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Effectiveness of Activity Based Mirror Therapy on the Gait in Patients with Stroke

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DECLARATION

I am; I hereby declare that I am fully responsible for any errors that may occur in my research endeavor and that no aspect of the study will cause damage to others. The study has cited all sources in a manner that is appropriate. Consequently, I am solely responsible for the accuracy and integrity of the complete study, and any errors in the endeavor are entirely my own.

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ACRONYMS

ABMT	Activity based mirror therapy
ADL, s	Activities of daily living
BBS	Berg Balance Scale
BMI	Body mass index
CM	Centimeter
CRP	Centre for the Rehabilitation of the Paralysed
IRB	Institutional Review Board
MT	Mirror Therapy
PT	Physiotherapy
RCT	Randomized Controlled Trial
WHO	World Health Organization

ABSTRACT

Introduction: Stroke often leads to long-term disability, with gait abnormalities being a major concern for recovery. Traditional rehabilitation techniques can have limited effects on improving mobility. This study explores the impact of Activity-Based Mirror Therapy (ABMT) on gait parameters in stroke patients, aiming to determine its effectiveness in improving gait and mobility. **Purpose:** The purpose of this study was to assess the effectiveness of ABMT in improving key gait parameters, including step length, stride length, cadence, velocity, and balance, in stroke patients undergoing rehabilitation. **Objective:** The main objective was to evaluate whether ABMT can lead to significant improvements in gait and mobility, compared to conventional rehabilitation methods. **Methodology:** This research used a randomize controlled trial study design. A total of 30 stroke patients were divided into two groups: an experimental group receiving ABMT and a control group undergoing conventional rehabilitation. The participants were assessed on various gait parameters before and after the intervention using standardized tests. **Analysis of Data:** The data were analyzed using the Wilcoxon signed-rank test to evaluate within-group changes in gait parameters. A significant difference was considered when the p-value was below 0.05. **Results:** The results showed that the experimental group exhibited significant improvements in step length, stride length, cadence, and balance ($p < 0.05$). However, the velocity showed moderate improvement. In contrast, the control group showed slight improvements, with no significant changes in velocity or cadence ($p > 0.05$). **Conclusion:** This study concluded that ABMT can be an effective addition to conventional stroke rehabilitation programs. The findings suggest that ABMT positively influences gait parameters and mobility, contributing to functional recovery in stroke patients. It is recommended that rehabilitation centers incorporate ABMT as a non-invasive, cost-effective intervention, and further research be conducted to evaluate its long-term effects and potential combined use with other therapies.

Key words: *Stroke, Mirror therapy, Gait, Berg Balance Scale (BBS).*

CHAPTER-I INTRODUCTION

1.1 Background

Stroke defined by the World Health Organization as abruptly developing clinical signs of focal or overall disruption of cerebral function, unceasing >24 h or resulting in death, without an evident cause except that of vascular origin. It is a reason for disability and early death (Bhoraniya et al. 2018, p. 1321). Stroke is a dominant, dangerous, and disable global health issue. Most nations view stroke as the one of the primary causes of adult impairment and the second or third most common cause of death. The majority of stroke patients will recover from their primary illness, therefore the long-term effects on patients and their families typically have the biggest bad impact on health (Acciarresi and Zampolini 2023, p. 882).

Stroke outcome is physical, sensory, cognitive, and visual impairments finally leading to a decrease in particulars ability to perform various activities of daily living, such as dressing, feeding, and walking. In broadly stroke is a leading cause of adult impairment with most rehabilitation hospitals having particularly devoted units for stroke patients. Remain the functional reach in rehabilitation, stroke patient is still restricted in their balance and walking ability well into the chronic phase of the disease (Katzan et al. 2018, p. 1364).

Impairments to gait are a common occurrence in stroke survivors. An estimated 50% of patients in the first stages of the illness will not be able to walk, in the chronic phase of the disease (more than six months), 20–40% will not be able to walk; and 11% will only be able to walk able to walk with assistance (Ma et al. 2018, p. 2798).

According to the World Health Organization, every year worldwide 15 million people suffer from stroke. Five million of this die and another five million are disabled permanently (Aydin et al. 2016, p. 553). The disability rates among stroke survivor are between 24–54% (Srivastava et al. 2010, p. 211). Stroke occurring rate is the same in men and women but women are more probable to die. Stroke, either ischemic or hemorrhagic is more common in men than in women (Zhang et al. 2011, p. 18). Stroke incidence was

about 30% higher in men than in women in Western Europe (Appelros, Stegmayr and Terent 2017, p. 1082).

The prevalence of stroke in Pakistan's KP province is 1.2 percent (1200 per 100,000 population). The majority of the patients were under the age of 50. There is no marked difference in stroke prevalence between men and women. In India, the estimated adjusted prevalence rate of stroke in rural areas is 84-262/100,000, while in urban areas it is 334-424/100,000. According to current population-based studies, the incidence rate is 119-145/100,000 (Pandian and Sudhan 2013, p. 128).

After a stroke in the first week only a third of persons are able to walk unassisted but at 3 weeks or at hospital discharge 50–80% of survivors can walk unassisted and by 6 months around 85% of stroke survivors are able to walk independently without physical assistance from another person. Independent walking is an important indicator of overall autonomy and quality of life and one of the main goals in stroke rehabilitation (Thieme et al. 2018, p. 977).

Gait recovery is a major objective in the rehabilitation of patients who experience stroke. A wide range of walking ability is present in patients after stroke that is dependent upon the severity of sensorimotor impairment. After stroke, 50% of patients initially are unable to walk, 12% can walk with assistance, and 37% can walk independently. At the end of 11 weeks of stroke rehabilitation, 18% of patients still are unable to walk, 11% can walk with assistance, and 50% can walk independently (Woolley 2010, p. 18).

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 (Balasubramanian, Clark and Fox 2014, p. 21).

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 Roger 2015, p. 377). 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 (Cristina M et al. 2015, p. 597). Mirror therapy was first introduced to treat the phantom limb pain (Yavuzer, Selles and Sezer 2018, p. 393). It is one of the methods which helps to enhance neuroplasticity. The main concept of MT is to use visual reflection in the mirror. The main concept of MT is to use visual reflection in the mirror. Rehabilitation strategies are required to be repetitive, intensive, and task-specific for neuroplasticity to produce recovery (Kleim and Jones 2012, p. 123).

Mirror therapy is a type of rehabilitation approach where the reflection (visual input) of a moving non-affected limb gives the illusion of movement in the affected limb. This is achieved by placing a mirror between the arms or legs. MT has been studied to have effects not just on motor impairments but also on sensations, partial neglect, and pain after stroke. It is reported that when therapy begins within 16hours to 6 months post stroke, there is significant improvement in ADL performance with augmented exercise therapy (Thieme et al. 2018, p. 472).

Mirror therapy is performed by positioning a mirror in the midsagittal plane to replace the image of the affected limb with a reflection of the unaffected side, while receiving physical stimulation or performing movement task (Deconinck et al. 2015, p. 349). Thieme et al in 2013 found that mirror therapy has a significant effect on motor function and improved activities of daily living. In 2017 Zeng et al15 found a moderate effect of mirror therapy on motor function of the upper extremity. several randomized controlled trials (RCTs) have found mirror therapy to have efficacy for reducing pain in the upper limb for stroke patients with complex regional pain syndrome (Deconinck et al. 2015, p. 349).

The movement of the non-paretic part in front of the mirror (reflective side) is perceived as that of the paretic body part (hidden beside the mirror). MT allows an individual to have an experience of normal movement, even for the severely paralyzed limb (Colomer, Noe and Llorens 2016, p. 271). The perception of movement illusion, a neuropsychological phenomenon may induce neural activation of the lesioned brain and enhance associated motor recovery (Arya et al. 2015, p. 1738).MT could activate occipital, sensorimotor, and premotor areas that are contralateral to the moving limb as well as the ipsilateral motor

cortex and cerebellum. Patients who received mirror therapy showed improved upper and lower extremity functions in subacute stroke patients. One study demonstrated that mirror therapy helpful in improving gait ability in subacute stroke (Ji and Kim 2015, p. 348).

In a magneton cephalography study, presence of the mirror changed the initial asymmetrical pattern of activation elicited during bimanual tasks in stroke patients to a more symmetrical pattern (Rossiter et al. 2015, p. 444). Authors conclude that the non-moving/affected area is activated after mirror therapy (Michielsen et al. 2011, p. 393). There are a limited number of studies on mirror therapy in stroke. A 2009 review identified 5 studies, in 2012 another review found 14 studies while in 2014 a number of 33 articles were found suitable. Most of the available reviews show that mirror therapy is able to improve upper limb function (Nilsen et al. 2015, p. 690).

1.2 Rationale:

Stroke often leads to various physical impairments, including gait disturbances. These impairments can significantly impact the quality of life and functional independence of stroke survivors. Bangladesh is densely populated country. Nowadays stroke is a relatively common condition and a major contributing factor to morbidity or mortality. Stroke is the world's most common cause of adult disability and impairment. One of the main purposes of the rehabilitative process is to help patients achieve as high a level of functional independence as possible within the limits of their impairments. Gait impairment is a common consequence of stroke, significantly affecting mobility and independence. Rehabilitating gait function is essential for enhancing overall functional capacity and reducing dependency to other. Mirror therapy is a promising intervention that utilizes visual feedback to promote motor recovery. By using mirrors to create the illusion of movement in the affected limb, mirror therapy has shown potential in improving motor function and reducing pain in various neurological conditions. Activity based interventions emphasize the importance of engaging patients in purposeful, task-oriented activities to promote neuroplasticity and functional recovery. Integrating mirror therapy within an activity-based rehabilitation program can enhance its effectiveness by providing meaningful, goal-directed training. 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. The researcher would like to conduct this study in order to develop evidence to improve balance and gait in relation to physiotherapy intervention of stroke patients. A new physiotherapy intervention will be established easily for stroke patients.

1.3 Research question:

Is activity-based mirror therapy on the gait effective for patients with stroke?

1.4 Aim of the study:

The aim of the study was to investigate the effect of activity-based mirror therapy on the gait in stroke patients, in addition to traditional physiotherapy.

1.5 Objective:

- **General objective:**

  I. To evaluate the efficacy of mirror therapy, compare to conventional treatment for enhancing gait in patient with stroke.

- **Specific objectives:**

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  I. To explore the socio demographic and baseline characteristic of the participant.
  II. To compare the effectiveness of conventional therapy and mirror therapy within experimental and control group.
  III. To assess the level of balance among the control and experimental group of stroke patients by using the Berg Balance Scale (BBS) before and after intervention.
  IV. To assess step length of the experimental and control group before and after intervention.
  V. To investigate stride length of the experimental and control group before and after intervention.
  VI. To assess cadence of the experimental and control group before and after intervention.
  VII. To investigate gait velocity of the experimental and control group before and after intervention.

1.6 Research Hypothesis

Null hypothesis:

Activity based Mirror therapy on the gait is not effective for patients with stroke.

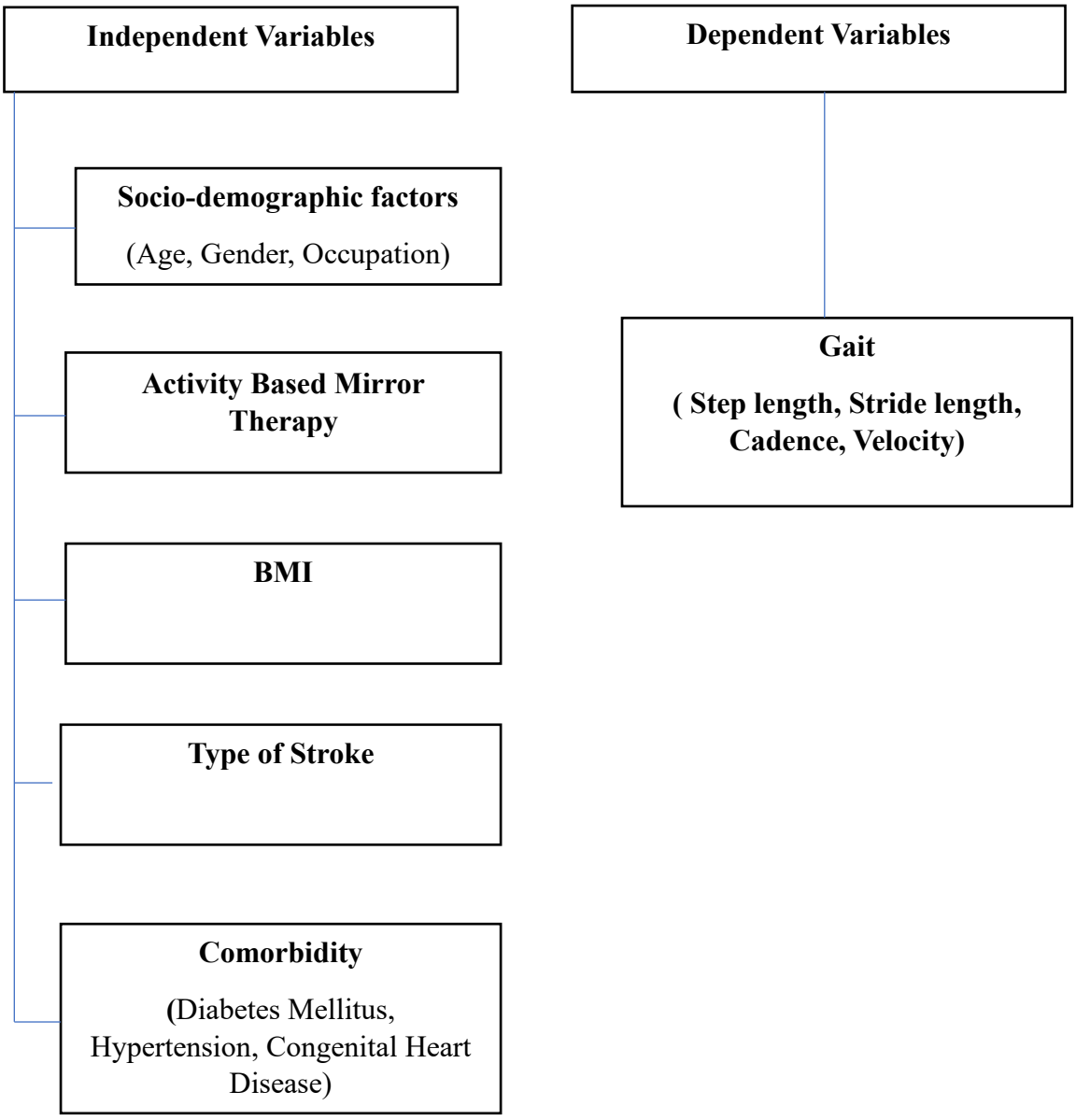
$$\mu_1 - \mu_2 \neq 0 \text{ or } \mu_1 \neq \mu_2$$

Alternative hypothesis:

Activity based Mirror therapy on the gait is effective for patients with stroke.

$$\mu_1 - \mu_2 = 0 \text{ or } \mu_1 \geq \mu_1$$

1.7 Conceptual framework:



1.8 Operational definition:

Stroke: Stroke may be defined as rapidly developing of clinical signs which lasting more than 24 hours with no apparent cause of vascular origin or leading to death. It is a clinical syndrome.

Gait: Gait refers to the specific way in which a person walks. It encompasses various aspects such as stride length, step width, foot angle, arm swing, and overall posture during walking.

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.

Conventional Therapy: Conventional physiotherapy is a group of selected treatment techniques set by a physiotherapist on the basis of evidence that are widely used around the world for the treatment of specific disease.

CHAPTER- II LITERATURE REVIEW

A stroke is derived from the Greek term "apoplexia." Apoplexy is a word used to describe a state in which all mental functions cease abruptly, although breathing and pulse rate continue to be maintained. Sudden pain, hypoxia, inability to move any body part, and loss of bowel control are all common symptoms of apoplexy. But this idea of a stroke is unable to properly explain the current definition of a stroke (Coupland et al. 2017, p. 9). A stroke is a sudden, localized neurological deficiency caused by a disorder in the brain (Gomez-Cuaresma et al. 2021, p. 1047).

Aphasia, carelessness, sensory loss, pain, dysarthria, cognitive abnormalities, dysphagia, depression, and, most importantly, motor weakness are all frequent stroke symptoms that may result in greater impairments. Strokes have long-term and significant impacts on patients, with reduced brain function having the largest impact (Stroke Association, 2017). Raising blood pressure, diabetes, heart illness, smoking, age and sex, race, personal or family history, being overweight or obese, lack of physical exercise, stress and depression, alcohol use, bad food, and so on are all risk factors for stroke (Boehme et al. 2017, p. 472). In adults, stroke is the primary cause of serious long-term impairment. More than 60% of stroke survivors have permanent neurological impairments that limit everyday activities. After a stroke, lower-extremity motor function is generally affected, limiting functional mobility (Ji and Kim 2015, p. 348).

The lower limbs are required for ambulation, standing, and walking, all of which are necessary for carrying out everyday tasks. Motor activation, muscle tone, selective joint movement, and balance are all controlled by the brain, whereas the spinal cord controls gait. As a result, paralysis in the lower limbs may result in motor function impairment and balance abnormalities associated with gait dysfunction in people who have had a stroke. Many hemiplegic individuals are still unable to walk independently after rehabilitation and varied degrees of spontaneous recovery (Li et al. 2011, p. 588).

The World Heart Federation estimates that each year, 15 million individuals experience a stroke, leaving nearly five million with paralysis and other lasting disabilities (Manko et al. 2019, p. 586). Stroke patients have the asymmetrical body which is induced by difference between paralyzed and non-paralyzed sides and these patients have difficulty in controlling posture (Lee et al. 2020, p. 173).Stroke is the most common clinical manifestation of diseases of the cerebral blood vessels and is a syndrome characterized by the acute onset of a neurologic deficit that persists for at least 24 hours, which reflects focal involvement of the central nervous system, and is due to a disturbance of the cerebral circulation (Ali et al. 2013, p. 36).

In 1970, the World Health Organization defined stroke as- ‘rapidly developed clinical signs of focal disturbance of cerebral function, lasting more than 24 hours or leading to death, with no apparent cause other than of vascular origin’. The World Health Organization definition, while also still widely used, is outdated, and according to American Heart Association and the American Stroke Association, due to significant advances in the 'nature, timing, clinical recognition of stroke and its mimics, and imaging findings that necessitate an updated definition (Sacco et al. 2013, p. 2064).

William Cole coined and introduced the term 'stroke' to medicine in the late 17th century, and it has remained a generic definition ever since. Physiologically Stroke is a vascular related acute, focal injury to the central nervous system (CNS) that contributes to a local or systemic neurological insult. Technological advancements have greatly helped in determining the cause of the injury and determining whether it is a cerebral infarction, subarachnoid hemorrhage, or intracerebral bleed. Despite these advancements, the definition of stroke needs to be clarified (Puthenpurakal and Crussell 2017, p. 44).

The word stroke used to be possibly first introduced into medicine through William Cole in 1689 in a physio-medical article regarding the late frequencies of apoplexies”. Before Cole, the most popular phrase used to describe acute non-traumatic brain damage used to be apoplexy. It was used by Hippocrates circa 400 BC for more than 2000 years (Alharbi, Alhayan and Alnami 2019, p. 60).

According to Global Burden of Disease (GBD) 2013, among adults aged 20-64 years, the worldwide prevalence of hemorrhagic stroke (HS) in 2013 was 3,725,085 and the prevalence of ischemic stroke (IS) was 7,258,216. The worldwide prevalence rates were 90.3 and 176 per 100,000 for hemorrhagic stroke and ischemic stroke, respectively. In 2013, the prevalence rate of ischemic and hemorrhagic stroke was considerably higher in developed countries in contrast to that in developing countries (Krishnamurthi et al. 2015, p. 190).

Global Burden of Disease (GBD) report for 2017, there were 11.9 million new stroke cases worldwide in 2017 compared to 6.8 million in 1990, a 76% increase. Age-standardized stroke prevalence grew by 3% worldwide between 1990 and 2017, with the majority of the rise occurring in UMICs (Upper Middle-Income Countries), at 1300.6 per 100,000. On the other hand, by 2017, the age-standardized rates of prevalent stroke cases had decreased in both Higher Income Countries (HICs) and Lower Income Countries (LICs) by 3% and 8%, respectively. Notably, from 1990 to 2017, there was a significant global decline in the age-standardized rates of hemorrhagic strokes, in contrast to ischemic strokes (Avan et al. 2019, p. 1).

In India, based totally upon an annual incidence of stroke of 135 to 145 per 100,000, and early case fatality of between 27% and 41%, it has been estimated that 1.5 million human beings experience a stroke every year, and similarly, 500,000 human beings survive with stroke-related disability. The long-term impacts of stroke on families in India, mainly in rural areas, are likely to be significant (Lindley et al. 2017, p. 588).

In Pakistan, there was once a crude age and sex-adjusted stroke incidence of 95 per 100,000 people per year for the following Years 2000 to 2016, with the highest incidence being 584,000 of 650,000, stated among men and women aged 75 to 85.In Bangladesh, Stroke prevalence's were accounted for as 0·20%, 0·30%, 0·20%, 1·00%, and 1·00% for the age bunches 40–49 years, 50–59 years, 60–69 years,70–79 years, and 80 years or more, separately. The general prevalence for stroke was 0·30%, and the proportion of male: female participants was 3·44: 2·41 (Islam et al. 2013, p. 211).

In the US 730,000 people suffer from strokes annually 400,000 people manage to live with some degree of neurological impairment and handicap. There were roughly 1.5–2.0 million new stroke patients in China each year. In China, it has been a significant issue for public health. There might be differences in the clinical variables between hemorrhagic and ischemic stroke. Compared to hemorrhagic stroke, ischemic stroke has a distinct etiology. A study conducted in East China revealed that 22% of patients were hemorrhagic and 78% were ischemic. Compared to hemorrhagic stroke, ischemic stroke had a greater incidence rate (Zhang et al. 2011, p. 18).

In 2010, 63 percent of ischemic strokes and 80 percent of hemorrhagic strokes occurred in low- and middle-income countries. According to estimates, there were 5.3 million hemorrhagic strokes and 11.6 million ischemic strokes worldwide in 2010. 13.7 million new strokes caused by accidents occurred in 2016, a considerable increase over 2015. Over 5.5 million people worldwide lost their lives to strokes in the same year. Significantly more people died as a result of ischemic and hemorrhagic strokes 2.7 million and 2.8 million, respectively (Khan et al. 2019, p. 30).

There are considerable disparities in the number of stroke deaths throughout European countries, with most eastern European countries faring considerably better, according to official mortality figures. Forecasts for the European region indicate that the middle-aged population will rise from 37.7 years in 2000 to 47.7 years in 2050, while the percentage of 65-year-olds, who account for the majority of stroke occurrences, will climb from 20% in 2000 to 35% in 2050 (Wafa et al. 2020, p. 2418).

The clinical manifestations of hemorrhagic strokes are diverse, but the most common signs and symptoms are sudden onset headache, vomiting, and substantial elevations in blood pressure. These symptoms are followed by localized neurological indications that appear within a few minutes of the onset of the stroke. It's possible that the signs and symptoms of these people will start to show up gradually over the course of many hours, with varied degrees of severity. Some of the symptoms that might arise as a result of an ischemic stroke are paresis, ataxia, paralysis, vomiting, and eye gazing, however, the location of these

symptoms relies on the brain area that is being supplied by vessels that are suffering damage (Pathak et al. 2014, p. 147)

Stroke is a disease of the brain but it can affect the entire body. Some warning signs of stroke are including sudden numbness or weakness of the face, arm, or leg sudden confusion or trouble speaking or understanding speech; sudden trouble seeing in one or both eyes, sudden trouble with walking, dizziness, or loss of balance or coordination; or sudden severe headache with no known causes. Spasticity, weakness, and balance impairment, loss of equilibrium on the affected side are some common deficits after stroke causing inability to maintain postural alignment (Pathak et al., 2014). The following common stroke symptoms may lead to more severe impairments: aphasia, clumsiness, sensory loss, pain, dysarthria, cognitive abnormalities, dysphagia, depression, and, most critically, motor weakness. Strokes have severe long-term effects on individuals, with diminished brain function being the most detrimental (Dhawale, Yeole and Pawar 2018, p. 15).

Stroke can affect the areas of cognitive, psychosocial and physical functioning. It is the leading cause of serious and long-term disability. Cognitive impairments post stroke are largely dependent on area of lesion of the brain. Depression is also 13 common vulnerable neuro-cognitive functions that occur after stroke. Post-stroke hemiplegic may result in unilateral upper extremity weakness, reduced active range of movement and arm function, and consequently, diminished independence in performing activities of daily living (ADLs) (Rabin et al. 2014, p. 368).

Hypertension is a mostly important risk factor for hemorrhagic stroke, although it contributes to atherosclerotic disease that can lead to ischemic stroke also (Boehme et al., 2017). Suzuki et al., argues that typical symptoms observed in stroke survivors with impaired motor function include abnormal muscle activation, coordination issues, spasticity, and a decline in dexterity and precision. The risk factors for stroke fall into two categories. There are two categories of factors: those that are modifiable or reversible and those that are not modifiable or irreversible. Non-modifiable or irreversible risk factors

include age, gender (male > female except in the very young and very old), previous vascular events such as myocardial infarction, stroke, or peripheral embolism (Boehme, Esenwa & Elkind 2017, p. 427), After a stroke, 50% of patients are initially unable to walk, whereas 12% can walk with assistance and 37% can walk without assistance. 18% of stroke patients are still unable to walk after 11 weeks of rehabilitation, 11% can walk with assistance, and 50% can walk independently (Balaban and Tok 2014, p. 635).

Assessing recovery after stroke is critical to treatment and research. In spite of severe disabilities and neurological impairments in the post-stroke period, most stroke patients attain some degree of recovery over time. some stroke patients show early recovery of motor function, occurring primarily during the first few months. While the degree of paralysis is a primary predictor but cannot be used to exactly predict the rate of motor recovery through the subacute phase (Lee et al. 2015, p. 173).

Stroke is a leading cause of gait impairment which results a long-term disability and handicap of stroke survivor. Some characteristics of hemiparetic gait of stroke survivors are including asymmetry of stride time and length, reduced velocity, poor joint and posture control, muscle weakness, abnormal muscle tone, abnormal muscle activation patterns and altered energy expenditure, mostly affecting the paretic side. So, the priority goal for most patients is recovery the walking ability for enhancing activities of daily living and quality of life (Pradon et al. 2013, p.105)

Post-stroke patients do not walk safely and 10 have increased risk of falling toward the paretic side. Balance is an essential part of walking activities as well as sitting and standing which is correlated with locomotor function, functional abilities. So, falls and injury prevention strategies are the essential part of rehabilitation after stroke (Verma et al. 2010, p. 14). After stroke (52-85) % patients regain the capacity to walk but have abnormal gait pattern usually remains different from that of healthy subjects. Walking ability is also important for stroke survivors. Improving walking ability is one of the most often stated goals for people with stroke undergoing rehabilitation and also for stroke survivors living in the community. Though Ninety percent (90%) of stroke survivors have some functional

disability with mobility but approximately 75 to 85% are discharged home after stroke (Eng and Tang 2020, p. 1417).

Recent evidence suggests that exercise therapy is the main component of Stroke rehabilitation. Exercises carried out after stroke may vary with regards to their goals such as goal-directed, task-oriented, repetitive task training, or their technical traits as duration, training load, and kind of feedback. To guide sufferers through the starting and ending of intended tasks, the Bobath treatment aims at the normalizing tone and facilitating volitional movement through dealing with specific points such as trunk, pelvis, shoulders, hands, and feet. During the treatment, both the affected person and the therapist need to participate actively (Hatem et al. 2016, p. 442).

Published studies have shown that in hemiplegic stroke survivors, the level of disability and likelihood of institutionalization is determined by walking ability and ambulatory independence. Evidence suggests that the degree to which gait can be restored after stroke is associated with both the initial impairment in walking ability and the severity of lower extremity paresis. They also added that early intervention with physical therapy to restore walking after stroke was recommended to improve motor function and decrease disability (Mao et al. 2015, p. 175).

The estimation of the 2011 World Health Organization (WHO) reports more than 1 billion people was living with some form of disability worldwide, and they added that nearly 200 million facing considerable difficulties in functioning and a significant proportion of them reside in developing countries. The available estimation suggests that the world prevalence (15%) of disability is expected to increase with the growing aging population, as disability is consistently associated with older age (Islam et al., 2016). A recently published study indicates that age, sex, stroke severity, type of stroke, baseline status, mood, and social risk appear to influence functional status as measured by scores on the Barthel Index. On the other hand, comorbid conditions, socioeconomic level, and area of residence did not seem to affect patients' functional status (Lopez et al. 2016, p. 144).

Many clinical studies confirm that exercise therapy is a one of the commonly used methods in the treatment of balance and gait dysfunction, that bring greater benefits in physical function for stroke patients. In addition, core stability exercises were shown to improve dynamic standing balance, functional autonomy, static balance, flexibility, and stability. Present study demonstrate that core stability exercises present with better effectiveness than conventional exercises (Sun et al. 2016, p. 1131).

A study suggests that the hip extensor strengthening exercise program may help to improve gait performance ability. Clinical balance function was evaluated using the Berg Balance Scale (BBS). Excellent intra-rater (ICC = 0.99) and inter-rater (ICC = 0.98) reliabilities for the BBS with stroke patients have been discovered. There was a substantial connection between BBS upon admission and falls, with fallers having lower BBS scores (cut-off 29; sensitivity 80%; specificity 78%). The BBS is a 14-item scale that uses a variety of standing activities to assess functional balance. Each item is given a value between 0 and 4, with a total score of 56. The BBS is a brief questionnaire that takes around 10–20 minutes to complete, and its usefulness as an outcome measure has been shown in stroke patients (Iruthayarajah et al. 2016, p. 68).

Among the different strategies of gait training for individuals with stroke, the use of a partial body weight support system has continued to gain popularity. Gait training humans affected by stroke using a body weight support system on a treadmill increased walking speed and endurance when compared to conventional gait training over ground or when using only a treadmill. Walking ability is a major determinant of independent living. So that improvement of walking functions is the most commonly stated priority of stroke patient (Sousa et al. 2011, p. 48).

During the stance phase common kinematic deviations is gait cycle are decreased peak hip extension angles, decreased lateral pelvic displacement, changed knee extension, and decreased plantar-flexion angles. During the swing phase, common kinematic deviations are gait cycle is decreased hip flexion, knee extension, and dorsiflexion. Ankle plantar

flexors have been found to be the primary contributors to forward propulsion and critical for increasing walking speed (Hall et al. 2018, p. 1017).

Mirror therapy is a feasible method for training post-stroke impairments (motor, sensory, perceptual deficits) in acute, sub-acute, and chronic phases. Inclusion of bilateral arm training improves patient response to MT. The required dosage of MT, long-term effects, and impact on ADLs and QOL on various subtypes of stroke need to be analyses extensively in larger populations (Tyson et al. 2015, p. 818). Mirror therapy combines the benefits of visual feedback and imagery training with the effect of bilateral movement training (In et al., 2016). Although there have been many various therapeutic ways to improve balance and gait, the most popular have been functional electrical stimulation, virtual reality training, whole body vibration training, treadmill training, and robot-assisted training (Mohan et al. 2013, p. 634).

Mirror therapy could be used, at the very least, as an extra intervention in stroke patients' rehabilitation, according to a systematic review that included 14 studies totaling 567 participants. However, it is unclear if mirror therapy should take the place of other interventions for enhancing motor function. Additionally, mirror treatment may enhance activities of daily living; however, as the results are based on a small number of research, caution should be exercised in interpreting them. Mirror therapy appears to be an efficient intervention for patients with a complex regional pain syndrome after a stroke, both for enhancing motor function and lowering pain. Mirror treatment does not appear to affect pain in stroke patients who are not chosen. Additionally, they contrasted mirror therapy with other therapies in the review (Thieme et al. 2016, p. 392).

CHAPTER-III METHODOLOGY

3.1 Study design:

The study design was a Randomized Control Trail (RCT). This design was best for comparing the effectiveness between activity-based mirror therapy and conventional physiotherapy among the patients with stroke.

3.2 Study area:

The areas of study were Center for Rehabilitation of the Paralysed (CRP) in Savar, Dhaka-1343.

3.3 Study place:

This study was conducted at Saic College of Medical Science and Technology (SCMT) at Mirpur, Dhaka.

3.4 Study period:

The study period was one year (September 2023 and August 2024).

3.5 Study Population:

The population of this study was patients with stroke of the Center for Rehabilitation of the Paralysed (CRP) in Savar, Dhaka.

3.6 Sample Size:

$$k = \frac{n_2}{n_2} = 1$$

$$n_1 = \frac{\left(\sigma_1^2 + \sigma_2^2 / K\right)\left(Z_1 - \frac{\alpha}{2} + Z_1 - \beta\right)2}{\Delta^2}$$

$$n_1 = \frac{(11.59^2 + 11.59^2/1)\,(1.96+1.28)^2}{12.52^2}$$

$n_1 = 18$

$n_2 = K \times n_1 = 18$

$\Delta = |\mu_2 - \mu_1|$ = absolute difference between two means

σ_1, σ_2 = variance of mean #1 and #2

n_1 = sample size for group #1

n_2 = sample size for group #2

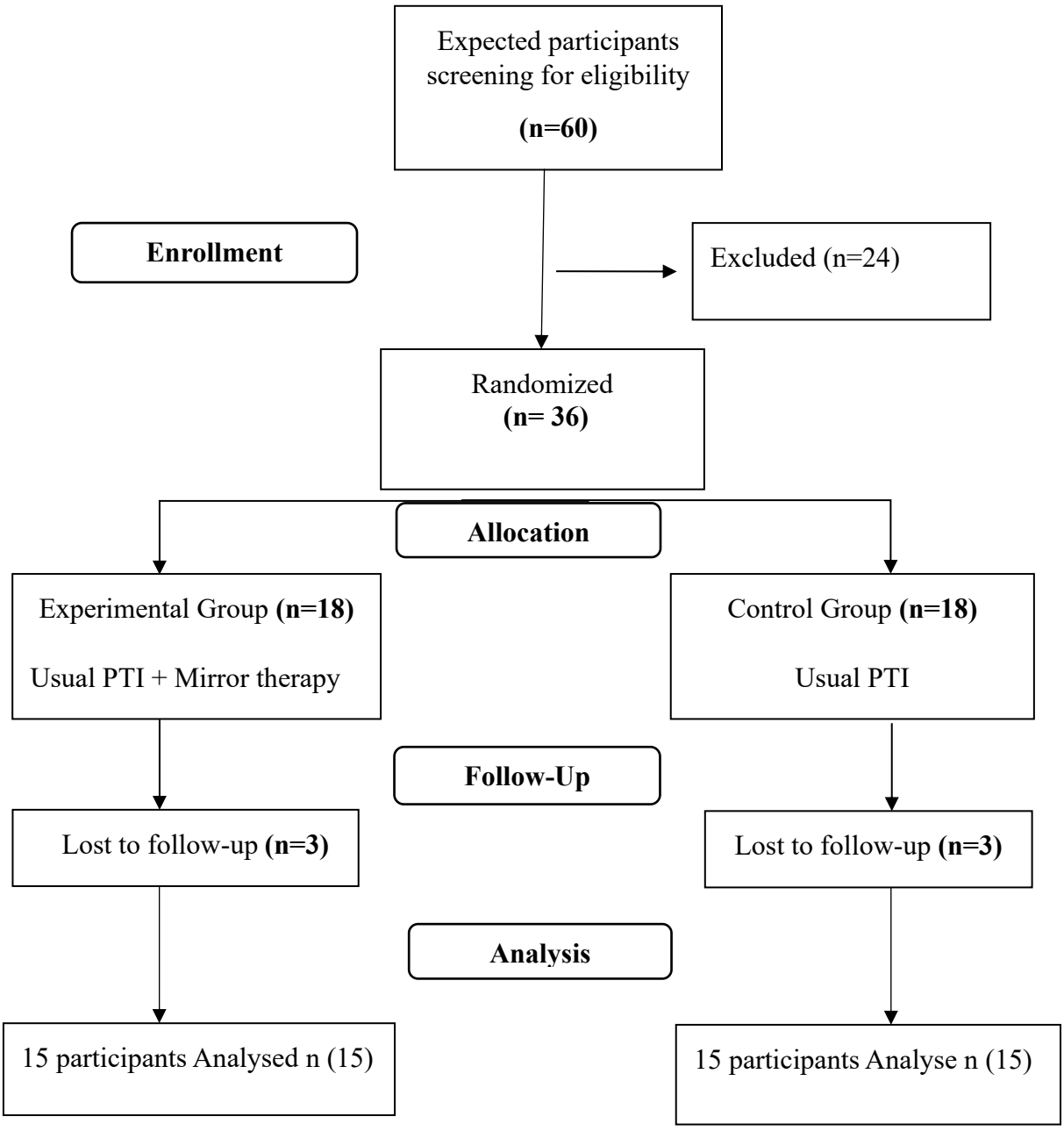
α = probability of type I error (usually 0.05)

β = probability of type II error (usually 0.2)

z = critical Z value for a given α or β

k = ratio of sample size for group #2 to group #1

3.7 CONSORT Frame work of Randomized Controlled Trial



3.8 Sampling Technique:

Convenience sampling technique was adopted to select the patient with stroke from CRP, Savar, Dhaka. Then screening of the patients was done on basis of inclusion criteria. The patients were included who meet the inclusion criteria. Thereafter, Simple random sampling technique was used to allocate the participants into experimental and control group.

3.9 Eligibility criteria:

3.9.1 Inclusion criteria:

i. **Subject selection from CRP:** Subject was selected from the Neurology unit, Physiotherapy Department, CRP at Savar, Dhaka.
ii. **Male and female both were included:** Both male and female who had stroke will be included because Sherrington, et al. (2016) showed that prevalence of male and female both are at high risk.
iii. **Patients diagnosed as stroke:** This type of stroke patients will be included because physiotherapy favors most in terms of ischemic or hemorrhagic stroke based on MRI or CT scan (Winstein et al., 2016).
iv. **Suffering from both acute and chronic stroke:** Experiencing stroke symptoms for a minimum of 6 months: Time frame for stroke occurrence within 6 months after the first stroke event (Kim et al., 2017)
v. **Able to communicate:** Capable of conveying information or ideas effectively. (Karthikbabu et al., 2011).

3.9.2 Exclusion criteria:

i. Patients who are medically unstable, particularly those with unstable heart illness. (Kim et al., 2017)
ii. Patient with a cognitive issue. (Morich and Wijck, 2012)
iii. Participants who were unwilling to participate.

3.10 Methods of data collection

3.10.1 Technique of data collection

Face to face formal interview technique was used to collected data from the selected patients with stroke.

3.10.2 Instrument of data collection

The pretested structured questionnaire was used as an instrument of data collection. The questionnaire had six parts. The first part contained questions on Socio-Demographic Information The second part included questions on anthropometric Information. The third part contained questions on stroke related Information. The fourth part contained questions Comorbidity Information. The fifth part contained questions on assessment of gait variable. The sixth part contained assessment of balance by Burg Balance Scale (BBS).

3.10.3 Data collection tool:

In this particular study measuring tape, stop watch, weight machine (bathroom scale) was used.

3.11 Data collection Procedure:

The data gathering procedure included patient evaluation, preliminary documentation, therapy administration, and conclusive documentation. A total of 30 individuals who met the inclusion criteria were recruited and split into two groups of 15 participants each. The experimental group had conventional physiotherapy in conjunction with task-specific training, while the control group got just conventional physiotherapy. Every participant completed 20 therapy sessions. A pre-test was administered before to the therapy to assess balance with the Berg Balance Scale (BBS) and Gait parameters. A post-test was administered after the 20 sessions using the same measures to evaluate results. A competent physiotherapist supervised data collection to mitigate bias, assuring precision in both experimental and control groups.

3.12 Intervention:

A common intervention program will be executed for both groups, it included in the study underwent regular physiotherapy exercises such as tone facilitation and a range of movement exercises. For specific intervention, the patients will receive task-specific movements of the upper and lower trunk exercises both in the supine and sitting positions.

Dosage: Participants received 45-minute therapist program 5 times per week for 4 weeks (total 20 sessions).

3.12.1 Conventional physiotherapy:

Treatment for patients with chronic stroke followed by different manual therapy along with home advices are practiced in clinical Department of Physiotherapy. The interventional procedure (treatment Strategy) depends on patient's condition and disease progress. Researcher collected opinion from staffs at least designated as Clinical Physiotherapist. They regarded conventional Physiotherapy as followings:

1. Positioning with postural correction
2. Functional activity
3. Neural connectivity exercise
4. Active facilitatory ROM exercise
5. Stretching for U/L and L/L-slow passive stretching
6. Co-ordination practice- Frenkel's exercise
7. Weight shifting and weight bearing
8. Trunk mobilization exercise
9. Bed mobility
10. Strengthening program (Isometric & Isotonic)
11. Gait re-education
    a) Side to side walking
    b) Backward walking
    c) Box walking
    d) Heel walking
    e) Toe walking Parallel bar walking

f) Straight line walking

12. Proprioceptive exercise
13. Soft tissue mobilization
14. Parallel bar walking
15. Transitional movement Practice
16. Stepping

3.12.2 Mirror Therapy:

1. Name of the exercise: Hip, knee and ankle flexion exercise (Mohan et al., 2013).

- **Purpose:** Improve hip, knee and ankle mobility
- **Starting Position:** Semi declined position, Hip 90-degree bend, knee straighten and ankle neutral position
- **Instruction:** Hip bend fully, knee bend fully, slowly point your toes up toward you, and then return to the starting position.
- **Dose:** 5 to 10 repetitions 2 set.

2. Name of the exercise: Hip medial rotation and lateral rotation exercise (Mohan et al., 2013).

- **Purpose:** Increase hip joint range of motion exercise
- **Starting Position:** Half lying position, Hip 90-degree bend, knee straighten and ankle neutral position
- **Instruction:** Hip and knee bend then moving the knee inward and outward. 21
- **Dose:** 5 to 10 repetitions 2 set.

3. Name of the exercise: Hip abduction with external rotation followed by hip adduction with internal rotation (Mohan et al., 2013).

- **Purpose:** Improve range of motion.
- **Starting Position:** Semi decline position, Hip 90-degree bend, knee straighten and ankle neutral position.
- **Instruction:** 1) Ankle rotate inward then hip adduction.

  2) Ankle rotate outward then hip abduction.

- **Dose:** 5 to 10 repetitions 2 set.

4. Name of the exercise: Ankle Dorsiflexion exercise (May et al., 2020)

- **Purpose:** Improve gait and range of motion.
- **Starting Position:** Sitting position**,** hip 90-degree bend, knee 90-degree bend and ankle neutral position.
- **Instruction:** 1) Sit on the chair with legs stretched out in front of you.

  2) Toes pointed forward away from your body and pulling your toes towards your shin, hold for 5 seconds and then return to the starting position.

- **Dose:** 5 to 10 repetitions 2 set.

5. Name of the exercise: Ankle Planter flexion exercise (May et al., 2020)

- **Purpose:** Improve gait and range of motion.
- **Starting Position:** Sitting position**,** hip 90-degree bend, knee 90-degree bend and ankle neutral position.
- **Instruction:** 1) Straighten your knee,

  2) Rise on your toes and hold for 5 seconds.

- **Dose:** 5 to 10 repetition 2 set.

6. Name of the exercise: Squatting

- **Purpose:** Improve balance and flexibility.
- **Starting Position:** Stand with a foot little wider than your hips and toes facing front
- **Instruction:** 1) Drive your hips back bending at the knees and ankles and pressing your knees slightly.

  2) Sit into a squat position while still keeping your heels and toes on the ground, chest up

  3) Strive to eventually reach parallel, knees are bent to a 90-degree angle.

  4) Press into your heels and straighten legs to a standing upright position.

- **Dose:** 5 to 10 repetition 2 set.

7. Name of the exercise: Forward stepping

- **Purpose:** Improve balance.
- **Starting Position:** Stand with feet, shoulder width apart. 24
- **Instruction:** 1) Lift unaffected foot and step forward, planting your foot firmly on the ground.

  2) Slowly shift your weight onto your affected foot.

  3) Return to the starting position.

  Dose: 5 to 10 repetition 2 set.

8. Name of the exercise: Weight shifting exercise

- **Purpose:** Improve balance.
- **Starting position:** Standing, place the feet slightly wider than hip width apart.
- **Instruction:** Leading with the upper body, lean the body gently to the right while keeping both feet in contact with the floor. Repeat in the other direction.
- **Dose:** 5 repetitions of 2 set.

9. Name of the exercise: Wobble board exercise

- **Purpose:** Improve balance.
- **Starting position:** 1) Begin by standing on the balance board with your feet hip distance apart. Your feet should be on the outer edges of the board.

  2) Keep your posture upright and maintain a neutral spine.

- **Instruction:** 1) Stand in the starting balance position.

  2) Slowly tilt the board to the right side and then to the left side.

- **Dose:** Tilt from side to side for 30 seconds.

10. Name of the exercise: Sit to Stand

- **Purpose:** Improve mobility.
- **Starting position:** 1) Sit toward the front edge of a sturdy chair without armrests. Your knees should be bent and your feet should be flat on the floor and shoulder-width apart.

2) Place your hands lightly on each side of the seat. Keep your back and neck as straight as possible, with your chest slightly forward.

- **Instruction:** 1) Lean forward and slightly shift your weight to the front of your feet.

2) Slowly stand up. Use your hands as little as possible.

3) Stand and sit down slowly. Tighten your core and abdominal muscles to control your lowering as much as possible.

- **Dose:** 5 to 10 repetition 2 set.

3.13 Management of data

At the end of each day, the collected questionnaires were checked for any errors or inconsistencies. The necessary corrections were made. The recorded data were coded accordingly into the SPSS-25 version of the program.

3.14 Data analysis:

Data were analyzed by SPSS version 25 using descriptive analysis for sociodemographic variables. Mann Whitney U test was used to assess pre-test and post-test intervention between groups and Wilcoxon Signed Rank test was used to assess pre-test and post-test intervention within the group. Microsoft Excel 2021 was used for the bar diagram and chart.

3.15 Ethical consideration:

The investigator obtained written permission from the Institutional Review Board of SAIC College of Medical Science and Technology to ensure the study met ethical standards. Additionally, permission from the CRP ethics committee was obtained. Informed written consent was obtained from all the participants, ensuring they were fully aware of the study’s purpose, procedures, and their right to withdraw. Finally, confidentiality of the data was maintained throughout the research, ensuring participants' privacy and the secure storage of sensitive information.

CHAPTER-IV RESULTS

In this study the researcher used comparison of baseline characteristics, frequency table and description of the variables to present the result of the study.

Table 1: Comparison of baseline characteristics of the participants

Variable	Control Group	Experimental	P
Age (mean, SD)	52.07 ±12.16	57.87 ±10.46	0.146
Height(m) (mean, SD)	1.66 ±.044	1.66 ±.06	0.801
Weight(kg) (mean, SD)	74.73 ±7.75	69.07 ±10.45	0.038
BMI (score) (mean, SD)	26.94 ±3.02	24.76 ±3.15	0.120
Step Length pre- score (mean, SD)	29.33 ±15.05	28.20 ±12.19	0.917
Stride length pre- score (mean, SD)	51.67 ±22.73	50.33 ±18.16	0.917
Cadence pre- score (mean, SD)	67.47 ±34.69	72.13 ±33.86	0.693
Velocity pre- score (mean, SD)	19.93 ±13.56	19.40 ±10.70	0.851
BBS pre- score (mean, SD)	29.13 ±9.38	24.07 ±8.20	0.119

The analysis of baseline characteristics and outcomes between the control and experimental groups revealed no significant differences in age, height, or BMI, though the control group had a significantly higher weight compared to the experimental group ($p = 0.038$). Pre-intervention scores for step length, stride length, cadence, velocity, and balance were comparable between the two groups, with no significant differences observed.

4.1. Socio-demographic Information

4.1.1. Age range distribution among participant

Age category	Experimental	Control	***P***
31-40	1(6.7) %	3(20.0)	0.245
41-50	2(13.3) %	4(26.7)	
51-60	5(33.3) %	5(33.3)	
61-70	7(46.7) %	2(13.3) %	

In the experimental group, the majority of participants (46.7%) were aged 61-70, followed by 33.3% in the 51-60 age range, indicating a predominance of older individuals. In contrast, the control group had a more even distribution, with 33.3% aged 51-60 and 26.7% aged 41-50. Interestingly, the control group included participants from the 71-80 age range (6.7%), absent in the experimental group. These findings suggest differing age profiles between groups, with the experimental group skewing older.

4.1.2 Gender of total participant:

Gender	Experimental	Control	***P***
Female	2(13.3) %	3(20.0) %	0.624
Male	13(86.7) %	12(80.0) %	

In the experimental group, the majority of participants were male (86.7%), with only 13.3% female, indicating a significant gender imbalance. Similarly, in the control group, males predominated (80.0%), with females comprising 20.0%. The slight increase in female representation in the control group does not substantially alter the male-dominant trend across both groups. This gender disparity may reflect broader sociodemographic patterns in the population or specific inclusion criteria of the study.

4.1.3 Marital Status of the Participant:

Marital Status	Experimental	Control	***P***
Married	14(93.3) %	14(93.3) %	1.000
unmarried	1(6.7) %	1(6.7) %	

In both the experimental and control groups, the marital status distribution was identical, with 93.3% of participants being married and only 6.7% unmarried. This striking uniformity suggests a consistent demographic trend across groups, potentially reflecting the marital composition of the broader population under study. The predominance of married individuals may influence study dynamics, as marital status can impact factors like social support, stress levels, and health behaviors.

4.1.4 Educational Qualification of the participants:

Educational Qualification	Experimental	Control	***P***
Graduation	3(20.0) %	3(20.0) %	0.995
HSC	1(6.7) %	1(6.7) %	
Illiterate	3(20.0) %	2(13.3) %	
Masters or Higher	2(13.3) %	2(13.3) %	
Primary	2(13.3) %	3(20.0)5	
SSC	4(26.7) %	4(26.7) %	

In both groups, educational qualifications showed a diverse distribution, with SSC qualification being the most common (26.7%), followed by graduation (20.0%) in both the experimental and control groups. Interestingly, the experimental group had a higher proportion of illiterate participants (20.0%) compared to the control group (13.3%), while the control group had more participants with primary education (20.0%). Both groups had an equal representation of participants with a Master's degree or higher (13.3%).

4.1.5 Occupational status of the total Participant:

Occupation	Experimental	Control	***P***
Businessman	5(33.3) %	4(26.7) %	0.555
Farmer	1(6.7) %	2(13.3) %	
Housewife	2(13.3) %	2(13.3) %	
Other	5(33.3) %	2(13.3) %	
Service Holder	2(13.3) %	5(33.3) %	

In the experimental group, businessmen and individuals in other occupations each constituted the largest proportions (33.3%), followed by housewives and service holders (13.3% each), and farmers (6.7%). In contrast, the control group had the highest representation among service holders (33.3%), followed by businessmen (26.7%), while farmers, housewives, and individuals in other occupations each accounted for 13.3%. These distributions suggest a diverse occupational representation in both groups, with notable differences in the proportions of businessmen and service holders. The relatively balanced spread across categories allows for meaningful analysis while reflecting the varied sociodemographic backgrounds of participants.

4.1.6 Living area of total Participant:

Living area	Experimental	Control	***P***
Rural	7(46.7) %	8(53.3) %	0.715
Urban	8(53.3) %	7(46.7) %	

In terms of living area, the experimental group had a slightly higher proportion of participants from urban areas (53.3%) compared to rural areas (46.7%). Conversely, the control group showed a reversed pattern, with a higher proportion of rural participants (53.3%) compared to urban participants (46.7%). These near-equal distributions in both groups reflect a balanced representation of rural and urban populations, ensuring diverse perspectives in the study. The slight differences in living area distribution between the experimental and control groups provide an opportunity to explore potential variations in outcomes influenced by participants' residential environments.

4.3 Stroke related information

4.3.1 Affected side distribution of the participants

Affected side	Experimental	Control	***P***
Left	6(40.0) %	6(40.0) %	1.000
Right	9(60.0) %	9(60.0) %	

The affected side distribution was identical in both the experimental and control groups. In each group, the right side was more commonly affected (60.0%) compared to the left side (40.0%). This consistent pattern across groups suggests no significant difference in the laterality of ankle avulsion fractures between the two cohorts. The predominance of right-sided injuries may reflect biomechanical or behavioral factors, such as the dominant leg being more prone to stress or injury.

4.3.2 Type of stroke distribution among the participants

Type of stroke	Experimental	Control	***P***
Hemorrhagic	5(33.3) %	3(20.0) %	0.409
Ischemic	10(66.7) %	12(80.0) %	

The type of stroke distribution varied between the experimental and control groups. In the experimental group, ischemic strokes were more prevalent (66.7%) than hemorrhagic strokes (33.3%). Similarly, in the control group, ischemic strokes predominated (80.0%), while hemorrhagic strokes accounted for 20.0%. These findings indicate a higher proportion of hemorrhagic strokes in the experimental group compared to the control group. The predominance of ischemic strokes in both groups aligns with global trends, where ischemic strokes are generally more common.

4.3.3 Duration of the stroke distribution among the participants

Duration of stroke	Experimental	Control	***P***
Less than 3 months	3(20.0) %	4(26.7) %	0.329
More than 1 year	3(20.0) %	4(26.7) %	
More than 2 years	1(6.7) %	7(46.7) %	
More than 3 months	3(20.0) %		
More than 6 months	5(33.3) %		

The duration of stroke showed varied distributions between the experimental and control groups. In the experimental group, participants were distributed across five categories, with the largest proportion having experienced a stroke for more than 6 months (33.3%), followed by equal distributions (20.0%) in the less than 3 months, more than 3 months, and more than 1-year categories, and a smaller proportion (6.7%) with more than 2 years. In the control group, most participants (46.7%) had a stroke duration of more than 6 months, followed by 26.7% in both the more than 1 year and more than 3 months categories. These distributions indicate more uniform durations in the control group compared to the experimental group.

4.3.4 Treatment session received by the participants

PT session receive	Experimental	Control	***P***
3-4 session	2(13.3) %	1(6.7) %	0.839
5-6 session	2(13.3) %	1(6.7) %	
7-8 session	4(26.7) %	5(33.3) %	
More than 8 sessions	7(46.7) %	8(53.3) %	

The distribution of physiotherapy sessions shows similarities between the experimental and control groups, with notable variations in session frequencies. In the experimental group, the majority of participants (46.7%) attended more than 8 sessions, followed by 26.7% attending 7–8 sessions. Smaller proportions (13.3% each) attended 3–4 and 5–6 sessions. Similarly in the control group, most participants (53.3%) attended more than 8 sessions, followed by 33.3% attending 7–8 sessions, with fewer participants attending 3–4 or 5–6 sessions (6.7% each).

4.3.5 Tobacco habit distributions of the participants

Tobacco habit	Experimental	Control	***P***
No	10(66.7) %	6(40.0) %	0.143
Yes	5(33.3) %	9(60.0) %	

The prevalence of tobacco use differed notably between the experimental and control groups. In the experimental group, the majority of participants (66.7%) reported no tobacco use, while 33.3% had a tobacco habit. Conversely, in the control group, the majority (60.0%) reported tobacco use, with only 40.0% abstaining. This contrast highlights a higher prevalence of tobacco habits in the control group compared to the experimental group. The disparity in tobacco use may influence health outcomes, as tobacco is a known risk factor for delayed recovery and complications.

4.4 Comorbidity Information

4.4.1 Hypertension distribution among the participants

HTN	Experimental	Control	***P***
No	2(13.3) %	4(26.7) %	0.361
Yes	13(86.7) %	11(73.3) %	

Hypertension was highly prevalent in both groups, with a slightly higher occurrence in the experimental group (86.7%) compared to the control group (73.3%). Only 13.3% of participants in the experimental group and 26.7% in the control group reported no history of hypertension. This high prevalence underscores the association of hypertension as a significant risk factor in stroke patients. The difference between the groups could influence recovery outcomes and response to interventions, highlighting the need to account for hypertension management in both cohorts when interpreting the study's results.

4.4.2 Diabetes distribution among the participants

DM	Experimental	Control	***P***
No	9(60.0) %	8(53.3) %	0.713
Yes	6(40.0) %	7(46.7) %	

The prevalence of diabetes mellitus was comparable between the experimental and control groups, with slight differences. In the experimental group, 60.0% of participants did not have diabetes, while 40.0% were diabetic. Similarly, in the control group, 53.3% were non-diabetic, and 46.7% had diabetes. These findings reflect a moderately high prevalence of diabetes in both groups, consistent with its role as a common comorbidity in stroke patients.

4.4.3 Congenital Heart Disease distribution among the participants

CHD	Experimental	Control	***P***
No	14(93.3)	15(100) %	0.309
Yes	1(6.7)		

The prevalence of chronic heart disease (CHD) was minimal in both groups, with only one participant (6.7%) in the experimental group reporting CHD, while none in the control group had the condition. The near absence of CHD among participants indicates limited influence of this comorbidity on the study outcomes. However, the presence of a single case in the experimental group could potentially affect individual recovery trajectories. This low prevalence allows for a more focused analysis of other factors influencing outcomes, though the role of CHD, even in isolated cases, should not be overlooked in comprehensive patient care.

4.5 Step Length Related Information

4.5.1 Pretest and Posttest of Step Length

Table 2: Total score of the participants in Step length (Pretest and posttest).

Control				Experimental			
Variable	**Pre**	**Post**	**Difference**	**Variable**	**Pre**	**Post**	**Difference**
C1	33	35	2	E1	11	14	3
C2	30	32	2	E2	53	55	2
C3	32	32	0	E3	18	20	2
C4	32	32	0	E4	20	25	5
C5	12	15	3	E5	15	18	3
C6	15	16	1	E6	23	25	2
C7	10	10	0	E7	22	22	0
C8	46	46	0	E8	20	25	5
C9	37	38	1	E9	50	55	5
C10	14	15	1	E10	35	35	0
C11	16	16	0	E11	32	33	1
C12	55	55	0	E12	40	44	4
C13	20	20	0	E13	25	25	0
C14	31	32	1	E14	28	30	2
C15	57	60	3	E15	31	35	4
Total	**440**	**454**	**14**	**Total**	**423**	**461**	**38**
Mean	**29.33**	**30.26**	**0.93 mean difference**	**Mean**	**28.2**	**30.73**	**2.53 mean difference**

The control group (C1–C15) showed a total pre-intervention step length of 440, which increased to 454 post intervention, resulting in a total difference of 14 units. The mean step length in the control group increased from 29.33 to 30.26, with a mean difference of 0.93 units. In contrast, the experimental group (E1–E15) demonstrated a total pre-intervention

step length of 423, which increased significantly to 461 post-interventions, yielding a total difference of 38 units. The mean step length in the experimental group improved from 28.2 to 30.73, with a mean difference of 2.53 units.

4.5.2 Mann Whitney U test

Table 3: Difference between group analysis for total Step Length

Difference between Step Length	Category of participants	N	Mean of posttest Step Length	Mean rank	Mann Whitney U score	P
	Experimental	15	30.73	19.37	54.5	0.13
	Control	15	30.26	11.63		
	Total	**30**				

The experimental group (N = 15) had a mean post-test step length of 30.73, with a mean rank of 19.37. In comparison, the control group (N = 15) had a mean post-test step length of 30.26, with a mean rank of 11.63. The Mann-Whitney U score for the comparison was 54.5, with a p-value of 0.13. Although the experimental group exhibited a slightly higher mean step length, the difference between the groups was not statistically significant at the conventional 0.05 level.

4.6 Pre - test and post - test of total Stride Length score

Table 4: Total score of the participants in Stride Length scale (Pretest and posttest).

Control				**Experimental**			
Variable	**Pre**	**Post**	**Difference**	**Variable**	**Pre**	**Post**	**Difference**
C1	47	48	1	E1	23	27	4
C2	56	56	0	E2	76	78	2
C3	61	61	0	E3	30	34	4
C4	57	57	0	E4	41	44	3
C5	26	26	0	E5	34	35	1
C6	26	26	0	E6	40	40	0
C7	23	23	0	E7	40	40	0
C8	82	82	0	E8	38	40	2
C9	76	76	1	E9	79	80	1
C10	30	30	1	E10	70	70	0
C11	36	36	0	E11	50	52	2
C12	90	90	0	E12	78	80	2
C13	37	37	0	E13	44	44	0
C14	45	45	0	E14	55	55	0
C15	83	84	1	E15	57	60	3
Total	**775**	**776**	**1**	**Total**	**755**	**779**	**24**
Mean	**51.66**	**51.73**	**0.06 mean difference**	**Mean**	**50.33**	**51.93**	**1.6 mean difference**

The stride length data was analyzed for both the control and experimental groups. In the control group, the total pre-test stride length was 775, and post-test it increased slightly to 776, with a total difference of 1 unit. The mean stride length in the control group changed marginally from 51.66 pre-test to 51.73 post-test, with a mean difference of 0.06 units. For the experimental group, the total pre-test stride length was 755, which increased to 779 post-tests, reflecting a total difference of 24 units. The mean stride length in the experimental group improved from 50.33 to 51.93, showing a mean difference of 1.6 units.

4.6.1 Mann Whitney U test

Table 5: Difference between group analysis for total Stride Length

Difference between Stride Length	Category of participants	N	Mean of posttest Stride Length	Mean rank	Mann Whitney U score	P
	Experimental	15	51.93	20.03	44.5	0.001
	Control	15	51.73	10.97		
	Total	**30**				

The Mann-Whitney U test was performed to compare the post-test stride length between the experimental and control groups. The experimental group (N = 15) had a mean post-test stride length of 51.93, with a mean rank of 20.03. In contrast, the control group (N = 15) had a mean post-test stride length of 51.73, with a mean rank of 10.97.

The Mann-Whitney U score for the comparison was 44.5, and the p-value was 0.001, indicating a statistically significant difference between the experimental and control groups at the 0.05 level.

4.7 Pre-test and post-test of total Cadence score

Table 6: Total score of the participants in Cadence Score (Pretest and posttest).

Control				**Experimental**			
Variable	**Pre**	**Post**	**Difference**	**Variable**	**Pre**	**Post**	**Difference**
C1	16	16	0	E1	36	36	0
C2	77	77	0	E2	118	120	2
C3	87	87	0	E3	47	50	3
C4	85	85	0	E4	68	70	2
C5	53	53	0	E5	62	62	0
C6	43	43	0	E6	67	67	0
C7	15	15	0	E7	63	65	2
C8	106	106	0	E8	18	20	2
C9	98	98	0	E9	119	125	6
C10	58	60	2	E10	102	102	0
C11	60	60	0	E11	18	20	2
C12	107	107	0	E12	123	125	2
C13	68	68	0	E13	75	75	0
C14	16	16	0	E14	82	82	0
C15	123	123	0	E15	84	84	0
Total	**1012**	**1014**	**2**	**Total**	**1082**	**1103**	**21**
Mean	**67.46**	**67.6**	**0.13 mean difference**	**Mean**	**72.13**	**73.53**	**1.4 mean difference**

In the control group, the total pre-test cadence was 1012, which slightly increased to 1014 post-test, resulting in a total difference of 2 units. The mean cadence in the control group changed from 67.46 pre-test to 67.6 post-test, with a mean difference of 0.13 units.In the experimental group, the total pre-test cadence was 1082, which increased to 1103 post-test, reflecting a total difference of 21 units. The mean cadence in the experimental group improved from 72.13 to 73.53, with a mean difference of 1.4 units.

4.7.1 Mann Whitney U test

Table 7: Difference between group analysis for total cadence

Difference between Cadence	Category of participants	N	Mean of posttest Cadence	Mean rank	Mann Whitney U score	P
	Experimental	15	73.53	19.07	59	0.006
	Control	15	67.6	11.93		
	Total	**30**				

The Mann-Whitney U test was used to compare the post-test cadence between the experimental and control groups. The experimental group (N = 15) had a mean post-test cadence of 73.53, with a mean rank of 19.07. In contrast, the control group (N = 15) had a mean post-test cadence of 67.6, with a mean rank of 11.93. The Mann-Whitney U score was 59, and the p-value was 0.006, indicating a statistically significant difference between the two groups at the 0.05 level.

4.8 Pre-test and post-test of total Velocity score

Table 8: Total score of the participants in Velocity Score (Pre-test and post-test).

Control				**Experimental**			
Variable	**Pre**	**Post**	**Difference**	**Variable**	**Pre**	**Post**	**Difference**
C1	8	8	0	E1	8	10	2
C2	21	24	3	E2	37	38	1
C3	23	25	2	E3	11	12	1
C4	20	20	0	E4	13	15	2
C5	10	12	2	E5	10	15	5
C6	10	12	2	E6	17	17	0
C7	7	7	0	E7	11	12	1
C8	39	40	1	E8	8	10	2
C9	30	30	0	E9	30	32	2
C10	10	10	2	E10	28	28	0
C11	10	10	0	E11	9	10	1
C12	47	50	3	E12	36	36	0
C13	14	15	1	E13	19	20	1
C14	8	10	2	E14	21	25	4
C15	42	42	0	E15	33	35	2
Total	**299**	**315**	**16**	**Total**	**291**	**315**	**24**
Mean	**19.93**	**21**	**1.06 mean difference**	**Mean**	**19.4**	**21**	**1.6 mean difference**

The velocity data was analyzed for both the control and experimental groups. In the control group, the total pre-test velocity was 299, which increased to 315 post-tests, resulting in a total difference of 16 units. The mean velocity in the control group changed from 19.93 pre-test to 21 post-tests, with a mean difference of 1.06 units. For the experimental group, the total pre-test velocity was 291, which increased to 315 post-tests, reflecting a total

difference of 24 units. The mean velocity in the experimental group improved from 19.4 to 21, with a mean difference of 1.6 units.

4.8.1 Mann Whitney U test

Table 9: Difference between group analysis for total Velocity Score

Difference between Velocity	Category of participants	N	Mean of posttest velocity	Mean rank	Mann Whitney U score	P
	Experimental	15	21	17.03	89.5	0.321
	Control	15	21	13.97		
	Total	**30**				

The Mann-Whitney U test was conducted to compare the post-test velocity between the experimental and control groups. Both the experimental group (N = 15) and the control group (N = 15) had a mean post-test velocity of 21, with mean ranks of 17.03 and 13.97, respectively. The Mann-Whitney U score was 89.5, and the p-value was 0.321, indicating that there was no statistically significant difference between the experimental and control groups at the 0.05 level. This suggests that both groups showed similar improvements in velocity, and the difference was not large enough to be considered significant.

4.9 Pretest and posttest of total BBS score

Table 10: Total score of the participants in BBS Score (Pretest and posttest).

Control				**Experimental**			
Variable	**Pre**	**Post**	**Difference**	**Variable**	**Pre**	**Post**	**Difference**
C1	37	38	1	E1	13	29	16
C2	22	25	3	E2	21	33	12
C3	35	36	1	E3	18	30	12
C4	30	30	0	E4	16	27	11
C5	28	26	2	E5	25	29	4
C6	20	22	2	E6	34	34	0
C7	17	18	1	E7	21	23	2
C8	36	36	0	E8	20	29	9
C9	38	38	0	E9	38	44	6
C10	26	27	1	E10	21	21	0
C11	22	26	4	E11	31	39	8
C12	41	41	0	E12	36	39	3
C13	11	13	2	E13	13	13	0
C14	31	33	2	E14	32	36	4
C15	43	43	0	E15	22	31	9
Total	**437**	**452**	**19**	**Total**	**316**	**457**	**96**
Mean	**29.13**	**30.13**	**1.26 mean difference**	**Mean**	**21.06**	**30.46**	**6.4 mean difference**

The BBS data was analyzed for both the control and experimental groups. In the control group, the total pre-test BBS score was 437, which increased to 452 post-tests, resulting in a total difference of 19 points. The mean BBS score in the control group changed from 29.13 pre-test to 30.13 post-test, with a mean difference of 1.26 points. For the experimental group, the total pre-test BBS score was 316, which significantly increased to

457 post-tests, reflecting a total difference of 96 points. The mean BBS score in the experimental group improved from 21.06 to 30.46, with a mean difference of 6.4 points.

4.9.1 Mann Whitney U test

Table 11: Difference between group analysis for total BBS

Difference between BBS	Category of participants	N	Mean of posttest BBS	Mean rank	Mann Whitney U score	P
	Experimental	15	30.46	20.30	40.5	0.002
	Control	15	30.13	10.70		
	Total	**30**				

The Mann-Whitney U test was conducted to compare the post-test BBS scores between the experimental and control groups. The experimental group (N = 15) had a mean post-test BBS score of 30.46, with a mean rank of 20.30. In contrast, the control group (N = 15) had a mean post-test BBS score of 30.13, with a mean rank of 10.70. The Mann-Whitney U score was 40.5, and the p-value was 0.002, indicating a statistically significant difference between the experimental and control groups at the 0.05 level.

4.10 Wilcoxon signed rank test

Table 12: Difference within Experimental group Step Length score after and before by Wilcoxon test

Posttest-Pretest Step length scores	N	Means Rank	Sum of Ranks	Wilcoxon signed rank test based on Z rank	P-Value
Negative Ranks	0	0	0	-3.078	0.002
Positive Ranks	12	6.50	78		
Ties	3				
Total	15				

The Wilcoxon signed-rank test was conducted to evaluate the difference in step length scores before and after the intervention in the experimental group. Of the 15 participants, 0 showed a negative rank, 12 exhibited positive ranks, and 3 had no change (ties). The mean rank for the positive differences was 6.50, with a sum of ranks of 78. The test statistic (Z) was -3.078, and the p-value was 0.002, indicating a statistically significant difference in step length scores before and after the intervention in the experimental group at the 0.05 level.

Table 13: Difference within Control group Step Length score after and before by Wilcoxon test

Posttest-Pretest Step length scores	N	Means Rank	Sum of Ranks	Wilcoxon signed rank test based on Z rank	P-Value
Negative Ranks	0	0	0	-2.558	0.011
Positive Ranks	8	4.50	36		
Ties	7				
Total	15				

The Wilcoxon signed-rank test was conducted to evaluate the difference in step length scores before and after the intervention in the control group. Of the 15 participants, 0 showed a negative rank, 8 exhibited positive ranks, and 7 had no change (ties). The mean rank for the positive differences was 4.50, with a sum of ranks of 36. The test statistic (Z) was -2.558, and the p-value was 0.011, indicating a statistically significant difference in step length scores before and after the intervention in the control group at the 0.05 level.

Table 14: Difference within Experimental group Stride Length score after and before by Wilcoxon test

Posttest-Pretest Stride length scores	N	Means Rank	Sum of Ranks	Wilcoxon signed rank test based on Z rank	P-Value
Negative Ranks	0	0	0	-2.827	0.005
Positive Ranks	10	5.50	55		
Ties	5				
Total	15				

The Wilcoxon signed-rank test was performed to evaluate the difference in stride length scores before and after the intervention in the experimental group. Out of 15 participants, 0 showed a negative rank, 10 exhibited positive ranks, and 5 had no change (ties). The mean rank for the positive differences was 5.50, with a sum of ranks of 55.The test statistic (Z) was -2.827, and the p-value was 0.005, indicating a statistically significant difference in stride length scores before and after the intervention in the experimental group at the 0.05 level.

Table 15: Difference within Control group Stride Length score after and before by Wilcoxon test

Posttest-Pretest Stride length scores	N	Means Rank	Sum of Ranks	Wilcoxon signed rank test based on Z rank	P-Value
Negative Ranks	0	0	0	-1.414	0.157
Positive Ranks	02	1.50	3		
Ties	13				
Total	15				

The Wilcoxon signed-rank test was conducted to assess the difference in stride length scores before and after the intervention in the control group. Among the 15 participants, 0 showed a negative rank, 2 exhibited positive ranks, and 13 had no change (ties). The mean rank for the positive differences was 1.50, with a sum of ranks of 3.The test statistic (Z) was -1.414, and the p-value was 0.157, indicating no statistically significant difference in stride length scores before and after the intervention in the control group at the 0.05 level.

Table 16: Difference within Experimental group Cadence score after and before by Wilcoxon test

Posttest-Pretest Cadence scores	N	Means Rank	Sum of Ranks	Wilcoxon signed rank test based on Z rank	P-Value
Negative Ranks	0	0	0	-2.636	0.008
Positive Ranks	08	4.50	36		
Ties	07				
Total	15				

The Wilcoxon signed-rank test was conducted to evaluate the difference in cadence scores before and after the intervention in the experimental group. Of the 15 participants, 0 showed a negative rank, 8 exhibited positive ranks, and 7 had no change (ties). The mean rank for the positive differences was 4.50, with a sum of ranks of 36. The test statistic (Z) was -2.636, and the p-value was 0.008, indicating a statistically significant difference in cadence scores before and after the intervention in the experimental group at the 0.05 level.

Table 17: Difference within Control group Cadence score after and before by Wilcoxon test

Posttest-Pretest Cadence scores	N	Means Rank	Sum of Ranks	Wilcoxon signed rank test based on Z rank	P-Value
Negative Ranks	0	0	0	-1.000	0.317
Positive Ranks	01	1	1		
Ties	14				
Total	15				

The Wilcoxon signed-rank test was conducted to evaluate the difference in cadence scores before and after the intervention in the control group. Among the 15 participants, 0 showed a negative rank, 1 exhibited a positive rank, and 14 had no change (ties). The mean rank for the single positive difference was 1, with a sum of ranks of 1. The test statistic (Z) was -1.000, and the p-value was 0.317, indicating no statistically significant difference in cadence scores before and after the intervention in the control group at the 0.05 level.

Table 18: Difference within Experimental group Velocity score after and before by Wilcoxon test

Posttest-Pretest Velocity scores	N	Means Rank	Sum of Ranks	Wilcoxon signed rank test based on Z rank	P-Value
Negative Ranks	0	0	0	-3.108	0.002
Positive Ranks	12	6.50	78		
Ties	03				
Total	15				

The Wilcoxon signed-rank test was performed to evaluate the difference in velocity scores before and after the intervention in the experimental group. Out of 15 participants, 0 showed a negative rank, 12 exhibited positive ranks, and 3 had no change (ties). The mean rank for the positive differences was 6.50, with a sum of ranks of 78. The test statistic (Z) was -3.108, and the p-value was 0.002, indicating a statistically significant difference in velocity scores before and after the intervention in the experimental group at the 0.05 level.

Table 19: Difference within Control group Velocity score after and before by Wilcoxon test

Posttest-Pretest Velocity scores	N	Means Rank	Sum of Ranks	Wilcoxon signed rank test based on Z rank	P-Value
Negative Ranks	0	0	0	-2.558	0.011
Positive Ranks	8	4.50	36		
Ties	7				
Total	15				

The Wilcoxon signed-rank test was conducted to assess the difference in velocity scores before and after the intervention in the control group. Among the 15 participants, 0 showed a negative rank, 8 exhibited positive ranks, and 7 had no change (ties). The mean rank for the positive differences was 4.50, with a sum of ranks of 36. The test statistic (Z) was -2.558, and the p-value was 0.011, indicating a statistically significant difference in velocity scores before and after the intervention in the control group at the 0.05 level.

Table 20: Difference within Experimental group BBS score after and before by Wilcoxon test

Posttest-Pretest BBS scores	N	Means Rank	Sum of Ranks	Wilcoxon signed rank test based on Z rank	P-Value
Negative Ranks	0	0	0	-3.063	0.002
Positive Ranks	12	6.50	78		
Ties	03				
Total	15				

The Wilcoxon signed-rank test was conducted to evaluate the difference in Berg Balance Scale (BBS) scores before and after the intervention in the experimental group. Among the 15 participants, 0 showed a negative rank, 12 exhibited positive ranks, and 3 had no change (ties). The mean rank for the positive differences was 6.50, with a sum of ranks of 78.The test statistic (Z) was -3.063, and the p-value was 0.002, indicating a statistically significant improvement in BBS scores before and after the intervention in the experimental group at the 0.05 level.

Table 21: Difference within Control group BBS score after and before by Wilcoxon test

Posttest-Pretest BBS scores	N	Means Rank	Sum of Ranks	Wilcoxon signed rank test based on Z rank	P-Value
Negative Ranks	1	6.50	6.50	-2.169	0.030
Positive Ranks	9	5.39	48.50		
Ties	5				
Total	15				

The Wilcoxon signed-rank test was conducted to evaluate the difference in Berg Balance Scale (BBS) scores before and after the intervention in the control group. Of the 15 participants, 1 showed a negative rank, 9 exhibited positive ranks, and 5 had no change (ties). The mean rank for the negative difference was 6.50, while the mean rank for the positive differences was 5.39, with a sum of ranks of 48.50. The test statistic (Z) was -2.169, and the p-value was 0.030, indicating a statistically significant improvement in BBS scores before and after the intervention in the control group at the 0.05 level.

CHAPTER-V DISCUSSION

In this study, the performance of ABMT in gait parameters was considered among post stroke survivors. Gait improvement is a matter of critical importance since there is huge involvement in impaired motility and impairment of the quality of life after the event. Improvement was shown at step length, stride length, cadence, velocity, and balance during and immediately following exercise. Therefore, the outcome has existing literature evidence for consistency been compared with the already and implication.

The step length in the experimental group significantly improved compared to that of the control group. It is supported by evidence that Thieme et al., 2018 found mirror therapy beneficial for motor recovery since it invokes mirror neurons, which improve gait symmetry. Improvement in step length for the group is also better than the controls, supporting that experimental ABMT is effective to further neuromuscular coordination. Visual feedback mechanisms that aid in this, are also mentioned by Michielsen et al. (2012, p. 393).

The stride length in the experimental group significantly improved, corroborating the findings of Goh et al. (2020, p. 169). They reported that mirror therapy enhanced spatial and temporal gait parameters in stroke patients, which they attributed to the activation of ipsilateral motor cortices. The current results extend this understanding further by showing that ABMT achieves these outcomes with a relatively short intervention duration, hence proving its efficiency in clinical settings.

Cadence and velocity represent the most important indicators of functional gait recovery. In the experimental group, both parameters showed significant improvement in agreement with the results of Yavuzer et al. (2018, p. 378), who showed that mirror therapy in combination with task-oriented exercises significantly improved gait velocity. Such findings confirm our hypothesis that ABMT not only improves gait parameters but also increases general walking efficiency, as was proposed by Sutbeyaz et al. (2007, p. 559). Improvement is nonetheless modest in the control group as regards cadence and velocity,

obviously due to generalized benefits from conventional supports that ABMT added to, not a physiotherapy. replacement for, comprehensive rehabilitation was

The significant group underlines the studies have related mirror needed. improvement of the BBS scores in the contribution experimental of ABMT in balance recovery. Previous therapy to improved postural control, simulating proprioceptive and visual-motor integration Wang et al. (2015, p. 384). The marked difference between the experimental and control groups in the BBS scores further underlines added value of ABMT in the treatment of balance impairments.

While the experimental group showed significant gains across multiple parameters, the control group exhibited limited progress, consistent with findings by Garry et al. (2019, p. 118). This disparity underscores the unique advantage of ABMT in addressing the neurological deficits caused by stroke. The visual feedback provided during mirror therapy likely facilitates cortical reorganization, a process less pronounced in conventional therapy alone.

Interestingly, the significant improvements observed in this study were achieved with relatively short ABMT sessions. Similar outcomes were reported by Dohle et al. (2009, p. 209), who noted that even brief, targeted mirror therapy sessions could yield measurable functional gains. This suggests that ABMT can be a time-efficient strategy, addressing the practical constraints often encountered in rehabilitation settings.

The study's demographic data indicated a predominance of older males in the experimental group, reflecting the stroke population’s general profile. Previous studies, such as by Truelsen et al. (2006, p. 818), have highlighted the gender and age disparities in stroke prevalence, which align with the current study's participant characteristics. The slightly greater improvements in the experimental group may also be partially influenced by differences in initial severity and motivation, factors that warrant further exploration in future studies.

The findings strongly support the integration of ABMT into stroke rehabilitation protocols, particularly for improving gait and balance. As post-stroke patients often face mobility challenges that hinder independence, interventions like ABMT offer a promising avenue

for enhancing functional recovery. However, as suggested by Pollock et al. (2014, p. 43), individualized therapy plans remain crucial for optimizing outcomes.

Despite the promising results, the study's small sample size and short intervention duration limit the generalizability of the findings. Future studies with larger cohorts and extended follow-up periods are needed to validate these results. Additionally, exploring the combined effects of ABMT with other neurorehabilitation techniques, such as virtual reality, could provide deeper insights into synergistic benefits.

LIMITATIONS

Limitations

The study has several limitations.36 stroke patients with balance and gait issues participated in the study which had a limited sample size in both groups and did not provide enough data to generalize the findings to the larger population with this condition. Researcher only explored the effect of mirror therapy after 20 sessions, so the long-term effect of treatment was not explored in this study. Data was collected from clinical setting CRP, Savar, it can influence the result. Sometimes treatment sessions were interrupted due to public holiday mistaken in appointment schedule may interrupt the result. The treatment period was small only 20 sessions of intervention for the two groups that experimental group and control group. Other studies with longer intervention time are required for conclusive results. There was no available research done in this area in Bangladesh. So, relevant information about with Mirror Therapy for Bangladesh was very limited in this study. So, further research is needed to confirm the effectiveness of Mirror therapy along with conventional physiotherapy for patients with stroke.

CHAPTER- VI CONCLUSION & RECOMMENDATION

Conclusion:

This study has established the positive impact of ABMT on the gait parameters in patients with stroke. There was significant improvement in the experimental group for step length, stride length, cadence, and balance, whereas the velocity showed moderate changes. These results thus indicate that ABMT can be effective in improving gait and mobility in individuals recovering from stroke. This has been achieved through mirror therapy-a sort of visual feedback that induces neuroplasticity and hence assisted in functional recovery and motor

Although the progress the control group demonstrated slight of coordination. improvements, the experimental group was significantly superior, hence pointing out that ABMT can be a very valuable addition to say that ABMT incorporated into could assure better outcomes, conventional stroke especially in patients suffering from persistent post-stroke rehabilitation. rehabilitation mobility This is to programs challenges. Thus, based on these findings, the adoption of ABMT as an adjunct in therapy for rehabilitation and especially gait abnormality is recommended. Rehabilitation centers may consider this approach since it is moderately cost-effective and non-invasive. Training for therapists should incorporate how best to utilize this ty pe of metacognitive motor therapy in order to gain maximum benefit with patients.

Recommendation:

Future research needs to confirm if ABMT leads to functional improvement in the run, and should be done with larger and more diverse samples. It may be worthwhile for researchers to start investigating if ABMT is combined with other modes of rehabilitation. Long term therapy with longer follow up measurements will yield information regarding the stability of treatment effects. Addressing these aspects will further refine the efficacy and application of ABMT, with the aim of its broader adoption in clinical practice for stroke rehabilitation.

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Appendix-A

Institutional Review Board (IRB) Permission Letter

SCMST-BPT/IRB/.....

Date: 6th June, 2024
To
Syed Nagib Julkarnaeen
4th Year Student of B.Sc. in Physiotherapy
Session: 2018-2019, Reg No:10475
SAIC College of Medical Science & Technology (SCMST)
Mirpur-14, Dhaka-1216, Bangladesh

Subject: Approval of the thesis proposal **"Effectiveness of Activity based Mirror therapy on the Gait in Patients with Stroke"** by ethics committee.

Dear Syed Nagib Julkarnaeen
Congratulations.
The Institutional Review Board (IRB) of SCMST 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)
3	Information sheet & consent form.

The purpose of the study is to find out the Effectiveness of Activity based Mirror therapy on the Gait in Patients with Stroke which is supervised by Professor Md. Obaidul Haque, Vice Principle Department of Physiotherapy, BHPI, CRP, Savar, Dhaka. The study involves face-to-face interviews by using a semi-structured questionnaire to assess the Effectiveness of Activity based Mirror therapy on the Gait in Patients with Stroke in the Neurology unit, CRP. It may take 20 to 30 minutes to fill in the questionnaire and there is no likelihood of any harm to the participants. The members of the Ethics Committee have approved the study to be conducted in the presented form at the meeting held at 09.00 AM on 28th September 2023 at SCMST.

The institutional Ethics committee expects to be informed about the progress of the study, any changes occurring during 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 the Nuremberg Code 1947, the World Medical Association Declaration of Helsinki, 1964 - 2013, and other applicable regulations.

Best regards, 30.12.24.

Dr. Abul Kasem Mohammad Enamul Haque
Principal, SCMST &Chairman, Institutional Review Board (IRB)
SAIC College of Medical Science & Technology (SCMST)
Mirpur-14, Dhaka-1216, Bangladesh

Appendix - B

Permission letter for data collection

CRP
Centre for the Rehabilitation of the Paralysed

পক্ষাঘাতগ্রস্তদের পুনর্বাসন কেন্দ্র (সিআরপি)
Centre for the Rehabilitation of the Paralysed (CRP)
a project of the Trust for the Rehabilitation of the Paralysed
Head Office: CRP Savar, Chapain, Savar, Dhaka-1343, Bangladesh
Tel: 02224445464-5, Fax: 02224445069, E-mail: contact@crp-bangladesh.org, Web: www.crp-bangladesh.org

CRP-ERC-R&E-0401-0453 15.07.2024

To

Syed Nagib Julkarnaeen
B.Sc. in Physiotherapy
Session: 2018-2019, Registration No: 10475
Saic College of Medical Science and Technology (SCMST)
Mirpur-14, Dhaka-1216, Bangladesh
E-mail: abirahmed330@gmail.com

Ref: *Study Title* ''Effectiveness of activity-based Mirror therapy on the gait in patients with stroke'.

Sub: Approval of documents for *Study Title* ''Effectiveness of activity-based Mirror therapy on the gait in patients with stroke'.

Dear author,

The CRP Ethics Committee reviewed and discussed your application to conduct the research entitled ''Effectiveness of activity-based Mirror therapy on the gait in patients with stroke'. Which was submitted on 25th June 2024.

The following documents were reviewed:

SL. No.	Documents	Version	*Dated*	*Copy*
1	Protocol	-		1

The following members of the ethics committee reviewed the protocol on 15.06.2024.

SL. No.	Name	Role in EC	Affiliation with Institute (Yes/No) If yes, Specify.....
1.	Prof. Dr. Mohammad Alamgir Kabir	Chair of CRPEC	No
2.	Md. Shaikhul Hasan	Member Secretary	Yes, Assist. Manager- Research, Monitoring & Evaluation.
3.	Nasirul Islam	Executive Member	Yes
4.	Dr. Mohammad Sohrab Hossain	Executive Member	Yes

CRP
Centre for the Rehabilitation of the Paralysed
পক্ষাঘাতগ্রস্তদের পুনর্বাসন কেন্দ্র (সিআরপি)
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CRP-ERC-REE-0401-0453

5.	Mohammad Anwar Hossain	Executive Member	Yes, Head of Physiotherapy Department, CRP.
6.	Tauhidul Islam	Executive Member	Yes, Acting Head of Occupational Therapy Department.
7.	Tahamina Sultana	Executive Member	Yes. Head of Speech and Language Therapy Department (Acting).
7.	Md Obaidur Rahman	Executive Member	No
8.	Md. Mizanur Rahnan	Executive Member	Yes, Assist. Professor, BHPI.

We confirm that neither you nor your study team members participated in the deliberations of the Ethics Committee & did not vote on the proposal for this study. He/She promised to CRP Research department, she/he will follow every rule and regulation of CRP and research policy. This Ethical Clearance only for those who will take/collect data from CRP.

We approve the research to be conducted in its presented form at Centre for the Rehabilitation of the Paralysed (CRP).

The CRP Ethics Committee expects to be informed about the progress of the study, any Serious Adverse Effects (SAE) occurring in the course of the study, any changes in the protocol and participant's information / informed consent and asks to be provided a copy of the final report.

Please submit to the Ethical Committee (EC) the published article of the study as per EC Standard Operating Protocol (SOP)'s.

The EC is organized & operates according to the requirements of Declaration of Helsinki and ICH-*GCP, local regulatory requirements and guidelines.*

Yours sincerely,

Md. Shaikhul Hasan
Assistant Manager- Research, Monitoring & Evaluation,
And Member Secretary of CRP-ERC, CRP.

Appendix- C

Questionnaire Bangla and English

CONSENT STATEMENT (English)

Please Read It Carefully

Assalamualaikum!

I am Syed Nagib Julkarnaeen, a student of B.Sc. in physiotherapy, 4th year 2018-19 session, at Saic College of Medical Science & Technology, affiliated with the University of Dhaka under the faculty of Medicine. I am conducting a research program entitled "Effectiveness of Activity Based Mirror Therapy on the Gait in Patient with stroke". In this study, I would like to find out the effect of activity-based Mirror therapy on the gait in patient with stroke.

I would like to request some information regarding your sociodemographic, balance, and gait impairment-related questions. Please note that this academic research project will take approximately 20-30 minutes to complete. Participating in this study will not affect your current or future treatment in any way. It is important to mention that the information collected will only be used for academic research purposes, and all your provided data will be kept confidential. In the case of any report or publication, we will ensure that your identity remains anonymous.

Your participation in this study is voluntary, and you may withdraw at any time during this study without any negative consequences. You also have the right not to answer a question you don't like or do not want to answer during the interview.

If you have any questions regarding the study or your rights as a participant, please feel free to contact the investigator Syed Nagib Julkarnaeen or the research supervisor Professor Dr. Md. Obaidul Haque, Vice Principal Department of Physiotherapy, BHPI, CRP, Savar, Dhaka.

Do you have any questions before I start?

Yes	No

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

Yes	No

Signature of the Participant_____

Date……

Signature of the Interviewer_____

Date……

Signature of the Physiotherapist_____

Date……

Patient Information

This questionnaire is developed to assess the level of trunk impairment and static and dynamic balance of the patient with stroke and this section will be filled by a physiotherapist using a pen.

Patient ID:		
Date of test:		
Name of participants:		
Code:		
Address:	**Village:** **Upazila:**	**Post-Office:** **District:**
Phone:		

PART-1: Socio-Demographic Information

[Please give a tick (√) mark at the left side box of the best correct answer]

Question No	Questions/ Information on	Response of the participant
1.1	Age	……Year
1.2	Gender	0= Male 1= Female
1.3	Marital status	0 = Unmarried 1 = Married
1.4	Educational Qualification	0 = Illiterate 1 = Primary 2 = SSC 3 = HSC 4 = Graduation 5 = Masters or higher
1.5	Occupation (Before Stroke)	0 = Service holder 1 = Businessman 2 = Housewife 3 = Student 4 = Teacher 5 = Labor 6 = Farmer 7= Other.....
1.6	Living area	0 = Rural 1 = Urban
1.7	Family type	0 = Nuclear family 1 = Extended family
1.8	Access Road	0 = Mud 1 = Brick 3 = Pitch

PART-2: Anthropometric Information

Question No	Questions	Response of the participants
2.1	Height	……...
2.2	Weight	……...
2.3	BMI	……

Part-3: Stroke Related Information

Questions No	Question	Response of Participants
3.1	Date of incidence	DD/MM/YEAR…….
3.2	Affected side	0 = Right 1 = Left
3.3	Type of stroke	0 = Ischemic 1 = Hemorrhagic
3.4	Duration of stroke	0 = < than 3 month 1 = > than 3 month 2 = > than 6 month 3 = > than 1 year 4 = > than 2 year
3.5	How many sessions of physiotherapy treatment have you received ?	0 = 1-2 session 1 = 3-4 session 2 = 5-6 session 3 = 7-8 session 4 = > 8 session
3.6	Smoking / Tobacco Habit	0 = No 1 = Yes

Part-4: Comorbidity Information

Question No	Questions	Response of the participants
4.1	Do you have Hypertension?	0 = No 1 = Yes
4.2	Do you have Diabetes mellitus?	0 = No 1 = Yes
4.3	Do you have congenital heart disease?	0 = No 1 = Yes

Part 5- Assessment of gait variable

No.	Variable	Test score
5.1	Step length (cm)	
5.2	Stride length (cm)	
5.3	Cadence (steps/min)	
5.4	Velocity (meter/min)	

Part 6: Assessment of balance by Burg Balance Scale(BBS)

[Tick √ the point, which is able to perform patient]

No.	INSTRUCTIONS	Score
6.1	**STANDING FROM SITTING** (Try not to use your hand for support) 4= Able to stand without using hands and stabilize independently 3= Able to stand independently using hands 2= Able to stand using hands after several tries 1= Needs minimal aid to stand or stabilize 0= Needs moderate or maximal assistance to stand	
6.2	**STANDING UNSUPPORTED** Please stand for two minutes without holding on 4= Able to stand safely for 2 minutes 3= Able to stand for 2 minutes with supervision 2= Able to stand 30 seconds unsupported 1= Needs several tries to stand 30 seconds unsupported 0= Unable to stand 30 seconds unsupported If a subject is able to stand 2 minutes unsupported, score full points for sitting unsupported. Proceed to item #4.	
6.3	**SITTING WITH BACK UNSUPPORTED** (Feet Supported On the Floor Or On A Stool) 4= Able to sit safely and securely for 2 minutes 3= Able to sit for 2 minutes under supervision 2= Able to able to sit for 30 seconds 1= Able to sit for 10 seconds 0= Unable to sit without support 10 seconds	
6.4	**STANDING TO SITTING**	

	4= Sits safely with minimal use of hands 3= Controls descent by using hands 2= Uses the back of legs against the chair to control the descent 1= Sits independently but has uncontrolled descent 0= Needs assist to sit	
6.5	**TRANSFERS** Arrange a chair for pivot transfer. Ask the subject to transfer one way toward a seat with armrests and one way toward a seat without armrests. You may use a bed and a chair. 4= Able to transfer safely with minor use of hands 3= Able to transfer safely definite need of hands 2= Able to transfer with verbal cueing and/or supervision 1= Needs one person to assist 0= Needs two people to assist or supervise to be safe	
6.6	**STANDING UNSUPPORTED WITH EYES CLOSED (Please close your eyes and stand still for 10 seconds.)** 4= Able to stand for 10 seconds safely 3= Able to stand for 10 seconds with supervision 2= Able to stand 3 seconds 1= Unable to keep eyes closed for 3 seconds but stays safely 0= Needs help to keep from falling	
6.7	**STANDING UNSUPPORTED WITH FEET TOGETHER** (Place your feet together and stand without holding on.) 4= Able to place feet together independently and stand 1 minute safely 3= Able to place feet together independently and stand 1 minute with supervision 2= Able to place feet together independently but unable to hold for 30 seconds 1= Needs help to attain position but able to stand 15 seconds feet together	

	0= Needs help to attain position and unable to hold for 15 seconds	
6.8	**REACHING FORWARD WITH OUTSTRETCHED ARM WHILE STANDING INSTRUCTIONS** Lift arm to 90 degrees. Stretch out your fingers and reach forward as far as you can. (Ask the subject to use both arms when reaching to avoid rotation of the trunk.) 4= Can reach forward confidently 25 cm (10 inches) 3= Can reach forward 12 cm (5 inches) 2= Can reach forward 5 cm (2 inches) 1= Reaches forward but needs supervision 0= Loses balance while trying/requires external support	
6.9	**PICK UP OBJECT FROM THE FLOOR FROM A STANDING POSITION** Pick up the shoe/slipper, which is placed in front of your feet. 4= Able to pick up slippers safely and easily 3= Able to pick up slipper but needs supervision 2= Unable to pick up but reaches 2-5 cm from slipper and keeps balance independently 1= Unable to pick up and needs supervision while trying 0= Unable to try/needs assistance to keep from losing balance or falling	
6.10	**TURNING TO LOOK BEHIND OVER LEFT AND RIGHT SHOULDERS WHILE STANDING** Turn to look directly behind you over toward the left shoulder. Repeat to the right. The examiner may pick an object to look at directly behind the subject to encourage a better twist turn. 4= Looks behind from both sides and weight shifts well 3= Looks behind one side only the other side shows less weight shift 2= Turns sideways only but maintains balance	

	1= Needs supervision when turning 0= Needs assistance to keep from losing balance or falling	
6.11	**TURN 360 DEGREES** Turn completely around in a full circle. Pause. Then turn a full circle in the other direction. 4= Able to turn 360 degrees safely in 4 seconds or less 3= Able to turn 360 degrees safely on one side in only 4 seconds or less 2= Able to turn 360 degrees safely but slowly 1= Needs close supervision or verbal cueing 0= Needs assistance while turning	
6.12	**PLACE ALTERNATE FOOT ON THE STEP OR STOOL WHILE STANDING UNSUPPORTED** Place each foot alternately on the step/stool. Continue until each foot has touched the step/stool four times 4= Able to stand independently and safely and complete 8 steps in 20 seconds 3= Able to stand independently and complete 8 steps in > 20 seconds 2= Able to complete 4 steps without aid with supervision 1= Able to complete > 2 steps need minimal assist 0= Needs assistance to keep from falling/unable to try	
6.13	**STANDING UNSUPPORTED ONE FOOT IN FRONT** Place one foot directly in front of the other. If you feel that you cannot place your foot directly in front, try to step far enough ahead that the heel of your forward foot is ahead of the toes of the other foot. (To score 3 points, the length of the step should exceed the length of the other foot and the width of the stance should approximate the subject's normal stride width.) 4= Able to place foot tandem independently and hold for 30 seconds 3= Able to place foot ahead independently and hold for 30 seconds	

	2= Able to take small steps independently and hold for 30 seconds 1= Needs help to step but can hold for 15 seconds 0= Loses balance while stepping or standing	
6.14	**STANDING ON ONE LEG** Stand on one leg as long as you can without holding on. 4= Able to lift leg independently and hold > 10 seconds 3= Able to lift leg independently and hold for 5-10 seconds 2= Able to lift leg independently and hold ≥ 3 seconds 1= Tries to lift leg unable to hold 3 seconds but remains standing independently 0= Unable to try or needs assistance to prevent fall	

Total Score:

Date: ..... Signature of Examiner.....

অনুমতি পত্র

অংশগ্রহনকারীকে পড়ার জন্য অনুরোধ করা হইল

আসসালামু আলাইকুম!

আমি সৈয়দ নাগীব জুলকারনাঈন, ঢাকা বিশ্ববিদ্যালয়ের চিকিৎসা অনুষদের অন্তর্ভূক্ত সাইক কলেজ অব মেডিকেল সায়েন্স এন্ড টেকনোলজির বি.এস.সি. ইন ফিজিওথেরাপীর ৪র্থ বর্ষের ২০১৮-১৯ সেশনের একজন শিক্ষার্থী। আমি একটি গবেষনা পরিচালনা করছি। আমার গবেষনার শিরোনাম ‘‘স্ট্রোকে আক্রান্ত রোগীর চলাফেরার উপর ভিত্তি করে মিরর থেরাপির কার্যকারিতা"। এই গবেষণায়, আমি স্ট্রোকের রোগীর চলাফেরার উপর কার্যকলাপ ভিত্তিক মিরর থেরাপির প্রভাব খুঁজে বের করতে চাই ।

আমি আপনার সামাজিক জনতাত্ত্বিক সংক্রান্ত, ভারসাম্য, এবং চলাফেরার উপর বৈকল্য-সম্পর্কিত প্রশ্নগুলির বিষয়ে কিছু তথ্যের জন্য অনুরোধ করছি। দয়া করে মনে রাখবেন যে এই একাডেমিক গবেষণা প্রকল্পটি সম্পূর্ণ হতে প্রায় ২০-৩০ মিনিট সময় লাগবে। এই গবেষণায় অংশগ্রহণ করা আপনার বর্তমান বা ভবিষ্যতের চিকিৎসাকে কোনোভাবেই প্রভাবিত করবে না। এটি উল্লেখ করা গুরুত্বপূর্ণ যে সংগৃহীত তথ্য শুধুমাত্র একাডেমিক গবেষণার উদ্দেশ্যে ব্যবহার করা হবে, এবং আপনার দেওয়া সমস্ত তথ্য গোপন রাখা হবে। কোনো প্রতিবেদন বা প্রকাশনার ক্ষেত্রে, আমরা নিশ্চিত করব যে আপনার পরিচয় গোপন থাকবে।

এই অধ্যয়নে আপনার অংশগ্রহণ স্বেচ্ছায় এবং আপনি এই অধ্যয়ন চলাকালীন যেকোনো সময় কোনো নেতিবাচক পরিণতি ছাড়াই নিজেকে প্রত্যাহার করতে পারেন। সাক্ষাত্কারের সময় আপনি পছন্দ করেন না বা উত্তর দিতে চান না এমন একটি নির্দিষ্ট প্রশ্নের উত্তর না দেওয়ার অধিকারও আপনার রয়েছে।

অধ্যয়ন বা অংশগ্রহণকারী হিসাবে আপনার অধিকার সম্পর্কে আপনার কোন প্রশ্ন থাকলে, অনুগ্রহ করে নির্দ্বিধায় আমার এবং/অথবা আমার গবেষণা তত্ত্বাবধায়কের সাথে যোগাযোগ করতে পারেন। অধ্যাপক ডা. মো. ওবায়দুল হক, উপাধ্যক্ষ, বিএইচপিআই, সিআরপি, সাভার, ঢাকা- ১৩৪০।

আমি শুরু করার আগে আপনার কোন প্রশ্ন আছে?

হ্যা	না

ইন্টারভিউ নিয়ে এগিয়ে যাওয়ার জন্য আমি কি আপনার সম্মতি পেতে পারি?

হ্যা	না

অংশগ্রহণকারীর স্বাক্ষর _____ তারিখ.....

সাক্ষাত্কারকারীর স্বাক্ষর _____ তারিখ.....

ফিজিওথেরাপিস্টের স্বাক্ষর _____ তারিখ.....

প্রশ্নপত্র (বাংলা)

শিরোনাম: "স্ট্রোকে আক্রান্ত রোগীর চলাফেরার উপর ভিত্তি করে মিরর থেরাপির কার্যকারিতা"।

রোগীর তথ্যাবলি

এই প্রশ্নপত্রটি দুর্বলতার মাত্রা এবং স্ট্রোকের রোগীর স্থিতিশীল এবং গতিশীল ভারসাম্য মূল্যায়ন করার জন্য তৈরি করা হয়েছে এবং এই বিভাগটি একটি ফিজিওথেরাপিস্ট একটি কলম ব্যবহার করে পূরণ করবেন।

রোগীর আইডিঃ		
মূল্যায়নের তারিখঃ		
অংশগ্রহণকারীর নামঃ		
কোডঃ		
ঠিকানাঃ	গ্রামঃ উপজেলাঃ	পোষ্ট অফিসঃ জেলাঃ
ফোন নাম্বারঃ		

পার্ট-১ঃ সামাজিক-জনতাত্ত্বিক তথ্য

[সঠিক উত্তর চিহ্নিত করতে টিক(√) ব্যবহার করুন]

নং	প্রশ্ন	উত্তর
১.১	বয়স	…….. বছর
১.২	লিঙ্গ	০= পুরুষ ১= মহিলা
১.৩	বৈবাহিক অবস্থা	০ = অবিবাহিত ১ = বিবাহিত

১.৪	শিক্ষাগত যোগ্যতা	০ = নিরক্ষর ১ = প্রাথমিক ২ = এসএসসি ৩ = এইচএসসি ৪ = স্নাতক ৫ = মাস্টার্স বা উচ্চতর
১.৫	পেশা (স্ট্রোকের আগে)	০ = সার্ভিস হোল্ডার ১ = ব্যবসায়ী ২ = গৃহিণী ৩ = ছাত্র ৪ = শিক্ষক ৫ = শ্রমিক ৬ = কৃষক ৭= অন্যান্য.....
১.৬	বাসস্থানের ধরন	০ = গ্রামীণ ১ = শহুরে
১.৭	পারিবারিক ধরন	০ = একক পরিবার ১ = বর্ধিত পরিবার
১.৮	রাস্তার ধরণ	০ = মাটির রাস্তা ১ = ইটের রাস্তা ২ = পিচের রাস্তা

পার্ট-২: নৃতাত্ত্বিক তথ্য

নং	প্রশ্ন	উত্তর
২.১	উচ্চতা	……...
২.২	ওজন	.....কেজি
২.৩	বিএমআই	……

পার্ট-৩: স্ট্রোক সম্পর্কিত তথ্য

নং	প্রশ্ন	উত্তর
৩.১	স্ট্রোকের ঘটনার তারিখ	দিন / মাস /বছর.....
৩.২	আক্রান্ত পাশ	০= বাম ১= ডান
৩.৩	স্ট্রোকের ধরন	০= ইস্কেমিক ১= রক্তক্ষরণজনিত
৩.৪	স্ট্রোকের সময়কাল	০= ৩ মাসের কম ১= ৩ মাসের বেশি ২= ৬ মাসের বেশি ৩= ১ বছরের বেশি ৪= ২ বছরের বেশি
৩.৫	আপনি কতটি ফিজিওথেরাপী চিকিৎসা পেয়েছেন?	০ = ১-২ সেশন ১ = ৩-৪ সেশন ২ = ৫-৬ সেশন ৩ = ৭-৮ সেশন ৪ = > ৮ সেশন
৩.৬	ধুমপান অভ্যাস	০= না ১= হ্যা

পার্ট-৪: সহ-অসুস্থতার তথ্য

নং	প্রশ্ন	উত্তর
৪.১	আপনার কি উচ্চ রক্তচাপ আছে?	০ = না ১ = হ্যাঁ
৪.২	আপনার কি ডায়াবেটিস আছে?	০ = না ১ = হ্যাঁ
৪.৩	আপনার কি জন্মগত হৃদরোগ আছে?	০ = না ১ = হ্যাঁ

পার্ট ৫- গেইট ভেরিয়েবলের মূল্যায়ন

নং	ভেরিয়েবল	মূল্যায়ন
৫.১	ধাপের দৈর্ঘ্য (সেমি)	
৫.২	স্ট্রাইড দৈর্ঘ্য (সেমি)	
৫.৩	ক্যাডেন্স (পদক্ষেপ/মিনিট)	
৫.৪	বেগ (মিটার/মিনিট)	

পার্ট-৬ঃ বার্গ-ব্যালেন্স স্কোর দ্বারা ভারসাম্যের মূল্যায়ন

এই প্রশ্নাবলী স্ট্রোক রোগীদের জন্য তাদের স্ট্যাটিক এবং গতিশীল ভারসাম্য মূল্যায়ন করার জন্য ডিজাইন করা হয়েছে। বার্গ ব্যালেন্স স্কেল হল একটি সাধারণভাবে ব্যবহৃত ক্লিনিকাল মূল্যায়ন যা একজন ব্যক্তির স্ট্যাটিক এবং গতিশীল ভারসাম্য বজায় রাখার ক্ষমতা মূল্যায়ন করে। এটি ক্যাথরিন বার্গের জন্য নামকরণ করা হয়েছে, এটির বিকাশে অবদানকারীদের একজন

১৪ টি আইটেমের এই স্কেল একটি পরিমাণগত ভারসাম্য মূল্যায়ন প্রদান করে। আইটেমগুলি ০ থেকে ৪ পর্যন্ত একটি স্কেলে মূল্যায়ন করা হয়, যেখানে ০ এর স্কোর কার্য সম্পাদনে অক্ষমতা নির্দেশ করে এবং ৪ এর স্কোর সহায়তা ছাড়াই কার্যকলাপের সফল সমাপ্তি নির্দেশ করে। সর্বাধিক ৫৬টি অর্জনযোগ্য পয়েন্টের উপর ভিত্তি করে একটি ক্রমবর্ধমান স্কোর গণনা করা হয়। ফিজিওথেরাপিস্ট একটি বলপয়েন্ট কলম ব্যবহার করে এই প্রশ্নাবলীর উপাদানটি সম্পূর্ণ করবেন যা হয় কালো বা নীল রঙের।

[সঠিক উত্তর চিহ্নিত করতে টিক(√) ব্যবহার করুন]

নং	কার্যকলাপ	স্কোর
৬.১	**বসা থেকে দাঁড়ানো** (আপনার হাতের সাহায্য ছাড়া চেষ্টা করুন) ৪= হাত ব্যবহার না করে দাড়াতে এবং নিজে নিজে ভারসাম্য রাখতে পারে। ৩= হাত ব্যবহার করে ভারসাম্য রাখতে পারা। ২= বেশ কয়েকবার চেষ্টা করে ভারসাম্য রাখতে পারা। ১= দাড়াতে বা স্থিতিশীল হতে নূন্যতম সহায়তা প্রয়োজন। ০= দাড়াতে মাঝারি বা সর্বাধিক সহায়তা প্রয়োজন।	
৬.২	**সাহায্য ছাড়া দাঁড়ানো** (২ মিনিট) ৪= ২ মিনিট নিরাপদে দাড়াতে সক্ষম। ৩= পর্যবেক্ষণ ও দেখাশুনার মাধ্যমে ২ মিনিট দাড়াতে সক্ষম। ২= ৩০ সেকেন্ড দাড়াতে সক্ষম। ১= বেশ কয়েকবার চেষ্টার পর ৩০ সেকেন্ড দাড়াতে সক্ষম। ০= ৩০ সেকেন্ড দাড়াতে অক্ষম।	
৬.৩	**সাহায্য ছাড়া বসা** (পিঠে সাহায্য ছাড়া এবং পা টুলের উপরে রেখে) ৪= ২ মিনিটের জন্য নিরাপদে বসতে সক্ষম। ৩= পর্যবেক্ষন ও দেখাশুনার মাধ্যমে ২ মিনিট বসতে সক্ষম। ২= ৩০ সেকেন্ড বসতে সক্ষম। ১= ১০ সেকেন্ড বসতে সক্ষম। ০= ১০ সেকেন্ড সাহায্য ছাড়া বসতে অক্ষম।	

৬.৪	**দাঁড়ানো থেকে বসা** ৪= হাতের কিছুটা সাহায্য নিয়ে বসতে পারে। ৩= হাতের সাহায্য নিয়ে নিচে পড়ে যাওয়া নিয়ন্ত্রন করতে পারে। ২= পায়ের পিছন দিক ব্যবহার করে নিচে পরে যাওয়া নিয়ন্ত্রন করতে পারে। ১= নিজে নিজে বসতে পারে কিন্তু নিচে পড়ে যাওয়া নিয়ন্ত্রন করতে পারে না। ০= বসতে সাহায্য লাগে।	
৬.৫	**স্থানান্তর** (স্থানান্তরের জন্য চেয়ার বা বিছানা ব্যবহার করুন) ৪= হাতের সামান্য ব্যবহার করে নিরাপদ স্থানে বসতে সক্ষম। ৩= হাতের যথাযথ ব্যবহার করে নিরাপদ স্থানে বসতে সক্ষম। ২= মৌখিক ইঙ্গিত দ্বারা স্থানান্তর করতে সক্ষম। ১= স্থানান্তরের জন্য একজন ব্যাক্তি প্রয়োজন। ০= নিরাপদে স্থানান্তরের জন্য দুইজন ব্যাক্তি প্রয়োজন	
৬.৬	**চোখ বন্ধ করে দাঁড়ানো** (১০ সেকেন্ড দাঁড়িয়ে থাকা) ৪= ১০ সেকেন্ড নিরাপদে দাড়াতে সক্ষম। ৩= পর্যবেক্ষন ও দেখাশুনার মাধ্যমে ১০ সেকেন্ড দাড়াতে সক্ষম। ২= ৩ সেকেন্ড দাড়াতে সক্ষম। ১= ৩ সেকেন্ড চোখ বন্ধ করে দাড়াতে অক্ষম কিন্তু নিরাপদে দাঁড়িয়ে থাকতে পারে। ০= পড়ে যাওয়া রোধ করতে সাহায্যের প্রয়োজন।	
৬.৭	**দুই পা একসাথে করে দাঁড়ানো** (আপনার পা একসাথে রেখে সাহায্য ছাড়া দাঁড়িয়ে থাকুন) ৪= নিজে নিজে পা রেখে নিরাপদে ১ মিনিট দাড়াতে সক্ষম। ৩= নিজে নিজে পা রেখে নিরাপদে ১ মিনিট দাড়াতে সক্ষম কিন্তু পর্যবেক্ষন প্রয়োজন। ২= অবস্থান ঠিক রাখতে পারে কিন্তু ৩০ সেকেন্ড এর বেশি বা একসাথে রাখতে অক্ষোম। ০= অবস্থান ঠিক রাখতে সাহায্য প্রয়োজন কিন্তু ১৫ সেকেন্ড পা একসাথে রাখতে পর্যবেক্ষন প্রয়োজন।	
৬.৮	**হাত দিয়ে দূরবর্তী জিনিস ধরা** (বাহু ৯০° উঠান এবং হাত সামনে বাড়িয়ে দিন) ৪= আত্মবিশ্বাসের সাথে ২৫ সেমি এগিয়ে যেতে পারে। ৩= ১২ সেমি এগিয়ে যেতে পারে।	

	২= ৫ সেমি এগিয়ে যেতে পারে। ১= সামনে পৌঁছাতে পারে কিন্তু পর্যবেক্ষনের প্রয়োজন। ০= সামনে এগিয়ে যাওয়ার সময় ভারসাম্য হারায়।	
৬.৯	**মেঝে থেকে জিনিস তোলা** (জুতা তুলে নিন যা আপনার পায়ের সামনে আছে) ৪= নিরাপদে ও সহজেই জুতা তুলে নিতে পারে। ৩= জুতা তুলতে সক্ষম কিন্তু পর্যবেক্ষণের প্রয়োজন। ২= তুলতে অক্ষম কিন্তু স্লিপার থেকে ২-৫ সেমি সামনে চলে যায় কিন্তু ভারসাম্য ধরে রাখতে পারে। ১= তুলতে অক্ষম কিন্তু ভারসাম্য রাখতে পর্যবেক্ষণ প্রয়োজন। ০= চেষ্টা করতে অক্ষম এবং ভারসাম্য হারায়।	
৬.১০	**পিছেন ঘুরে তাকানো** (বাম দিকে ঘুরে তাকান। ডান দিকে পুনরাবৃত্তি করুন) ৪= উভয়পাশ থেকে ভালোভাবে তাকাতে পারে এবং সমান ওজন বিনিময় করতে পারে। ৩= একপাশে তাকাতে পারে এবং একদিকে কম ওজন বিনিময় করতে পারে। ২= একপাশে তাকাতে পারে কিন্তু ভারসাম্য রাখতে পারে না। ১= ঘুরে যাবার সময় পর্যবেক্ষণ প্রয়োজন হয়। ০= ঘুরে যাবার সময় পড়ে যাওয়া রোধ করতে সাহায্যের প্রয়োজন হয়।	
৬.১১	**৩৬০° ডিগ্রী ঘুরে যাওয়া** (একটি পূর্ণ বৃত্ত ঘুরুন এবং বিপরীত দিক থেকে চেষ্টা করুন) ৪= ৪ সেকেন্ড বা তার কম সময়ে ৩৬০° ডিগ্রী ঘুরতে সক্ষম। ৩= ৪ সেকেন্ড বা তার কম সময়ে ৩৬০° ডিগ্রী নিরাপদে শুধুমাত্র একদিক থেকে ঘুরতে সক্ষম। ২= নিরাপদে ধীরে ধীওে ৩৬০° ডিগ্রী ঘুরতে সক্ষম। ১= মৌখিক ইঙ্গিত প্রয়োজন। ০= ঘুরার সময় সাহায্য প্রয়োজন।	
৬.১২	**টুলের ওপর বিপরীত পা রাখা** (দুই পা দিয়ে অন্তত চারবার চেষ্টা করুন) ৪= স্বাধীনভাবে এবং নিরাপদে দাড়াতে এবং ২০ সেকেন্ডের মধ্যে ৮ টি ধাপ সম্পন্ন করতে পারে। ৩= স্বাধীনভাবে এবং নিরাপদে দাড়াতে এবং ২০ সেকেন্ডের অধিক সময়ের মধ্যে ৮ টি ধাপ সম্পন্ন করতে পারে। ২= পর্যবেক্ষণ ছাড়াই ৪ টি ধাপ সম্পূর্ণ করতে পারে।	

	১= কিছুটা সাহায্য দ্বারা ২ টির কম পদক্ষেপ দিতে পারে। ০= পড়ে যাওয়া থেকে রক্ষা পেতে সাহায্য প্রয়োজন।	
৬.১৩	**সামনে এক পা দিয়ে দাঁড়ানো** ৪= স্বাধীনভাবে একপা সামনে দিয়ে দাড়াতে পারে এবং বিপরীত পা দিয়ে সমান ভাবে পারে এবং ৩০ সেকেন্ড ধরে রাখতে পারে । ৩= স্বাধীনভাবে একপা সামনে দিয়ে দাড়াতে পারে এবং বিপরীত পা দিয়ে সমান ভাবে পারে না এবং ৩০ সেকেন্ড ধরে রাখতে পারে । ২= পদক্ষেপের জন্য সাহায্যের প্রয়োজন কিন্তু ৩০ সেকেন্ড ধরে রাখতে পারে। ১= পদক্ষেপের জন্য সাহায্যের প্রয়োজন কিন্তু ১৫ সেকেন্ড ধরে রাখতে পারে। ০= পদক্ষেপ বা দাড়ানোর সময় ভারসাম্য রাখতে পারে না।	
৬.১৪	**এক পায়ে দাঁড়ানো** (যতক্ষন আপনি পারেন এক পায়ে দাঁড়িয়ে থাকুন ধরে না রেখে) ৪= স্বাধীনভাবে পা তুলতে পারে এবং ১০ সেকেন্ড এর বেশি সময় ধরে রাখতে পারে। ৩= স্বাধীনভাবে পা তুলতে এবং ৫-১০ সেকেন্ড এর বেশি সময় ধরে রাখতে পারে। ২= স্বাধীনভাবে পা তুলতে পারে এবং ৩ সেকেন্ড বা এর কম সময় ধরে রাখতে পারে। ১= স্বাধীনভাবে পা তুলতে পারে এবং ৩ সেকেন্ড ধরে রাখতে পারে না কিন্তু স্বাধীনভাবে দাঁড়িয়ে থাকতে পারে। ০= পড়ে যাওয়া থেকে রক্ষা পেতে সাহায্য প্রয়োজন।	

মোট পরীক্ষা স্কোরঃ

তারিখঃ ..... **পরীক্ষকের স্বাক্ষরঃ**.....

Appendix- D

Gant Chart

Activities/ months	Sep 23	Oct 23	Nov 23	Dec 23	Jan 24	Feb 24	Mar 24	Apr 24	May 24	June 24	July 24	Aug 24
Proposal presentation												
Introduction												
Literature review												
Methodology												
Data collection												
Data Analysis												
Result												
1st progress presentation												
Discussion												
Conclusion And Recommendation												
2nd progress presentation												
Communication with supervisor												
Final submission												