page No.
Table – 1	Age of the Participants	27
Table – 2	Baseline study of Socio-demographic part	28-29
Table – 3	Stability at 15 degree DF (elbow 90 degree, forearm pronated, shoulder 0) within control group	30
Table – 4	Stability at 15 degree DF (elbow 90 degree, forearm pronated, shoulder 0) within trial group	31
Table – 5	Repeated DF (elbow 90 degree, forearm pronated, Shoulder 0, slight finger flexion) within control group	32
Table – 6	Repeated DF (elbow 90 degree, forearm pronated, shoulder 0, slight finger flexion) within trial group	33
Table – 7	Stability at 15 degree DF (elbow 0 degree, forearm pronated, slight shoulder flexion/abduction) within control group	34
Table – 8	Stability at 15 degree DF (elbow 0 degree, forearm pronated, slight shoulder flexion/abduction) within trial group	35
Table – 9	Repeated DF (elbow 0 degree, forearm pronated, slight shoulder flexion/abduction) within control group	36
Table – 10	Repeated DF (elbow 0 degree, forearm pronated, slight shoulder flexion/abduction) within trial group	37
Table – 11	Circumduction within control group	38
Table – 12	Circumduction within trial group	39
Table – 13	Mass flexion within control group	40
Table – 14	Mass flexion within trial group	41
Table – 15	Mass extension within control group	42
Table – 16	Mass extension within trial group	43

Table – 17	Flexion in PIP & DIP, extension in MCP within control group	44
Table – 18	Flexion in PIP & DIP, extension in MCP within trial group	45
Table – 19	Thumb abduction within control group	46
Table – 20	Thumb abduction within trial group	47
Table – 21	Opposition within control group	48
Table – 22	Opposition within trial group	49
Table – 23	Cylinder grip within control group	50
Table – 24	Cylinder grip within control group	51
Table – 25	Spherical grip within control group	52
Table – 26	Spherical grip within trial group	53
Table – 27	Tremor within control group	54
Table – 28	Tremor within trial group	55
Table – 29	Dysmetria within control group	56
Table – 30	Dysmetria within trial group	57
Table – 31	Time/Speed within control group	58
Table – 32	Time/Speed within trial group	59
Table – 33	Unpaired t- test for between Groups	60

Abstract

Background: Stroke is a leading neurological problem & one of the most vulnerable cause of long term disability & death which is defined by WHO as a rapidly developed clinical sign of focal disturbance of cerebral function of presumed vascular origin and of more than 24 hours duration. And Mirror therapy is a simple, inexpensive, and patient-oriented treatment approach used for the rehabilitation of stroke, phantom limb pain, amputee patients etc. **Purpose:** The purpose of the study was to explore the effectiveness of mirror therapy with conventional physiotherapy compare to only conventional physiotherapy for chronic stroke patients. **Objectives:** To find out the effectiveness of Mirror Therapy on chronic stroke patients after receiving both mirror therapy and conventional physiotherapy at neurology outpatient unit of CRP. **Methodology:** Experimental study design was used in this study. 10 patients with Chronic Stroke were randomly allocated into two groups from outdoor neurological unit, CRP. Among them 5 patients were assigned into trial group received Mirror Therapy with conventional physiotherapy and another 5 into control group received only conventional physiotherapy. Total treatment sessions were 12 comprising of 5 sessions per week for 4 weeks. Single blinding procedure was used during data collection. **Analysis of data:** Unpaired t test was used for between groups. Wilcoxon signed rank test was used for within group improvement of function using SPSS version 20. **Results:** In this study, the results found the calculated t values (0.312, 0.171, 0.482) were less than “Table value or Critical t value” that is 2.306, p value was more than α level (0.05), therefore the test was not significant, means result due to variation or by chance is >5% and confidence level is <95%, and thus difference between two groups in their effectiveness is due to variation or by chance. Therefore we cannot reject the null hypothesis, rather it is accepted. **Conclusion:** This experimental study showed that mirror therapy with conventional physiotherapy was not more effective than conventional physiotherapy alone for patients with chronic stroke.

Key words: Mirror Therapy, Stroke, Hand function, Conventional physiotherapy.

1.1 Background

Stroke is one of the most frequent disabling pathologies in neurological practice (Mirela et al., 2015). It is an important health problem with a high incidence and mortality that affects a large proportion of the population and causes disability in the survivors (Gurbuz et al., 2016). Stroke is the third leading cause of death in Bangladesh. The World Health Organization ranks Bangladesh's mortality rate due to stroke as number 84 in the world. The reported prevalence of stroke in Bangladesh is 0.3%, although no data on stroke incidences have been recorded. Hospital-based studies conducted in past decades have indicated that hypertension is the main cause of ischemic and hemorrhagic stroke in Bangladesh. The high number of disability-adjusted life-years lost due to stroke (485 per 10 000 people) show that stroke severely affects upper extremity (Islam et al., 2013). In 2013, the prevalence rate of HS (Hemorrhagic Stroke) was significantly higher in developed countries than in developing countries. The prevalence rate of IS (Ischemic Stroke) was also significantly higher (by about 5-fold) in developed countries compared to that in developing countries. In 2013, the absolute number of prevalent HS cases in developed countries was 5-fold higher than that of IS, with greatest differences seen in those aged 50-59 years. In contrast, the number of prevalent HS cases was similar or lower than prevalent IS across age groups in developing countries (Feigin et al., 2014).

Mirror Therapy (MT) was first introduced in the treatment of limb-amputated patients with phantom limb pain, and resultant reductions in pain were reported (Ramachandran, Rogers-Ramachandran, 2006). It (MT) has been first developed by Ramachandran and Roger-Ramachandran in an attempt to control abnormal sensation in phantom limb syndrome. It has also been used in complex regional pain syndrome, amputation and stroke (Matei et al., 2015). MT acts by providing a false input to the brain that in turn integrates it into a multimodal sensation or action: the patient has the illusion that the healthy limb he sees moving in the mirror is the affected one (that is hidden behind it), and associates correct movement with his intention (Cristina et al., 2015) and aims at improving the functional movements of the paretic limb (Park et al., 2015). At the end of the 2000s, Altschuler et al.

introduced Mirror Therapy in the rehabilitation of hemi-paretic stroke survivors, showing improvement in their range of motion, speed & dexterity of the paretic arm (Altschuler et al., 2009). Mirror therapy is a simple, inexpensive, and patient-oriented treatment. Functional brain imaging studies conducted on healthy individuals have shown that the ipsilateral primary cortex excitability increases when observing the mirror image of the hand during unilateral hand movements (Garry, 2005). The exact mechanisms mirror therapy triggers are not clear. (Rossiter et al., 2015). Similar results with a shift in activation balance within the primary motor cortices toward the affected hemisphere solely in the mirror group were found in an fMRI study (Michielsen et al., 2011).

Mirror therapy was invented by Vilayanur S. Ramachandran to help alleviate the Phantom limb pain, in which patients feel they still have a pain in the limb even after having it amputated. Ramachandran and Rogers-Ramachandran first devised the technique in an attempt to help those with phantom limb pain resolve what they termed a 'Learned Paralysis' of the painful phantom limb. The visual feedback, from viewing the reflection of the intact limb in place of the phantom limb, made it possible for the patient to perceive movement in the phantom limb. Their hypothesis was that every time the patient attempted to move the paralyzed limb, they received sensory feedback (through vision and Proprioception) that the limb did not move. This feedback stamped itself into the brain circuitry through a process of Hebbian learning, so that, even when the limb was no longer present, the brain had learned that the limb (and subsequent phantom) was paralyzed. To retrain the brain, and thereby eliminate the learned paralysis, Ramachandran and Rogers Ramachandran created the mirror box.

According to IOSR Journal of Nursing and Health Science (IOSR-JNHS), the patient places the good limb into one side, and the stump into the other. The patient then looks into the mirror on the side with good limb and makes "mirror symmetric" movements, as a symphony conductor might, or as we do when we clap our hands. Because the subject is seeing the reflected image of the good hand moving, it appears as if the phantom limb is also moving. Through the use of this artificial visual feedback it becomes possible for the patient to "move" the phantom limb, and to unclench it from potentially painful positions.

Mirror therapy has been studied in several clinical trials, but most of the patients were in the chronic phase of stroke and the studies were conducted to evaluate the efficacy of MT combined with classical treatment in improving motor recovery of the upper limb (Thieme et al., 2012)

1.2 Rationale

Stroke rehabilitation is mainly completed by MDT. Physiotherapy is a significant part of this MDT. As the physiotherapy profession is newly introduced in Bangladesh, many people are not aware of its purpose. But it is an important part of health care to prevent diseases as well as to improve or maximize independence in people with disabilities. Therefore, physiotherapy can play an absolute role in the management of the people with stroke. Eventually, other professionals as well as general public will become aware about this service and this will be helpful to establish this profession at different institution, hospitals and clinics to fulfill the health care needs of the patient. At least 85% of stroke patients experience hemiplegia and upper-extremity function of at least 69% of patients is damaged. Functional loss in the upper extremity causes difficulty in performing daily living activities, and causes to become dependent. The target in stroke rehabilitation is to enable the highest functional independence level possible for the individual and to increase the quality of life despite the current limitations. However, conventional treatment methods used for this purpose are insufficient in enabling upper extremity functional recovery. Several studies are made on the effectiveness of mirror therapy in post- stroke upper extremity rehabilitation. Mirror therapy will help us in improving hand functions faster & motivate the patients also. By this result we get appropriate measure of improvement of upper motor recovery such as hand function after stroke. The study will also help to play more attention to perform hand function. The researcher would like to conduct this study in order to develop an evidence to improve hand function in relation to physiotherapy interventions of stroke patient. A new physiotherapy intervention will be established easily for stroke patients. And as a physiotherapist we can easily use that intervention for treating a stroke patient. A new dimension will be added for improving the hand function of stroke patients. So that after doing this study patient will be more aware of physiotherapy management. In Bangladesh, most of the patients come at later stage and their improvement are not satisfactory. It is thought, if we can identify the specific factors, then we can give concentration on those specific factors for the better outcome of the people who are suffering from stroke and they will get maximum benefit from physiotherapy treatment. As a result it will improve the functional outcome, reducing limitation of activity.

1.3. Aim

To find out the effectiveness of mirror therapy combined with conventional treatment in improving hand function of chronic stroke patients.

1.4. Objectives

1.4.1. General objectives

- To investigate the effectiveness of Mirror Therapy on chronic stroke patients after receiving both mirror therapy and conventional physiotherapy at neurology outpatient unit of CRP.

1.4.2. Specific objectives

- To determine the efficacy of mirror therapy combined with conventional treatment in improving hand function among patients with chronic stroke in this study.
- To compare the hand functional activity after receiving this mirror therapy.
- To identify the improvement of coordination after receiving this mirror therapy.
- To find out the improvement of wrist functional activity after receiving this mirror therapy.

1.5. Hypothesis

1.5.1. Null Hypothesis

Mirror therapy with conventional physiotherapy is no more effective than conventional physiotherapy alone for the improvement of hand function of patients with chronic stroke.

$H_0: \mu_1 - \mu_2 = 0$, or $\mu_1 = \mu_2$: where the experimental group and control group initial and final mean difference is same.

Here,

H_0 = Null hypothesis

H_a = Alternative hypothesis

μ_1 = Mean difference in initial assessment

μ_2 = Mean difference in final assessment

1.5.2. Alternative Hypothesis

Mirror therapy with conventional physiotherapy is more effective than conventional physiotherapy alone for the improvement of hand function of patients with chronic stroke.

$H_a: \mu_1 - \mu_2 \neq 0$, or $\mu_1 \neq \mu_2$: where the experimental group and control group initial and final mean difference is not same.

1.6. Operational Definitions

1.6.1. Stroke

WHO (World Health Organization) defines stroke as: A rapidly developed clinical sign of focal disturbance of cerebral function of presumed vascular origin and of more than 24 hours duration.

1.6.2. Hemorrhagic Stroke

A hemorrhagic stroke occurs when a blood vessel that carries oxygen and nutrients to the brain bursts and spills blood into the brain. When this happens, a portion of the brain becomes deprived of oxygen and will stop functioning.

1.6.3. Ischemic stroke

This type of stroke occurs as a result of an obstruction within a blood vessel supplying blood to the brain. It accounts for 87 percent of all stroke cases.

1.6.4. Mirror Therapy

Mirror therapy refers to the use of a mirror to create a reflective illusion of an affected limb in order to trick the brain into thinking movement has occurred without pain. It involves placing the affected limb behind a mirror, which is sited so the reflection of the opposing limb appears in place of the hidden limb.

1.6.5. Effectiveness

Effectiveness is the capability of producing a desired result. When something is deemed effective, it means it has an intended or expected outcome, or produces a deep, vivid impression.

1.7. List of Variables

- **Independent Variables:**

1. Mirror therapy
2. Conventional physiotherapy

- **Dependent Variables:**

1. Chronic stroke
2. Hand function
3. Wrist function
4. Coordination

Stroke is classically characterized as a neurological deficit attributed to an acute focal injury of the central nervous system (CNS) by a vascular cause, including cerebral infarction, intracerebral hemorrhage (ICH), and subarachnoid hemorrhage (SAH), and is a major cause of disability and death worldwide. Despite its global impact, the term “stroke” is not consistently defined in clinical practice, in clinical research, or in assessments of the public health. Advances in basic science, neuropathology, and neuroimaging have improved the understanding of ischemia, infarction, and hemorrhage in the CNS. (Sacco et al., 2013)

Stroke refers to the rapid loss of brain function due to an interruption of blood supply to the brain. It is the most frequent cause of death and neurological disability in the world's adult population. Stroke is defined by WHO as a rapidly developed clinical sign of focal disturbance of cerebral function of presumed vascular origin and of more than 24 hours duration (Hossain et al., 2011).

The ‘Stroke’ usually refers to the patients who have had Cerebrovascular Accident (CVA) as the results in circulatory defects in which the symptoms have continued for more than 24 hours and it is due to a lesion affecting the opposite side of the cerebrum (Carr & Shepherd, 2003).

This definition of stroke excludes transient ischemic attacks (TIA), which refers to a clinical presentations consistent with stroke may be caused by subdural hemorrhage, mass effect and trauma (Mensah, 2008). The father of Western Medicine ‘Hippocrates’, more than 2400 years ago first described stroke as a neurological condition which is characterized by the sudden onset of paralysis of muscles on one side or both side of the body (National Institute of Neurological Disorders and Stroke, 2004). Stroke is a leading cause of long-term disability which results from brain cell damage due to either an interruption of the blood supply to the brain or hemorrhage into the brain tissue (Eng et al., 2007).

There are two forms of stroke: ischemic and hemorrhagic (National institute of neurological disorder and stroke, 2004). Ischemic stroke or cerebral infarct (80% of

strokes) occurs due to blockage or a reduction of blood flow in artery that supplies brain. They are caused either by a clot which blocks the blood vessel or by the buildup of plaque often due to cholesterol within the arteries which narrows vessel resulting in a loss of blood flow. Hemorrhagic stroke are due to the rupture of an artery within the brain triggering an intracerebral hemorrhage (15% of strokes) or to the rupture of aneurysm or AVM entailing sub arachnoids hemorrhage (5% of strokes) (Braunwald et al., 2003).

Each year in China, there were about 1.5-2.0 million new stroke patients. It has been a major public health problem in China. The clinical factors would not be the same in ischemic and hemorrhagic stroke. The pathogenesis of ischemic stroke is different from that of hemorrhagic stroke. In East China, a study showed that 78% ischemic patient and 22% hemorrhagic patients. The incidence rate of ischemic stroke was higher than that of hemorrhagic stroke (Zhang et al., 2011). The incidence of stroke is higher in African Americans than Caucasians Americans (Sergeev et al., 2015).

Bangladesh is one of the most densely populated and developing country in the world. World widely Stroke is the second leading cause of death and the one of the leading causes of long term disability. Stroke occurs at an equal rate in men and women, but women are more likely to die. The occurrences of stroke amplify day by day and in many developing countries, the incidence is getting higher because of adaptation of unhealthy life style and lack of awareness (Siddiqui et al., 2012).

In 2007, the overall mortality rate from stroke was 273 000, which makes stroke the third-leading cause of death in the United States (Summers et al., 2009). Two-thirds of these deaths happened in people who live in developing countries and 40% of the subjects were aged less than 70 years. Moreover, cerebrovascular disease is the largest part of leading disability in adults and each every year millions of stroke patients have to adapt their life with restrictions in activities of daily living as an end result of cerebrovascular disease. Many surviving stroke patients often depend on other people's nonstop support to survive (Thomas et al., 2006).

The third most ordinary cause of death and adult disability in Bangladesh is Stroke. The mortality rate of Bangladesh due to stroke is 84 in the world based on WHO ranks and overall prevalence for stroke is 0.30% (Islam et al., 2012).

According to the World Health Organization, in every year, world widely 15 million people experience stroke 5 million die and another 5 million are permanently disabled among the 15 million stroke people each year (Tyson & Connell, 2009).

At onset of stroke other deficits may be present such as loss of consciousness, dysfunction of the cranial nerves, postural imbalance, coordination disorders and loss of sphincter control. In the sub-acute and chronic phase some complications secondary to the initial neurological deficits may develop. These consist of shoulder-hand syndrome due to multiple traumatization in patients with paralysis of the upper extremity and hemi neglect or contractures resulting from severe spasticity (Hendricks, 2003).

After stroke chest infection, epileptic seizures, DVT (Deep Venous Thrombosis), pulmonary embolism, contracture, painful shoulder, pressure sore, urinary tract infection, constipation, depression and anxiety may also occur. Other psychological problems like depression, unrealistic state, labile state and personality changes (Boon et al., 2009).

Approximately 50%-60% of stroke patients still experience some degree of motor impairment and approximately 50% are at least partly dependent in activities-of-daily-living after completing standard rehabilitation (Lois et al., 2011).

Physical fitness is important for the performance of everyday activities. In stroke patients, muscle strength and cardio respiratory fitness are impaired and it is not known whether improving fitness by physical fitness training reduces disability after stroke (Saunders et al., 2004). Following a stroke recovery and improvement of function is very much important during the first year after the stroke (Pyo`ria et al., 2004).

Approximately 14% of stroke survivors achieve a full recovery in physical function, and between 25% and 50% require at least some assistance with activities of daily living, and half experience severe long-term effects such as partial paralysis. As a result, activity intolerance is common among stroke survivors, especially in the elderly. Stroke may also

result in activity limitations which sometimes referred to as disabilities are manifested by reduced ability to perform daily functions, such as dressing, bathing or walking. The level of activity limitation is generally related to but not completely dependent on the level of body impairment such as severity of stroke (Gordon et al., 2004).

Our brains cannot grow new cells to replace the ones that have been damaged after a stroke, so recovery depends on brain's ability to reorganize its undamaged cells and make up for what has been lost. This is called neuroplasticity. Physiotherapy can give an expert practical guidance to prevent this condition. Physiotherapists are frequently work with other members of the stroke team to make sure that they can help with the range of problems that stroke can cause. The team which consists of physiotherapists, occupational therapists, speech and language therapists, doctors, nurses and social workers and also other specialists, is called the multidisciplinary stroke rehabilitation team (Stroke association, 2012).

Usually, concepts of physiotherapy were focused on restoring and reduced motor control of the affected limb as well as postural control (Outermans et al., 2010).

The principle of mirror therapy (MT) is the use of a mirror to create a reflective illusion of an affected limb in order to trick the brain into thinking movement has occurred without pain. It involves placing the affected limb behind a mirror, which is sited so the reflection of the opposing limb appears in place of the hidden limb. A Mirror box is a device which allows the clinician to easily create this illusion. It' is a box with one mirror in the center where on each side of it, the hands are placed in a manner that the affected limb is kept covered always and the unaffected limb is kept on the other side whose reflection can be seen on the mirror (IOSR Journal of Nursing and Health Science).

Mirror therapy was invented by Vilayanur S. Ramachandran to help alleviate the Phantom limb pain, in which patients feel they still have a pain in the limb even after having it amputated. Ramachandran and Rogers-Ramachandran first devised the technique in an attempt to help those with phantom limb pain resolve what they termed a 'Learned Paralysis' of the painful phantom limb. The visual feedback, from viewing the reflection of the intact limb in place of the phantom limb, made it possible for the patient to perceive

movement in the phantom limb. Their hypothesis was that every time the patient attempted to move the paralyzed limb, they received sensory feedback (through vision and Proprioception) that the limb did not move. This feedback stamped itself into the brain circuitry through a process of Hebbian learning, so that, even when the limb was no longer present, the brain had learned that the limb (and subsequent phantom) was paralyzed. To retrain the brain, and thereby eliminate the learned paralysis, Ramachandran and Rogers-Ramachandran created the mirror box (Ramachandran et al., 2006).

Mechanism: The patient places the good limb into one side, and the stump into the other. The patient then looks into the mirror on the side with good limb and makes "mirror symmetric" movements, as a symphony conductor might, or as we do when we clap our hands. Because the subject is seeing the reflected image of the good hand moving, it appears as if the phantom limb is also moving. Through the use of this artificial visual feedback it becomes possible for the patient to "move" the phantom limb, and to unclench it from potentially painful positions (IOSR Journal of Nursing and Health Science).

One of the most common deficits following stroke is a persistent impairment of the arm and hand due to a hemiparesis, which has a significant impact on performance in daily life activities (Wade et al., 2005). The paretic upper limb is a common and undesirable consequence of stroke that increases activity limitation. It has been reported that up to 85% of stroke survivors experience hemiparesis and that 55% to 75% of stroke survivors have continued to have limitations in upper-extremity functioning (Adams et al., 2009).

Mirror therapy (MT) has been employed with some success in treating stroke patients. Clinical studies that have combined mirror therapy with conventional rehabilitation have achieved the most positive outcomes. (Yavuzer et al., 2007). Paretic upper-extremity function and hand coordination abilities were significantly different between the mirror therapy and conventional therapy groups. Intervention in the mirror therapy group was more effective than in the conventional therapy group for improving the ability to perform activities of daily living. Self-care showed statistically significant differences between the two groups (Kim et al., 2015).

A systematic review including 14 studies with a total of 567 participants, indicates that mirror therapy could be applied at least as an additional intervention in the rehabilitation of patients after stroke, but no clear conclusion can be drawn if mirror therapy should replace other interventions for improving motor function. Furthermore, mirror therapy may improve activities of daily living, but the results must be interpreted with caution because they are based on only four studies. For patients with a complex regional pain syndrome following stroke, mirror therapy seems to be an effective intervention, both for improving motor function and reducing pain. Mirror therapy seems not to influence pain in unselected stroke patients. And in the review, they compared mirror therapy with other interventions. When compared with all other interventions, mirror therapy was found to have a significant effect on motor function (post intervention data: SMD 0.61; 95% CI 0.22 to 1.0; $P=0.002$; change scores: SMD 1.04; 95% CI 0.57 to 1.51; $P<0.0001$). However, effects on motor function are influenced by the type of control intervention. Additionally, mirror therapy was found to improve activities of daily living (SMD 0.33; 95% CI 0.05 to 0.60; $P=0.02$). They found a significant positive effect on pain (SMD -1.10 ; 95% CI -2.10 to -0.09 ; $P=0.03$), which is influenced by patient population. They also found limited evidence for improving visuospatial neglect (SMD 1.22; 95% CI 0.24 to 2.19; $P=0.01$). The effects on motor function were stable at follow-up assessment after 6 months. (Thieme et al., 2012)

3.1. Study Design

The study was conducted by using Randomized Controlled Trial (RCT). From the indoor neurology unit patients with stroke, 10 stroke patients were randomly selected and then 5 stroke patients were randomly assigned to mirror therapy with conventional physiotherapy group and 5 stroke patients were assigned only to the conventional physiotherapy group for this randomized control trial study. The study was a single blinded study, which was conducted at neurology department of CRP, Savar, Dhaka. A pre-test (before intervention) and post-test (after intervention) was administered with each subject of both groups to compare the functional improvement of hands before and after the treatment.

According to DePoy & Giitlin (2013) the design could be shown by:

Experimental Group: $r_1 \quad O_1 \quad X_1 \quad O_2$

Control Group: $r_2 \quad O_3 \quad X_2 \quad O_4$

Here researcher had chosen that mirror therapy along with conventional physiotherapy was applied to the experimental group and only conventional physiotherapy was applied to the control group. The subjects were administered a pretest followed by treatment intervention & a posttest in order to compare their effectiveness.

Flow-chart of the phases of Randomized Controlled Trial

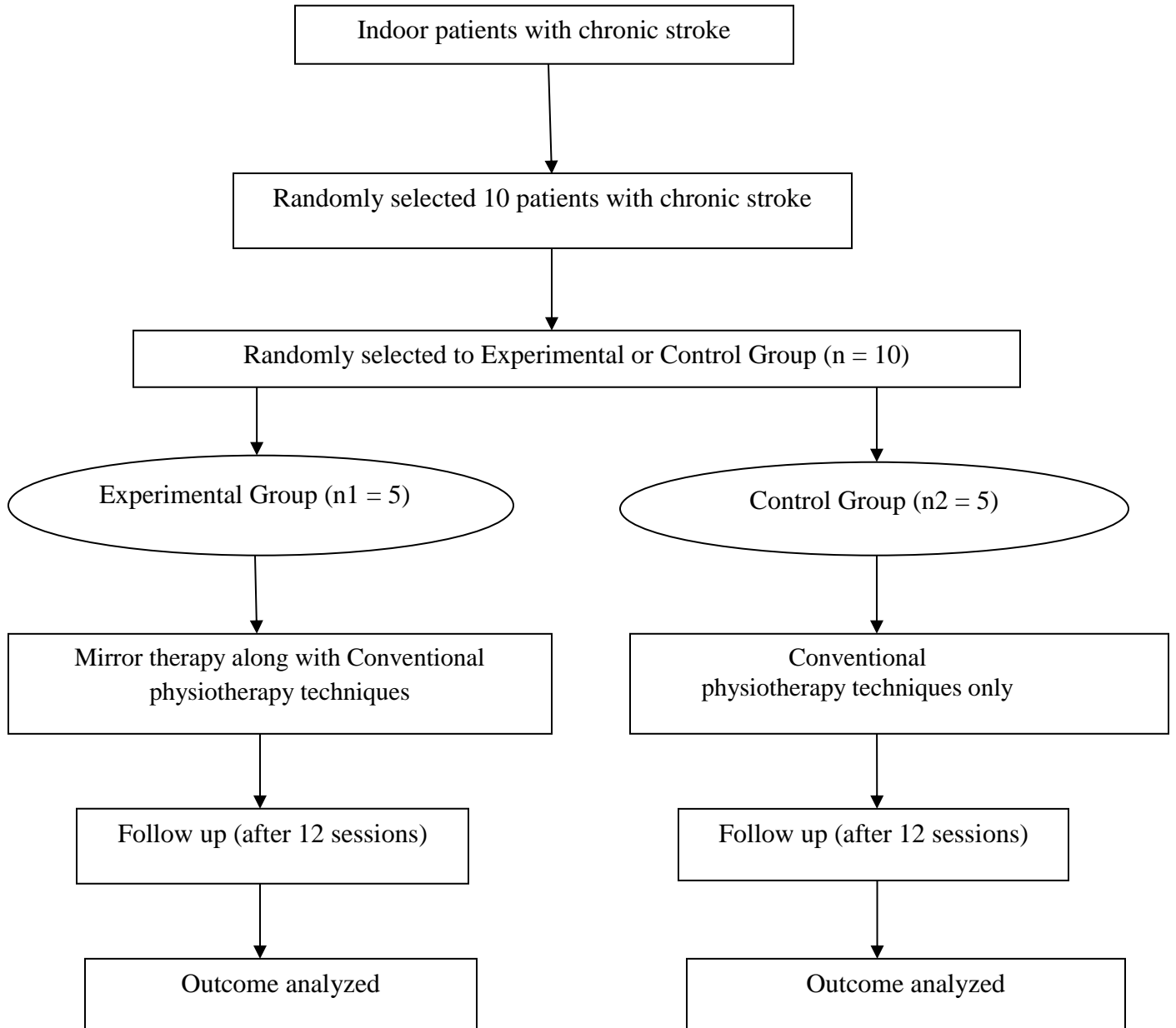


Fig: Flow-chart of the phases of Randomized Controlled Trial

3.2. Study Site

The study was conducted at Neurology unit, Department of Physiotherapy, CRP, Savar, Dhaka- 1343.

3.3. Study Area

The researcher was a 4th year B.Sc in physiotherapy student of Bangladesh Health Professions Institute (BHPI) and the research was conducted as part of the course curriculum. For this reason, the researcher had to collect data within short time to maintain the contrasts of the course module time. The study was conducted in neurology unit of CRP (Center for the Rehabilitation of the Paralyzed) which is a non-government organization working for the development of health care delivery system of Bangladesh through providing Physiotherapy, Occupational therapy, Speech and Language therapy services in indoor and outdoor programs. Neurology unit provides service for persons with different types of neurological disorders. The unit had both indoor and outdoor programs.

3.4. Study Population and Sample Population

A population refers to the entire group of people who meet the criteria set by the researcher. The populations of this study were chronic stroke patients with hand function impairment.

3.5. Sampling Technique

Simple Random sampling technique was used for group allocation of this study.

Subjects, who met the inclusion criteria, were taken as sample in this study. 10 patients with chronic stroke were selected from indoor neurology department of CRP, Savar. Then 5 patients with chronic stroke were randomly assigned to mirror therapy with conventional physiotherapy group and 5 patients were randomly assigned to the conventional physiotherapy group for this randomized controlled trial study. The study was a single blinded study. When the samples were collected, the researcher randomly assigned the

participants into experimental and control group, because it improves internal validity of experimental research. The samples were given numerical number C1, C2, C3, C4, C5 for control group and E1, E2, E3, E4, E5 for experimental group. Total 10 samples were included in this study, among them 5 patients were selected for the experimental group (received mirror therapy with conventional physiotherapy) and rest 5 patients were selected for control group (received conventional physiotherapy treatments only).

3.6. Randomization

After the completion of sample collection, the researcher had randomly assigned the participants into experimental and control group, because it improves internal validity of experimental research. The samples were given numerical number C1, C2, C3 etc. for the control group and E1, E2, E3 etc. for experimental group. Total 10 samples were included in this study, among them 5 patients were selected for the experimental group (received mirror therapy with conventional physiotherapy) and rest 5 patients were selected for control group (received conventional physiotherapy treatments only).

3.7. Selection Criteria

3.7.1. Inclusion Criteria

- Patients with hemiparesis following a first stroke (documented by CT scan).
- The participants were those individual who have been diagnosed chronic stroke by qualified physiotherapist (Plummer et al., 2017).
- Age range between 25 to 75 years: This age range was selected because most of the people around the age range showed most prevalent time of stroke in their life (Dohle 2009).
- Time from stroke/ duration ≥ 3 month.
- Subjects having decreased hand function.
- Patients who can understand or follow verbal instructions.
- Both male and female: Both male and female patients were included (Arshad, et al., 2015).
- Willingness: Patients were provided by written consent form and might be helpful or might not leave treatment during the study (Gautam et al., 2014).

3.7.2. Exclusion Criteria

- Stroke patients having intact hand functions (movement).
- Patients with global aphasia, cognitive impairments that might interfere with understanding instructions for testing, concomitant progressive central or peripheral nervous system disorders.
- Patients who had a prior stroke (duration ≥ 3 month) & having no improvement of hand function by that time.
- Below the ages of 25 and above 75 years.
- Medically unstable patients.
- Patients with severe attention deficit.
- Subjects who will receive physiotherapy treatment less than 12 sessions.
- Non-cooperative patients.

3.8. Treatment Regime

Duration: 1hour

Experimental Group: (with conventional physiotherapy)

Wrist

- Wrist dorsiflexion stability at 15 degree (elbow at 90 degree, forearm pronated, shoulder neutral) - **10 repetition**
- Repeated dorsiflexion / volar flexion (elbow at 90 degree, forearm pronated, shoulder neutral, slight finger flexion) - **10 repetition**
- Wrist dorsiflexion stability at 15 degree (elbow neutral, forearm pronated, slight shoulder flexion/abduction) - **10 repetition**
- Repeated dorsiflexion / volar flexion (elbow neutral, forearm pronated, slight shoulder flexion/abduction) - **10 repetition**
- Circumduction - **10 repetition**

Hand

- Mass flexion (from full active or passive extension) - **10 repetition**
- Mass extension (from full active or passive flexion) - **10 repetition**

Grasp

- Flexion in PIP & DIP, Extension in MCP - **10 repetition**
- Thumb abduction - **10 repetition**
- Opposition - **10 repetition**
- Cylinder grip (holding small can) - **10 repetition**
- Spherical grip (holding tennis ball) - **10 repetition**

Coordination ex. (tip of the index finger from knee to nose) - 10 repetition

Control Group: (Duration- 45minutes)

- Proper positioning of the limbs
- Muscle stretching & strengthening ex.
- Postural stability control ex.
- Sensory techniques
- Stabilization of the pelvic girdle, knees & shoulder girdle
- Sensory stimulation of U/L & L/L
- Proprioceptive ex. of U/L & L/L
- Transitional mvt. practice
- Selective mvt. practice
- Midline orientation ex.
- Bobath Hand mobilization
- Bobath Trunk mobi. + Pelvic girdle mobi. + Shoulder girdle mobi.
- Functional activity training
- Functional mvt. practice of U/L & L/L
- Sit to Stand practice
- Dynamic sitting/standing balance practice
- Stepping practice
- SPG/CPG (Single pattern generator/ Central pattern generator)
- Stair up & Stair down practice
- Gait reeducation
- Gym activity

3.9. Sample Size

10 participants with chronic stroke were selected due to limited time. The study had its own limitations constructed by limited time scale and as a result by the sample size.

3.10. Data processing

3.10.1. Measurement Tools

The organized materials were questionnaires, consent forms, paper, pen & a pencil. All questionnaires were designed to conduct the interviews. In this study researcher used “Fugl–Meyer Motor Function Assessment (upper extremity)” (modified) to assess changes in hand function after intervention.

3.10.2. Data collection procedure

The study procedure was conducted through assessing the patient, initial recording, treatment and final recording. After screening the patient at department, the patients were assessed by qualified physiotherapist. 12 sessions of treatment were provided for every subject. 10 subjects were chosen for data collection according to the inclusion criteria. The researcher divided all participants into two groups and coded C1, C2, C3, C4, C5 for control group and E1, E2, E3, E4, E5 for experimental group. Experimental group received conventional physiotherapy with mirror therapy and control group received only conventional physiotherapy.

Data was gathered through a pre-test, intervention and a post-test and the data was collected by using a structured and close-ended written questionnaire form which had been formatted by the researcher. Data collection procedure was single blinded as the researcher was directly involved here. Data was collected by the researcher and intervention was given by the clinical physiotherapist with the supervision of a qualified physiotherapist. Pre-test was performed before beginning the treatment. The same procedure was performed to take post-test at the end of 12 sessions of treatment.

3.11. Data management and analysis plan

Statistical analysis was performed by using Microsoft Office Excel 2013 and scientific calculator. Data was analyzed with the software named ‘Statistical Package for Social Science’ (SPSS) version 20.00 to compute the descriptive statistics using pie chart and also percentage were conducted using paired t-test. The researcher had calculated the variables mean, mean difference, standard deviations, standard error, degree of freedom and significant level. In the between group, the data showed that the mean difference was greater than the control group. The researcher had tested mean variables stating problem to test using paired t-test.

3.11.1 Statistical Test

In order to ensure the research had some values, the meaning of collected data had to be presented in ways that other research workers can understand. Statistical analysis was performed by using SPSS 20.00, Microsoft Excel 2013 and scientific calculator. To find out the ‘p’ value for the significance of the result, the examiner used unpaired t-test. Two independent variables of the treatment group were statistically tested by Wilcoxon signed-rank test and eventually gave a ‘t’ value based on Z and a ‘p’ value. In this study, the data were not distributed normally and the sample size was smaller that’s the reason the researcher used Wilcoxon signed-rank test instead of using paired t test.

Unpaired t-test

Unpaired t-test was used to compare difference between two means of two independent groups.

Selection of test of hypothesis was mean difference under t distribution.

Assumption:

- Different and independent groups
- Variables were quantitative
- Normal distribution of the variables

Null and alternative hypothesis

Ho: $\mu_1 - \mu_2 = 0$ or $\mu_1 \geq \mu_2$; where the experimental group and control group initial and final mean difference was same.

Ha: $\mu_1 - \mu_2 \neq 0$, $\mu_1 < \mu_2$; where the experimental group and control group initial and final mean difference was not same.

Here,

Ho= Null hypothesis

Ha= Alternative hypothesis

μ_1 = Mean difference in initial assessment

μ_2 = Mean difference in final assessment

Formula: test statistic t is follows:

$$t = \frac{\bar{x}_1 - \bar{x}_2}{S \sqrt{\frac{1}{n_1+n_2}}}$$

Where,

x_1 = mean of first sample group

x_2 = mean of second sample group

S = pooled standard deviation of the differences and

n = size of the sample

Calculation of unpaired t value of the functional changes of wrist as below -

$$t = \frac{\bar{x}_1 - \bar{x}_2}{S \sqrt{\frac{1}{n_1+n_2}}}$$

3.11.2 Level of Significance

In order to find out the significance of the study, the “p” value was calculated. The value refers to the probability of the results for experimental study. The word probability refers to the accuracy of the findings. A ‘p’ value is called level of significance for an experiment and a ‘p’ value of ≤ 0.05 was accepted as significant result for health service research. If the ‘p’ value is equal or smaller than the significant level, the results are said to be significant.

3.12. Informed consent

An information sheet and consent form both in English and Bengali were used by the researcher to take the participants’ consent. The researcher obtained consent of participation from every individuals. A signed informed consent form was received from each participant. Participants were informed that they were completely free to decline answering any question as well as to withdraw their consent and terminate participation at any time during the study. The researcher also ensured that withdrawal of participation from the study would not affect their treatment in the physiotherapy department and they could get the same facilities. Every individuals had the opportunity to discuss their problem and ask any questions related to their problem with the higher authority or administration of CRP for their own satisfaction. They were also told that the confidentiality would be maintained and the benefits of the study for future participants and therapists were explained.

3.13. Ethical consideration

The proposal of the dissertation including methodology was approved by Institutional Review Board and obtained permission from the concerned authority of ethical committee of Bangladesh Health Professions Institute (BHPI). The whole process of this research project was done by following the Bangladesh Medical Research Council (BMRC)

guidelines and World Health Organization (WHO) Research guidelines. Again before the beginning of the data collection, the researcher obtained the permission ensuring the safety of the participants from the concerned authorities of the clinical setting and was allotted with a witness from the authority for the verification of the collected data. The researcher strictly maintained the confidentiality regarding participant's condition and treatments.

10 patients were enrolled in the study. Among them, 5 were in the mirror therapy with conventional treatment group (experimental group) and 5 were in the only conventional treatment group (control group). The whole subject of both experimental and control group scored their improvement of functional activity of hand, wrist, and coordination before and after completing 12 session of treatment.

4.1 Socio-Demographic Information

Age of the Participants:

Table - 1 Age of the Participants

Subjects	Age (Years)	Subjects	Age (Years)
E1	70	C1	50
E2	50	C2	42
E3	62	C3	38
E4	32	C4	40
E5	75	C5	42
Mean \pm SD	57.8 \pm 12.61	Mean \pm SD	42.4 \pm 12.61

From the above mentioned table, it is obvious that mean age of participant in control group was 42.4 \pm 12.61 years whereas experimental group mean age was 57.8 \pm 12.61 years on average.

Table - 2 Baseline study of Socio-demographic part

Variable	Frequency	Percentage (%)
Age		
31-40 years	3	30
41-50 years	4	40
51-60 years	0	0
61-75 years	3	30
Gender		
Male	8	80
Female	2	20
Marital Status		
Married	10	100
Unmarried	0	0
Living Area		
Rural	2	20
Urban	8	80
Occupation		
Businessman	4	40
Housewife	2	20
Service Holder	3	30
Others	1	10
Income (BDT)		
10000 - 19000	2	20
20000 - 29000	1	10
30000 - 39000	3	30
40000 - \geq 49000	1	10
No Income	3	30
Duration of Stroke		
3 months	3	30
3-6 months	2	20
More than 6 months	5	50
Involved Side		
Right	0	0
Left	10	100

Weight (kg)		
51-55	1	10
56-60	3	30
61-65	0	0
65-70	3	30
More than 70	3	30
Height (cm)		
156-160	1	10
161-165	7	70
More than 165	2	20

10 Patients with Chronic Stroke were included as sample of the study. Among them 8 persons were male & 2 persons were female that means 80% were Male and 20% were Female. All of them were married. In the “living area” part, 80% were in urban area & 20% were in rural area. And in the “occupation” part, it is seen that 40% were businessman, 30% were service holder, 20% were housewives and others 10%. Among them 40% were at the age of 41-50 years, 30% were at the age of 31-40 years and 30% were at the age of 61-75 years. 100% patients were left side hemiplegic & none of them were right side hemiplegic. 30% patients had no income, 30% had income between 30 thousand from 39 thousand, 20% had income between 10 thousand from 19 thousand, 10% had income between 40 thousand to 50 thousand or more. If we see the “duration of stroke” part, 50% had the duration of more than 6months, 30% had 3months duration of stroke, and 20% had 3 to 6 months duration of stroke. 70% patients were of 161cm to 165cm of height, 10% were of 156cm to 160cm of height & 20% patients were of more than 165cm of height. Among all the patients, 10% were at 51-55kg, 30% were at 56-60kg, 30% were at 65-70kg & 30% were at more than 70kg of weight.

4.2. Comparison of functional changes of Wrist

Table-3 Stability at 15 degree DF (elbow 90 degree, forearm pronated, shoulder 0) within control group

Stability at 15 degree DF (elbow 90 degree, forearm pronated, shoulder 0) (posttest) – Stability at 15 degree DF (elbow 90 degree, forearm pronated, shoulder 0) (pretest)	N	Mean rank	Sum of ranks	Wilcoxon Signed rank test based on Z	P
Negative ranks	0	.00	.00	.000	1.000
Positive ranks	0	.00	.00		
Ties	5				
Total	5				

Table-3 described the comparison of participant's before (pre) and after (post) stability of wrist at 15 degree dorsiflexion. By examining the final test statistics portion of table by Wilcoxon signed-rank test it was discovered that control group for 4 weeks, 5 days in a week, conventional physiotherapy showed a statistically change which was not significant in the stability of wrist at 15 degree DF (elbow 90 degree, forearm pronated, shoulder 0) among individuals with chronic stroke ($Z = .000$, $p = 1.000$).

Table-4 Stability at 15 degree DF (elbow 90 degree, forearm pronated, shoulder 0) within trial group

Stability at 15 degree DF (elbow 90 degree, forearm pronated, shoulder 0) (posttest) – Stability at 15 degree DF (elbow 90 degree, forearm pronated, shoulder 0) (pretest)	N	Mean rank	Sum of ranks	Wilcoxon Signed rank test based on Z	P
Negative ranks	0	.00	.00	-1.414	.157
Positive ranks	2	1.50	3.00		
Ties	3				
Total	5				

Table-4 described the comparison of participant’s before (pre) and after (post) stability of wrist at 15 degree dorsiflexion. By examining the final test statistics portion of table by Wilcoxon signed-rank test it was discovered that trial group for 4 weeks, 5 days in a week, mirror therapy along with conventional physiotherapy showed a statistically change which was not significant in the stability of wrist at 15 degree (elbow 90 degree, forearm pronated, shoulder 0) among individuals with chronic stroke ($Z = -1.414$, $p = .157$).

Table –5 Repeated DF (elbow 90 degree, forearm pronated, Shoulder 0, slight finger flexion) within control group

Repeated DF (elbow 90 degree, forearm pronated, shoulder 0, slight finger flexion) (posttest) – Repeated DF (elbow 90 degree, forearm pronated, shoulder 0, slight finger flexion) (pretest)	N	Mean rank	Sum of ranks	Wilcoxon Signed rank test based on Z	P
Negative ranks	0	.00	.00	-1.000	.317
Positive ranks	1	1.00	1.00		
Ties	4				
Total	5				

Table-5 described the comparison of participant’s before (pre) and after (post) measure of repeated DF (elbow 90 degree, forearm pronated, shoulder 0, slight finger flexion) within control group. By examining the final test statistics portion of table by Wilcoxon signed-rank test it was discovered that control group for 4 weeks, 5 days in a week, conventional physiotherapy showed a statistically change which was not significant in the stability of wrist at 15 degree (elbow 90 degree, forearm pronated, shoulder 0) among individuals with chronic stroke ($Z = -1.000$, $p = .317$).

Table-6 Repeated DF (elbow 90 degree, forearm pronated, shoulder 0, slight finger flexion) within trial group

Repeated DF (elbow 90 degree, forearm pronated, shoulder 0, slight finger flexion) (posttest) – Repeated DF (elbow 90 degree, forearm pronated, shoulder 0, slight finger flexion) (pretest)	N	Mean rank	Sum of ranks	Wilcoxon Signed rank test based on Z	P
Negative ranks	0	.00	.00	-1.414	.157
Positive ranks	2	1.50	3.00		
Ties	3				
Total	5				

Table-6 described the comparison of participant's before (pre) and after (post) measure of repeated DF (elbow 90 degree, forearm pronated, shoulder 0, slight finger flexion) within trial group. By examining the final test statistics portion of table by Wilcoxon signed-rank test it was discovered that trial group for 4 weeks, 5 days in a week, mirror therapy along with conventional physiotherapy showed a statistically change which was not significant in the stability of wrist at 15 degree (elbow 90 degree, forearm pronated, shoulder 0) among individuals with chronic stroke ($Z = -1.414$, $p = .157$).

Table-7 Stability at 15 degree DF (elbow 0 degree, forearm pronated, slight shoulder flexion/abduction) within control group

Stability at 15 degree DF (elbow 0 degree, forearm pronated, slight shoulder flexion/abduction) (posttest) – Stability at 15 degree DF (elbow 0 degree, forearm pronated, slight shoulder flexion/abduction) (pretest)	N	Mean rank	Sum of ranks	Wilcoxon Signed rank test based on Z	P
Negative ranks	0	.00	.00	-1.000	.317
Positive ranks	1	1.00	1.00		
Ties	4				
Total	5				

Table-7 described the comparison of participant's before (pre) and after (post) stability at 15 degree DF (elbow 0 degree, forearm pronated, slight shoulder flexion/abduction) within control group. By examining the final test statistics portion of table by Wilcoxon signed-rank test it was discovered that control group for 4 weeks, 5 days in a week, conventional physiotherapy showed a statistically change which was not significant in the stability of wrist at 15 degree (elbow 90 degree, forearm pronated, shoulder 0) among individuals with chronic stroke ($Z = -1.000$, $p = .317$).

Table-8 Stability at 15 degree DF (elbow 0 degree, forearm pronated, slight shoulder flexion/abduction) within trial group

Stability at 15 degree DF (elbow 0 degree, forearm pronated, slight shoulder flexion/abduction) (posttest) – Stability at 15 degree DF (elbow 0 degree, forearm pronated, slight shoulder flexion/abduction) (pretest)	N	Mean rank	Sum of ranks	Wilcoxon Signed rank test based on Z	P
Negative ranks	0	.00	.00	-1.731	.083
Positive ranks	3	2.00	6.00		
Ties	2				
Total	5				

Table-8 described the comparison of participant's before (pre) and after (post) stability at 15 degree DF (elbow 0 degree, forearm pronated, slight shoulder flexion/abduction) within trial group. By examining the final test statistics portion of table by Wilcoxon signed-rank test it was discovered that trial group for 4 weeks, 5 days in a week, mirror therapy along with conventional physiotherapy showed a statistically change which was not significant in the stability of wrist at 15 degree (elbow 0 degree, forearm pronated, slight shoulder flexion/abduction) among individuals with chronic stroke ($Z = -1.731$, $p = .083$).

Table-9 Repeated DF (elbow 0 degree, forearm pronated, slight shoulder flexion/abduction) within control group

Repeated DF (elbow 0 degree, forearm pronated, slight shoulder flexion/abduction) (posttest) – Repeated DF (elbow 0 degree, forearm pronated, slight shoulder flexion/abduction) (pretest)	N	Mean rank	Sum of ranks	Wilcoxon Signed rank test based on Z	P
Negative ranks	0	.00	.00	-1.414	.157
Positive ranks	2	1.50	3.00		
Ties	3				
Total	5				

Table-9 described the comparison of participant's before (pre) and after (post) measure of repeated DF (elbow 0 degree, forearm pronated, slight shoulder flexion/abduction) within control group. By examining the final test statistics portion of table by Wilcoxon signed-rank test it was discovered that control group for 4 weeks, 5 days in a week, conventional physiotherapy showed a statistically change which was not significant in repeated DF (elbow 0 degree, forearm pronated, slight shoulder flexion/abduction) among individuals with chronic stroke ($Z = -1.414$, $p = .157$).

Table-10 Repeated DF (elbow 0 degree, forearm pronated, slight shoulder flexion/abduction) within trial group

Repeated DF (elbow 0 degree, forearm pronated, slight shoulder flexion/abduction) (posttest) – Repeated DF (elbow 0 degree, forearm pronated, slight shoulder flexion/abduction) (pretest)	N	Mean rank	Sum of ranks	Wilcoxon Signed rank test based on Z	P
Negative ranks	0	.00	.00	-1.414	.157
Positive ranks	2	1.50	3.00		
Ties	3				
Total	5				

Table-10 described the comparison of participant's before (pre) and after (post) measure of repeated DF (elbow 0 degree, forearm pronated, slight shoulder flexion/abduction) within trial group. By examining the final test statistics portion of table by Wilcoxon signed-rank test it was discovered that trial group for 4 weeks, 5 days in a week, mirror therapy along with conventional physiotherapy showed a statistically change which was not significant in repeated DF among individuals with chronic stroke ($Z = -1.414$, $p = .157$).

Table-11 Circumduction within control group

Circumduction (posttest) – Circumduction (pretest)	N	Mean rank	Sum of ranks	Wilcoxon Signed rank test based on Z	P
Negative ranks	0	.00	.00	-1.000	.317
Positive ranks	1	1.00	1.00		
Ties	4				
Total	5				

Table-11 described the comparison of participant’s before (pre) and after (post) measure of circumduction within control group. By examining the final test statistics portion of table by Wilcoxon signed-rank test it was discovered that control group for 4 weeks, 5 days in a week, conventional physiotherapy showed a statistically change which was not significant in circumduction among individuals with chronic stroke ($Z = -1.000$, $p = .317$).

Table-12 Circumduction within trial group

Circumduction (posttest) – Circumduction (pretest)	N	Mean rank	Sum of ranks	Wilcoxon Signed rank test based on Z	P
Negative ranks	0	.00	.00	-1.000	.317
Positive ranks	1	1.00	1.00		
Ties	4				
Total	5				

Table-12 described the comparison of participant's before (pre) and after (post) measure of circumduction within trial group. By examining the final test statistics portion of table by Wilcoxon signed-rank test it was discovered that control group for 4 weeks, 5 days in a week, mirror therapy along with conventional physiotherapy showed a statistically change which was not significant in circumduction among individuals with chronic stroke ($Z = -1.000$, $p = .317$).

4.3. Comparison of functional changes of Hand

Table-13 Mass flexion within control group

Mass flexion (posttest) – Mass flexion (pretest)	N	Mean rank	Sum of ranks	Wilcoxon Signed rank test based on Z	P
Negative ranks	0	.00	.00	-1.414	.157
Positive ranks	2	1.50	3.00		
Ties	3				
Total	5				

Table-13 described the comparison of participant's before (pre) and after (post) measure of mass flexion within control group. By examining the final test statistics portion of table by Wilcoxon signed-rank test it was discovered that control group for 4 weeks, 5 days in a week, conventional physiotherapy showed a statistically change which was not significant in mass flexion among individuals with chronic stroke ($Z = -1.414$, $p = .157$).

Table-14 Mass flexion within trial group

Mass flexion (posttest) – Mass flexion (pretest)	N	Mean rank	Sum of ranks	Wilcoxon Signed rank test based on Z	P
Negative ranks	0	.00	.00	.000	1.000
Positive ranks	0	.00	.00		
Ties	5				
Total	5				

Table-14 described the comparison of participant's before (pre) and after (post) measure of mass flexion within trial group. By examining the final test statistics portion of table by Wilcoxon signed-rank test it was discovered that trial group for 4 weeks, 5 days in a week, mirror therapy along with conventional physiotherapy showed a statistically change which was not significant in mass flexion among individuals with chronic stroke ($Z = .000$, $p = 1.000$).

Table-15 Mass extension within control group

Mass extension (posttest) – Mass extension (pretest)	N	Mean rank	Sum of ranks	Wilcoxon Signed rank test based on Z	P
Negative ranks	0	.00	.00	-1.414	.157
Positive ranks	2	1.50	3.00		
Ties	3				
Total	5				

Table-15 described the comparison of participant's before (pre) and after (post) measure of mass extension within control group. By examining the final test statistics portion of table by Wilcoxon signed-rank test it was discovered that control group for 4 weeks, 5 days in a week, conventional physiotherapy showed a statistically change which was not significant in mass flexion among individuals with chronic stroke ($Z = -1.414$, $p = .157$).

Table-16 Mass extension within trial group

Mass extension (posttest) – Mass extension (pretest)	N	Mean rank	Sum of ranks	Wilcoxon Signed rank test based on Z	P
Negative ranks	0	.00	.00	-1.000	.317
Positive ranks	1	1.00	1.00		
Ties	4				
Total	5				

Table-16 described the comparison of participant's before (pre) and after (post) measure of mass extension within trial group. By examining the final test statistics portion of table by Wilcoxon signed-rank test it was discovered that trial group for 4 weeks, 5days in a week, mirror therapy along with conventional physiotherapy showed a statistically change which was not significant in mass flexion among individuals with chronic stroke ($Z = -1.000$, $p = .317$).

Table-17 Flexion in PIP & DIP, extension in MCP within control group

Flexion in PIP & DIP, extension in MCP (posttest) – Flexion in PIP & DIP, extension in MCP (pretest)	N	Mean rank	Sum of ranks	Wilcoxon Signed rank test based on Z	P
Negative ranks	0	.00	.00	.000	1.000
Positive ranks	0	.00	.00		
Ties	5				
Total	5				

Table-17 described the comparison of participant's before (pre) and after (post) measure of Flexion in PIP & DIP, extension in MCP within control group. By examining the final test statistics portion of table by Wilcoxon signed-rank test it was discovered that control group for 4 weeks, 5 days in a week, conventional physiotherapy showed a statistically change which was not significant in Flexion in PIP & DIP, extension in MCP among individuals with chronic stroke ($Z = .000$, $p = 1.000$).

Table-18 Flexion in PIP & DIP, extension in MCP within trial group

Flexion in PIP & DIP, extension in MCP (posttest) – Flexion in PIP & DIP, extension in MCP (pretest)	N	Mean rank	Sum of ranks	Wilcoxon Signed rank test based on Z	P
Negative ranks	0	.00	.00	-1.414	.157
Positive ranks	2	1.50	3.00		
Ties	3				
Total	5				

Table-18 described the comparison of participant’s before (pre) and after (post) measure of Flexion in PIP & DIP, extension in MCP within trial group. By examining the final test statistics portion of table by Wilcoxon signed-rank test it was discovered that trial group for 4 weeks, 5 days in a week, mirror therapy along with conventional physiotherapy showed a statistically change which was not significant in Flexion in PIP & DIP, extension in MCP among individuals with chronic stroke ($Z = -1.414$, $p = .157$).

Table-19 Thumb abduction within control group

Thumb abduction (posttest) – Thumb abduction (pretest)	N	Mean rank	Sum of ranks	Wilcoxon Signed rank test based on Z	P
Negative ranks	0	.00	.00	-1.000	.317
Positive ranks	1	1.00	1.00		
Ties	4				
Total	5				

Table-19 described the comparison of participant's before (pre) and after (post) measure of thumb abduction within control group. By examining the final test statistics portion of table by Wilcoxon signed-rank test it was discovered that control group for 4 weeks, 5 days in a week, conventional physiotherapy showed a statistically change which was not significant in thumb abduction among individuals with chronic stroke ($Z = -1.000$, $p = .317$).

Table-20 Thumb abduction within trial group

Thumb abduction (posttest) – Thumb abduction (pretest)	N	Mean rank	Sum of ranks	Wilcoxon Signed rank test based on Z	P
Negative ranks	0	.00	.00	-1.000	.317
Positive ranks	1	1.00	1.00		
Ties	4				
Total	5				

Table-20 described the comparison of participant's before (pre) and after (post) measure of thumb abduction within trial group. By examining the final test statistics portion of table by Wilcoxon signed-rank test it was discovered that trial group for 4 weeks, 5 days in a week, mirror therapy along with conventional physiotherapy showed a statistically change which was not significant in thumb abduction among individuals with chronic stroke ($Z = -1.000$, $p = .317$).

Table-21 Opposition within control group

Opposition (posttest) – Opposition (pretest)	N	Mean rank	Sum of ranks	Wilcoxon Signed rank test based on Z	P
Negative ranks	0	.00	.00	-1.732	.083
Positive ranks	3	2.00	6.00		
Ties	2				
Total	5				

Table-21 described the comparison of participant's before (pre) and after (post) opposition within control group. By examining the final test statistics portion of table by Wilcoxon signed-rank test it was discovered that control group for 4 weeks, 5 days in a week, conventional physiotherapy showed a statistically change which was not significant in opposition among individuals with chronic stroke ($Z = -1.732$, $p = .083$).

Table-22 Opposition within trial group

Opposition (posttest) – Opposition (pretest)	N	Mean rank	Sum of ranks	Wilcoxon Signed rank test based on Z	P
Negative ranks	0	.00	.00	-1.000	.317
Positive ranks	1	1.00	1.00		
Ties	4				
Total	5				

Table-22 described the comparison of participant's before (pre) and after (post) opposition within trial group. By examining the final test statistics portion of table by Wilcoxon signed-rank test it was discovered that control group for 4 weeks, 5 days in a week, mirror therapy along with conventional physiotherapy showed a statistically change which was not significant in opposition among individuals with chronic stroke ($Z = -1.000$, $p = .317$).

Table-23 Cylinder grip within control group

Cylinder grip (posttest) – Cylinder grip (pretest)	N	Mean rank	Sum of ranks	Wilcoxon Signed rank test based on Z	P
Negative ranks	0	.00	.00	-1.000	.317
Positive ranks	1	1.00	1.00		
Ties	4				
Total	5				

Table-23 described the comparison of participant's before (pre) and after (post) measure of cylinder grip within control group. By examining the final test statistics portion of table by Wilcoxon signed-rank test it was discovered that control group for 4 weeks, 5 days in a week, conventional physiotherapy showed a statistically change which was not significant in cylinder grip among individuals with chronic stroke ($Z = -1.000$, $p = .317$).

Table-24 Cylinder grip within trial group

Cylinder grip (posttest) – Cylinder grip (pretest)	N	Mean rank	Sum of ranks	Wilcoxon Signed rank test based on Z	P
Negative ranks	0	.00	.00	-1.000	.317
Positive ranks	1	1.00	1.00		
Ties	4				
Total	5				

Table-24 described the comparison of participant’s before (pre) and after (post) measure of cylinder grip within trial group. By examining the final test statistics portion of table by Wilcoxon signed-rank test it was discovered that trial group for 4 weeks, 5 days in a week, mirror therapy along with conventional physiotherapy showed a statistically which was not significant change in cylinder grip among individuals with chronic stroke ($Z = -1.000$, $p = .317$).

Table-25 Spherical grip within control group

Spherical grip (posttest) – Spherical grip (pretest)	N	Mean rank	Sum of ranks	Wilcoxon Signed rank test based on Z	P
Negative ranks	0	.00	.00	-1.000	.317
Positive ranks	1	1.00	1.00		
Ties	4				
Total	5				

Table-25 described the comparison of participant's before (pre) and after (post) measure of spherical grip within control group. By examining the final test statistics portion of table by Wilcoxon signed-rank test it was discovered that control group for 4 weeks, 5 days in a week, conventional physiotherapy showed a statistically change which was not significant in spherical grip among individuals with chronic stroke ($Z = -1.000$, $p = .317$).

Table-26 Spherical grip within trial group

Spherical grip (posttest) – Spherical grip (pretest)	N	Mean rank	Sum of ranks	Wilcoxon Signed rank test based on Z	P
Negative ranks	0	.00	.00	-1.000	.317
Positive ranks	1	1.00	1.00		
Ties	4				
Total	5				

Table-26 described the comparison of participant’s before (pre) and after (post) measure of spherical grip within trial group. By examining the final test statistics portion of table by Wilcoxon signed-rank test it was discovered that trial group for 4 weeks, 5 days in a week, mirror therapy along with conventional physiotherapy showed a statistically change which was not significant in spherical grip among individuals with chronic stroke ($Z = -1.000, p = .317$).

4.4. Comparison of functional changes of Coordination

Table-27 Tremor within control group

Tremor (posttest) – Tremor (pretest)	N	Mean rank	Sum of ranks	Wilcoxon Signed rank test based on Z	P
Negative ranks	0	.00	.00	-1.000	.317
Positive ranks	1	1.00	1.00		
Ties	4				
Total	5				

Table-27 described the comparison of participant's before (pre) and after (post) measure of tremor within control group. By examining the final test statistics portion of table by Wilcoxon signed-rank test it was discovered that control group for 4 weeks, 5 days in a week, conventional physiotherapy showed a statistically change which was not significant in tremor among individuals with chronic stroke ($Z = -1.000$, $p = .317$).

Table-28 Tremor within trial group

Tremor (posttest) – Tremor (pretest)	N	Mean rank	Sum of ranks	Wilcoxon Signed rank test based on Z	P
Negative ranks	0	.00	.00	-1.732	.083
Positive ranks	3	2.00	6.00		
Ties	2				
Total	5				

Table-28 described the comparison of participant's before (pre) and after (post) measure of tremor within trial group. By examining the final test statistics portion of table by Wilcoxon signed-rank test it was discovered that trial group for 4 weeks, 5 days in a week, mirror therapy along with conventional physiotherapy showed a statistically change which was not significant in tremor among individuals with chronic stroke ($Z = -1.732$, $p = .083$).

Table-29 Dysmetria within control group

Dysmetria (posttest) – Dysmetria (pretest)	N	Mean rank	Sum of ranks	Wilcoxon Signed rank test based on Z	P
Negative ranks	0	.00	.00	-1.000	.317
Positive ranks	1	1.00	1.00		
Ties	4				
Total	5				

Table-29 described the comparison of participant's before (pre) and after (post) dysmetria within control group. By examining the final test statistics portion of table by Wilcoxon signed-rank test it was discovered that control group for 4 weeks, 5 days in a week, conventional physiotherapy showed a statistically change which was not significant in dysmetria among individuals with chronic stroke ($Z = -1.000$, $p = .317$).

Table-30 Dysmetria within trial group

Dysmetria (posttest) – Dysmetria (pretest)	N	Mean rank	Sum of ranks	Wilcoxon Signed rank test based on Z	P
Negative ranks	0	.00	.00	-1.000	.317
Positive ranks	1	1.00	1.00		
Ties	4				
Total	5				

Table-30 described the comparison of participant's before (pre) and after (post) dysmetria within trial group. By examining the final test statistics portion of table by Wilcoxon signed-rank test it was discovered that trial group for 4 weeks, 5 days in a week, mirror therapy along with conventional physiotherapy showed a statistically change which was not significant in dysmetria among individuals with chronic stroke ($Z = -1.000$, $p = .317$).

Table-31 Time/Speed within control group

Time/speed (posttest) – Time/speed (pretest)	N	Mean rank	Sum of ranks	Wilcoxon Signed rank test based on Z	P
Negative ranks	0	.00	.00	-1.000	.317
Positive ranks	1	1.00	1.00		
Ties	4				
Total	5				

Table-31 described the comparison of participant's before (pre) and after (post) measure of speed/time within control group. By examining the final test statistics portion of table by Wilcoxon signed-rank test it was discovered that control group for 4 weeks, 5 days in a week, conventional physiotherapy showed a statistically change which was not significant in speed among individuals with chronic stroke ($Z = -1.000$, $p = .317$).

Table-32 Time/Speed within trial group

Time/speed (posttest) – Time/speed (pretest)	N	Mean rank	Sum of ranks	Wilcoxon Signed rank test based on Z	P
Negative ranks	0	.00	.00	-1.342	.180
Positive ranks	2	1.50	3.00		
Ties	3				
Total	5				

Table-32 described the comparison of participant's before (pre) and after (post) measure of speed/time within trial group. By examining the final test statistics portion of table by Wilcoxon signed-rank test it was discovered that trial group for 4 weeks, 5 days in a week, mirror therapy along with conventional physiotherapy showed a statistically change which was not significant in speed among individuals with chronic stroke ($Z = -1.342, p = .180$).

4.5. Unpaired t- test for between Groups

Table-33

Unpaired t- test for between Groups

Subject	Unpaired t	df	P
Wrist	0.312	8	2.306
Hand	0.171	8	2.306
Coordination	0.482	8	2.306

Table-33 described that the calculated t value for wrist is 0.312, for hand is 0.171, for coordination is 0.482 and for df= 8. Since the calculated t values (0.312, 0.171, 0.482) are less than “Table value or critical t value” that is 2.306, p value is more than α level (0.05), therefore the test was not significant, means result due to variation or by chance is >5% and confidence level is <95%, and thus difference between two groups in their effectiveness is due to variation or by chance. Therefore we cannot reject the null hypothesis, rather it is accepted.

In this chapter the results are discussed in relation to the aim and objectives of the study as well as relevant literature. The present study found different characteristics on baseline in age, gender, duration of stroke, occupation, income, weight, height and pretest-posttest score of functional changes by the questionnaire-‘Fugl–Meyer Motor Function Assessment (upper extremity)’ between both trial and control group participants. Similarities in baseline characteristics between both groups confirmed successful randomization (Boer et al., 2015).

In this study it was revealed that there were 80% men and 20 % women in trial group and in control group the ratio was same. Also found that men are most affected than women.

In the study of Dosunceli et al. (2009), participants of trial group and control group received 3 sessions per week and totaling 24 sessions of treatment at the time of treatment period of study.

But here participants of both group took 5 sessions per week and totaling 12 sessions of treatment due to time limitation. Though here the researcher didn’t find effectiveness of mirror therapy along with conventional treatment among patients with chronic stroke. In this way, above criteria matched with the current study to prove the hypothesis and disprove the null hypothesis (Kellicker, 2011).

Different studies found (Michielsen 2011, Ietswaart 2011, Yun 2010, Yavuzer 2008, Rothgangel 2004, Altschuler 1999) that the age group was Between 25 and 80 years. There were more participants with a hemiparesis of the left side (55%). Among those studies, patients with known etiology, 83% had an ischemic and 17% a hemorrhagic stroke. Also there were more male (57%) than female (43%) participants. Additionally found when compared with all other interventions, mirror therapy may have a significant effect on motor function improvement.

Here in this study, the age group was between 25 and 75 years. Male participants (80%) were more than female (20%) participants. Most of the patients had ischemic attack. Hemiparesis of the left side were more (90%) than right side hemiparesis.

In accordance with a previous study, there was a significant improvement of upper-extremity function & activities of daily living by applying mirror therapy with conventional physiotherapy (Park et al., 2015). Another study provides preliminary evidence that mirror therapy is also effective in improving motor function of upper extremity when given by a trial. However, it is more effective than the conventional physiotherapy for stroke patients (Gurbuz et al., 2016). An experimental study showed that among the 26 participants, control group was received conventional physiotherapy and experimental group was received mirror therapy for 1-month trial, significant improvement of motor recovery of upper limb in chronic stroke patients was seen (Invernizzi et al., 2013).

And here in this study, it was also found that mirror therapy is no more effective when it is given in a trial with conventional physiotherapy for a limited time. And hand function was not improved significantly in the experimental group where mirror therapy was given with other conventional physiotherapy.

The analysis of significance was carried out by using unpaired t test to find out the effectiveness of mirror therapy along with conventional physiotherapy compared to only conventional physiotherapy for patients with chronic stroke.

Limitations:

100% accuracy will not be possible in any research so that some limitation may exist.

Regarding this study, there might be some limitations or barriers to consider the result of the study as below:

- Despite of the effectiveness of mirror therapy combined with conventional physiotherapy on dependent variables in this study, there were some limitations. As it was the first research of the researcher, so the researcher might overtake some mistakes.
- The main limitation was unable to develop a sampling frame to which the study lacks external validity.
- Physiotherapists could not be blinded to the interventions. The other main limitation of the study was that the trial therapists were not blinded to the treatment allocation.
- The researcher tried to minimize the effect of unbinding by training the trial therapists.
- As samples were collected only from CRP- Savar, it could not represent the wider chronic stroke population. As the researcher collected data from the neurology department at CRP (Savar, Dhaka), so the result of this study could not generalize of all stroke patients in Bangladesh.
- In addition, the study was conducted with 10 patients of chronic stroke, which was a very small number of samples in compare with the real world prevalence.
- Also patient got only 12 sessions of treatment, it can be more effective and accurate if they get more sessions.
- Data were collected only two times during study and it created study limitation as there is no follow up session. The study did not offer any follow up for participants which was essential component to find out effectiveness of treatment for longer period of time.
- However, participants were only blinded and it lacks the absolute minimization of physiotherapist's bias during delivering treatment. As far as known, there were no available researches representing effectiveness of this intervention before this one in Bangladesh. So timeline comparison of the particular exercise's effectiveness couldn't be possible.
- Two patients among all the sample met with an accident during the intervention period. That was a serious reason for not getting their improvement much like other patients.

Conclusion

In conclusion, this study shows that the MT combined with conventional physiotherapy is safe, easy & effective treatment to improve the hand function in chronic stroke patients. Mirror therapy with conventional physiotherapy was more effective in improvement of hand function among patients with chronic stroke in this study. In clinical practice the usual treatment for an example manual therapy, exercise therapy electrotherapy is used frequently for stroke patients. After doing this study a new treatment approach is introduced to everyone which is effective and can be applicable for the benefit of the patients. Conversely, the aim and objectives of this study has been fulfilled and the null hypothesis was rejected favoring the mirror therapy combined with conventional physiotherapy for chronic stroke patients. Since mirror therapy has been practicing by physiotherapists in limiting manner outside of this study setting, the outcomes of thesis would help practitioners outside the study setting to formulate a management guideline to treat patients with chronic stroke. From the study we got the calculated t values (0.312, 0.171, 0.482) which are less than “Table value or critical t value” that is 2.306, p value is more than α level (0.05), therefore the test was not significant. Therefore we cannot reject the null hypothesis, rather it is accepted.

Recommendation

As a consequence of this research it is recommended to do further study including comparison of the conventional physiotherapy along with mirror therapy & conventional physiotherapy alone to assess the effectiveness of these interventions with ‘Double blinding’ procedure. It is also recommended to do further study with more number of subjects or large sample size and with a longer time frame. It is also recommended to include the functional outcome and strength of patient and to identify the average number of sessions that are needed to be discharged from treatment to validate the treatment technique. Recommended trial study for 6 weeks with 5 days per week (30 minutes of MT) (Dohle et al., 2009). Sham therapy (same exercise program & for the same duration as in the Mirror group but the reflecting part of the mirror is covered with paper) can be added

in the control group (Invernizzi et al., 2013). Study area can be broaden if data is collected from various source of places. Moreover, it is also recommended to conduct the study with subacute stroke patients. And a follow-up session for each patient is also recommended to make the study more valid.

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Appendix

Permission Letter of Data Collection

August 5, 2018

Head of Department,
Department of Physiotherapy,
Centre for the Rehabilitation of the Paralyzed (CRP),
Chapain. Savar, Dhaka -1343.
Through: Head, Department of Physiotherapy, BHPI.

Subject: An application to obtain permission for data collection in order to conduct my research project.

Respected sir,

With due respect and humble submission to state that I am Zihad Chowdhury, student of 4th professional B.Sc. in physiotherapy at Bangladesh Health Professions Institute (BHPI). According to the course curriculum, I have to conduct a research project for the partial fulfillment of the degree of B.Sc. in Physiotherapy. The title of my research project is "Effectiveness of Mirror therapy on hand function improvement among patients with chronic stroke". My research project will be conducted under the supervision of Ehsanur Rahman, Assistant professor of the Physiotherapy Department, BHPI, CRP, Savar, Dhaka. I want to collect data for my research project from the patients of neurology unit, department of Physiotherapy, CRP-Savar. So, I need permission for data collection from the neurology unit of physiotherapy department of CRP-Savar. I would like to assure that anything of my study will not be harmful for the participants.

May I, therefore, pray and hope that you would be kind enough to grant my application and give me permission for data collection and oblige thereby.

Yours obediently,

Zihad Chowdhury

Mr. Zihad Chowdhury

4th Professional B.Sc. in Physiotherapy

Roll-29, Session: 2013-2014

Bangladesh Health Professions Institute (BHPI)

CRP, Chapain, Savar, Dhaka-1343.

Forwarded
Ehab
5/8/18

Recommended
[Signature]
5/8/18

Approved
[Signature]
5/8/18

Mohammad Amir Hossain
Associate Professor
CRP, Chapain, Savar, Dhaka-1343

Ethical Approval

Date: 5th February, 2018

The Chairman
Institutional Review Board (IRB)
Bangladesh Health Professions Institute (BHPI)
CRP-Savar, Dhaka-1343, Bangladesh

Subject: **Application for review and ethical approval.**

Sir,

With due respect I would like to draw your kind attention that I am a student of B.Sc. in Physiotherapy at Bangladesh Health Professions Institute (BHPI)- an academic institute of CRP under Faculty of Medicine of University of Dhaka (DU). I have to conduct a thesis entitled, **"Effectiveness of Mirror therapy on hand function improvement among patients with chronic stroke"** under honorable supervisor, Ehsanur Rahman, (Assistant professor, Department of Physiotherapy, BHPI). The purpose of the study is to determine the effectiveness of Mirror Therapy on subacute stroke patients after receiving both conventional physiotherapy and mirror therapy at neurology outpatient unit of CRP.

The study involves use of a questionnaire (Fugl-Meyer Motor Function Assessment for upper extremity) to find out the improvement of hand function that may take 20 to 25 minutes to answer / fill in the questionnaire or participate in the test. There is no likelihood of any harm to the participants and / or participation in the study may benefit the participants. Related information will be collected from the patients' guide books. Data collectors will receive informed consents from all participants. Any data collected will be kept confidential.

Therefore I look forward to having your kind approval for the thesis proposal and to start data collection. I can also assure you that I will maintain all the requirements for study.

Sincerely,

Zihad Chowdhury
Zihad Chowdhury
Student of B.Sc. in Physiotherapy
BHPI, CRP, Savar, Dhaka-1343, Bangladesh

Recommendation from the thesis supervisor:

E. Rahman
4.8.2018
Ehsanur Rahman
Assistant Professor, Department of Physiotherapy,
BHPI, CRP, Savar, Dhaka-1343, Bangladesh.

Attachment: Thesis Proposal including measurement tools and process and procedure for maintaining confidentiality, Questionnaire (English and Bengali version), Information sheet & consent.

IRB Permission Letter

CRP-BHPI/TRB/.....

To
Zihad Chowdhury
B.Sc. in Physiotherapy
Session: 2013-2014, Student ID: 112130226
BHPI, CRP, Savar, Dhaka-1343, Bangladesh

Subject: Approval of the thesis proposal "Effectiveness of Mirror therapy on hand function improvement among patients with chronic stroke" by ethics committee.

Dear Zihad Chowdhury,
Congratulations.

The Institutional Review Board (IRB) of BHPI has reviewed and discussed your application to conduct the above mentioned dissertation, with yourself, as the Principal investigator. The following documents have been reviewed and approved:

Sr. No.	Name of the Documents
1	Dissertation Proposal
2	Questionnaire (English version & Bangla version)
3	Information sheet & consent form.

The purpose of the study is to determine the effectiveness of Mirror Therapy on chronic stroke patients after receiving both conventional physiotherapy and mirror therapy at neurology outpatient unit of CRP. The study involves use of a questionnaire (Fugl-Meyer Motor Function Assessment for upper extremity) to find out the improvement of hand function that may take 20 to 25 minutes to answer/fill in the questionnaire or participate in the test / any instruction or precaution for collection of specimen and there is no likelihood of any harm to the participants and / or participation in the study may benefit the participants or other stakeholders. The members of the Ethics committee have approved the study to be conducted in the presented form at the meeting held at 9.30 AM on July 21, 2018 at BHPI.

The institutional Ethics committee expects to be informed about the progress of the study, any changes occurring in the course of the study, any revision in the protocol and patient information or informed consent and ask to be provided a copy of the final report. This Ethics committee is working accordance to Nuremberg Code 1947, World Medical Association Declaration of Helsinki, 1964 - 2013 and other applicable regulation.

Best regards,

Muhammad Millat Hossain
Assistant Professor, Dept. of Rehabilitation Science
Member Secretary, Institutional Review Board (IRB)
BHPI, CRP, Savar, Dhaka-1343, Bangladesh

Consent form (Bangla)

Consent form (Bangla)

সম্মতিপত্র

আসসালামু আলাইকুম,

আমি জিহাদ চৌধুরী, বাংলাদেশ হেলথ প্রফেশনাল ইনস্টিটিউট (বি.এইচ.পি.আই), সি.আর.পি এর বি.এস.সি ইন ফিজিওথেরাপী কোর্সের ৪র্থ বর্ষের শিক্ষার্থী। আমার প্রাতিষ্ঠানিক কাজের অংশ হিসেবে আমাকে একটি গবেষণা করতে হবে। আমার গবেষণার বিষয় হলো, “স্ট্রোক রোগীদের মধ্যে হ্যান্ড-ফাংশন উন্নতিতে মিরর থেরাপি এর কার্যকারিতা”। এ পরীক্ষামূলক গবেষণার মাধ্যমে আমি একটি পরীক্ষা করবো যে, স্ট্রোক রোগীদের ক্ষেত্রে শুধুমাত্র প্রচলিত ফিজিওথেরাপী অপেক্ষা প্রচলিত ফিজিওথেরাপীর সাথে মিরর থেরাপি বেশী কার্যকারী হবে।

গবেষণাটি সম্পাদনের জন্য, আমার তথ্য সংগ্রহ করা প্রয়োজন হবে। এজন্য, আপনি আমার গবেষণার একজন সম্মানিত অংশগ্রহনকারী হতে পারেন। আপনার নিয়মিত ফিজিওথেরাপীর সময় আমি আপনার সাথে কয়েকবার দেখা করব। আমি নিশ্চিত করছি যে, যেই চিকিৎসা পদ্ধতি প্রয়োগ করা হবে তা আপনার জন্য ব্যথামুক্ত ও নিরাপদ হবে।

আমি আপনাকে অবগত করছি যে, এটি একটি সম্পূর্ণ প্রাতিষ্ঠানিক গবেষণা এবং এটি অন্য কোনো উদ্দেশ্যে ব্যবহৃত হবে না। আমি আপনাকে আরো নিশ্চিত করছি যে, আপনার প্রদত্ত সকল তথ্য গোপন রাখা হবে। আপনার অংশগ্রহন হবে ইচ্ছাকৃত। এই গবেষণা থেকে আপনি যে কোনো মুহূর্তে সম্মতি প্রত্যাহার করতে পারবেন।

আপনার যদি এই গবেষণা সম্পর্কে এবং অংশগ্রহনকারী হিসেবে আপনার অধিকার সম্পর্কে কোনো জিজ্ঞাসা থাকে তবে আপনি আমার সাথে অথবা আমার পর্যবেক্ষক এহসানুর রহমান (ফিজিওথেরাপী সহকারী অধ্যাপক, বি.এইচ.পি.আই) এর সাথে যোগাযোগ করতে পারবেন।

উপাত্ত সংগ্রহের পূর্বে আপনার কি কোনো প্রশ্ন আছে?

আমি কি আপনার সাক্ষাৎকার গ্রহনের সম্মতি পেতে পারি?

হ্যাঁ না

অংশগ্রহনকারীর স্বাক্ষর.....তারিখ.....

তথ্যসংগ্রহকারীর স্বাক্ষর.....তারিখ.....

স্বাক্ষীর স্বাক্ষর.....তারিখ.....

Consent Form (English)

Consent Form (English)

Assalamualaikum/Namasker,

My name is Zihad Chowdhury. I am conducting this study for a B.Sc. in Physiotherapy project study dissertation titled "Effectiveness of Mirror therapy on hand function improvement among patients with chronic stroke" under Bangladesh Health Professions Institute (BHPI), University of Dhaka. By this study I will find out if mirror therapy along with conventional physiotherapy is more effective than conventional physiotherapy alone.

I would like to know about some personal and other related information regarding functional improvement following a questionnaire. You have to answer some questions which are mentioned in the attached form. This will take approximately 20 minutes.

I would like to inform you that this is a purely academic study and will not be used for any other purpose. The researcher is not directly related with this Neurology unit, so your participation in the research will have no impact on your present or future treatment in the neurology unit. All information provided by you will be treated as confidential and in the event of any report or publication it will be ensured that the source of information remains anonymous and also all information will be destroyed after completion of the study. Your participation in this study is voluntary and you may withdraw yourself at any time during this study without any negative consequences. You also have the right not to answer a particular question that you don't like or do not want to answer during interview.

If you have any query about the study or your right as a participant, you may contact with me, and/or my supervisor Ehsanur Rahman, Assistant Professor, department of physiotherapy, BHPI, CRP, Savar, Dhaka.

So, may I have your consent to proceed with the interview or work?

Yes No

Signature of the Participant/carer with date

Signature of the Data collector

Signature of the Interviewer with date

Bangla Questionnaire

বাংলা প্রশ্নাবলী

মোডিফাইড ফুগল মেয়োর এসেসমেন্ট (আপার এক্সট্রিমিটি)	আইডি:
	তারিখ:
	পরীক্ষক:

পর্ব- ১ (ব্যক্তিগত বিবরণী)

- ১। বোগীর নাম:
- ২। বয়স:
- ৩। লিঙ্গ: পুরুষ / মহিলা
- ৪। ঠিকানা:
- ৫। মোবাইল নম্বর:

পর্ব- ২ (স্ট্রোক সম্পর্কিত তথ্যাবলি)

- ১। স্ট্রোক এর সময়কাল:
- ২। স্ট্রোক এর ধরন: ইস্কেমিক/ হেমারেজিক
- ৩। আক্রান্ত অংশ: ডান / বাম
- ৪। কত সেশন কিজিওথেরাপি নিয়ে:

পর্বে - ৩ (সামাজিক ও বৈষয়িক তথ্যাবলি)

প্রশ্ন	উত্তর
১. বয়স বছর
২. লিঙ্গ	পুরুষ / মহিলা
৩. বৈবাহিক	বিবাহিত / অবিবাহিত
৪. বসবাসের এলাকা	গ্রাম / শহর
৫. পেশা	
৬. আয়	

পর্বে - ৪ (স্বাস্থ্য বিষয়ক তথ্যাবলী)

প্রশ্ন	উত্তর
৭. কত সময় ধরে সময়গ্য বছর মাস
৮. কোন পাশে সময়গ্য	ডান / বাম
৯. ওজন (কে.জি)	
১০. উচ্চতা (সেমি)	

পরীক্ষার আগের উপাত্ত

ক। কাজি		নাই	আংশিক	সম্পূর্ণ
১৫° ডরসিফেক্সনে ধরে রাখতে হবে (কনুই ৯০°, ফোরআর্ম প্রোনেটেড শোল্ডার ০°)	একটি ডরসিফেক্সন > ১৫°	০		
	১৫° ডরসিফেক্সন কোন বাধা ছাড়া		১	
	বাধার বিরুদ্ধে অবস্থান ধরে রাখতে পারা			২
পুনরায় ডরসিফেক্সন/ ভেলার ফ্লেক্সন (কনুই ৯০°, ফোরআর্ম প্রোনেটেড শোল্ডার ০°, সামান্য ফিঙ্গার ফ্লেক্সন)	প্রিট্রিকভাবে করতে পারে না	০		
	একটি রিজ অর মোশন, সীমিত		১	
	একটি রিজ অর মোশন, সম্পূর্ণ			২
১৫° ডরসিফেক্সন অবস্থার স্থায়িত্ব (কনুই ০°, ফোরআর্ম প্রোনেটেড, সামান্য শোল্ডার ফ্লেক্সন/এবডাকশন)	একটি ডরসিফেক্সন > ১৫°	০		
	১৫° ডরসিফেক্সন কোন বাধা ছাড়া		১	
	বাধার বিরুদ্ধে অবস্থান ধরে রাখতে পারা			২
পুনরায় ডরসিফেক্সন/ ভেলার ফ্লেক্সন (কনুই ০°, ফোরআর্ম প্রোনেটেড সামান্য শোল্ডার ফ্লেক্সন/এবডাকশন)	প্রিট্রিকভাবে করতে পারে না	০		
	একটি রিজ অর মোশন, সীমিত		১	
	একটি রিজ অর মোশন, সম্পূর্ণ			২
সারকামডাকশন	প্রিট্রিকভাবে করতে পারে না	০		
	এনোমেলাভাবে/অসম্পূর্ণভাবে		১	
	সম্পূর্ণরূপে করতে পারে			২
সর্বমোট ক (সর্বোচ্চ ১০)				

খ। হাত		নাই	আংশিক	সম্পূর্ণ
সর্বাধিক ফ্লেক্সন (সম্পূর্ণ একটি বা পেসিভ ফ্লেক্সন থেকে)		০	১	২
সর্বাধিক এক্সটেনশন (সম্পূর্ণ একটি বা পেসিভ ফ্লেক্সন থেকে)		০	১	২
গ্রুপ				
পি.আই.পি ও ডি.আই.পি জয়েন্ট এ ফ্লেক্সন, এম.পি.পি জয়েন্ট এ এক্সটেনশন	করতে পারে না	০		
	অবস্থান ধরে রাখতে পারে কিন্তু দুর্বল		১	
	বাধার বিরুদ্ধে অবস্থান ধরে রাখতে পারা			২
থাম্ব এবডাকশন	করতে পারে না	০		

	কগজ ধরে রাখতে পারে কিন্তু টানের বিরুদ্ধে নয়		১	
	টানের বিরুদ্ধে কগজ ধরে রাখতে পারে			২
অপোজিশন	করতে পারে না	০		
	পেন্সিলধরে রাখতে পারে কিন্তু টানের বিরুদ্ধে নয়		১	
	টানের বিরুদ্ধে পেন্সিল ধরে রাখতে পারে			২
সিলিন্ডার গ্রিপ	করতে পারে না	০		
	সিলিন্ডার ধরে রাখতে পারে কিন্তু টানের বিরুদ্ধে নয়		১	
	টানের বিরুদ্ধে সিলিন্ডার ধরে রাখতে পারে			২
স্ফেরিকাল গ্রিপ	করতে পারে না	০		
	টেনিস বল ধরে রাখতে পারে কিন্তু টানের বিরুদ্ধে নয়		১	
	টানের বিরুদ্ধে টেনিস বল ধরে রাখতে পারে			২
সর্বমোট খ (সর্বোচ্চ ১৪)				

গ। সমন্বয় / গতি		বেশি	সামান্য	নেই
কাঁপুনি		০	১	২
ডিফেন্ডিভা	অগোছালো বা নিয়মবহির্ভূত	০		
	আংশিক ও সুসংবদ্ধ		১	
	ডিফেন্ডিভা ব্যাক্তিত			২
		০-৫ সেকেন্ড	২-৫ সেকেন্ড	৫ সেকেন্ড
সময়		০	১	২
সর্বমোট গ (সর্বোচ্চ ৬)				

ক। কন্ড্রি		/১০
খ। হাত		/১৪
গ। সমন্বয় / গতি		/৬
সর্বমোট (ক-গ)		/৩০

পরীক্ষার পরের উপাত্ত

ক। কাজ		নাই	আংশিক	সম্পূর্ণ
১৫° ডবসিফেকশনে ধরে রাখতে হবে (কনুই ৯০°, ফোরআর্ম প্রোনেটেড শোল্ডার ০°)	একটি ডবসিফেকশন > ১৫°	০		
	১৫° ডবসিফেকশন কোন বাধা ছাড়া		১	
	বাধার বিরুদ্ধে অবস্থান ধরে রাখতে পারা			২
পুনরায় ডবসিফেকশন/ ভোলার ফ্লেক্সন (কনুই ৯০°, ফোরআর্ম প্রোনেটেড শোল্ডার ০°, সামান্য ফিঙ্গার ফ্লেক্সন)	প্রীচ্ছিকভাবে করতে পারে না	০		
	একটি রেঞ্জ অব মোশন, সীমিত		১	
	একটি রেঞ্জ অব মোশন, সম্পূর্ণ			২
১৫° ডবসিফেকশন অবস্থান স্থায়িত্ব (কনুই ০°, ফোরআর্ম প্রোনেটেড, সামান্য শোল্ডার ফ্লেক্সন/এবডাকশন)	একটি ডবসিফেকশন > ১৫°	০		
	১৫° ডবসিফেকশন কোন বাধা ছাড়া		১	
	বাধার বিরুদ্ধে অবস্থান ধরে রাখতে পারা			২
পুনরায় ডবসিফেকশন/ ভোলার ফ্লেক্সন (কনুই ০°, ফোরআর্ম প্রোনেটেড সামান্য শোল্ডার ফ্লেক্সন/এবডাকশন)	প্রীচ্ছিকভাবে করতে পারে না	০		
	একটি রেঞ্জ অব মোশন, সীমিত		১	
	একটি রেঞ্জ অব মোশন, সম্পূর্ণ			২
সারকামডাকশন	প্রীচ্ছিকভাবে করতে পারে না	০		
	এলোমেলোভাবে/অসম্পূর্ণভাবে		১	
	সম্পূর্ণরূপে করতে পারে			২
সর্বমোট ক (সর্বোচ্চ ১০)				

খ। হাত		নাই	আংশিক	সম্পূর্ণ
সর্বাধিক ফ্লেক্সন (সম্পূর্ণ একটি ড বা পেসিভ ফ্লেকশন থেকে)		০	১	২
সর্বাধিক এক্সটেনশন (সম্পূর্ণ একটি ড বা পেসিভ ফ্লেক্সন থেকে)		০	১	২
গ্রাম্প পি.আই.পি ও ডি.আই.পি জয়েন্ট এ ফ্লেক্সন, এম.সি.পি জয়েন্ট এ এক্সটেনশন	করতে পারে না	০		
	অবস্থান ধরে রাখতে পারে কিন্তু দুর্বল		১	
	বাধার বিরুদ্ধে অবস্থান ধরে রাখতে পারা			২
থান্ড এবডাকশন	করতে পারে না	০		

	কাগজ ধরে রাখতে পারে কিন্তু টানের বিরুদ্ধে নয়		১	
	টানের বিরুদ্ধে কাগজ ধরে রাখতে পারে			২
অপেক্ষিত	করতে পারে না	০		
	পেপিলধরে রাখতে পারে কিন্তু টানের বিরুদ্ধে নয়		১	
	টানের বিরুদ্ধে পেপিল ধরে রাখতে পারে			২
সিলিন্ডার গ্রিপ	করতে পারে না	০		
	সিলিন্ডার ধরে রাখতে পারে কিন্তু টানের বিরুদ্ধে নয়		১	
	টানের বিরুদ্ধে সিলিন্ডার ধরে রাখতে পারে			২
ফেব্রিকাল গ্রিপ	করতে পারে না	০		
	টেনিস বল ধরে রাখতে পারে কিন্তু টানের বিরুদ্ধে নয়		১	
	টানের বিরুদ্ধে টেনিস বল ধরে রাখতে পারে			২
সর্বমোট খ (সর্বোচ্চ ১৪)				

গ। সময় / গতি	বেশি	সামান্য	নেই
কাঁপনি	০	১	২
ডিম্বাঙ্ক	০		
		১	
			২
	১-৫ সেকেন্ড	২-৫ সেকেন্ড	১ সেকেন্ড
	০	১	২
সময়	সর্বমোট গ (সর্বোচ্চ ৬)		

ক। কাজ		১০
খ। হাত		১৪
গ। সময় / গতি		৬
সর্বমোট (ক-গ)		৩০

English Questionnaire

FUGL-MEYER ASSESSMENT UPPER EXTREMITY (FMA-UE) (Modified)

ID:

Date:

Examiner:

Fugl-Meyer AR, Jaasko L, Leyman I, Olsson S, Stegling S: The post-stroke hemiplegic patient. A method for evaluation of physical performance. Scand J Rehabil Med 1975, 7:13-31.

A. WRIST support may be provided at the elbow to take or hold the position, no support at wrist, check the passive range of motion prior testing		none	partial	full
Stability at 15° dorsiflexion elbow at 90°, forearm pronated shoulder at 0°	less than 15° active dorsiflexion dorsiflexion 15°, no resistance is taken maintains position against resistance	0	1	2
Repeated dorsiflexion / volar flexion elbow at 90°, forearm pronated shoulder at 0°, slight finger flexion	cannot perform volitionally limited active range of motion full active range of motion, smoothly	0	1	2
Stability at 15° dorsiflexion elbow at 0°, forearm pronated slight shoulder flexion/abduction	less than 15° active dorsiflexion dorsiflexion 15°, no resistance is taken maintains position against resistance	0	1	2
Repeated dorsiflexion / volar flexion elbow at 0°, forearm pronated slight shoulder flexion/abduction	cannot perform volitionally limited active range of motion full active range of motion, smoothly	0	1	2
Circumduction	cannot perform volitionally jerky movement or incomplete complete and smooth circumduction	0	1	2
Total A (max 10)				

B. HAND support may be provided at the elbow to keep 90° flexion, no support at the wrist, compare with unaffected hand, the objects are interposed, active grasp		none	partial	full
Mass flexion from full active or passive extension		0	1	2
Mass extension from full active or passive flexion		0	1	2
GRASP				
A – flexion in PIP and DIP (digits II-V) extension in MCP II-V	cannot be performed can hold position but weak maintains position against resistance	0	1	2
B – thumb adduction 1-st CMC, MCP, IP at 0°, scrap of paper between thumb and 2-nd MCP joint	cannot be performed can hold paper but not against tug can hold paper against a tug	0	1	2
C – opposition pulpa of the thumb against the pulpa of 2-nd finger, pencil, tug upward	cannot be performed can hold pencil but not against tug can hold pencil against a tug	0	1	2
D – cylinder grip cylinder shaped object (small can) tug upward, opposition in digits I and II	cannot be performed can hold cylinder but not against tug can hold cylinder against a tug	0	1	2
E – spherical grip fingers in abduction/flexion, thumb opposed, tennis ball	cannot be performed can hold ball but not against tug can hold ball against a tug	0	1	2
Total B (max 14)				

C. COORDINATION/SPEED after one trial with both arms, blind-folded, tip of the index finger from knee to nose, 5 times as fast as possible		marked	slight	none
Tremor		0	1	2
Dysmetria	pronounced or unsystematic slight and systematic no dysmetria	0	1	2
		> 5s	2 - 5s	< 1s
Time	more than 5 seconds slower than unaffected side 2-5 seconds slower than unaffected side maximum difference of 1 second between sides	0	1	2
Total C (max 6)				

TOTAL A-C (max 30)	
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A. WRIST	/10
B. HAND	/14
C. COORDINATION / SPEED	/6
TOTAL A-C (motor function)	/30

END