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The Effect Of Trunk Exercises With Hip Strategy Training To Maximize Independence Level And Balance For Patient With Stroke

A Thesis Submitted in Partial Fulfillment of the Requirements for the Degree of Master of Science in Physical Therapy

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بسم الله الرحمن الرحيم

المملكة العربية السعودية
وزارة التعليم
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تقرير لجنة المناقشة

تأثير تمارين الجذع مع استراتيجية تدريب الورك لزيادة مستوى الاستقلالية والتوازن لمرضى السكته الدماغيه.

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ABSTRACT

BACKGROUND: Sitting balance and the ability to perform selective trunk movements are important predictors of functional outcome after stroke. Patient with Inappropriate muscle activation and poor movement control of the trunk muscles lead to difficulty in mobility and daily functioning. Patients with a stroke have weak leg muscles and decreased balance, leading in compensatory alterations. To restore balance in these patients, postural strategy functional training is required. The Studies investigating effect of physical therapy trunk exercises with hip strategy training with an aim to improve balance as well as increase independence level after stroke are limited **PURPOSE:** This study aims to explore the effect of selective trunk exercises with hip strategy training in improving balance in patients with stroke as well as independence level. **METHOD:** a randomized pre-test and post-test control trial was carried out at multi center inpatient stroke rehabilitation. In total of forty-six subjects with history of stroke were randomly recruited for the sake of comparison to an experimental group (n = 23) or a control group (n =23). In addition to conventional therapy, the experimental group received additional selective trunk exercises with hip strategy training. All groups underwent physical therapy based on the neuro-developmental therapy (NDT) four times per week for six weeks. The static and dynamic sitting balance as well as co-ordination of trunk movement was evaluated by the trunk impairment scale (TIS), the static and dynamic functional balance abilities was evaluated by Berg balance scale (BBS), and Functional independence measure (FIM) was used for measure functional status and independence level. were measured before and after the 6 weeks of therapy. **RESULTS:** Based on the results of measurements taken from patients after the therapeutic intervention in the experimental group was significantly higher than that in the control group. The trunk impairment scale TIS score, and its subscale of the experimental group showed significantly greater improvement than did that of the control group. Also, Berg balance scale (BBS) score significantly improved in the experimental group. In addition, these improvements were significantly higher in Functional independence measure (FIM) in the experimental group **CONCLUSION:** This study demonstrated that adding selective trunk exercises in conjunction with hip strategy training to patients after a has positive impact in trunk control while static and dynamic sitting balance, functional balance, and independence level. which be effective in stroke rehabilitation

Keywords: Stroke, Trunk, Hip Strategy, balance. Functional independence, Rehabilitation

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LIST OF ABBREVIATION

BBT	Berg Balance Test
COP	Center of Pressure
CVA	cerebrovascular accident
CVD	Cardiac Vascular Disease
DM	Diabetes Mellitus
ADL	Active daily live
HR	Heart Rate
HTN	Hypertension
ICU	Intensive Care Unit
KSA	Kingdome of Saudi Arabia
GBD	global burden disease
ICH	intracerebral hemorrhage
SAH	subarachnoid hemorrhage
MCA	Middle Cerebellar Artery
TIA	Transit Ischemic Attack
TIS	Trunk Impairment Scale
WHO	Word Health Organization
ECG	electro cardio graphy
ROM	Range Of Motion
CNS	Central nervous system
FIM	Functional Independence measure

CHAPTER I

INTRODUCTION

In developed nations, stroke ranks third following heart disease and cancer. It's a neurological condition induced by a vascular damage to the central nervous system (CNS), like cerebral infarction, intracerebral hemorrhage, or subarachnoid hemorrhage (Feigin et al., 2017). Paralysis, reduced balance, or spasticity are common neurological abnormalities that cause physical handicap (Seitz & Donnan, 2015). Weakness of muscle seems to restrict the patient's physical rehabilitation. At least 20% of stroke patients are under 65 . Muscle weakness, stiffness, motor control loss, cognitive and sensory impairment are common symptoms of stroke (Pak & Patten, 2008). According to the World Health Organization in 1970 it is stated that "Rapidly acquired clinical symptoms of focal (or global) impairment of brain function lasting more than 24 hours or leading to death, with no evident cause other than vascular origin" (Aho et al., 1980a).

The global mortality rate of strokes has decreased recently as a result of improvements in acute stroke medical care, yet many patients still suffer from severe disabilities. Duncan and colleagues state this (Duncan et al., 2005a). 40% of stroke survivors eventually experience disability, and 15% to 30% experience severe disability. Stroke patients and their families are probably going to suffer the most negative long-term effects in terms of their health and financial burden (Alvarado Flores et al., 2011).The subsequent limitations have a significant impact on the survivors' productivity, independence, and quality of life. Common problems in stroke patients include spasticity, weakness, and loss of balance on the afflicted side, which makes it difficult for them to maintain good posture (Pathak et al., 2014). Affectations may be seen in the trunk in addition to the face, upper, and lower limbs.

Trunk performance is crucial for body motion biomechanics and is closely related to the performance of the lower limb, balance, and movement (Kong & Krishnan, 2021; van Criekinge et al., 2017).Additionally, muscular weakness and sensory disturbances in stroke patients lead to motor issues such impaired trunk control, instability, deteriorated walking ability, and challenges with daily functional mobility (Verheyden et al., 2006).Due to trunk muscular weakness and impaired proprioception, stroke patients are less capable of balance(Dickstein et al., 2004b; Geurts et al., 2005; Karatas et al., 2004a; Tanaka et al., 1997)and postural control(Karatas et al., 2004a). Furthermore, in the sitting position, postural sway increases(van Nes et al., 2008), while weight-shifting capacity decreases(Tessem et al., 2007a).

Trunk impairments in static and dynamic conditions are typically found in stroke patients. These deficiencies are distinguished by decreased sitting balance, trunk coordination, and muscle strength.(Verheyden et al., 2006).Furthermore, trunk function appears to be the most important predictor of functional independence in acute stroke patients(Likhi et al., 2013; Smith et al., 2017; Veerbeek et al., 2011).Most physical functions require suitable balance to be performed. As that poor trunk control has a negative impact on overall balance(Karatas et al., 2004a; Keenan et al., 1984; Verheyden, Nieuwboer, et al., 2006).Trunk control is necessary for maintaining a body posture, remaining steady when changing positions, performing everyday activities, and locomotion(R.

W. Bohannon, 1992). It is critical for patients with ischemic and hemorrhagic stroke to regain balance to achieve autonomy in daily activities. Muscular weakness in the legs makes balance control difficult, indicating inappropriate movement strategies(de Oliveira et al., 2008; Hendrickson et al., 2014; Kirker, Simpson, et al., 2000). According to studies conducted in the 1980s, the human body possesses postural strategies that are broad sensorimotor solutions for postural control, including ankle, hip, and step strategies. (Horak & Nashner, 1986b; Nashner & McCollum, 1985a).

Because of the reduced surface base, stroke patients cannot employ the ankle strategy and must rely on the step strategy or other compensating methods to hold a wall or an object(de Oliveira et al., 2008). The ankle strategy is required for balance, whereas the hip strategy is essential for maintaining base support and fall prevention(Mok et al., 2004; Nagy et al., 2007; Saito et al., 2014). Patients with stroke mostly employ the hip strategy and use the ankle strategy to a lesser level to maintain the same base of support.(I. C. Chen et al., 2000) However, as seen by the high risk of falls in stroke patients (Lamb et al., 2003; Harris et al.; 2005), Belgen et al.; 2006), these techniques are frequently ineffective for stability(Shumway-Cook & Woollacott, 1995).

Rehabilitation that begins soon after a stroke has been found to help reduce complications and post-stroke functional deficits. A reduction in functional impairment, as well as a lower incidence of comorbidities, leads to improved quality of life for stroke survivors and lower long-term care expenses.(Brewer et al., 2013;Duncan et al., 2005b). Despite mounting evidence, employing a clinical evaluation instrument revealed that adults with stroke had considerably poorer trunk performance ratings than age-and gender-matched healthy people. (Verheyden, Nieuwboer, Feys, Thijs, Vaes, & De Weerdt, 2005). After a stroke, cross-sectional research found a strong link between trunk performance and measures of balance, gait, and functional capacity.(Verheyden, Vereeck, et al., 2006). Functioning depends on trunk control, which can also provide an early indicator of everyday activities(Hsieh et al., 2002; Sandin & Smith, n.d.).

According to Alhwoaimel, performing trunk exercises helps persons with acute, subacute, and chronic strokes execute their trunks more effectively(Alhwoaimel et al., 2019). The effectiveness of trunk stability training for improving trunk function, standing balance, and mobility in stroke patients has received considerable critical attention and was also studied by Haruyama et al. They discovered that post-stroke patients' trunk function, balance, and mobility were all improved with trunk stabilization training(Haruyama et al., 2017). In order to maintain postural stability and transfer weight to the lower extremities during standing, the lower trunk and hip muscles work in concert to stabilize the pelvis(Dalstra & Huiskes, 1995; Grimaldi, 2011a).

Several postural strategy exercises have been developed to assist stroke patients regain their balance(Jeon & Choi, n.d.). Ankle and hip strategy training in stroke patients has received considerable critical attention as studied by Park, Shinjun, which enhanced the forward, backward, paretic, and nonparetic side. Additionally, center of pressure movement performance improved with ankle and hip strategy training rather than only ankle strategy training (Park et al., 2019).

There is a surprising lack paucity of evidence-based literature describing the impact of training stroke patients with hip strategy training and combining trunk exercises that examine the patient's response in terms of independence, self-reliance, and balance. Hence the motivation to conduct a study in which given the importance of balance in the hip strategy, this study aimed to explore the effects of adding hip strategy training with trunk exercise to maximize independence level and balance to the patient with stroke.

1.1. statement of problem:

The study proposes to shed light on studying the effect of selective trunk exercises with hip strategy training in improving balance in patients with stroke as well as independence level among patients with stroke and share our experiences on our country as useful method.

1.2. Need for study:

There are different approaches for improving independence level and balance in hemiplegic patients. This study is designed to find out the effects of adding hip strategy training with trunk exercise to maximize independence level and balance to the patient with stroke. The goal of various therapeutic interventions for people with stroke is to enhance functional improvement. Given the importance of balance in the hip strategy, there is limited evidence in the literature. Despite the fact that this strategy is often implemented for patients with impaired balance under postural approaches So, it is necessary to shed light on explore the effect of trunk exercises with hip strategy training in improving independence level in patients with stroke as well as balance.

1.3. Aim and objective of the study:

1.3.1 Aim

This study aims to explore the effect of selective trunk exercises with hip strategy training in improving independence level in patients with stroke as well as balance.

1.3.2 Objectives

General objective:

To spotlight on Effects of selective trunk exercises with hip strategy training to maximize independence level and balance for patient with stroke.

Specific objectives:

-To find out effectiveness of selective trunk exercise with hip strategy training in improving balance in static and dynamic sitting among patients with stroke.

-To evaluate independence level after selective trunk exercises with hip strategy training among patient with stroke

-To evaluate the standing balance in static and dynamic following selective trunk exercise with hip strategy training and how balance is being controlled among stroke patients.

1.4. Hypothesis:

-Null hypothesis

There is no significant effect in selective trunk exercises with hip strategy training to improve independence level in patients with stroke as well as balance.

-Alternate hypothesis

There is a significant effect in effect in selective trunk exercises with hip strategy training to improve independence level in patients with stroke as well as balance.

CHAPTER II

LITERATURE REVIEW

2.1. Term stroke:

The unexpected emergence of symptoms was ascribed to a "stroke of God's hande" in 1599".(Clarke, 1963) It was not recognized into medical nomenclature at the time, therefore doctors used the word apoplexy, a diagnosis that dates back to Hippocratic literature.(Pound et al., 1997) Despite the fact that name "stroke" is derived from the Greek word "apoplexia," which suggests a deadly blow, drawing straight analogies between our current understanding of stroke and what was originally known as apoplexy would be inaccurate. (Schutta & Howe, 2006)

The World Health Organization defined stroke in 1970 as "rapidly acquired clinical symptoms of focal (or global) impairment of brain function, lasting more than 24 hours or leading to death, with no evident cause other than vascular origin," according to the World Health Organization.(Aho et al., 1980b) Despite its widespread use, the World Health Organization definition has significant changes in the "nature, timing, clinical detection of stroke and its mimics, and imaging results that necessitate an updated definition," according to the American Heart Association and American Stroke Association, have considered the previous definition useless (Sacco et al., 2013).

Stroke is defined as a cerebral vascular accident (CPA) that has radiological or clinical signs of hemorrhage or ischemia(Esenwa & Gutierrez, 2015). It is characterized by the narrowing or blocking of blood arteries. Brain clots are serious because they block off blood flow and cause blood vessels to burst, resulting in bleeding. When a CVA occurs, blood vessels in the brain burst, cutting off oxygen supply and damaging brain cells(Kuriakose & Xiao, 2020).

2.2. Incidence and prevalence of stroke

2.2.1. Stroke Statistics in USA

Stroke is the leading cause of long-term adult impairment and the fifth leading cause of death in the United States, with approximately 795,000 incidences annually. While stroke mortality in the United States has decreased over the past two decades, recent mortality patterns indicate that these declines may have stalled, and stroke death may be on the rise again. The reasons for this are unknown, but they might be related to the obesity pandemic and diabetes that it has spawned.(Katan & Luft, 2018) Stroke morbidity is high, with annual expenses of $34 billion for healthcare, pharmaceuticals, and lost workdays. Furthermore, estimates of morbidity and cost burden based on clinical stroke research and traditional metrics such as physical impairment and healthcare expenses are likely to underestimate the impact of cerebrovascular illness. Subclinical cerebrovascular illness, such as "silent infarction" discovered on brain imaging in up to 28% of the population over 65, and ischemic white matter disease, is becoming recognized as a cause of memory loss, dementia, gait impairment, and other functional impairments.(Vermeer et al., 2007)

Nearly 800,000 Americans have a stroke each year. This condition has a mortality rate of 45.2 per 100,000 people, making it the fifth- highest cause of death. In 2009, 34% of people hospitalized for a stroke were under the age of 65. According to the National Institute of Neurological Disorders and Stroke, 160,000 individuals in the United States die each year from stroke-related causes.(D'Agostino, 2021) According to the CDC, nearly 3% of individuals (7.8 million) have ever experienced a stroke, and stroke was the major diagnosis for 2.2 million physician office visits and 492,000 emergency department (ED) visits in 2018. In 2017, 3.2 percent of chronic diseases identified during ED visits were cerebrovascular disease and a history of stroke or transient ischemic attack (TIA).(NIH, 2019)

2.2.2. Stroke Statistics in Saudi Arabia:

Stroke causes functional incapacity and long-term brain damage, as well as a high death rate across the world.(Asirvatham Alwin & Marwan Mohamed, 2014) Despite the fact that the number and variety of stroke cases continue to increase due to an aging population, the incidence of stroke is declining in many affluent nations as a result of improved risk factor management .(Lackland & Weber, 2015) The Kingdom of Saudi Arabia is dealing with a high burden of stroke due to an increasing incidence rate, with fatality rates expected to almost treble by 2030. (Asirvatham Alwin & Marwan Mohamed, 2014)

The Kingdom of Saudi Arabia, which accounts for almost 80% of the Arabian Peninsula's land area, is the largest nation in the Middle East. (Lackland & Webe 2015 ; Asirvatham Alwin & Marwan Mohamed, 2014) It has a population of more than 32 million people, with around 63 percent of the population being Saudis and the rest being working-age immigrants from Pakistan, India, Bangladesh, and the Philippines. (Al-Senani et al., 2020) moreover the Kingdom of Saudi Arabia is a high-income nation with a GDP per capita of USD 5,211, just 4.7 percent of its GDP is spent on health care, which is substantially lower than many other wealthy countries.(Asirvatham Alwin & Marwan Mohamed, 2014; Al-Senani et al., 2020)

According to World Health Organization data, stroke is the second leading cause of death in Saudi Arabia .(Al-Senani et al., 2020) Stroke survivors are frequently left with severe physical and mental problems, adding to family, communal, and economic obligations in the United States.(Asirvatham Alwin & Marwan Mohamed, 2014) Despite these facts, prior research has revealed a concerningly low level of stroke awareness in the public, which is exacerbated by the absence of data on stroke in the Kingdom of Saudi Arabia.(Alzahrani et al., (2019); AlAqeel et al., (2012); Alhijji et al., (2018).

The incidence and frequency of stroke in the Kingdom of Saudi Arabia are comparatively low when compared to other industrialized nations such as the United States and the United Kingdom, owing to the KSA's youthful population .(Asirvatham Alwin & Marwan Mohamed, 2014) According to many researches, there is a considerable gap in stroke incidence in the KSA.(Al Rajeh et al., 1993); (Al-Rajeh et al., 1998); (Ayoola et al., 2003); (Almekhlafi, 2016); (Alhazzani et al., 2018) It's possible that inconsistencies in the provision of health-care services in the Kingdom of Saudi Arabia, particularly between the commercial and public sectors, are contributing to the disparities.(Alahmari & Paul, 2016) Although the data show a decline in the incidence at one point in time, more recent studies show that the incidence of stroke in the Kingdom of Saudi Arabia is increasing, with no decrease in all mortalities or permanent disabilities, especially in heavily populated and more modernized areas such as Qunfuthah (Makkah province), Al Hasa (the eastern province), Jizan (Jizan province), and Qassim (Jizan province).(Akbar & Mushtaq, 2001)

Authors and study year	Total population incidence rate per 100,000 person-years
(al Rajeh et al., 1993) – 1993	43.80
(Al-Rajeh et al., 1998) – 1998	29.80
(Ayoola et al., 2003) – 2003	15.90
(Almekhlafi, 2016) – 2016	30.00
(Alhazzani et al., 2018) – 2018	57.64

Table 1: incidence of stroke in KSA

2.3. Causes And Types:

The two most prevalent forms of stroke are ischemic and hemorrhagic. Hemorrhagic strokes are less common than ischemic ones, yet both are serious health problems. Both the brain's parenchyma and the subarachnoid space might be affected by a hemorrhagic stroke. Strokes are classified further according to their presumed etiology, or "etiologic subtypes," which include cardioembolic, atherosclerotic, lacunar, and other causes (dissections, vasculitis, certain genetic disorders, and others) .(Avan et al., 2019)

Some research suggests that developing countries, where hypertension-related disorders are more common, also experience a higher incidence of hemorrhagic stroke than ischemic stroke. As hypertension has been better detected and treated in those countries, sometimes in conjunction with an increase in western-style diets, the incidence of hemorrhagic strokes has reduced, but the incidence of ischemic strokes and cardiovascular disease in general has grown. Studies of stroke in Beijing, China, during a very short period during that city's rapid economic expansion, depict this pattern of epidemiologic change from hypertensive hemorrhagic to ischemic strokes and the associated risk factors very well. (Zhao et al., 2008) For example, between 1984 and 2004, the incidence of hemorrhagic stroke decreased by 1.7 percent each year, but the incidence of ischemic stroke grew by 8.7%. Furthermore, the proportion of fatalities caused by cerebrovascular illness decreased, but the proportion of deaths caused by ischemic heart disease increased.

2.4. Risk Factors:

Different types of strokes make it more challenging to identify risk factors than it is for myocardial infarction, which is nearly always caused by large vessel atherosclerotic disease affecting the coronary arteries. Ischemic strokes account for 87% of all strokes, while hemorrhagic strokes account for 13%, with the majority (75%) being first-time occurrences. Among those who make a full recovery from their first stroke, 33.3% will suffer another stroke within two years, 25% within five years, and 3% within thirty days. Age is a major risk factor for developing a stroke, and men are more likely to experience a stroke than women are at any age between 55 and 84 (22.3 (From 3% in the 55-59 age group to 23.9 percent in the 80-84 age group). The gender difference is at its widest between the ages of 55 and 69, when it stands at 96.6%, and at its narrowest between the ages of 80 and 84, when it is at 16.1%. (Donkor, 2018).

Stroke can be either hemorrhagic or ischemic, with significant differences in risk factors between the two. There is strong evidence that hypertension increases the risk of both ischemic and hemorrhagic strokes. Conversely, hyperlipidemia is a key risk factor for atherosclerosis of the extracranial and intracranial blood vessels, as well as coronary atherosclerosis, which is the leading cause of strokes. Atrial fibrillation has been associated to a higher risk of stroke caused by a clot-induced cardioembolic.(Tirschwell et al., 2004).

It is essential to identify modifiable risk factors and demonstrate the effectiveness of risk reduction methods to minimize the effects of stroke on society. Stroke risk factors include both those that can be changed (such as dietary choices) and those that cannot (e.g., age, race). Stroke risk factors can be classified as either short-term (such as viral events, sepsis, or stress) or long-term (such as hypertension or hyperlipidemia) (e.g., sex, race). There is a good chance that the risk factors for stroke in younger people are different from those in older persons.(Johnston et al., 2009)

Stroke prevention involves changing one or more risk factors at the population, community, or individual level. However, anti-platelets may be used to minimize the risk of ischemic stroke in high-risk individuals rather than targeting a single risk factor. Three methods prevent stroke: Primordial prevention is the most generalizable and relates to healthy-living approaches that, when practiced in a group, aim to reduce physiologic stroke risk factors in the community; 2) primary prevention, which improves the risk factor profile of persons who have never had a stroke or transient ischemic attack TIA to prevent a first cerebrovascular event; and 3) secondary prevention, which is most targeted and only utilized after a stroke or TIA to prevent recurrence. (Weintraub et al., 2011) Primitive stroke preventive measures include initiatives that encourage avoiding smoking, dietary adequately, increasing physical activity, and maintaining a healthy body weight. Both primary and secondary stroke prevention strategies center on reducing behavioral and medical risk factors, such as high blood pressure and diabetes, that put an individual at a higher risk of having a stroke.

2.5. Stroke And Disabilities:

When referring to the leading cause of disability in western countries, the term "stroke" is used to describe a group of diseases that present with sudden onset and cause neurological damage(Gagliardi et al., 2005; Roger et al., 2012; Rosamond et al., 2008). The most frequent cause of elderly people's disability or dependence on activities of daily living (ADL) is stroke(Stineman et al., 1997). Different theoretical frameworks were developed to shed light on the interplay between impairment, disability, and the need for support programs. There was research done that compared several of these models. Alves et al. described disability as an ongoing process that includes physiological, psychological, and social impairments. One component of this is the concept of “functional disability” which is used as a measure of impairment based on how well an individual can physically carry out routine daily tasks. (Alves & Oswaldo Cruz, n.d.; Nagi, 1976).

The most prevalent impairments and the basis of the ensuing degree of physical disability are sensory and motor deficiencies arising from neurological injury, such as paralysis, decreased balance, or spasticity(Seitz & Donnan, 2015b). Furthermore, around 80% of the survivors have motor issues in their upper extremities, which affects their ability to carry out daily tasks, their contribution to the community, and their health-related quality of life (HRQoL)(Bosomworth et al., 2021; Duncan Millar et al., 2019; Schnabel et al., 2021). Patients with stroke frequently have spasticity, weakness, and loss of equilibrium on the affected side, which makes it difficult for them to maintain proper postural alignment.(Pathak et al., 2014b).

On the other hand, more than 85 percent of stroke patients develop hemiplegia immediately after a stroke, and between 55 and 75 percent of stroke survivors suffer lifelong impairments, such as mobility abnormalities, that diminish their quality of life (Nichols-Larsen et al., 2005).Patients with hemiplegia induced by a stroke suffer from sensory problems and a diminished capacity to maintain balance. In the standing position, they tend to place less weight on the paretic leg, resulting in an asymmetric posture that negatively impacts their activities of daily life, gait, and movement(Shumway-Cook & Woollacott, 2000). Additionally, shifts in body alignment occur, necessitating the implementation of therapeutic modalities aimed at enhancing postural control and weight-bearing symmetry(Cano-Mañas et al., 2020; Tessem et al., 2007; Tyson et al., 2006).

2.6. Stoke Recovery Stages:

Recovery assessment after a stroke is essential for therapeutic and scientific objectives. Some stroke patients, for instance, make remarkable recoveries in motor function during the first few months after the stroke. However, it is not possible to estimate the pace of motor recovery in the subacute period with reference to the patient's starting state, despite the fact that the degree of paralysis is a main predictor. Sixty-five percent or more of patients with initial motor impairments have improvement in lower motor function, while the likelihood of normal recovery in the upper limbs is very low (15% or less). Clinical recovery after stroke is quick in the first few weeks after the event but subsequently slows down significantly between the first and third months afterwards (Benjamin et al., 2017) . Neuroplasticity caused by rehabilitative therapy is limited in patients with chronic stroke.(R. Chen et al., 2002), This is especially true for those individuals who did not make the most of the opportunities presented during the subacute stage of the illness because brain plasticity is preserved during both the acute and subacute stages.(Hara, 2015; Su & Xu, 2020).

Recent systematic review(Peng et al., 2021) conduct the virtual reality provides significant motor improvement compared to pre-intervention levels in patients with subacute stroke. Slight to moderate gains in motor function were observed, but these were not statistically significant when compared to those seen with conventional therapy. As a result, virtual reality can supplement traditional treatment to improve patients' motor skills. Furthermore, recovery of neurological damage and disability exhibits a nonlinear pattern as a function of time, according to the findings of all longitudinal investigations with repeated measurements(Duncan et al., n.d.; Loewen & Anderson, n.d.; Nakayama et al., 1994; Nishimura et al., 2007; Sunderland et al., 1989; Wade et al., 1983).

Often, the time following a stroke is separated into phases. It was proposed by the Stroke Roundtable Consortium that the first 24 hours be considered the hyperacute period, the next 7 days the acute phase, the first 3 months the early subacute phase, the next 4-6 months the late subacute phase, and the years after the stroke the chronic phase.(Bernhardt et al., n.d.).This distinction is justified by the fact that recovery-related processes and post-stroke symptoms vary with time. Within hours of brain ischemia beginning, a series of plasticity-enhancing mechanisms trigger dendritic growth, axonal sprouting, and the development of new neurons synapses(Kitagawa, 2007; Thomas Carmichael et al., 2001). Additionally, the most dramatic improvements happen in the first few weeks following a stroke, frequently reaching a relative plateau after three months and then recovering less significantly, especially in terms of motor symptoms(Kwakkel et al., 2003).

After six months, spontaneous restoration typically reaches its limit, resulting in a relatively persistent, i.e., chronic impairment. Nevertheless, with training or other interventions, some stroke-induced deficiencies can be improved even in the chronic phase, particularly in cognitive areas such as language(Cramer, 2008).A recent study in 2015(K. B. Lee et al., 2015) studied how recovery in functional impairments (activities of daily living and gait) and neurologic impairments (trunk control, motor function, sensory, and cognitive function) developed over time from the initiation of rehabilitation to six months following a stroke. Clinical recovery is also rather quick in the first few weeks following a stroke, but it considerably slows between the first and third months. Between 3 and 6 months after a stroke, recovery slows so significantly that it is barely detectable, yet there still seems to be an overall effect toward some greater recovery during this time. (Duncan and Lai, 1997).

Two phenomena have been proposed as significant elements in motor recovery after stroke. To begin, a significant majority of patients (2/3) demonstrate a natural improvement of 70% of their initial disability. This recovery is aided by essential mechanisms of intrinsic neural plasticity (spontaneous biological recovery), which could be a crucial target for future therapeutics. The remaining patients (1/3) recover at a far slower natural (proportional) rate and are classified as non-fitters in this study(Stinear et al., 2017; Winters et al., 2015).Immobility after a stroke may have major health repercussions, but quick rehabilitation can reduce or eliminate them. Many recommendations recommend commencing rehabilitation quickly after a stroke, despite a lack of evidence (Yagi, Yasunaga et al. 2017).

When to start rehabilitation and at what intensity should be considered. Multiple studies suggest that early post-stroke therapy results in the best outcomes. According to a meta-analysis, early rehabilitation improves outcomes (Cumming, Thrift et al. 2011). Inconsistent research has compared early vs. delayed rehabilitation. Recent randomized controlled studies indicated that early rehabilitation within 24 hours was viable, safe, and improved walking recovery (Bernhardt, English et al. 2015)

2.7. Stroke And Rehabilitation Approaches:

The availability of randomized controlled studies of rehabilitation in the first two weeks following a stroke is low. Very early mobilization has been the subject of mixed results, with one small experiment finding benefit and two larger ones finding possible damage for patients who were mobilized within the first 24 hours following stroke. Constraint-induced mobility treatment seems to be beneficial for the upper extremity if begun within 2 weeks after stroke onset. Non-invasive brain stimulation during the acute phase has seen little to no convincing research. There is conflicting data about the effectiveness of rigorous early treatment for people with severe aphasia. Promising results have been shown with the use of mirror therapy shortly after a stroke in the treatment of neglect. Early treatment of stroke-related dysphagia using novel techniques shows promise, but their efficacy is hard to measure because of the high incidence of spontaneous improvement (Stinear, Ackerley et al. 2013; Coleman, Moudgal et al. 2017).

Although there is no consensus on when to start rehabilitation after a stroke, there is growing evidence that doing so within the first two weeks is useful for at least certain impairments. There is also concern that rushing into extensive treatment during the first 24 hours might have negative consequences (Krakauer, Carmichael et al. 2012).Long believed that the brain's hardware is "hard" and that after a stroke, structures and functions are gone permanently. Clinically, rehabilitation training improves functional recovery. The definition of rehabilitation is "the process of restoring an individual to maximum and optimal functioning in one or more of the physical, intellectual, psychological, or social domains." Along with a greater comprehension of clinical recovery, its neurological foundation has also been better understood(Kolb, 2003; Nudo, 2006).

Given that rehabilitation is a labor-intensive and expensive intervention, determining its therapeutic efficacy is of the utmost concern. Although some studies have demonstrated the benefits of rehabilitation(Aisen et al., 1996; Carey et al., 1988; Dodds et al., 1993; Freeman et al., 1997; Greenspun et al., 1987; Kidd et al., 1995). The purpose of rehabilitation is to improve a patient's life in a variety of ways, such as their disability, their handicap, and their quality of life; ideally, all of these should be included in the evaluation of the patient's progress(Gompertz et al., 1993). Despite a tendency toward using patient- and quality-of-life-based outcome measures, many researchers and practitioners still rely on observer-rated general measures of impairment(Patrick & Deyo, 1989). Because self-care and mobility are seen as foundational to better levels of functioning, it stands to reason that improvements in disability are likely to have a significant impact on a person's level of handicap and health-related quality of life(Keith et al., 1987).

Skillful usage promotes neuronal repair, it has also shown cortical motor map remodeling in animals after arm and hand training, suggesting comparable neuroplastic pathways in motor learning(Harvey, 2003; Nudo et al., 1996; Nudo & Milliken, 1996). Synaptic strengthening and activity-dependent rewiring are examples of plasticity processes. Understanding how to effectively engage and adjust surviving neural networks to provide innovative response methods for wounded tissue is crucial for enhancing stroke recovery.(Murphy & Corbett, 2009). Post-stroke rehabilitation is to help stroke survivors recover to premorbid functioning in their family, community, and job environments. Inpatient or outpatient rehabilitation is available(Whitehead & Baalbergen, 2019). An interdisciplinary team usually comprises nurses, medical practitioners, physiotherapists, occupational therapists, speech and language therapists, social workers, and dietitians with rehabilitation experience. Depending on the patient's needs, the rehabilitation team may include a psychologist or trauma counselor. Team and patient communication enables a comprehensive program.(Jessup, 2007).

In the majority of nations, physical therapy is a standard component of stroke recovery, and various guidelines suggest that all stroke patients undertake physical therapy (Paediatric Stroke Working Group, 2004). Rehabilitation that begins soon after a stroke has been found to help reduce complications and post-stroke functional deficits. A reduction in functional impairment, as well as a lower incidence of comorbidities, leads to improved quality of life for stroke survivors and lower long-term care expenses.(Brewer et al., 2013,;Duncan et al., 2005b)

2.8. Trunk anatomy, physiology, and biomechanics:

The trunk of the human body houses the pectoral muscles, intercostal muscles, abdominal muscles, pelvic muscles, and back muscles. These muscle groups provide proper posture when seated or standing (Bordoni, Sugumar et al. 2018). In turn, the trunk is an anatomical term for the central part, or core, of the body. is usually divided into the thoracic segment, also known as the" upper trunk" the abdominal segment, also known as the "mid-section", and the pelvic and perineal segments sometimes known together with the abdomen as the lower trunk .Functional motions rely heavily on this region, and an injury tendency can be the result of insufficient core muscle development .The major muscles of the core reside in the belly and the mid and lower back (not the shoulders), and peripherally include the hips.(Karageanes & Faoasm, 2005). The spine, hips, and pelvis, proximal lower limbs, and abdominal structures comprise the musculoskeletal core of the body. The muscles of the trunk and pelvis comprise the core musculature, which is responsible for the stability of the spine and pelvis as well as the creation and transmission of energy from large to small body parts during numerous activities (Faigenbaum.A.D, 2008; Putnam, 1993).

Core musculature is comprised of the diaphragm as the floor, the abdominal muscles as the walls, the paraspinals and gluteal as the roof, and the pelvic and hip girdle musculature as the bottom.(Shinkle et al., 2012). Since there is no agreed-upon definition of "core stability," we'll stick with a broad one here. The ability to maintain control of the trunk in relation to the pelvis and legs during activities involving a continuous motion of the kinetic chain is referred to as core stability. Past studies have shown that the central nervous system transmits along to contract the multifidus and abdominal muscles before activating the lower limb's prime mover, all in an effort to maintain spinal stability. The transverse abdominis muscle is the second skeletal muscle to activate during leg movement, succeeding the obliques, after the body has shifted weight from one side to the other.(Hodges & Richardson, 1997).Core stability demands three-dimensional trunk control. Muscles may be recruited in ways other than their core functions to give stability in all planes. Quadratus lumborum (QL) stabilizes frontal plane flexion and extension. The QL attaches to the iliac crests from the spine's transverse processes and the 12th rib. This orientation allows QL activity during flexion, extension, and lateral bending to buffer spine shearing in the plane of movement, making it more than a frontal plane stabilizing muscle(Sevens et al., 2006).

2.9. Importance trunk muscle:

The trunk's role in keeping the pelvis and spine in place cannot be overestimated. When performing practical tasks, the trunk muscles are crucial for maintaining stability and walking motion. (Behm et al., 2010; Farley & Koshland, 2000; Kibler et al., 2006) .Furthermore, the trunk must be stable for the spine and pelvis to remain in a neutral position, for movement to be efficient, for strength to be increased, for muscle control to be maintained, and for balance to be preserved.(Richardson et al., 2002). Additionally ,motor control in the trunk is essential for distal limb mobility and is linked to functional actions.(Verheyden, Nieuwboer, et al., 2006). During distal limb motions and unanticipated disturbances, the instability is mitigated by intentional contraction of trunk muscles. These muscles also contribute to the proper spatial alignment of the trunk for movement.(Karatas et al., 2004; Kim et al., 2014; PW & CA, 1997).The trunk balances the movements of the extremities. It is possible to make selected movements around the body's circumference if it functions properly. It is significant that the trunk is both stable and dynamic, as only then can selective movement occur.(P. Hodges et al., 2002).

Lee et al. evaluated the impact of breathing exercises on trunk control under the presumption that the respiratory system's use of the trunk muscles is significant.(D.-K. Lee & Kim, 2018). As well as functioning depends on trunk control, can also serve as an early indicator of everyday activities.(C. L. Hsieh et al., 2002; Sandin & Smith, n.d.)In turn, weight shifting requires selective trunk motions, and maintaining an upright stance requires keeping one's center of gravity within their supporting structure. (Ryerson et al., 2008).According to Verheyden et al, good trunk performance is essential for carrying out fundamental actions like sitting, standing, and walking because trunk muscles maintain proximal body segments during voluntary movements of the extremities.(Verheyden et al., 2006).

2.10. Trunk impairment in stroke:

Following a stroke, patients experience spasticity, cognitive dysfunction, decreased balance (Tyson et al., 2006; Weerdesteyn et al., 2008) and sensorimotor deficits(Oliveira et al., 2011), as well as diminished strength in trunk muscles(Dickstein et al., 2004b; Tanaka et al., 1998) .These patients are more prone to falling to the paretic side and have limited functional capabilities(Batchelor et al., 2010). Most physical functions require sufficient balance to be performed. Trunk control is essential to keep a body position, to remain steady when changing positions, to execute daily activities, and to motion.(R. W. Bohannon, 1992) Stroke patients have a "limit of stability," which is the farthest they can shift their gravitational center without losing their equilibrium.(Geiger et al., 2001). Patients with hemiplegia have impaired balance(Liston & Brouwer, 1996a), Those with hemiplegia may be unable to shift their center of gravity as far in any direction before losing their balance, a measure known as their "limits of stability." (Geiger et al., 2001). Despite this, motor control of the trunk is impaired in people who have had a stroke, particularly in the frontal plane. They can't keep their weight equally distributed between their feet because of trunk muscle weakening and loss of trunk motor control.(Chou et al., 2003; de Haart et al., 2004).

Functional recovery can be predicted by how well a person maintains their balance while seated, and the trunk muscles play a crucial part in this task because sitting results in a lower center of mass than standing does. (Van de Port et al., 2006). Kim et al. reported that in stroke patients, trunk muscle activation during a reaching task is highly correlated with both trunk control and balance. (Kim et al., 2015) on the other hand, during standing, weight shifting, and sustaining static and dynamic postures, the trunk muscles are involved in selected motions to maintain the center of gravity as the basis of support(Verheyden et al., 2004).

In contrast, normal balance requires having a balanced body mass distribution (postural symmetry) and transferring weight according to task needs.(Goldie et al., 1989; Nichols et al., 1996) This capability is frequently impaired in stroke patients. They frequently exhibit increased sway in their posture as well as an impaired capacity for weight shifting and poor dynamic stability (Badke & Duncan, 1983; Dettmann et al., 1987; Goldie et al., 1996; Horak et al., 1984; Shumway-Cook et al., 1988; Tessem et al., 2007).onto the paretic lower extremity while seated and standing (Dickstein et al., 1984; Goldie et al., 1996; Hacmon et al., 2012; Mizrahi et al., 1989; Nichols, 1997).These effects can make living independently difficult(Shumway-Cook et al., 2007) Balance, synchronization of movement patterns, especially trunk control, and stability all depend on elaborate pyramidal and extrapyramidal systems that are frequently impaired by stroke(Adams et al., 2001). Trunk movement impairment is related to impaired balance (51%), decreased walking speed (27%), and impaired functional mobility (44%)(Verheyden et al., 2006).

A healthy person's trunk muscles are often involved in regulating initial posture and are recruited before the movement of the upper and lower limbs. However, it is recognized that in stroke patients, the activation of the trunk muscles is delayed because the muscles responsible for reaching the arm are engaged earlier than the trunk muscles.(Dickstein et al., 2000) In contrast to the limb muscles, the innervation of the trunk muscles comes from both cerebral hemispheres(Brinkman & Kuypers, 1972; Carr et al., 1994; Taoka et al., 1998; Wilson & Harrison, 1991). As a result, a unilateral stroke could possibly impair trunk muscle function on both the contralateral and ipsilateral sides of the body(R. W. Bohannon, 1992, 1995; R. w. Bohannon et al., 1995; Tanaka et al., 1997, 1998).

When compared to matched controls, stroke patients' trunk muscle strength was found to be significantly reduced for both forward flexion and lateral flexion on the affected and unaffected sides. This was determined using a hand-held dynamometer(R. w. Bohannon et al., 1995).Using a clinical measurement tool, studies determined that stroke patients had considerably lower trunk performance ratings than age- and gender-matched healthy persons(Verheyden et al., 2005).

There is strong evidence that trunk performance is a significant predictor of functional prognosis following stroke(Duarte et al., 2002; Franchignoni et al., 1997; C. L. Hsieh et al., 2002). A correlation between trunk performance and measures of balance, gait, and functional ability after stroke was demonstrated by a cross-sectional study(Verheyden, Nieuwboer, et al., 2006). on the other hand, Previous research has demonstrated that static balance correlates strongly with hospital duration of stay, locomotor function, and functional ability following stroke(R. W. Bohannon & Leary, 1995; Brosseau et al., 1996; Franchignoni et al., 1997; Juneja et al., 1998; Prescott et al., 1982; Sandin & Smith, 1990; Wade & Hewer, 1987). In addition, a recent systematic review found that stroke patients walk with greater mediolateral and anteroposterior trunk movements, greater in-phase coordination, and greater instability and asymmetry than healthy persons(van Criekinge et al., 2017).

When it comes to the activities of daily living a critical aspect of performing ADL is trunk control(Hewer, 1987). Some studies found that trunk control or sitting balance at an early stage could predict ADL outcome at a later stage in patients with a stroke(Franchignoni et al., 1997; Loewen & Anderson, n.d.; Sandin & Smith, 1990; Wade & Hewer, 1987). Stroke patients may have trouble maintaining their position and performing daily tasks independently due to impaired trunk mobility and muscle weakness. Consequently, training to restore other functions should precede training to recover trunk control(Jang & Kim, 2016; J. Song & Kim, 2010).

2.11. Trunk training with stroke patients:

This increased focus on trunk rehabilitation in recent years has led to a massive increase in scientific literature. Several research emphasize on training interventions in stroke patients have concentrated on strengthening trunk motor control(Howe et al., 2005; Saeys et al., 2012; Verheyden et al., 2007).trunk control defined as the ability of the trunk muscles to maintain an upright position, redistribute weight, and move selectively to maintain the center of gravity over the base of support(Karthikbabu, Solomon, et al., 2011a).

A RECENT META-ANALYSIS demonstrated that trunk rehabilitation in stroke patients is an excellent method for enhancing trunk control and sitting balance, as well as standing balance and mobility(van Criekinge et al., 2020) . One study investigated functional independence in the early acute period following a stroke; it was found to be positively correlated with trunk impairment levels, followed by upper extremity impairment levels, but not lower extremity impairment levels(Likhi et al., 2013)**.** As trunk impairments during walking may be compensatory to lower limb deficits or related to intrinsic trunk deficits, improvement of mobility may be the result of decreased lower limb compensatory movements and/or increased trunk motion(Corbett et al., 2017; van Criekinge et al., 2017).

Stroke therapy aims to restore walking and balance. Find out whether subacute stroke patients may restore trunk control by completing activities on unstable surfaces. One-to-six-year-olds who experienced their first stroke were randomly allocated to an upper limb exercise group or a trunk exercise group. After training, the experimental group improved on the Trunk Impairment Scale and 6-meter walking time. (Lee, Huang et al. 2020).Training strategies for improving seated balance include pelvic tilt or bridging, weight-shifting, and trunk stability exercises using the arms and legs(Verheyden et al., 2009). During a sitting shoulder or hip flexion exercise, the trunk muscles contract to combat postural sway(Dickstein et al., 2004a). and the capacity to control trunk alignment is essential to compensate for center of mass shifts during weight-shifting activities(Lanzetta et al., 2004).The most important exercises for trunk stabilization are pelvic tilt, quadruped, abdominal hollowing, and bridging exercise(Hubley-Kozey & Vezina, 2002). Even though several studies have been conducted on the effects of bridging exercise in different positions on how the trunk muscles work and how the activity ratio between global and local muscles changes(Arokoski et al., 2004; Marshall & Murphy, 2005; Stevens et al., 2006).

A SYSTEMATIC REVIEW AND META-ANALYSIS were conducted by Alhwoaimel N, to assess the impact of trunk training on trunk performance following a stroke, as well as to see if these activities enhance upper-limb function. The researchers looked at 17 trials with a total of 599 individuals. Trunk exercises had a strong and significant effect on trunk function after stroke, according to a meta-analysis. This impact ranged from extremely strong in acute stroke to moderate in subacute and chronic stroke. The impact of trunk training on upper limb disability or functional activity was not measured in any of the research examined(Alhwoaimel et al., 2019).In turn, Haruyama et al. studied the impact of trunk stabilization training on stroke patients' trunk function, standing balance, and mobility. They discovered that trunk stability training improved post-stroke patients' trunk function, balance in standing positions, and mobility(Haruyama et al., 2017).

A SYSTEMATIC REVIEW was conducted in 2013 investigated the benefits of targeted trunk exercise programming on trunk impairment. The results of 11 randomized controlled trials (RCTs) included in the systematic review revealed that there was moderate evidence for using stable and unstable surface trunk training exercises to improve dynamic sitting, balance, and trunk performance in subacute and chronic stroke patients(Cabanas-Valdés et al., 2013).

Kim discovered that trunk stabilization exercises using proprioceptive neuromuscular facilitation (PNF) are useful in enhancing stroke patients' ability to perform daily tasks(B. H. Kim et al., 2012).Furthermore, Dean demonstrated that reaching while sitting efficiently improves sitting balance(Dean & Shepherd, 1997).

Selective trunk muscle training is relevant to clinical practice for stroke patients. RANDOMIZED RESEARCH that adding 10 hours of additional trunk exercises to conventional rehabilitation improved trunk control, particularly dynamic sitting postural control, in subacute stroke patients.(Verheyden et al., 2009) Mudie et al. discovered that enhancing the patient's awareness of trunk motion can enhance sitting weight symmetry in sub-acute stroke patients(Mudie et al., 2002).Therefore, improvement in trunk motor control can enhance balance and performance in daily activities.(Verheyden et al., 2009; Verheyden, Nieuwboer, et al., 2006). To provide some context, impairments to the trunk may cause problems with motor control, balance, and walking.

Performing core stability exercises, also known as CSE, is an effective way to enhance local strength in the trunk, as well as balance and gait. Procedures and investigations: This are a MULTICENTER RANDOMIZED CONTROLLED EXPERIMENT with a single blind investigator. The primary outcome measures are dynamic sitting and the Brunel Balance Assessment. Secondary outcomes include standing balance and risk of fallinf, gait speed and quality of life. The average length of the study for each participant is 29 weeks (a five-week intervention, followed by a 24-week post-intervention).(Cabanas-Valdés, Boix-Sala et al. 2021).

Few studies have studied the effectiveness of core stability exercises in stroke patients, despite their relevance for standing balance, mobility, and functional outcome. This research aims to assess whether core stability training improves stroke patients' trunk function, standing balance, and mobility. 32 stroke rehab patients were distributed equally (n = 16) between the experimental and control groups. The experimental group spent 400 minutes on core stability exercises, while the control group conducted their normal workouts. The experimental group improved on the dynamic balance subscale and total TIS score (P =.002 and P.001, respectively) and pelvic tilt active range of motion (P.001). (Koshiro, Michiyuki et al. 2016; Haruyama, Kawakami et al. 2017).

Strong connections between measures of balance, gait, and functional capacity underscore the need of trunk rehabilitation(Verheyden, Nieuwboer, et al., 2006). Control of the trunk has been established as a key predictor of post-stroke activities of daily living(Tsuji et al., 2003). The Functional Independence Measure and gait speed are correlated with trunk muscle activation. The lower or upper extremity was the focus of the majority of earlier investigations on performance after stroke(J. H. van der Lee et al., 2001; van Peppen et al., 2004). Trunk recovery is a relatively understudied aspect of stroke rehabilitation research when compared to limb rehabilitation. However, one study by Hsieh et .al, reports that the results of this study show that trunk control is a strong predictor of ADL performance after a stroke. The findings highlight the importance of prioritizing early assessment and management of trunk control following stroke.(C.-L. Hsieh et al., 2002).

2.12. Trunk and its relationship with hip:

When standing, pelvic stability, postural stability, and load transmission to the lower extremities all benefit from the coordinated activity of the lower trunk and hip muscles.(Dalstra & Huiskes, 1995; Grimaldi, 2011b)on the other hand, one way the human body moves is by rotating individual body parts around their ends or their longitudinal axes. Any translational movement of a body part is due to a pair of counteracting rotations.(Plagenhoef et al., 1983).The trunk of a human body houses the pectoral muscles, intercostal muscles, abdominal muscles, pelvic muscles, and back muscles. These muscle groups provide proper posture when seated or standing (Bordoni, Sugumar et al. 2018).Due to the fact that the trunk makes up around 50% of an individual's total body mass, even minor changes in its position could have a big impact on forces across the knee joint, hip and knee muscle demand, and overall body mass.(Plagenhoef et al., 1983). Additionally, the hip can be impacted by the trunk, and it has been determined that many abnormal knee motions have their proximal origin in the hip.(Kulas et al., 2008; Sheehan et al., 2012).

In a recent CROSS-SECTIONAL investigation, it was discovered that poor trunk control and lower extremity recovery are connected to pelvic instability in chronic stroke patients(Karthikbabu et al., 2017)The body's weight is supported by and transferred to the lower limbs through the pelvis, a crucial structure that connects the trunk to the lower extremities. Additionally, when a person is seated, the pelvis is a functional element of the lower trunk, whereas when they are standing or walking, the pelvis is a part of the lower limb. Pelvic stability is defined as the ability of the lower trunk and proximal hip muscles to coordinate their activity during functional balance and mobility tasks in which the pelvis offers the proximal dynamic stability to allow for successful lower limb mobility.(D. Lee, 2004)

The altered pelvic alignment in the standing posture caused by impaired lower trunk control following a stroke will positively affect the patient's balance, walking, and functional performance. (Verheyden, Nieuwboer, et al., 2006). In addition, it was discovered that pelvic malalignment, notably severe lateral and anterior pelvic tilt, affects the standing weight-bearing symmetry between the feet of stroke patients. (Karthikbabu et al., 2016)Inadequate lower trunk control and pelvic instability may permit increased lateral pelvic displacement towards the least impaired side and diminished vertical movement on the most affected side during post-stroke walking.(Tyson, 1999). The hip muscles, specifically the extensors and adductors, are the weakest in patients with a chronic stroke, and this weakness is associated with poorer gait symmetry.(Dorsch et al., 2016).

Reduced swing phase gait speed is a direct result of impaired movement control of ipsilateral side hip and knee flexion due to hip extensor muscle weakness and greatly reduced hip extension mobility on the most involved lower limb during terminal stance.(Cruz et al., 2009; Herbert, 1993) . Additionally, more lateral and anterior pelvic tilt in the frontal and sagittal planes, respectively, can be attributed to the altered recruitment of hip abductors and extensors on the most affected leg, which in turn alters pelvic stability.(Tyson, 1999). After a stroke, the gluteus Medius is severely impaired, although the activity of the contralateral hip muscles increases to make up for it during disturbances in standing. (Kirker, Jenner, et al., 2000).

Stroke survivors often stand with their pelvis tilted forward, an abnormal postural alignment that has been linked to diminished trunk control and balance. (Verheyden et al., 2014). Transverse thorax-pelvis coordination is related with poor gait and balance in people who have had a stroke, as measured by monitoring intersegmental trunk coordination during walking, and the thoracic range of motion is higher than the pelvic range of motion.(Hacmon et al., 2012). When a stroke patient is seated and extends forward, less of their weight is transferred to their front leg than their back leg. Poor lower trunk postural stability is shown by the pelvis' minor anterior tilt during flexion, which is mostly performed by the upper trunk.(Messier et al., 2004)

Stroke-related pelvic instability may make walking difficult. Insufficient pelvic muscle activation and control may create mobility issues and dysfunction. Stroke patients may regain mobility and independence through improving hip strength, walking speed, and daily activities. In this RANDOMIZED CONTROLLED STUDY, A group of 34 stroke survivors underwent pelvic stability training and a control group underwent routine physiotherapy. Pelvic stability training helped stroke patients regain mobility in their trunk and lower extremities, as well as increase hip strength, gait speed, and participation in everyday activities. (Dubey et al., 2018)

2.13. Trunk impairment scale:

A stroke may compromise a person's trunk function, affecting balance, walking, and activities of daily living (ADL). Regaining trunk control is crucial to performing many functional tasks after a stroke. The trunk's function isn't restricted to maintaining equilibrium when sitting; it also supports the proximal body, allows distal body movement, and selectively starts trunk movement. Several studies examine the impact of stroke on extremity muscle strength. Numerous studies have examined the trunk muscles' capacity to regulate balance, trunk movement, and trunk muscular strength whether sitting or standing. When determining a person's functional prognosis after a stroke, trunk performance, particularly static sitting balance, is significant. Trunk function is a key determinant of how well a stroke patient may recover. The trunk function is crucial for sitting, rolling, and transitioning from supine to sitting (Lee, Hong et al. 2013; Lee, Kim et al. 2015; Shi and Wardlaw 2016; Suh, Lee et al. 2022).

During acute stroke therapy, physical activity must be maintained, and ADLs improved. Sitting and functioning effectively in the trunk increases one's ability to undertake everyday life and physical activity. The Trunk Impairment Scale (TIS), which consists of seven questions, was created to measure trunk dysfunction in stroke patients. TIS reliably predicts subacute stroke function. If medically possible, turning, sitting, and other activities should be done 24–48 hours after the onset of stroke symptoms. The group that began therapy within 72 hours of admission had a shorter stay and improved walking condition at release. Despite having the same death rate, patients who began sitting and standing therapy within 24 hours of the onset of their illness had better functional outcomes(Lees, Broomfield et al. 2014).

Age and early motor and functional limitations affect ADLs after a stroke. Trunk performance predicts ADL after stroke. Verheyden performed multicenter research to determine the predictive validity of the TIS and its subscales at 6 months following a stroke. The TIS total score and static sitting balance subscale score at admission best predicted Barthel Index score. The TCT was established to measure stroke patients' trunk function. It was demonstrated that the FIM score at discharge may be better explained by incorporating the TCT score at admission as a predictor. Incorporating a trunk function assessment into the ADL before discharge improved predictive value. TCT, PASS trunk control items, Fujiwara TIS, and Verheyden TIS may be used to analyze trunk performance (Verheyden, Nieuwboer et al. 2004; Spader, Grossberg et al. 2013; Forestier, Terrier et al. 2015; Motta, Ramadan et al. 2015)

2.14. Balance Definition:

Balance is the capacity to keep a person’s center of gravity over their support base. Problems with equilibrium and movement are common after a stroke because of paralysis and weakening in the lower limb muscles. As a result, those who have had a stroke are limited in their ability to do routine tasks. Training methods such as sensory feedback, virtual reality training, whole-body vibration training, treadmill training, and robot-assisted training are just a few of the treatment techniques that have gotten the most attention for improving balance and gait. Despite the fact that many of these therapies have been shown to be successful interventions, they are not widely used because of the high expense of the necessary equipment and the time-consuming, individual natur of the treatments. As a result, it's clear that there's a need for low-cost, self-contained training programs that may be used for rehabilitation purposes (Daly, Zimbelman et al. 2011; Yang, Hwang et al. 2011; Brogårdh, Flansbjer et al. 2012; Høyer, Jahnsen et al. 2012).

Patients with hemiplegia induced by a stroke suffer from sensory disorders and a diminished capacity to maintain balance. In the standing position, they tend to place less weight on the paretic leg, resulting in an asymmetric posture that negatively impacts their activities of daily life, gait, and motion.(Shumway-Cook & Woollacott, 2000). The limit of stability (LOS) is defined as the maximum distance a subject can lean without losing their balance or lifting their feet off the ground. This is the initial postural control strategy.(Shumway-Cook & Woollacott, 2000) Lack of muscle strength, restricted joint movement, changes in muscle tone, sensory abnormalities, and loss of coordination are all potential reasons for balance difficulties in stroke patients. (Bonan et al., 2004). Restricted functional mobility is strongly connected with balance problems. (Cho et al., 2014; Pollock et al., 2007). Hemiplegic patients with balance difficulties recover more slowly than people without balance disorders. Balance impairment negatively impacts gait. (Cho et al., 2014).

On the other hand, having poor balance not only raises the risk of falls and social isolation, but also decreases the amount of physical activity one can engage in. (Michael et al., 2009). Patients who have recovered from a stroke often have slowed and impaired balance reactions, decreased body weight support on the affected limb, and abnormally high levels of postural sway. (Sawacha et al., 2013; Yavuzer et al., 2006).

Static and dynamic balance are the two main types distinguished. Static balance is described as the ability to keep a person's body in place relative to one's base of support with no or very little movement, and dynamic balance is defined as the capacity to carry out a task while maintaining an individual's balance.(Bressel et al., 2007)Mancini and Horak outlined the balance system's goals: maintaining a sitting or standing posture; Facilitate voluntary movement, like posture shifts; and Reactions that restore balance after a fall, slip, or push.(Mancini & Horak, 2010).

2.15. Balance Control and Influencing Factors:

The following mechanisms were identified by Oliveira et al. as being involved in balance control:

The sensory system and its integration (sensory afferents)(de Oliveira et al., 2008)**.**

The somatosensory mechanism (the proprioceptive system, which provides information about the relative position of different body parts), the visual mechanism (which defines head position and movement in relation to surrounding objects), and the vestibular system are the three primary sensory mechanisms involved in the regulation of proprioception (defines the direction and the acceleration of body movements with respect to the gravity of the Earth)(de Oliveira et al., 2008; Peterka, 2002).The sensory information is dynamically regulated and modified in response to varying environmental situations. According to Petarka, the central nervous system (CNS) prefers one sensory system over another to maintain vertical equilibrium despite the presence of several available sensory sources. (Peterka, 2002).This capacity to select and utilize appropriate sensory contributions under varying environmental situations is referred to as" sensory reweighting" (de Oliveira et al., 2008; Horak, 2006).

Biomechanical constraints: Controlling the body's center of mass in relation to its support base is one of the most important aspects of balance control(Horak, 2006). The foundation is not firmly established and can shift depending on the tasks at hand, the nature of the action, the worker's biomechanics, and the conditions of the worksite. The capacity to keep one's balance is compromised by any decrease in muscular strength, mobility, tone, or control.(de Oliveira et al., 2008). In the 1980s, researchers established that the human body possesses postural strategies, which are sensorimotor solutions for postural control and comprise ankle, hip, and step strategies.(Horak & Nashner, 1986a; Nashner & McCollum, 1985b)Which are the primary **movement strategies** that can be employed to restore the body's balance(de Oliveira et al., 2008; Horak, 2006; Maki & McIlroy, 2006) These strategies are now much rapid than voluntary limb movements and help reduce the effects of a sudden and unexpected loss of balance on the body's center of mass.(Maki & McIlroy, 2006) These techniques consist of specific muscle synergies, movement models, momenta of joint rotation, and vertical forces against the base of support(Maki & McIlroy, 2006) The **ankle strategy** is used to maintain balance when sway is relatively mild and the base of support is stable." Muscles are activated from distal to proximal in the ankle strategy, and the center of mass (CM) is shifted by torques mostly in the ankle(Winter, 1995)".The **hip strategy** is employed in the face of greater or faster disturbances or when the base of support is small or sloping, and the ankle technique is insufficient for regaining balance, while the center of mass must be promptly recovered." Muscle activation in the hip strategy happens primarily in the hip and trunk, adding torque to the hip joint, knee, and ankle(Horak & Nashner, 1986)". The **stepping strategy** is a completely separate strategy. Unlike the other two procedures(de Oliveira et al., 2008; Horak, 2006), this technique adjusts the base of support by altering the body's center of mass. In the step strategy, hip abductor contraction and ankle contraction lead to asymmetric lower limb weight discharge to move the BS during CM movement.(Horak & Nashner, 1986a)

Cognitive processing: Sensory feedback influences motor responses and muscle synergy for sustaining balance, as do attention (concentration), experience, context, and intentions (de Oliveira et al., 2008). Complexity of posture-related task depends on cognitive process. Neurological disorders that alter cognition may need more cognitive resources for balancing(Horak, 2006). Stroke patients may need to exert more cognitive load when completing tasks requiring static posture control, especially as the tasks' complexity rises. Inconsistent focus can cause falls(de Oliveira et al., 2008)

Perception of verticality is essential for upright posture when walking or doing other motor tasks. Injury to the brainstem, which processes vestibular, somatosensory, and visual information, or to the central or peripheral vestibular systems, respectively, might impede the proper processing of one's body's vertical orientation.(Mazibrada et al., 2008) Balance-impaired stroke survivors avoid putting weight on the unaffected side. This is called "pusher syndrome." In clinical practice, this manifests as preferring the paretic side to avoid falling on the unaffected one. Patients with paretic hemiparesis think they're standing erect while they're actually swaying. It's notable that these patients don't have issues with visual and vestibular feedback processing. (de Oliveira et al., 2008; Horak, 2006)

2.16. Balance Evaluation Techniques in Post Stroke Patients:

Clinical scales and tests

Patients recovering from a stroke are evaluated for their balance using a variety of methods(Oliveira et al., 2011). Static balance tests determine if a patient can keep their center of gravity over their base of support while standing or sitting. Dynamic tests are used to evaluate a person's equilibrium while they are actively moving or experiencing external perturbations. Maintaining equilibrium while doing a variety of tasks (turning, sitting, rising from a seated position, standing in different postures, walking, etc.) is a hallmark of functional balancing tests.(de Oliveira et al., 2008). The literature provides several standardized measures and tests for evaluating balance in post-CVA patients. Most used are the Postural Assessment Scale for Stroke Patients (PASS), Dynamic Gait Index, Multidirectional Reach Test, Activities-Specific Balance Confidence Scale, Fullerton Advanced Balance Scale, Timed Up and Go Test, Tineti Assessment Tool, Functional Reach Test, Balance Subscale of Fugl-Meyer Assessment, and Berg Balance Scale.(de Oliveira et al., 2008; Ha et al., 2014; Sawacha et al., 2013)

Instrumental studies:

Jiejiavo and coauthors evaluated balance training utilizing dual cognitive tasks. Static balance (lateral body sway with eyes closed or open and sagittal sway with eyes open) was considerably better following dual cognitive-type exercises than after regular physical therapy (Jiejiao et al., 2012).The intervention's results revealed that oscillations of the center of mass were statistically considerably reduced in all three groups. The findings of the Berg Balance Scale balance evaluation and the Functional Independence Measure daily activity evaluation demonstrated a statistically significant improvement in balance and daily activity scores in all subject groups after the intervention. When the outcomes of the three groups were compared, the third group's results were statistically considerably better than the other two groups(Her et al., 2011).

On the other hand, somatosensory information from the feet pressing on the support surface is used to manage posture. Standing on an unsteady surface increases external body sway, which improves posture coordination. Lee and colleagues compared the effectiveness of balance training on stable and unstable surfaces for post-CVA patients. After six weeks of intervention, the results indicated that balance training on unstable surfaces produced considerably improved outcomes.(J. Y. Lee et al., 2011).

Onigbind and colleagues conducted a study in which normal physical therapy and physical therapy on unstable surfaces were used for balance training. Researchers discovered that unstable surfaces were more effective at restoring balance function. After the intervention, statistically significant changes were detected in the evaluation of dynamic balance and static balance with eyes closed, but not in the evaluation of static balance with eyes open.(Onigbinde et al., 2009).

Balance depends on the ability to stand, shift weight, and conduct selected trunk motions while keeping the body's center of mass within the base of support. Karthikbabu and colleagues compared the impact of activities conducted on an unstable surface (an exercise ball) vs a stable surface in acute post-CVA patients. Two groups were randomly formed. The experimental group did trunk exercises on a ball in addition to conventional PT, while the control group used mats. Both groups improved their trunk control after the intervention, although the group using exercise ball had better results.(Chu et al., 2004; Karthikbabu, Nayak, et al., 2011a).

2.17. Berg Balance Scale:

A study was conducted on the "Functionality of the Berg Balance Scale in Stroke Rehabilitation." The primary intent of the Berg balance scale was to quantify the balance of elderly persons. In a recent study of 655 physical therapists involved in stroke rehabilitation, the Berg balance scale was shown to be the most frequently utilized evaluation instrument from acute care to community care. The results imply that the Berg balancing scale has strong validity, reliability, and change responsiveness, and that the test is helpful and simple to perform without requiring costly equipment or extensive evaluation time.(Blum & Korner-Bitensky, 2008)

On the other hand, another study was conducted of the Berg balance scale and other outcome measures for people with traumatic brain injury. The purpose of this research is to determine whether or not the Berg Balance Scale predicts functional recovery after traumatic brain injury. Forty patients in a row were given a berg balance test.

The Berg Balance Scale was created to quantify concerns about unstable footing and the potential for injury from falls. Combining Berg Balance Scale scores with other clinical parameters upon admission to inpatient acute rehabilitation may improve the prediction of rehabilitative outcome.(Feld et al., 2001)

2.18. **Stroke Patient and Independence Level**:

stroke is the third highest cause of death worldwide and a primary cause of elderly disability. Only 13% of handicapped stroke victims return to work. Stroke may impact gross and fine motor control, mobility, ADL, mood, communication, comprehension, and cognition. Depending on the artery involved, the size and location of the pliable cerebral area, and the degree of brain damage, different complications may develop. Common stroke aftereffects include balance and coordination difficulties, poor sensation and movement, one-sided weakness (hemiplegia or hemiparesis), impaired thinking and memory, decreased ADL and self-care abilities, emotional and behavioral disorders, sexual dysfunction, and limited social contact. These difficulties affect the patient's ability to function and lower his or her quality of life. Long-term impacts of CNS disorders include functional deterioration, which may lead to everyday task incapacity (Krakauer, Carmichael et al. 2012; Kim and Park 2014; Lee, Kim et al. 2015). Functional Independence Measure is a popular assessment tool (FIM). First FIM questionnaire in 1983. The American Academy of Physical Medicine and Rehabilitation and the American Congress of Rehabilitation Medicine conducted this symposium. It keeps a check on patients, analyzes their recovery, and formulates therapy strategies. It's a way to track how people are doing physically and mentally as their illnesses progress. Activities of daily living (ADLs) include things like eating, grooming, bathing, dressing, using the restroom, swallowing, sphincter control, and movement. Housekeeping is not included. There are 18 items total; 13 are physical and 5 are mental. Mobility, transferability, and self-care are discussed. (Lee, Kim et al. 2015; Lee, Huang et al. 2020). Clinical research relies on trustworthy measuring tools to quantify clinical outcomes, evaluate therapeutic effectiveness, and compare study findings. This is particularly important in rehabilitation, since most indications are qualitative. Patients who require rehabilitation after a stroke must first have their physical and functional state evaluated. Due to CVA's breadth and tenacity, disability, functional impairment, and quality of life must be measured. Immediate and long-term consequences must be considered. This data may be used to improve rehabilitation programs (Mun, Kim et al. 2014; Koshiro, Michiyuki et al. 2016; Cabanas-Valdés, Boix-Sala et al. 2021).

2.19. Research Gap:

In previous research, it has been established that trunk rehabilitation for post-stroke patients is an excellent method for enhancing trunk control and sitting balance, as well as standing balance and mobility. In recent years, there has been a massive increase in scientific literature. This issue has received considerable critical attention. Several research studies have focused on the importance of training interventions for stroke patients in a variety of ways.

Physical therapists have a particular interest in the correlations between trunk impairment, functional performance, and muscle activity in patients who have had a stroke. This is because many trunk exercises done in the early stages of rehabilitation have the potential to improve functional performance in the later stages.

In this study, we are looking for better rehabilitation therapies for post-stroke management, including the effect of combining these exercises, which are linked by more than one link, as well as the relationship of the trunk with the hip, which provides pelvic stability and coordinates their activity during functional balance and mobility, and any impairment or altered pelvic alignment in the standing posture caused by impaired lower trunk control following stroke.

Thus, the goal of this study was to explore the effect of selective trunk exercises combined with hip strategy training on improving independence and balance in stroke patients. Until now, far too little attention has been paid to it.

CHAPTER III

SUBJECTS AND METHODS

3.1. Research design

pretest-posttest randomized control trail design.

3.2. Study task

To investigate the effectiveness of selective trunk exercises with hip strategy training to maximize independence level and balance for patients with stroke.

3.3. Variables used in the study.

3.3.1 Independent variables

- Selective trunk exercise.
- Hip strategy training.
- Conventional therapy.

3.3.2 Dependent variables

- Balance.
- Independence level.

3.4. Study setting

The study was conducted in Al Iman General Hospital physical therapy department and Prince Sultan Bin Abdulaziz Huminity City at stoke unit rehabilitation center.

3.5. Sample population and method of sampling

A total of 46 patients with hemiparetic stroke were recruited for this study.

Study sample will be two groups: control who are receiving conventional treatment and intervention groups in a ratio of 1 case to 1 control. **Followed by** Randomization (between the groups) will be done by a person who will be not involved in the assessment or treatment of the patients. Using simple randomization technique (table randomization sampling method)

3.6. Sample size

G*Power is a tool to compute statistical power analyses for many different t tests, F tests, $\chi 2$ tests, z tests and some exact tests. (Faul et al. 2007) One use of effect-size is as a standardized index that is independent of sample size and quantifies the magnitude of the difference between populations or the relationship between explanatory and response variables. (Nakagawa, S., & Cuthill, I. C. 2007) We used an effect size that ranged from (0.27 and

0.76), an alpha level of 0.05, a power of 80%. We estimated that 46 subjects (23 in each group) will be needed for our study.

3.7. Criteria for selection

3.7.1 Inclusion criteria

- A hemorrhagic or ischemic stroke diagnosis, confirmed based on computed tomography imaging or magnetic resonance imaging, left or right sided chronic hemiplegic stroke.
- Unknown history of previous stroke. (Not recurrent have single stroke not multiple and this is the first stroke) confirmed first stroke.
- Stroke onset within the previous 6 months before the study (12–24 weeks post-stroke early chronic stage) not more than 6 months to avoid natural recovery.
- Patients are between 28 and 68 years of age of both genders.
- Being able to walk 10 meters independently with or without a walking aid
- Mini-Mental State Exam (MMSE) scored more Than (24/30).
- Scoring less than 21 on the trunk impairment scale (TIS).
- Subjects who signed the informed consent.

3.7.2 Exclusion criteria

- Other neurological and orthopedic disorders that could influence motor performance.
- Inability to follow simple instructions due to cognitive impairments.
- Patients with scores higher than 21 TIS on the tis were excluded from this study as it indicates that they can perform everyday activities independently.
- Any presence of visual impairments and visual field defects.
- Recent participation in similar studies.

3.8. Study duration

The study duration was taken1 years (6 months for IRB review and approval) and (6 months for recruitment and treatment 4 session per week for 6 weeks)

3.9. Assessment tools:

- Mini-mental state exam (MMSE)
- Trunk Impairment scale (TIS)
- Motor assessment scale

3.10. Materials used.

Instrumentation:

- Pen &papers.
- Stopwatch.
- Step.
- Chair with armrest
- Chair without armrest
- Bed
- AIREX Balance Pad
- Quiet environment with limited Visual and auditory distractions.

3.11. Procedure:

3.11.1. Data Collection:

The subject's demographic data was collected on the data entry sheet of each individual subject. The assessment of mini mental state examination (MMSE), Motor Assessment Scale (MAS) and Trunk Impairment scale TIS was done for the screening purpose and regular neurological assessment was carried out for the treatment decision making process the outcome measures like Trunk Impairment scale TIS, Functional independence measure FIM and Berg Balance Scale BBS was conducted before and after the whole treatment process.

3.11.2. Outcome Measures:

Berg balance scale clinical test static and dynamic balance. The Berg Balance Scale comprises of 14 tasks where each one receives a score from 0 to 4, according to the patient's performance. The total score for all tasks consists of 56 scores, being from 0 to 20 considered a poor balance and from 40 to 56, a good balance.

Trunk Impairment scale (TIS).to measure motor impairment of the trunk after stroke. The TIS evaluates static and dynamic sitting balance as well as co-ordination of trunk movement on a scale.

ranging from 0 to 23 points, a higher score indicating a better trunk performance. The subscale static sitting balance evaluates if a patient can maintain a sitting posture with both feet on the floor and with the legs crossed. Furthermore, the patient is asked to cross the nonaffected leg over the hemiplegic leg while keeping the trunk upright and stable. The dynamic sitting balance subscale evaluates lateral flexion initiated from the upper and lower part of the trunk.

Independent performance in self-care, measure with **Functional independence measure (FIM**) to assess and grade the functional status of a person based on the level of assistance he or she requires. evaluate the functional status of patients throughout the rehabilitation process following a stroke.

The Kolmogorov-Smirnov Test and visual inspection of the data will be performed to evaluate whether the data are normally distributed. Differences between the experimental and control groups for the results of (Trunk

Impairment Scale (TIS) pre and post], Functional Independence Measure (FIM) Instrument [pre and post], and Berg Balance Tests pre and post],) will be evaluated by means of repeated measures (ANOVA). Level of significance will be set at $p < 0.05$.

3.11.3. Procedure

Approval was taken from SBAHC and KSMC Ethical Committee prior to the commencement of the study. Information's about the study procedures was explained and all the participants signed a written informed consent before their participation in the research.

subjects were assessed before treatment with The Mini-Mental State Exam (MMSE), The Motor Assessment Scale (MAS) and Trunk Impairment Scale (TIS) The outcome measures were taken

before and after interventions, The Trunk Impairment Scale (TIS), Functional independence measure (FIM)And Berg balance scale (BBS).

The subjects were assigned by using two groups that were recruited for the sake of comparison. The control group (n=23) and experimental group (n=23) participants. Both groups were received conventional therapy, (30 min-per session four times per week for six weeks) it will be consisting of: stretching exercises, strengthening of lower extremity muscle, balance control, weight shifting, bearing and progressive gait training. Were the experimental group will receive additional selective trunk exercises with hip strategy training.

The additional exercises (Selective Trunk Exercise) STE:

Contains: selective movements of the upper and lower part of the trunk in supine and sitting. The). The exercise on the supine exercise program consisted of: Four supine exercises were upper and lower trunk flexion rotation, unilateral pelvic bridge and lifting the pelvis with crook-lying. Seven sitting exercises were as follows: selective flexion extension of the lower trunk, upper and lower trunk lateral flexion, upper and lower trunk rotation and forward and lateral reach were performed at shoulder height.

The training intensity was controlled by reducing the base of support and changing the holding time. In addition, we supported the patient in training to minimize compensatory movements and to move the patient's trunk, which reduced observation and verbal advice. We were done with two minutes warm up and cool down before and after treatment (Karthikbabu, Nayak, et al., 2011b; Karthikbabu, Solomon, et al., 2011b)

Hip strategy exercises consisted of hip and trunk movement exercise, exercise was done on a stable surface, and exercise on an unstable surface. Standing posture exercises: anteroposterior and mediolateral hip movements and trunk (Standing with hip movement and standing with trunk movement for 5 min. The exercise on the stable surface subject was performed standing on one leg of the non-paretic side for 10 s and then tandem standing for

5 s. for 5min until possible. The exercise on the unstable surface the same exercises as performed on the stable surface will be applied on the AIREX Balance Pad.(Park et al., 2019)

3.11.4. Statical Analysis:

Statistics provide an objective approach to understanding and interpreting the behaviors that we observe and measure. SPSS 23 software was used for data analysis. Descriptive statistics were used to describe and summarize personal data (age, gender, associated diabetes or hypertension, and stroke related questions like type of stroke, affected site and onset time). Measures of central tendency (mean, median, mode) and measures of variability (range, variance, standard deviation) were applied to those variables. Moreover, descriptive statistics were presented in the form of graphs. Moreover, Therefore, these descriptive data was compared between the two main groups using the t-test ($P<0.05$). The Kolmogorov-Smirnov Test and visual inspection of the data will be performed to evaluate whether the data are normally distributed. Differences between the experimental and control groups for the results of (Trunk Impairment Scale (TIS) pre and post], Functional Independence Measure (FIM) Instrument [pre and post], and Berg Balance Tests pre and post],) were evaluated by means of repeated measures (ANOVA). Level of significance will be set at $p < 0.05$

CHAPTER IV

RESULTS

4.1. Participants:

Forty-six subjects with a history of stroke participated in this pre-test post-test randomized control trail study.

4.2. Sociodemographic Characteristics

To explore the sociodemographic characteristics of the study population the descriptive statistics of a total of 46 (Control = 23; intervention = 23), indicated that in the control group majority were male participants (78.3%). However, in the intervention group the gender distribution was almost equal. Further, based on education the findings indicated that in the control group majority had education level lower secondary (34.8%), while in the intervention group majority had education level primary (34.8%) and post-secondary (30.4%). Furthermore, in terms of duration of stroke the results revealed that in the control group majority (52.2%) had a history of four-month duration of stroke, while in intervention group majority had the history of three-month duration of stroke (47.8%).

In terms of clinical characteristics such as hypertension history, the findings indicated that in the control group the participants had hypertension history were less (65.2%) compared to the intervention group (82.6%). However, based on the DM history the participants had a history of DM were almost equal in both control and intervention groups. In addition, the findings indicated that in terms of stroke type the Ischemic type of stroke was high in both control and intervention group while the hemorrhagic type of stroke was low. Similarly, in term of site of stroke both left and right in both control and intervention groups were almost similar. However, in terms of affected side in the control group majority experienced the left hemiplegia (56.5%) and in the intervention group majority experienced right hemiplegia (60.9%).

Despite the fact that there are variations between groups in terms of sociodemographic and clinical characteristics, these variations were not statistically significant ($p > .05$) except gender ($p < .05$). This reveals that in both groups the participants had similar sociodemographic and clinical characteristics. Table 2 and figure 1-8 shows detail.

Variable	Category	Control Group		Intervention Group		p
		f	%	*f*	%	
Gender	Female	5	21.7	12	52.2	0.032
	Male	18	78.3	11	47.8	
	Total	23	100.0	23	100.0	
Education	Bachelor	3	13.0	2	8.7	0.362
	Lower Secondary	8	34.8	3	13.0	
	Post-secondary	3	13.0	7	30.4	
	Primary	7	30.4	8	34.8	
	Upper Secondary	2	8.7	3	13.0	
	Total	23	100.0	23	100.0	
Duration of Stroke	3 Months	4	17.4	11	47.8	0.146
	4 Months	12	52.2	6	26.1	
	5 Months	5	21.7	4	17.4	
	6 Months	2	8.7	2	8.7	
	Total	23	100.0	23	100.0	
Hypertensive	No	8	34.8	4	17.4	0.179
	Yes	15	65.2	19	82.6	
	Total	23	100.0	23	100.0	
Diabetes Mellitus	No	8	34.8	9	39.1	0.760
	Yes	15	65.2	14	60.9	
	Total	23	100.0	23	100.0	
Stroke Type	Hemorrhagic	6	26.1	7	30.4	0.743
	Ischemic	17	73.9	16	69.6	
	Total	23	100.0	23	100.0	
Site of Stroke	Left	10	43.5	11	47.8	0.767
	Right	13	56.5	12	52.2	
	Total	23	100.0	23	100.0	
Affected Side	Left Hemiplegia	13	56.5	9	39.1	0.238
	Right Hemiplegia	10	43.5	14	60.9	
	Total	23	100.0	23	100.0	

Note. *f* = Frequency; p = Probability value; Significance level ($p < .05$)

Table 2: Sociodemographic and clinical Characteristics of the study Population

Figure 1. *Graphical Representation of the Gender Distribution among groups*

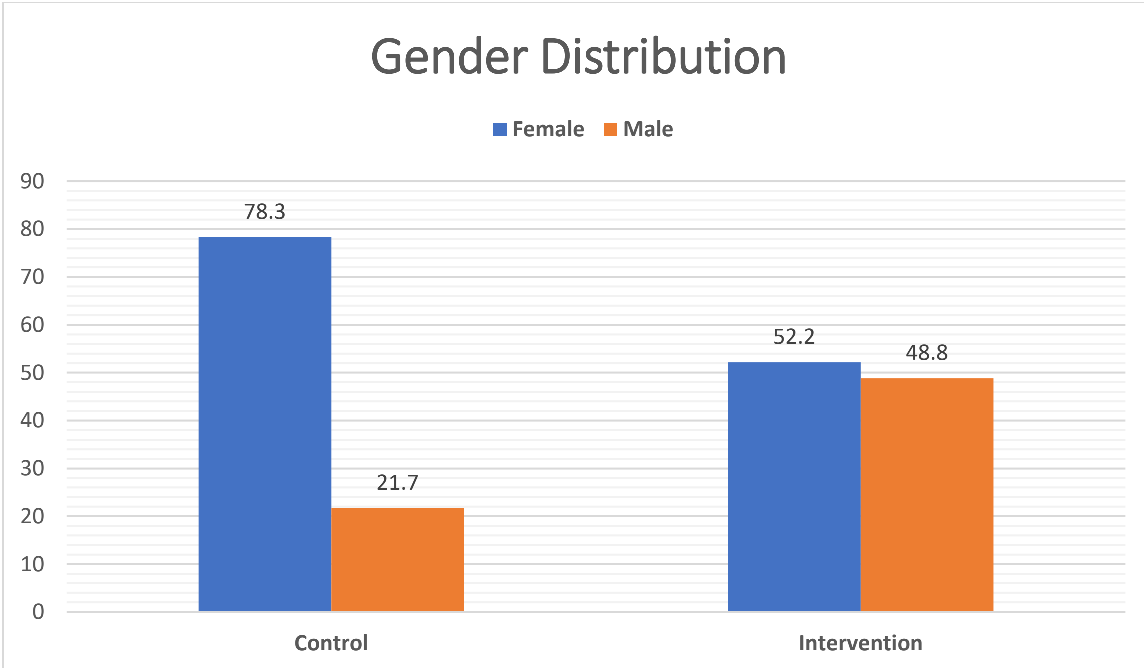


Figure 2. *Graphical Representation of the Hypertension Distribution among groups*

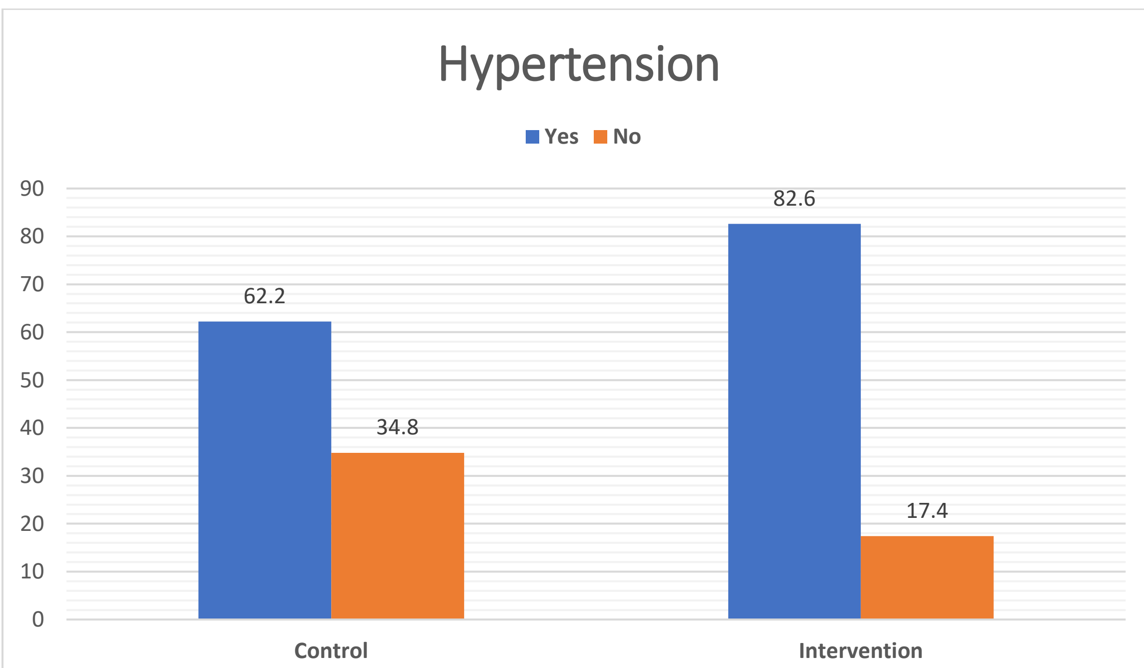


Figure 3. *Graphical Representation of the Diabetes Mellitus Distribution among groups*

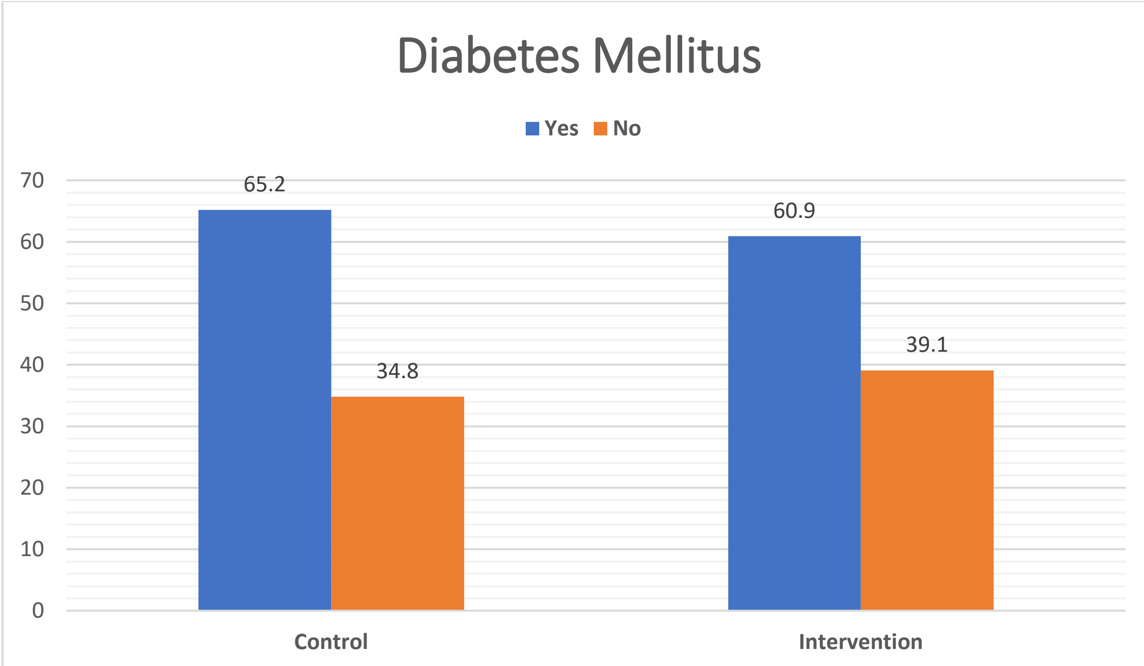


Figure 4. *Graphical Representation of the Stroke Type Distribution among groups*

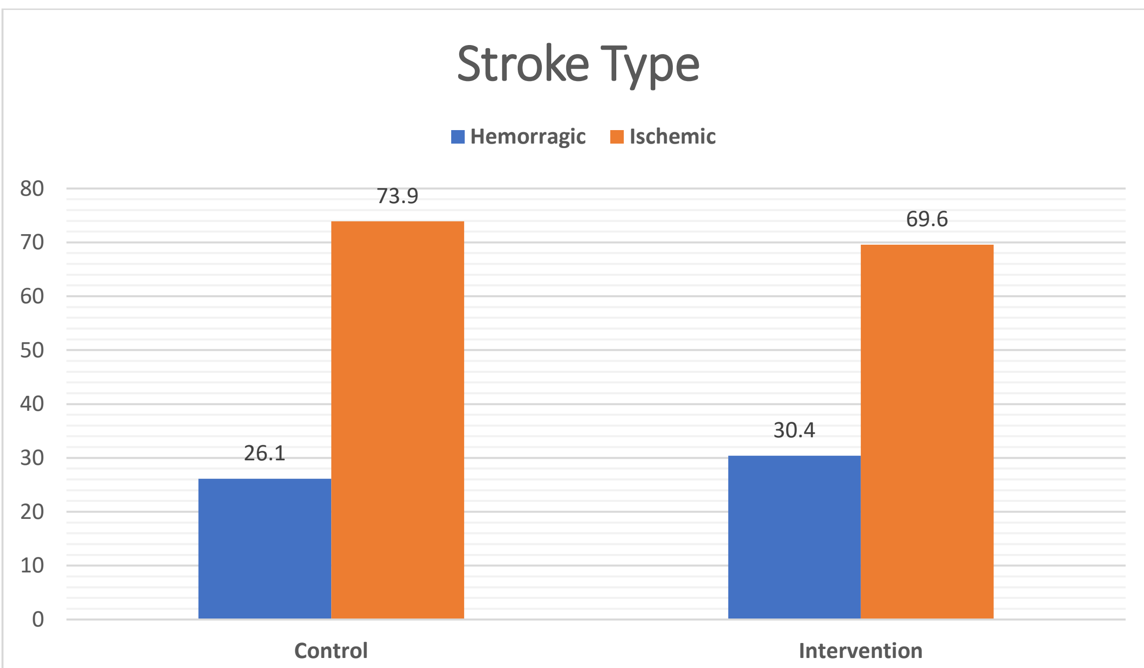


Figure 5. *Graphical Representation of the Site of Stroke Distribution among groups*

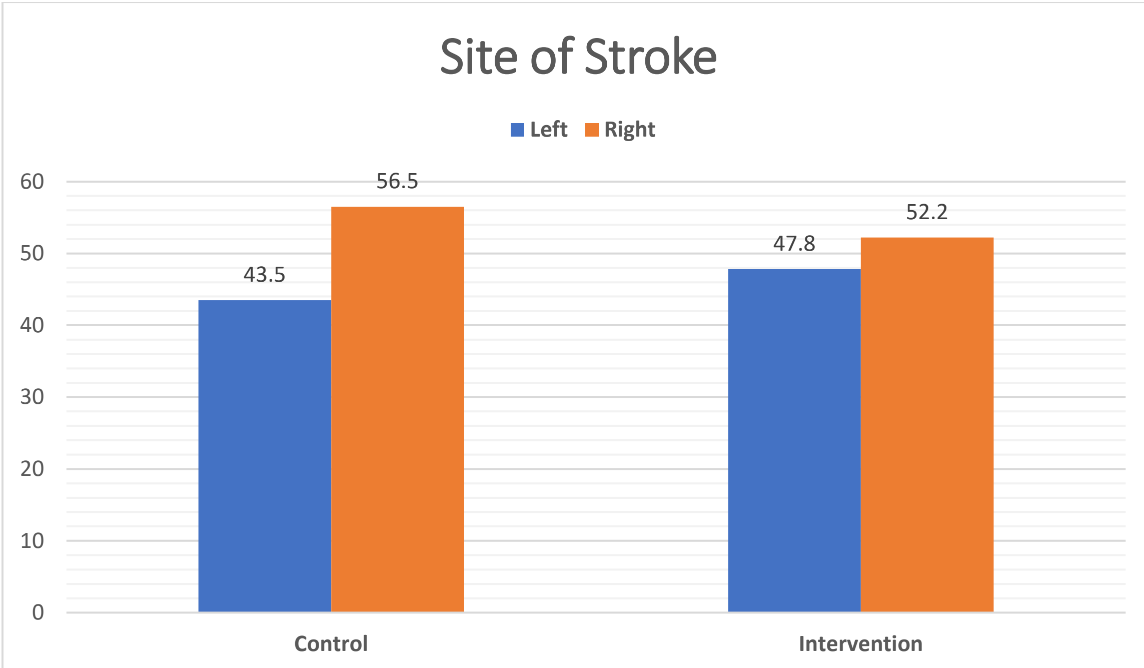


Figure 6. *Graphical Representation of the Affected Side Distribution among groups*

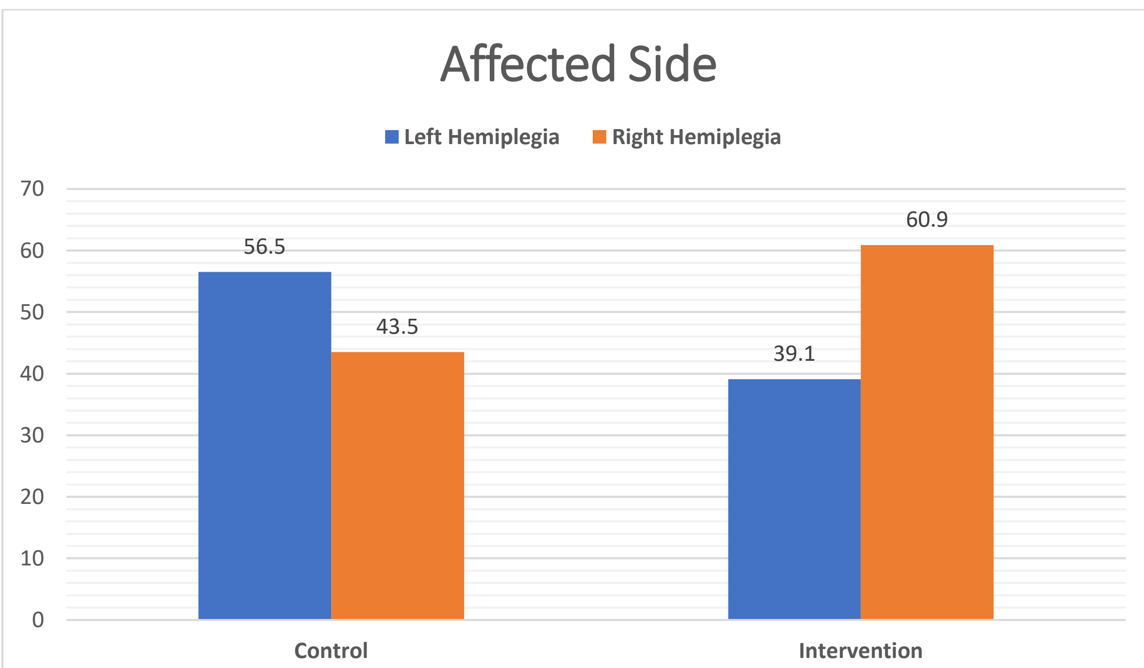


Figure 7. *Graphical Representation of the Education Distribution among groups*

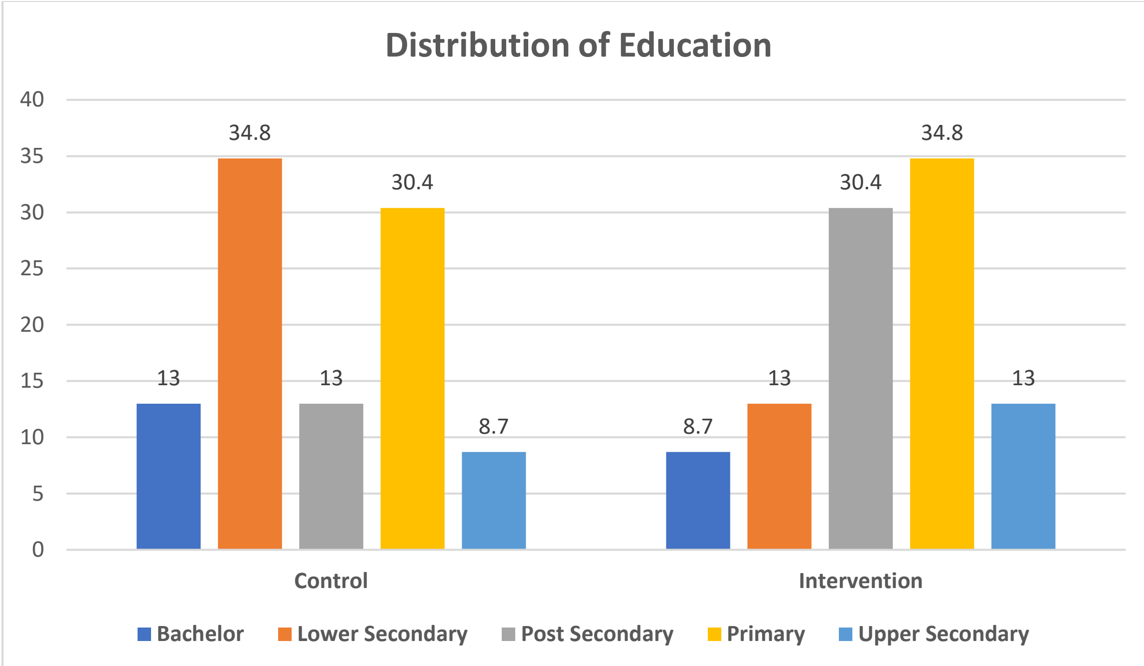
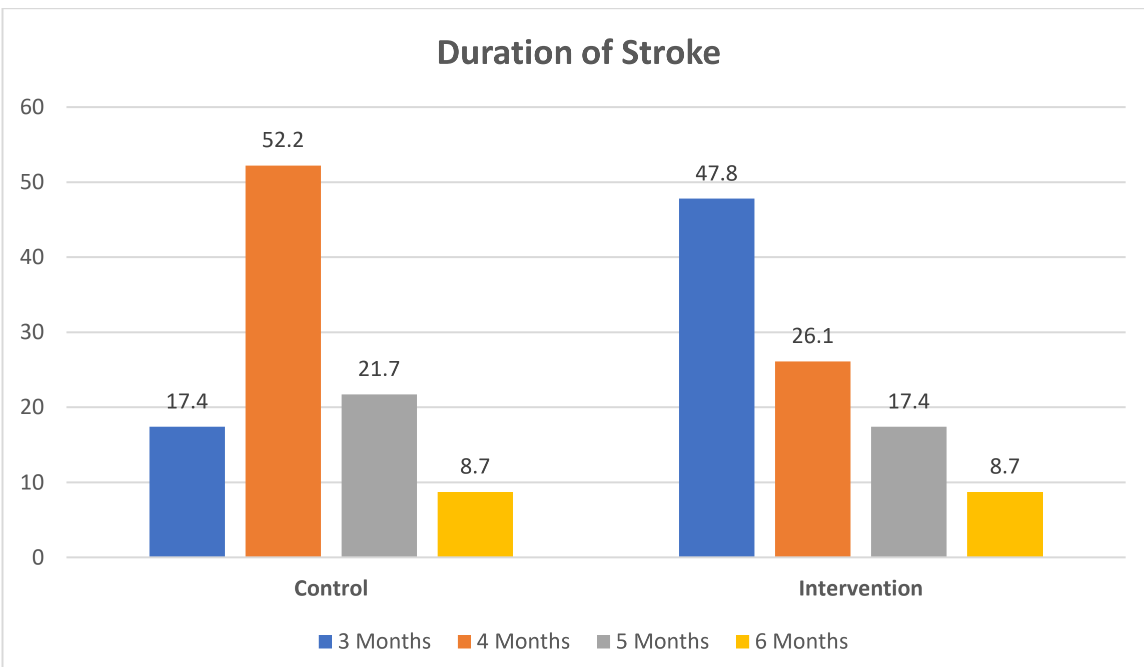


Figure 8. *Graphical Representation of the Duration of Stroke Distribution among groups*



The results indicated the descriptive statistics including mean, standard deviation, and p values regarding age, height and weight in both control and intervention groups. The findings indicated that there was no significant mean difference between Control and Intervention groups in terms of age, gender and their weight ($p > .05$).this revealed that both the groups were similar based on these characteristics. Table 3 shows detail

Variables	Control Group Mean ± SD	Intervention Group Mean ± SD	*p-value*
Age	56.7 ± 8.95	55.6 ± 8.78	0.692
Height	168.1 ± 7.32	165.9 ± 6.59	0.268
Weight	72.0 ± 7.63	74.0 ± 13.42	0.529

Note. SD = Standard Deviation; p-value = probability value; Significance level (p < .05)

Table 3 Descriptive Statistics for Age, Height, and Weight

The results indicated that the mean difference between control and intervention group was not statistically significant at the time of pre intervention in terms of TIS and its subscales, BBS and FIM (p>.05). However, the mean difference between control and intervention group was statistically significant at the time of post intervention in terms of TIS and its subscales, BBS and FIM (p<.001). Further, the results revealed that at the time of pre intervention both the groups were similar in terms of TIS along with its subscales, BBS and FIM. However, after intervention the mean score of intervention group in terms of BBS, FIM and TIS along with its subscales including TIS Static, TIS Dynamic and TIS Coordination, significantly increased than control group which indicated the efficacy of the intervention. Table 4 shows detail.

Table 4. Mean difference between control and intervention Groups in terms of pre and post TIS & its Subscales, BBS and FIM

Variables	Group	*M*	*SD*	*t*(44)	*p*	Cohens' d
Pre TIS-S	Control	4.57	0.73	-1.59	.118	0.47
	Intervention	5.00	1.09			
Pre TIS-D	Control	5.83	1.19	-0.64	.525	0.19
	Intervention	6.04	1.11			
Pre TIS-C	Control	2.04	1.40	-0.79	.435	0.23
	Intervention	2.39	1.59			
Pre TIS-Total	Control	12.5	2.59	-1.12	0.267	0.33
	Intervention	13.4	2.90			
Pre BBS	Control	36.1	1.79	-2.06	0.051	0.71
	Intervention	37.5	1.24			
Pre FIM	Control	76.9	18.54	-1.73	0.091	0.51
	Intervention	84.8	11.80			
Post TIS-S	Control	6.35	0.71	-2.82	.007	0.83
	Intervention	6.83	0.39			
Post TIS-D	Control	6.87	1.01	-5.38	<.001	1.59
	Intervention	8.57	1.12			
Post TIS-C	Control	2.61	0.99	-4.38	<.001	1.29
	Intervention	3.65	0.57			
Post TIS Total	Control	17.6	1.75	-8.98	<.001	2.647
	Intervention	21.7	1.30			
Post BBS	Control	39.6	1.67	-14.68	<.001	4.329
	Intervention	46.3	1.39			
Post FIM	Control	82.7	17.37	-5.75	<.001	1.695
	Intervention	107.1	10.67			

Note. M = Mean; SD = Standard Deviation; p-value = probability value; Significance level ($p < .05$)

The results indicated that the mean score of post intervention of BBS, FIM, TIS and subscales of TIS including TIS Static, TIS Dynamic and TIS Coordination was significantly higher than pre intervention ($p<.001$). Hence, the results revealed the efficacy of the intervention in terms of BBS, FIM, TIS and its subscales. Table 5 shows detail.

Table 5. Mean difference between Pre and Post Intervention in terms of TIS, BBS and FIM

Variables	Group	*M*	*SD*	*t*(44)	*p*	Cohens' d
TIS-S	Pre	4.78	0.94	-13.83	< .001	2.04
	Post	6.59	0.62			
TIS-D	Pre	5.93	1.14	-8.75	< .001	1.29
	Post	7.72	1.36			
TIS-C	Pre	2.22	1.49	-4.98	< .001	0.73
	Post	3.13	0.96			
TIS Total	Pre	13.0	2.76	-17.75	<.001	2.62
	Post	19.6	2.57			
BBS	Pre	80.8	15.88	-9.97	<.001	1.47
	Post	94.9	18.86			
FIM	Pre	36.8	1.68	-13.40	<.001	1.98
	Post	42.9	3.69			

Note. M = Mean; SD = Standard Deviation; p-value = probability value; Significance level ($p<.05$)

The findings of the two-way repeated measure ANCOVA indicated that there was a statistically significant interaction effect of TIS in terms of time (pre and post intervention) and across both groups including control and intervention ($F(1,43) = 6.15$, $p < .017$, $\eta p^2 = .13$) while controlling for gender. Moreover, the descriptive statistics revealed that in the intervention group the mean score of TIS was significantly greater after (post) intervention compared to the mean score of TIS in control group. Hence, we can conclude that the findings for the two-way repeated measure ANCOVA indicate a significant time (pre & post) and group (control & intervention) effect for TIS after controlling for gender. Table 6 and 7 and Figure 9 shows detail.

Table 6. Descriptive Statistics

						Kolmogorov-Smirnov	
	Group	**Mean**	**SD**	**Minimum**	**Maximum**	**Statistic**	**p**
Pre-TIS	Control	12.5	2.59	10.0	18.0	0.201	0.052
	Intervention	13.4	2.90	10.0	18.0		
Post-TIS	Control	17.6	1.75	14.0	20.0	0.155	0.217
	Intervention	21.7	1.30	19.0	23.0		

Note. SD = Standard Deviation; p = probability value; Significance level (p < .05)

Table 7. Within Subjects Effects

	Sum of Squares	**df**	**Mean Square**	**F**	**p**	**η^2_p**
TIS	237.80	1	237.80	95.89	< .001	0.69
TIS ✻ Group	15.25	1	15.25	6.15	0.017	0.13
TIS ✻ Gender	10.92	1	10.92	4.40	0.042	0.09
Residual	106.64	43	2.48			
Between Subjects Effects						
Group	96.12	1	96.12	11.04	0.002	0.20
Gender	0.94	1	0.94	0.11	0.744	0.00
Residual	374.36	43	8.71			

Note. Type 3 Sums of Squares; df = degrees of freedom; p = probability; F = F-Statistics; Significance level (p < .05)

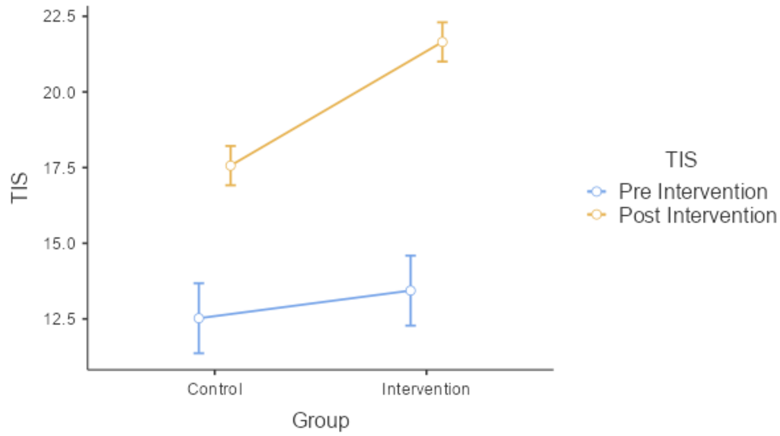


Figure 9 **TIS means different pre& post**

4.2.1. FIM Means Different Pre& Post intervention:

The findings of the two-way repeated measure ANCOVA indicated that there was a statistically significant interaction effect of FIM in terms of time (pre and post intervention) and across both groups including control and intervention ($F(1,43) = 128.98$, $p < .001$, $\eta p^2 = .75$) while controlling for gender. Moreover, the descriptive statistics revealed that in the intervention group the mean score of FIM was significantly greater after (post) intervention compared to the mean score of FIM in control group. Hence, we can conclude that the findings for the two-way repeated measure ANCOVA indicate a significant time (pre & post) and group (control & intervention) effect for FIM while controlling for gender. Table 8 and 9 and Figure 10 shows detail.

Table 8. Descriptive Statistics

						Kolmogorov-Smirnov	
	Group	**Mean**	**SD**	**Minimum**	**Maximum**	**Statistic**	**p**
Pre-FIM	Control	76.9	18.5	40.0	100	0.135	0.370
	Intervention	84.8	11.8	66.0	102		
Post-FIM	Control	82.7	17.4	50.0	104	0.139	0.335
	Intervention	107.1	10.7	88.0	120		

Note. SD = Standard Deviation; p = probability value; Significance level (p < .05)

Table 9. Within Subjects Effects

	Sum of Squares	**df**	**Mean Square**	**F**	**p**	**η^2_p**
FIM	1473.06	1	1473.06	131.10	< .001	0.75
FIM ✻ Group	1449.21	1	1449.21	128.98	< .001	0.75
FIM ✻ Gender	2.23	1	2.23	0.20	0.658	0.00
Residual	483.16	43	11.24			
Between Subjects Effects						
Group	4132.79	1	4132.79	9.65	0.003	0.18
Gender	874.86	1	874.86	2.04	0.160	0.05
Residual	18409.31	43	428.12			

Note. Type 3 Sums of Squares; df = degrees of freedom; p = probability; F = F-Statistics; Significance level (p < .05)

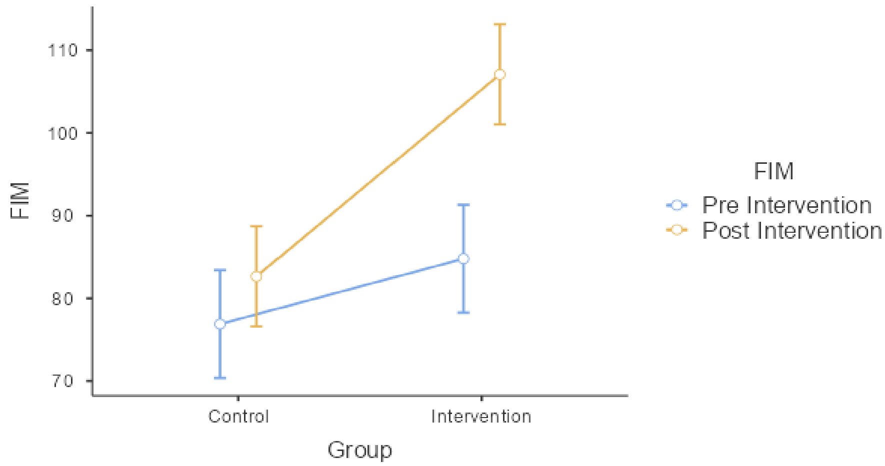


Figure 10 FIM means different pre& post

4.2.2. BBS Means Different Pre& Post intervention:

The findings of the two-way repeated measure ANCOVA indicated that there was a statistically significant interaction effect of BBS in terms of time (pre and post intervention) and across both groups including control and intervention ($F(1,43) = 137.15$, $p < .001$, $\eta p^2 = .76$) while controlling for gender. Moreover, the descriptive statistics revealed that in the intervention group the mean score of BBS was significantly greater after (post) intervention compared to the mean score of BBS in control group. Hence, we can conclude that the findings for the two-way repeated measure ANCOVA indicate a significant time (pre & post) and group (control & intervention) effect for BBS while controlling for gender. Table 10, 11 and Figure 11 shows detail.

Table 10. Descriptive Statistics

						Kolmogorov-Smirnov	
	Group	**Mean**	**SD**	**Minimum**	**Maximum**	**Statistic**	**p**
Pre_BBS	Control	36.1	1.79	33.0	39.0	0.188	0.076
	Intervention	37.5	1.24	35.0	39.0		
Post_BBS	Control	39.6	1.67	37.0	42.0	0.146	0.280
	Intervention	46.3	1.39	44.0	48.0		

Note. SD = Standard Deviation; p = probability value; Significance level (p < .05)

Table 11. Within Subjects Effects

	Sum of Squares	df	Mean Square	F	p	η^2_p
BBS	235.05	1	235.05	199.62	< .001	0.82
BBS ✻ Group	161.49	1	161.49	137.15	< .001	0.76
BBS ✻ Gender	5.45	1	5.45	4.63	0.037	0.10
Residual	50.63	43	1.18			
Between Subjects Effects						
Group	356.62	1	356.62	103.06	< .001	0.71
Gender	3.39	1	3.39	0.98	0.328	0.02
Residual	148.79	43	3.46			

Note. Type 3 Sums of Squares; df = degrees of freedom; p = probability; F = F-Statistics; Significance level (p < .05)

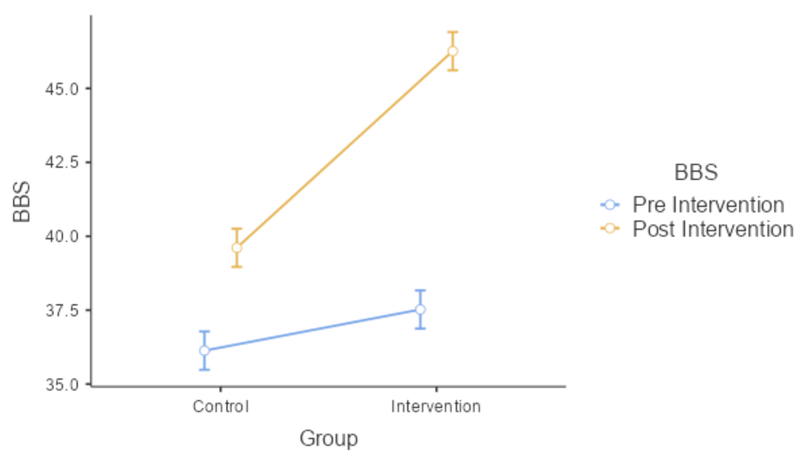


Figure 11 BBS means different pre& post

4.2.3. Mean Different Of TIS-S Pre& Post intervention:

The findings of the two-way repeated measure ANCOVA indicated that there was a statistically non-significant interaction effect of TIS Static in terms of time (pre and post intervention) and across both groups including control and intervention (F(1,43) =0.06, p = .806, ηp^2 = .00) while controlling for gender. Moreover, the descriptive statistics revealed that in the intervention group the mean score of TIS Static was significantly greater after (post) intervention compared to the mean score of TIS Static in control group. Table 12 and 13 and Figure 12 shows detail.

Table 11. Descriptive Statistics

	Group	Mean	Median	SD	Minimum	Maximum	Kolmogorov-Smirnov Statistic	p
Pre-TIS-S	Control	4.57	4.00	0.73	4.00	7.00	0.23	.014
	Intervention	5.00	5.00	1.09	4.00	7.00		
Post-TIS-S	Control	6.35	6.00	0.71	5.00	7.00	0.27	.002
	Intervention	6.83	7.00	0.39	6.00	7.00		

Note. SD = Standard Deviation; p = probability value; Significance level (p < .05)

Table 12. Within Subjects Effects

	Sum of Squares	df	Mean Square	F	p	η^2_p
TIS-Static	24.35	1	24.35	59.58	< .001	0.58
TIS-Static ✻ Group	0.03	1	0.03	0.06	0.806	0.00
TIS-Static ✻ Gender	0.04	1	0.04	0.09	0.770	0.00
Residual	17.57	43	0.41			
Between Subjects Effects						
Group	2.83	1	2.83	3.69	0.062	0.08
Gender	1.58	1	1.58	2.06	0.159	0.05
Residual	32.99	43	0.77			

Note. Type 3 Sums of Squares; df = degrees of freedom; p = probability; F = F-Statistics; Significance level (p < .05)

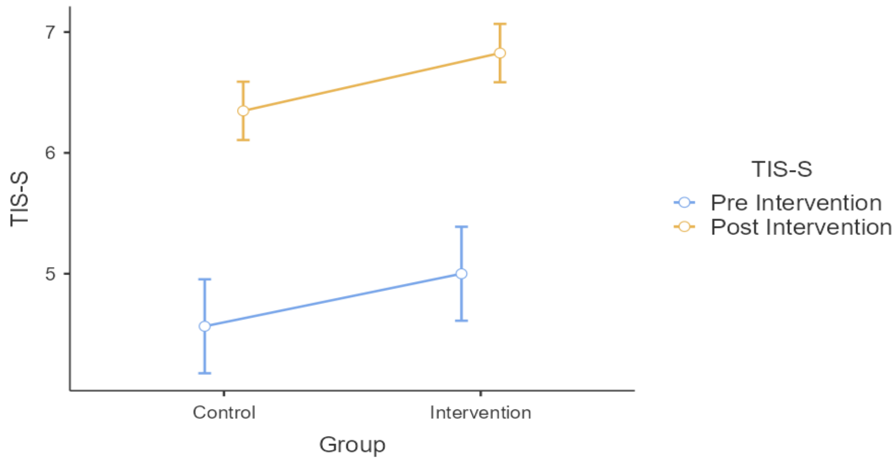


Figure 12 TIS-S means different pre& post

4.2.4. Mean Different Of TIS-D Pre& Post intervention:

The findings of the two-way repeated measure ANCOVA indicated that there was a statistically significant interaction effect of TIS Dynamic in terms of time (pre and post intervention) and across both groups including control and intervention ($F(1,43) = 11.79$, $p = .001$, $\eta p^2 = .22$) while controlling for gender. Moreover, the descriptive statistics revealed that in the intervention group the mean score of TIS Dynamic was significantly greater after (post) intervention compared to the mean score of TIS Dynamic in control group. Hence, we can conclude that the findings for the two-way repeated measure ANCOVA indicate a significant time (pre & post) and group (control & intervention) effect for TIS Dynamic while controlling for gender. Table 14 and 15 and Figure 13 shows detail.

Table 14. Descriptive Statistics

							Kolmogorov-Smirnov	
	Group	**Mean**	**Median**	**SD**	**Minimum**	**Maximum**	**Statistic**	**p**
Pre TIS-D	Control	5.83	6.00	1.19	4.00	7.00	0.17	.143
	Intervention	6.04	6.00	1.11	4.00	8.00		
Post-TIS-D	Control	6.87	7.00	1.01	5.00	8.00	0.16	.179
	Intervention	8.57	9.00	1.12	7.00	10.00		

5. Note. SD = Standard Deviation; p = probability value; Significance level (p < .05)

Table 15. Within Subjects Effects

	Sum of Squares	**df**	**Mean Square**	**F**	**p**	**η^2_p**
TIS-Dynamic	51.08	1	51.08	93.57	< .001	0.69
TIS-Dynamic ✻ Group	6.44	1	6.44	11.79	0.001	0.22
TIS-Dynamic ✻ Gender	6.88	1	6.88	12.60	< .001	0.23
Residual	23.47	43	0.55			
Between Subjects Effects						
Group	20.08	1	20.08	11.07	0.002	0.20
Gender	0.16	1	0.16	0.09	0.765	0.00
Residual	78.01	43	1.81			

Note. Type 3 Sums of Squares; df = degrees of freedom; p = probability; F = F-Statistics; Significance level (p < .05)

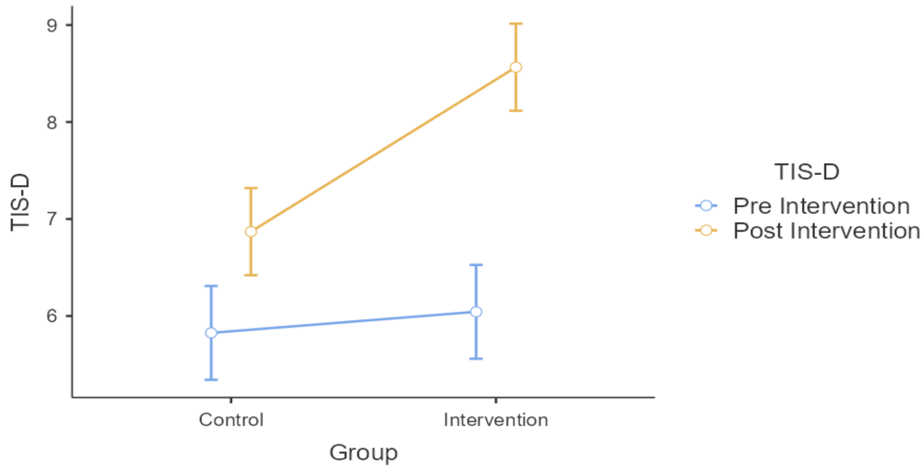


Figure 13 TIS-D means different pre& post

5.1.1. Mean Different Of TIS-C Pre& Post intervention:

The findings of the two-way repeated measure ANCOVA indicated that there was a statistically non-significant interaction effect of TIS Coordination in terms of time (pre and post intervention) and across both groups including control and intervention (F(1,43) =2.30, p = .136, ηp^2 = .05) while controlling for gender. Moreover, the descriptive statistics revealed that in the intervention group the mean score of TIS Coordination was significantly greater after (post) intervention compared to the mean score of TIS Coordination in control group. Table 16 and 17 and Figure 14 shows detail.

Table 15. Descriptive Statistics

							Kolmogorov-Smirnov	
	Group	**Mean**	**Median**	**SD**	**Minimum**	**Maximum**	**Statistic**	**p**
Pre TIS-C	Control	2.04	2.00	1.40	0.00	4.00	0.17	.159
	Intervention	2.39	3.00	1.59	0.00	4.00		
Post TIS-C	Control	2.61	2.00	0.99	1.00	4.00	0.23	.013
	Intervention	3.65	4.00	0.57	2.00	4.00		

Note. SD = Standard Deviation; p = probability value; Significance level (p < .05)

Table 17. Within Subjects Effects

	Sum of Squares	df	Mean Square	F	p	η^2_p
TIS-Coordination	11.01	1	11.01	15.18	< .001	0.26
TIS-Coordination ✻ Group	1.67	1	1.67	2.30	0.136	0.05
TIS-Coordination ✻ Gender	0.85	1	0.85	1.17	0.286	0.03
Residual	31.20	43	0.73			
Between Subjects Effects						
Group	13.87	1	13.87	6.49	0.015	0.13
Gender	3.14	1	3.14	1.47	0.232	0.03
Residual	91.95	43	2.14			

Note. Type 3 Sums of Squares; df = degrees of freedom; p = probability; F = F-Statistics; Significance level ($p < .05$)

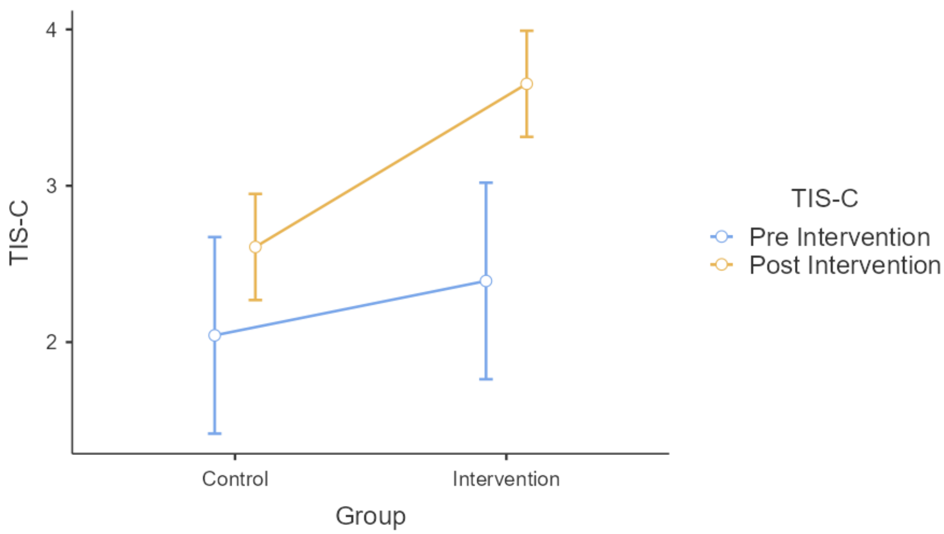


Figure 14 TIS-C means different pre& post

CHAPTER

DISCUSSION

5.1. Discussion:

In both the control group and the innovation group, the total number of patients who had a stroke was the same. Furthermore, 78.3 percent of the people who participated in this study were male. The goal of the study was to find evidence of the advantages of trunk exercises combined with hip strategy training for stroke patients, with the final goal of maximizing the patients' levels of independence while also improving their balance. , as compared to the control group, has a statistically significant impact on both levels of independence and balance, demonstrating that it is a useful strategy for improving levels of balance and independence after a stroke.

Patients who have had a stroke often learn and implement compensatory methods that aren't particularly helpful, which leads to a reduction in the amount of trunk control they have, despite the fact that their functional abilities have improved. (Verheyden et al., 2009). When a person in a sitting position raises one of their arms, the center of gravity moves forward while the body rotates backwards to maintain equilibrium.. (Bouisset & Zattara, 1987) and Postural sway is produced as a consequence of this shift in the body's center of gravity as well as the accompanying response force. (Horak et al., 1984) In addition, a well-coordinated and regulated activity of the muscles is required by the neurological system in order to compensate for the shift in the body's center of mass that is caused by weight shifting (Lanzetta et al., 2004).

In the current study, when the data are evaluated in detail, the subscales of TIS (TIS-S Static, TIS-D Dynamic, and TIS-C Coordination) indicate a greater effect size. These subscales have cohen's d values of 0.83, 1.59, and 1.29, respectively

The trunk exercises assisted the paralyzed side to move and bear weight again by increasing the trunk's flexion, extension, lateral flexion, and rotation. They also improved proprioception. The movements of the trunk and limbs had an effect, in both FIM and BBS, on the location of the center of gravity as well as the sitting and standing motions. Strengthening and stabilizing the muscles in the trunk requires exercise. Patients who have had a stroke may have asymmetrical movements and pelvic motions that are unstable. (Tyson, 1999). Physical therapists who specialize in rehabilitation have identified the trunk as the primary pivot point of the body. The primary effect that the NDT has on the migration of proximal-to-distal body segments It is impossible for distal limb movement to occur without the proximal trunk maintaining its stability.(Davies, 1990a; Majsak, 1996) Because of this, the enhancement of proximal trunk control has an effect on functional tasks such as standing and walking. (Davies, 1990a; Verheyden et al., 2004, 2009)

In the present study, when trunk exercises were conducted, they were done so in accordance with a protocol devised by (Karthikbabu, Nayak, et al., 2011b; Karthikbabu, Solomon, et al., 2011b).

The significant effect size index (d) that was found for TIS in the trunk control (2.64), validates the hypothesis that our research was attempting to test.

Evidence supporting this perspective may be found(Verheyden et al., 2009) 's research. In their research, subacute stroke patients who received an additional ten hours of task-specific training on the trunk improved their trunk control. According to (Mudie et al., 2002) instructing stroke patients on proper trunk posture improved their weight distribution when they were seated during the early phase of the disease.

Patients in the intervention group performed these exercises both sitting and supine throughout the course of their treatment. The trunk must be maintained in order to achieve functional stabilization of the spine and pelvis, improvement of stability during movement, strengthening of muscles, and modification of muscle motions and balance.(Richardson et al., 2002).The pelvic tilt exercise is one of the most essential exercises for maintaining the stability of the trunk. "bridging exercises:" : (Hubley-Kozey & Vezina, 2002) In addition, these exercises were carried out when the subject was sleeping in a supine posture. They included raising the pelvis by crook-lying and doing a unilateral pelvic bridge. are often used for the purpose of achieving therapeutic lumbopelvic stabilization (Drysdale et al., 2004) Patients carried out the activities while lying in a supine position. This method was used while working with both the physio ball and the plinth (Karthikbabu, Nayak, et al., 2011b)(Karthikbabu, Solomon, et al., 2011b) When it comes to improving lateral flexion and rotation of the trunk, as measured by the dynamic sitting balance and coordination subscales, respectively, of the Trunk Impairment Scale, the study found that trunk exercises performed on the physio ball are more effective than those performed on the plinth when performed on the physio ball. This was the case regardless of whether or not the exercises were performed on the plinth.

From the point of view of the researcher, there were two main reasons why we thought it was important for the exercises to be conducted on the plinth. To begin, doing BE on a plinth lowers the patient's center of gravity, which in turn reduces the patient's anxiety and the instability of weight bearing when walking and makes it possible for the patient to exercise in a safe posture (Goldie et al., 1996) As part of our efforts to teach the patient on hip strategy, we performed particular trunk movements while they stood on an unstable surface. This is considered a combination of more than one rehabilitation application for the patient.

The bridge exercise helps to coordinate the development of muscles both globally and locally (Drysdale et al., 2004). Several studies have been conducted to investigate the effects that BE with different postures have on the global/local muscle activity ratio as well as the activation of the trunk muscles. (Arokoski et al., 2004; Marshall & Murphy, 2005b; Stevens et al., 2006). According to the findings of our research, the unilateral bridging exercise, which was one of the exercises that were performed over the course of our study, is fantastic for weight bearing and balance (G. bin Song & Heo, 2015) This study looked on the weight-bearing and weight-shifting capabilities of the side that was affected by the condition. All three groups were able to increase their maximum weight bearing capacity to between 46.21.44 and 47.01.33 pounds. SBG 1020.6210.1 had a smaller COM shifting impact in the AL and PL directions compared to UBG 689.5269.7, which exhibited a larger impact. UBG possesses the highest body weight bearing capacities as well as the greatest PL and AL COM shifting abilities. The balancing exercise that the UBG group did was judged to be the most effective. In a great number of the earlier studies, bridging exercises were either included or modified.

In the current study, the TIS dynamic showed a significant improvement of 1.59 in the intervention group when compared to the control group. (Karthikbabu, Nayak, et al., 2011b) discovered that trunk exercise using a physio-ball was superior to using a plinth with the improvement of 1.47 in TIS dynamic category among acute stroke patients. (Verheyden et al., 2009)determined that 10 hours of additional exercise for trunk lateral flexion in addition to routine treatment improved 2.22 in TIC dynamic category among sub-acute stroke patients. determined that improvement in TIC dynamic category among sub (An & Park, 2017)followed the same training strategy for a total of four weeks while also adding in trunk exercises. TIS-dynamic (d =.81) shows that the training of trunk control in combination with functional activities has favorable benefits.

According to the results of the TIS-coordination category, the rotation of the trunk consists of the top and bottom parts of the trunk rotating in opposite directions. To be more specific, the coordinated rotation of the lower trunk should transmit weight to the side of the body that is paralyzed (Davies, 1990b; Majsak, 1996) In the study that we conducted, TIS-coordination improved with a value that was 1.29 times higher than the control group. A recent study (An & Park, 2017) found that doing exercises that include lower and higher rotation improved TIS-coordination by a score of 0.59 (out of 6), which corresponds to 9.8 percent.

In addition, clinical research reveals that people who have had a stroke have a harder difficulty turning their lower trunk (Verheyden, Nieuwboer, Feys, Thijs, Vaes, & de Weerdt, 2005). As revealed by posturographic testing, stroke patients prefer to avoid moving their center of pressure to the hemiplegic side, whether they are sitting (van Nes et al., 2008) or standing (Chern et al., 2010)

The pre-test and post-test scores for the TIS-static category, which was easier to administer than the TIS-dynamic and coordination categories for the participants, show a slight variation between each other, with a difference of 5 points out of a possible 7. However, the TIS-dynamic and coordination categories for the participants were more difficult to administer.

Hemiplegic persons have a tendency to move their center of gravity to the hemiplegic side when sitting and standing. This is especially true when it comes to exercises that are performed while seated. (Chern et al., 2010; van Nes et al., 2008)When there are demands placed on a person's profession, postural deficits may have a detrimental influence on their functional independence and are one of the most important risk factors for falling. (Barclay-Goddard et al., 2005; Nyberg & Gustafson, 1997; Verheyden, Nieuwboer, et al., 2006)Postural stability is a predictor of functional recovery in stroke patients because it plays a role in transfer, transportation, and walking. (R. W. Bohannon & Leary, 1995; Brosseau et al., 1996; Franchignoni et al., 1997; Juneja et al., 1998; Prescott et al., 1982; Sandin & Smith, 1990) As a consequence of this, the patient was instructed to do seven exercises while in a seated position. This was done since the results of the TIS and its subscale suggested that these exercises were helpful in enhancing the patient's sitting balance.

The findings of the studies that have been conducted on this subject show that the ability to shift weight to the hemiplegic side is primarily reliant on the synchronization of lower trunk rotation. (Davies, 1990b; Verheyden, Nieuwboer, et al., 2006; Verheyden, Nieuwboer, Feys, Thijs, Vaes, & de Weerdt, 2005) Therefore, early training of the trunk promotes weight symmetry in individuals recovering from stroke. The proximal body segments are stabilized whenever there is voluntary movement of the extremities, whether they the lower or the upper extremities. (Karthikbabu, Nayak, et al., 2011b; Verheyden, Nieuwboer, Feys, Thijs, Vaes, & de Weerdt, 2005)

In our study, we intended to combine trunk exercises with hip strategy training. We hypothesized that this combination of exercises would specifically strengthen the muscles and rehabilitate the patient, leading to improvements in the patient's static and dynamic balance while sitting and standing, as well as an increase in the patient's level of independence and a greater degree of independence for the patient. When compared to the regular exercises, the addition of these workouts resulted in substantial improvements across the board in terms of balance, control, and degree of independence.

Training that focuses on the hip strategy attempts to enhance the activation of the trunk and hip muscles in the standing posture. This is accomplished by focusing on the hip strategy. The functional reach test was altered and improved in order to accommodate the introduction of the first exercise that focused on the hips, which was the hip and trunk movement exercise. (Wernick-Robinson et al., 1999) The functional reach test is a method of evaluation that makes use of the hip approach by increasing the forward reach while the subject is standing. As the level of difficulty of the activity increases, the subject's capacity to keep their balance is restored. (Duncan et al., 1992).

in our opinion, one of the merits of this study, which demonstrates a relationship between a scientific instrument and a clinically useful treatment procedure.

However, in order to stabilize the body in the frontal plane, exercises such as tandem stance and single-leg stance are required (Mao et al., 2006; Sozzi et al., 2013).These enhance body movement and provide assistance with balance in a variety of settings. As a result, training the hip strategy enables the modification of the body's COP, which is an essential reaction in maintaining balance when the ankle strategy cannot be attained. (Horak et al., 1989; Horak & Nashner, 1986a; Nagy et al., 2007; Winter, 1995).

On the side of their body affected by hemiplegia, a great number of persons have trouble bearing weight and moving forward and backward. People who have hemiplegia as a consequence of a stroke generally employ a hip approach as opposed to an ankle strategy. This is because alterations in the ground reaction force and the increased muscle tone of the hip flexors cause these people to adopt a hip method. As a direct result of this, people worry about tripping and falling whenever they go even a little distance forward or backward. As a consequence of this, restoring the capacity to move forward and backward is required in order to have a good posture when standing and walking. Because a person is only evaluated with the TIS while they are sitting, the TIS does not differentiate between when they are lying down or when they are standing. The TIS offers elements that may be used for compensatory movement of the trunk, but it is unable to evaluate subjective factors, which is still another challenge. Because we believe that they are measures of balance and mobility that correlate to real-world activities like stair climbing, ambulation, and transfers, we decided to utilize the general functional balance scale, or BBS, as the evaluation instrument for this inquiry. In addition to their widespread application, user-friendliness, and capacity to provide accurate and dependable measurement results, these instruments are in high demand. (K. Berg et al., 1995; K. O. Berg et al., 1992; Bogle Thorbahn et al., 1996; Liston & Brouwer, 1996b; vander Linden, 1996)

In contrast, shortly after having a stroke, many patients demonstrate impairments in their dynamic balance, despite the fact that they are still able to stand erect and maintain their posture. It will be difficult for you to move your weight laterally throughout this time period. If you transfer your weight to the nonparetic side, the hyperactivity in your lower extremities will decrease. Because of the postural instability, the compensatory response of the nonparetic side might potentially hinder weight transfer.(Kiyota et al., 2011; Tyson et al., 2006)

Additionally, we looked at how the exercise might affect one's ability to keep their balance. The results of Cohen's d tests show that those who were part of the experimental group did much better than those who were part of the control group. The results of our research make it abundantly evident that there are advantages to combining certain trunk exercises with hip approach training. This result is supported by evidence that indicates training the core and hips is associated with improved balance in people of senior age (Nagy et al., 2007)

The training method of performing repeated movements of the trunk and hips has the potential to influence both the onset and the magnitude of early and anticipatory postural alterations . In addition, trunk contractions enable for continuous input and posture control by the central nervous system, which in turn allows for effective body-environment interaction.(Saito et al., 2014)

It's possible that the reaction force applied against the shaking surface stimulated the trunk muscles more than they would have otherwise been activated. According to Marshall and Murphy's research (Marshall & Murphy, 2005b) ,when the center of mass moves away from the midline on an unstable surface, the activation of the muscles that are involved in postural sway and task performance increases. This has the effect of slowing down the performance of the task. As a result, we decided to include hip strategy training into this study. The workouts for the hip approach comprised activities that focused on hip and trunk mobility, activities that were performed on stable surfaces, and activities that were performed on unstable surfaces. The standing hip and trunk movement exercise incorporates mediolateral and anterior-posterior hip motions, as well as trunk movements.

Another piece of recent study backs up the conclusion that we came at, which is that improving one's balance by doing hip-strategy exercises in addition to ankle-strategy activities is effective. According to the findings of this study, the group who received training on both their ankles and hips had a shorter length of stay (LOS) in the paretic side and forward area as well as a higher coefficient of performance (COP) overall movement. (Park et al., 2019).

The hip strategy exercise causes a greater number of muscles to contract during knee, ankle, trunk, and hip movement while the body is supported by the ground (Bryanton et al., 2015; Chizewski & Chiu, 2012)). These activities cause the foot to experience a variety of weight transfers as well as increased shear stresses (Saito et al., 2014).These conclusions are in line with those that have been uncovered by the ongoing inquiry.

The only condition in the BBS that requires a change in the sensory input is standing with one's eyes closed. This condition is only administered once. The BBS ceiling effect is seen in stroke patients who have very minimal neurological deficits, which our results are consistent with.

On the other hand, as was to be predicted, we found that participating in this activity led to an increase in a measure of independence known as FIM 1.695 as compared to levels that existed before the intervention. These findings should not come as a surprise since previous research by (Juneja et al., 1998)and others has shown that the BBS correlates with FIM-measured disability in stroke patients.

In addition, a recent study came to the conclusion that there is a significant association between trunk performance and functional outcomes in stroke patients, underscoring the importance of trunk rehabilitation as a treatment option. In particular, medical professionals need to evaluate initial TIS after stroke, specifically TIS-D; this may serve as a good predictor of functional prognosis in patients (T. J. Kim et al., 2015).

However, there is strong evidence in the studies on stroke that indicates that trunk performance is an important predictor of functional prognosis. Studies have indicated an association between functional ability measured at rehabilitation center discharge and even six months after a stroke and trunk performance evaluated early on after a stroke or on entry to the rehabilitation center. According to the findings of a recent multicenter study, the TIS and the static sitting balance subscale of the TIS on admission to the rehabilitation facility (median days after stroke, 20) are the most significant predictors of Barthel Index score at 6 months following stroke (Duarte et al., 2002; Franchignoni et al., 1997; C. L. Hsieh et al., 2002) .The total and static sitting balance subscale scores on the TIS were more reliable predictors of admission to a rehabilitation facility than the Barthel Index score itself was. Both of these scores had an explained variance of at least 50%. (Verheyden et al., 2007).

CHAPTER VI

Conclusion, limitation, and Recommendations for future studies

6.1. conclusion:

According to the findings of this study, patients who had suffered an early chronic stroke benefited significantly from the combination of trunk exercise and hip strategy training. This resulted in significantly improved trunk muscle activation, postural control, balance, and functional independence. Because of this, providing this combination of trunk exercise and hip strategy training to stroke patients is an intervention that is helpful.

6.2. limitation:

Our study's findings should be interpreted with care due to several limitations. A possible weakness of this research is that the majority of participants were male. Another possibility. However, the strength of the lower limb muscles was not evaluated in a functioning posture; isokinetic strength testing in future studies may reveal the true benefits of hip strategy training and trunk exercises. Participants were not in the acute phase of stroke. We feel that a longer research length would further validate the motor learning benefits of hip strategy training and trunk exercises in stroke patients. In addition, we suggest that the advantages of hip strategy training and trunk exercises on postural sway and community participation be examined in future clinical studies with a larger number of participants with follow-up. A further drawback of our research was the short length of the intervention; a long-term follow-up was not conducted to see if the 4 sessions per week for 6 weeks of short-term exercise were maintained over time.

6.3. Recommendation

- Future studies need to determine postural sway and effects of same exercises protocol on postural sway In addition, more study will be needed to examine effects of exercises on LOS using balance device
- Future research are needed to compare s strategy training with control group
- Future researchers must work on the mentioned exercises and strategies on a larger sample to generalize the efficiency of exercises.

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Appendix A: IRB from King Saud Medical City

Kingdom of Saudi Arabia
Ministry of Health
King Saud Medical City

مدينة الملك سعود الطبية
KING SAUD MEDICAL CITY

المملكة العربية السعودية
وزارة الصحة
مدينة الملك سعود الطبية

***IRB Registration Number with KACST, KSA*: H-01-R-053**
***IRB Registration Number U.S. Department of HHS IORG #*: IORG0010374**

- Memorandum -

Date: May 15, 2022

Proposal Reference No.	: **H1RE-22-Apr22-01**
Proposal Title	: "The Effect of trunk exercises with hip strategy training to maximize independence level and balance for patient with stroke"
PI	: Dr. Alanoud Othman K Almasoudi
Co-Investigators	: None
Type of Review	: Initial
Category of Approval	: Expedited
Date of IRB Approval-Expiration (Validity)	: 15/05/2022 14/11/2022 (06 months)

Dear Dr. Alanoud Othman K Almasoudi,

We are pleased to inform you that the above-referenced research proposal has been reviewed and was approved. The Institutional Review Board (IRB) committee found that the research met the applicability criteria and was eligible for expedited review. However, to commence the collection of data a permission letter must be issued from the Director of the Research Center first.

This approval is valid for **06 months** from the date of IRB review when approval is granted. The approval will no longer be in effect on the date listed above as the IRB expiration date. Please note that you are obligated to submit the following to IRB committee:

1. progress/final report on the 06 **months (14-Nov-2022)** (or earlier in the case the study has completed)
2. any manuscript resulting from this research for approval by IRB before submission to journals for publication.

The approval of the conduct of this proposal will be automatically suspended after 06 months, in the case the Progress Report (or Final Report, if relevant) is pending acceptance. You also need to notify the Research Centre as soon as possible in case of:

1. any amendments to the proposal;
2. termination of the study;
3. any serious or unexpected adverse events;
4. any event or new information that may affect the benefit/risk ratio of the proposal.

All records relating to the research including consent form must be retained and available for audit for at least 3 years after the research has ended.

We wish you every success in your research endeavors.

Dr. Faisal Almazroua
Chairman, Institutional Review Board (IRB)
King Saud Medical City Riyadh, KSA

وزارة الصحة المملكة العربية السعودية
مدينة الملك سعود الطبية
King Saud Medical City
لجنة أخلاقيات البحوث (IRB)

☎435-5555 Ext. 2345 irb@ksmc.med.sa

Appendix B: IRB from Prince Sultan Bin Abdulaziz Huminity City

مدينة سلطان بن عبد العزيز للخدمات الإنسانية
SULTAN BIN ABDULAZIZ HUMANITARIAN CITY

مدينة سلطان بن عبد العزيز للخدمات الإنسانية
SULTAN BIN ABDULAZIZ HUMANITARIAN CITY
لجنة أخلاقيات البحوث الطبية
Institutional Review Board (IRB)

Date: 07/07/2022
IRB No.: 77-2022-IRB

To: Ms. AlAnoud AlMasoudi
PI: "The Effect of trunk exercises with hip strategy training to maximize independence level and balance for patient with stroke"
AlMajmaah University
E-mail: Alanoud92an@gmail.com

Subject:	Approval for Research No. 73/MSc/2022
Study Title:	"The Effect of trunk exercises with hip strategy training to maximize independence level and balance for patient with stroke"
Study Code:	73/MSc/2022
Date of Approval:	07/07/2022
Date of Expiry:	05/03/2023
Board approval:	All members except the absentee

Dear Ms. AlAnoud AlMasoudi,

Your Project has been approved and you have the permission to conduct this study following your submitted documents as follow:

1. Curriculum Vitae for the PI researcher
2. Letter from the researcher requesting SBAHC participation in the clinical study
3. Research proposal according to SBAHC IRB Guidelines
4. SBAHC Informed Consent Template
5. Research Obligatory Agreement. Available upon the completion of the other requirements

You are required to obey by the rules and regulations of the Government of Saudi Arabia, the SBAHC IRB Policies and procedures and the ICH-GCP guidelines. You have to note that this approval mandate responding to IRB's periodic request and surveillance result. Drawing your attention to the following:

- Amendment of the project with the required modification to providing Periodical report for this project specially when study extension is required or expiry before study completion

Page 1 of 2

- All unforeseen events that might affect continued ethical acceptability of the project should be reported to the IRB as soon as possible
- Any serious unexpected adverse events should be reported immediately within 24 hours.
- Personal identifying data should only be collected when necessary for research.
- Secondary disclosure of personal identifiable data is not allowed.
- Monitoring: projects may be subject to an audit by the IRB at any time.
- The PI is responsible for the storage and retention of original data pertaining to the project for a minimum period of five (5) years.
- Data should be stored securely so that a few authorized users are permitted access to the database.

The IRB registered with the IRB KACST Registration No. H-01-R-090. It is authorized to conduct the ethical review of clinic studies and operates in accordance with ICH-GCP Guidelines and all applicable national/local and institutional regulations and guidelines which govern Good Clinical Practices.

For Future Correspondence, please quote the project number and project title above and you are requested to keep IRB informed about your study progress and submit project progress report every six (6) months. A final report should be provided upon completion of the study.

Wish you a success in your research project.

Yours sincerely,

Prof. Khalid Al-Rubeaan
Chairman-IRB
Sultan Bin Abdulaziz Humanitarian City

مدينة سلطان بن عبد العزيز للخدمات الإنسانية
SULTAN BIN ABDULAZIZ HUMANITARIAN CITY
لجنة أخلاقيات البحوث الطبية
Institutional Review Board (IRB)

Appendix C: Consent Form KSMC

King Saud Medical City	مدينة الملك سعود الطبية
Research Center	مركز الابحاث
Generic Signed Consent Form	استمارة موافقة للمشاركة في بحث

Computer Number			رقم السجل
Study Number			رقم الدراسة
Patient Name			إسم المريض
Date of Birth			تاريخ الميلاد
Gender (Male/Female)			الجنس (ذكر | أنثى)
Nationality			الجنسية

You are free to ask as many questions as you like before, during or after in this research, you decide to give consent to participate in this research study. The information in this form is only meant to better inform you all possible risks or benefits. Your participation in this study is voluntary. You do not have to take part in this study, and your refusal to participate will involve no penalty or loss of rights to which you are entitled. You may withdraw from this study at any time without penalty or loss of rights or other benefits to which you are entitled. The investigator(s) may stop your participation in this study without your consent for reasons such as: it will be in your best interest; you do not follow the study plan; or you experience a study-related injury.

كمشارك فى هذا البحث العلمى لك مطلق الحرية في طرح أى سؤال أو إستفسار عن هذا البحث وذلك قبل , أثناء إجراء, أو بعد إكمال إجراء البحث إذا قررت إعطاء الموافقة على المشاركة في هذا البحث. الهدف الرئيسى من المعلومات الواردة في هذا النموذج هو أن نقدم لكم الشرح الوافى والمستفيض عن كل الأخطار والفوائد التى يمكن أن تتمخض عن إجراء هذا البحث. المشاركة فى هذا البحث عمل طوعى خالص وبالتالى لكم مطلق الحرية بعدم المشاركة. قراركم بعدم المشاركة فى هذا البحث العلمى لا يترتب عليه اى تبعات او حرمان من حقوقكم المستحقة. أيضا يمكنكم الانسحاب وعدم مواصلة المشاركة فى هذا البحث فى أى وقت أو مرحلة دون أن يؤثر ذلك فى حقوقكم أو فوائدكم المستحقة والمشرعة. لأعضاء فريق البحث العلمى الخاص بهذه الدراسة الحق في إيقاف أو إلغاء مشاركتكم في هذه الدراسة إذا رأو مصلحة لكم فى هذا الإيقاف أو الإلغاء أو فى حالة عدم التزامكم بخطة البحث الموضوعة أو إذا تبين لهم ضرر أو إصابة نتيجة إجراء الدراسة وذلك دون أخذ موفقتكم

عنوان المشروع	تأثير تمارين الجذع مع التدريب على استراتيجية الورك لزيادة مستوى الإستقلالية والتوازن لمرضى السكتة الدماغيه
Project Title	The Effect of trunk exercises with hip strategy training to maximize independence level and balance for patient with stroke
الباحث الرئيسي	العنود عثمان خالد المسعودي
Principle investigator	Alanoud Othman K Almasoudi

Appendix D: Consent Form PSBAHC

مدينة سلطان بن عبد العزيز للخدمات الإنسانية
SULTAN BIN ABDULAZIZ HUMANITARIAN CITY
RESEARCH & SCIENTIFIC CENTER

INFORMED CONSENT FOR RESEARCH INVOLVING THE ADMINISTRATION OF (DRUGS, USE OF DEVICES OR PERFORMANCE OF PROCEDURES) *

اذن نافذ للجهالة بالموافقة على المشاركة في الأبحاث
التي تتطلب استعمال (دواء/جهاز/ أو اجراءات خاصة)*
(اشطب ما لا ينطبق)*

Patient's Nameplate:

Title of Proposal:	عنوان البحث :
Part I – Research Participant Information Sheet: You are invited to participate in a scientific research project	الجزء الأول – معلومات للمشارك في البحث: ندعوك للمشاركة في بحث علمي
A. Purpose of the Research is to increase general knowledge about	أ. الغرض من البحث هو زيادة المعرفة عن
[To study the effect of a new type of specific customized exercises and study the extent of its effect on the patient's balance, independence, and self-reliance and, to find out effectiveness of selective trunk exercise with hip strategy training in improving independence level and balance in sitting and standing among patient with stroke. To evaluate the balance following selective trunk exercise with hip strategy training and how balance is being controlled among stroke patients	لدراسة تأثير نوع جديد لتمارينات مخصصه معينه جديده ودراسة مدى تأثيرها على اتزان واستقلالية المريض المصاب بالسكتة الدماغية واعتماده الذاتي ايضا لاكتشاف فعالية تمرين الجذع مع التدريب على استراتيجية الورك في تحسين مستوى الاستقلالية للمريض المصاب بالسكتة الدماغية ولتقييم التوازن بعد تمرين الجذع مع التدريب على استراتيجية الورك وكيف يتم التحكم في التوازن بين مرضى السكتة الدماغية
B. Description of the Research:	ب. وصف البحث:
It includes participating in a general exercise program that includes strengthening, stretching, balance and trunk training, in addition to an increased focus on trunk exercises with hip strategy training. Patients will be evaluated before and after the exercise program and to investigate effects of this exercises in balance and independence level	يتضمن المشاركه في برنامج تمارين عامه تأهيليه تشمل الاستطاله والتوازن وتدريب الجذع بالاضافه الى زيادة التركيز على تمارين الجذع مع تدريب استراتيجية الورك سيتم تقييم المرضى قبل وبعد برنامج التمارين ودراسة تأثير هذه التمارين على مستوى الاستقلاليه والتوازن لمرضى السكتة الدماغيه
C. Potential Risks and Discomforts:	جـ. المخاطر أوالازعاجات المحتملة:
1-Risk of fall: The following safety measures would follow during the assessment of balance in static and dynamic measures could prevent the participant from fall in case of loss of his or her balance.	/ خطر السقوط: سنتبع تدابير السلامة التالية اثناء تقييم التي يمكن أن تمنع المشارك من السقوط في حالة فقد توازنه. أ- اثنان من المعالجين الفيزيائيين سوف يقفون بالقرب

For Official Use Only
INFORMED CONSENT FOR RESEARCH INVOLVING THE ADMINISTRATION OF (DRUGS, USE OF DEVICES OR PERFORMANCE OF PROCEDURES) *
(Cross out the not applicable)*

إذن نافذ للجهالة بالموافقة على المشاركة في الأبحاث
التي تتطلب استعمال (دواء/جهاز/ أو إجراءات خاصة)*
(اشطب ما لا ينطبق)*

From: __________
To __________
RAC# __________

SBAHC 1803 – RSC CS (11/21) ME
Informed Consent for Research Involving the Administration of (Drugs, Use of Devices or Performance of Procedures)

مدينة سلطان بن عبد العزيز للخدمات الإنسانية
SULTAN BIN ABDULAZIZ HUMANITARIAN CITY
لجنة أخلاقيات البحوث الطبية
Institutional Review Board (IRB)

Page | 1

Appendix E: MMSE-2 Arabic Version

Creating Connections. Changing Lives. PAR

Sent Via Email: alanoud92an@gmail.com

June 24, 2022

Alanoud Othman Almasoudi
Almajmaah University
saad bin abi waqass
Alyarmouk
Almajmaah, Riyadh 11952
Saudi Arabia

Dear Alanoud Almasoudi:

In response to your recent request, permission is hereby granted to you to reproduce up to a total of 30 copies of the Arabic version of the Mini-Mental State Examination-2 (MMSE-2) Standard Version Blue Form for use only in your research titled, *The Effect of trunk exercises with hip strategy training to maximize independence level and balance for patient with stroke*. If additional copies are needed, it will be necessary to write to PAR for further permission.

This Agreement is subject to the following restrictions:

(1) Any and all materials used will contain the following credit line:

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(3) The Forms will be supplied to all persons/sites in hard copy. The form will not be distributed by electronic means (e-mail or website download) to any person/site. Distribution of forms will be in-person or via postal mail /courier only.

(4) The Forms will not be stored on any local computer/server/ network, website/ share drive or portable device for access by any individual.

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(6) Payment of a royalty fee of $60.00 USD. This fee includes a 40% student discount.

Licensing fees paid to PAR will be payable in US Dollars drawn on a US bank. Any taxes levied on fees by Licensee's government, or fees deducted by Licensee's bank (originating or intermediary) and/or financial institution, shall be paid by Licensee and shall not reduce the amount due to PAR.

(7) One copy of any of the material reproduced will be sent to PAR to indicate that the proper credit line has been used.

TWO COPIES of this Permission Agreement should be signed and returned to me, along with your payment for $60.00 USD for the royalty fee, to indicate your agreement with the above restrictions. I will then sign it for PAR and return a fully executed copy to you for your records.

Sincerely,

Andrea Butler Fernandez
Jr. Permissions Specialist
afernandez@parinc.com
1-800-331-8378 (phone)
1-800-727-9329 (fax)

ACKNOWLEDGED, ACCEPTED AND AGREED:

Licensee:	PAR:
By: ________ Alanoud Othman Almasoudi	By: ________ Andrea Butler Fernandez
Date: 16-07-2022	Date: July 19, 2022
	Payment Received: VISA
	PAR Customer No.: CU-10018917

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SIGNATURE OF PROFESSOR REQUIRED:

I hereby agree to supervise this student's use of these materials. I also certify that I am qualified to use and interpret the results of these tests as recommended in the *Standards for Educational and Psychological Testing*, and I assume full responsibility for the proper use of all materials used per this Agreement.

By:______________________________

Dr. Mohammad Seyam

مجموع النقاط الخام لاختبار الحالة العقلية المصغر-BV:2

(16 نقطة حد أقصى)

الإنتباه والحساب (تسلسل 7s)

الآن أود منك أن تطرح 7 من 100، ثم إستمر بطرح 7 من كل إجابة حتى أطلب منك أن تتوقف.

ما حاصل طرح 7 من 100 (93)	0	1
إذا لزم الأمر قل **إستمر** (86)	0	1
إذا لزم الأمر قل **إستمر** (79)	0	1
إذا لزم الأمر قل **إستمر** (72)	0	1
إذا لزم الأمر قل **إستمر** (65)	0	1

إحسب نقطة لكل جواب صحيح. الجواب يعتبر صحيحا إذا كان اقل بـ7 من الجواب السابق، حتى إذا كان الجواب السابق غير صحيح.

التسمية

ما هذا؟ (أشر إلى العين)	0	1
ما هذا؟ (أشر إلى الاذن)	0	1

التكـــرار

الآن سوف اسالك أن تكرر ما سوف أقول. جاهز؟ إنه يوم جميل ومشمس ولكن دافئ جداً. الآن كرر ذلك.

(إنتظر إجابة المفحوص وسجل الإجابة حرفيا. كرر مرة واحدة).

إنه يوم جميل ومشمس ولكن دافئ جداً 0 1

أفصل الصفحة الأخيرة من هذه الإستمارة. فرق الصفحة المفصولة عند النصف على طول الخط الافقي المثقوب. إستعمل النصف الأعلى من الصفحة المفصولة، والتى عليها ثلاثة أشكال، كإستمارة تحفيز لمهمة الفهم. إستعمل النصف الأسفل من الصفحة كإستمارة تحفيز لمهمة القراءة (إغمض عينيك). إستعمل ظهر النصف الأعلى من الصفحة المفصولة كاستمارة تحفيز وإجابة لمهمة الرسم (شكلين خماسيين متقاطعين) والنصف الأسفل من الصفحة (بيضاء) كإستمارة إجابة لمهمة الكتابة.

الفهـــــم

إستمع بعناية لأنني سوف أسالك أن تفعل شيئا. (اظهر للمفحوص صفحة تحفيز الأشكال الهندسية). **انظر إلى هذه الصور وأشر إلى الدائرة، ثم أشر إلى المربع، ثم أشر إلى المثلث.**

الإجابة الصحيحة	الإجابة الملاحظة		
○		0	1
□		0	1
△		0	1

القـــراءة

(إظهر للمفحوص صفحة تحفيز الكلمة). **من فضلك إفعل ما تقوله هذه أن تفعل.**

إغلق عينيك 0 1

الكتابــــة

(ضع الجزء الفارغ من الورقة امام المفحوص وزوده بقلم حبر أو قلم رصاص).
من فضلك إكتب جملة. (إذا لم يستجب المفحوص، قل: **اكتب عن أين تعيش**). إحسب نقطة واحدة إذا كانت الجملة مفهومة وتحتوى على فعل وفاعل. تجاهل أخطاء قواعد النحو أو التهجئة.

0 1

الرســـــم

(إعرض الشكلين الخماسيين المتقاطعين علي إستمارة التحفيز وزوده بقلم حبر أو قلم رصاص). **من فضلك إنسخ هذا التصميم.** إحسب نقطة واحدة إذا تألف الرسم من شكلين ذوى خمسة جوانب تتقاطع لتشكل شكلا ذو أربعة جوانب.

0 1

مجموع النقاط الخام لاختبار الحالة العقلية المصغر – 2: الإصدار القياسي

(30 نقطة حد أقصى)

إختبار الحالة العقلية المصغر - 2

الإصدار القياسي

الإستمارة الزرقاء

تاريخ الفحص: ______	الفاحص: ______	
الاسم: ______	العمر: ______	الجنس: ______
سنوات الدراسة المنجزة: ______	الغاية من الفحص: ______	

تقدير مستوى الوعي

يقظ / متجاوب	**نعسان**	**سبات (نوم عميق)**	**غيبوبة / غير متجاوب**

التعليمات: الكلمات بحروف داكنة يجب أن تقرأ بوضوح بصوت مسموع واضح وبطء للمفحوص. بدائل البند تظهر بين قوسين. إجراء الفحص ينبغي أن يجرى على انفراد وبلغة المفحوص الأولية. ما لم ينص على خلاف ذلك، ضع دائرة حول 0 إذا كانت الإجابة غير صحيحة أو 1 إذا كانت الإجابة صحيحة. إبدأ بتقديم الإختبار:

الآن أود أن أطرح عليك بعض الأسئلة بخصوص ذاكرتك

الإجابـــــة — **العلامة** *(ضع دائرة حول رقم)*

التسجيل

إستمع بعناية. سوف أقول ثلاث كلمات. أنت تعيدها بعد أن أتوقف. جاهز؟ ها هم: حليب (صمت لمدة قصيرة)، **معقول** (صمت لمدة قصيرة)، **قبل** (صمت لمدة قصيرة). **الآن كرر لي هذه الكلمات.** *(كرر حتى ثلاث مرات، لكن سجل نقاط المحاولة الأولى فقط).*

حليب	0	1
معقول	0	1
قبل	0	1

الآن إحفظ هذه الكلمات في عقلك، سوف أطلب منك إعادتها مرة اخرى بعد بضعة دقائق

توجهات الزمان

ما هو اليوم الحالي؟ ما هو / هي ال ...

سنة؟	0	1
فصل؟	0	1
شهر من السنة؟	0	1
اليوم من الاسبوع؟	0	1
تاريخ اليوم؟	0	1

توجهات المكان *

أين نحن الآن؟ ما هو / هي ال ...

دولة (مقاطعة)؟	0	1
محافظة (أو مدينة / بلدة)؟	0	1
مدينة / بلدة (أو جزء من المدينة / الحي)؟	0	1
مبنى (الإسم أو النوع)؟	0	1
طابق المبنى (رقم الغرفة أو العنوان)؟	0	1

* كلمات المكان البديلة والتي تكون مناسبة للمحيط وتزيد الدقة قد يمكن إستبدالها وتدوينها.

التذكر

ماهي الثلاث كلمات التي سألتك ان تتذكرها؟ (لا تقدم أي تلميحات)

حليب	0	1
معقول	0	1
قبل	0	1

لإجراء اختبار الحالة العقلية المصغر-2: الإصدار القياسي، انسخ "مجموع النقاط الخام لاختبار الحالة العقلية المصغر-BV:2"، وسجّله في المساحة الموجودة في أعلى الصفحة 2 ثم استمر بإجراء الاختبار.

مجموع النقاط الخام لاختبار الحالة العقلية المصغر-BV:2

(16 نقطة حد أقصى)

اغمض عينيك

Appendix F: Trunk Impairment Scale TIS

Item			
	Static sitting balance		
1	Starting position	Patient falls or cannot maintain starting position for 10 seconds without arm support	☐ 0
		Patient can maintain starting position for 10 seconds If score = 0, then TIS total score = 0	☐ 2
2	Starting position Therapist crosses the unaffected leg over the hemiplegic leg	Patient falls or cannot maintain sitting position for 10 seconds without arm support	☐ 0
		Patient can maintain sitting position for 10 seconds	☐ 2
3	Starting position Patient crosses the unaffected leg over the hemiplegic leg	Patient falls	☐ 0
		Patient cannot cross the legs without arm support on bed or table	☐ 1
		Patient crosses the legs but displaces the trunk more than 10 cm backwards or assists crossing with the hand	☐ 2
		Patient crosses the legs without trunk displacement or assistance	☐ 3
		Total static sitting balance	/7
	Dynamic sitting balance		
1	Starting position Patient is instructed to touch the bed or table with the hemiplegic elbow (by shortening the hemiplegic side and lengthening the unaffected side) and return to the starting position	Patient falls, needs support from an upper extremity or the elbow does not touch the bed or table	☐ 0
		Patient moves actively without help, elbow touches bed or table If score = 0, then items 2 and 3 score 0	☐ 1
2	Repeat item 1	Patient demonstrates no or opposite shortening/lengthening	☐ 0
		Patient demonstrates appropriate shortening/lengthening If score = 0, then item 3 scores 0	☐ 1
3	Repeat item 1	Patient compensates. Possible compensations are: (1) use of upper extremity, (2) contralateral hip abduction, (3) hip flexion (if elbow touches bed or table further then proximal half of femur), (4) knee flexion, (5) sliding of the feet	☐ 0
		Patient moves without compensation	☐ 1
4	Starting position Patient is instructed to touch the bed or table with the unaffected elbow (by shortening the unaffected side and lengthening the hemiplegic side) and return to the starting position	Patient falls, needs support from an upper extremity or the elbow does not touch the bed or table	☐ 0
		Patient moves actively without help, elbow touches bed or table If score = 0, then items 5 and 6 score 0	☐ 1
5	Repeat item 4	Patient demonstrates no or opposite shortening/lengthening	☐ 0
		Patient demonstrates appropriate shortening/lengthening If score = 0, then item 6 scores 0	☐ 1

Item			
6	Repeat item 4	Patient compensates. Possible compensations are: (1) use of upper extremity, (2) contralateral hip abduction, (3) hip flexion (if elbow touches bed or table further then proximal half of femur), (4) knee flexion, (5) sliding of the feet	☐ 0
		Patient moves without compensation	☐ 1
7	Starting position Patient is instructed to lift pelvis from bed or table at the hemiplegic side (by shortening the hemiplegic side and lengthening the unaffected side) and return to the starting position	Patient demonstrates no or opposite shortening/lengthening	☐ 0
		Patient demonstrates appropriate shortening/lengthening If score = 0, then item 8 scores 0	☐ 1
8	Repeat item 7	Patient compensates. Possible compensations are: (1) use of upper extremity, (2) pushing off with the ipsilateral foot (heel loses contact with the floor)	☐ 0
		Patient moves without compensation	☐ 1
9	Starting position Patient is instructed to lift pelvis from bed or table at the unaffected side (by shortening the unaffected side and lengthening the hemiplegic side) and return to the starting position	Patient demonstrates no or opposite shortening/lengthening	☐ 0
		Patient demonstrates appropriate shortening/lengthening If score = 0, then item 10 scores 0	☐ 1
10	Repeat item 9	Patient compensates. Possible compensations are: (1) use of upper extremities, (2) pushing off with the ipsilateral foot (heel loses contact with the floor)	☐ 0
		Patient moves without compensation	☐ 1
		Total dynamic sitting balance	/10
	Co-ordination		
1	Starting position Patient is instructed to rotate upper trunk 6 times (every shoulder should be moved forward 3 times), first side that moves must be hemiplegic side, head should be fixated in starting position	Hemiplegic side is not moved three times	☐ 0
		Rotation is asymmetrical	☐ 1
		Rotation is symmetrical If score = 0, then item 2 scores 0	☐ 2
2	Repeat item 1 within 6 seconds	Rotation is asymmetrical	☐ 0
		Rotation is symmetrical	☐ 1
3	Starting position Patient is instructed to rotate lower trunk 6 times (every knee should be moved forward 3 times), first side that moves must be hemiplegic side, upper trunk should be fixated in starting position	Hemiplegic side is not moved three times	☐ 0
		Rotation is asymmetrical	☐ 1
		Rotation is symmetrical If score = 0, then item 4 scores 0	☐ 2
4	Repeat item 3 within 6 seconds	Rotation is asymmetrical	☐ 0
		Rotation is symmetrical	☐ 1
		Total co-ordination	/6
		Total Trunk Impairment Scale	/23

Appendix G: Berg Balance Scale BBS

7- Berg Balance Tests and Rating Scale [To be filled by the researcher]

ITEM DESCRIPTION SCORE (0-4) Sitting to standing _____ Standing
unsupported _____ Sitting
unsupported _____ Standing to sitting _____ Transfers _____ Standing with eyes
closed _____
Standing with feet together _____ Reaching forward with outstretched arm _____
Retrieving object
from floor _____ Turning to look behind _____ Turning 360 degrees _____ Placing
alternate foot
on stool _____ Standing with one foot in front _____ Standing on one foot _____
TOTAL _____

GENERAL INSTRUCTIONS

Please demonstrate each task and/or give instructions as written. When scoring, please record the
lowest response category that applies for each item.
In most items, the subject is asked to maintain a given position for a specific time. Progressively
more points are deducted if the time or distance requirements are not met, if the

subject's
performance warrants supervision, or if the subject touches an external support or receives
assistance from the examiner. Subjects should understand that they must maintain their balance
while attempting the tasks. The choices of which leg to stand on or how far to reach are left to the
subject. Poor judgment will adversely influence the performance and the scoring.
Equipment required for testing are a stopwatch or watch with a second hand, and a ruler or other
indicator of 2, 5 and 10 inches (5, 12 and 25 cm). Chairs used during testing should be of
reasonable height. Either a step or a stool (of average step height) may be used for item #12.

1. SITTING TO STANDING

INSTRUCTIONS: Please stand up. Try not to use your hands 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 to stabilize
( ) 0 needs moderate or maximal assist to stand

2. STANDING UNSUPPORTED

INSTRUCTIONS: Please stand for two minutes without holding.
( ) 4 able to stand safely 2 minutes
( ) 3 able to stand 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 unassisted
Page 2
If a subject is able to stand 2 minutes unsupported, score full points for sitting unsupported.
Proceed to item #4.

3. SITTING WITH BACK UNSUPPORTED BUT FEET SUPPORTED ON FLOOR OR ON A STOOL

INSTRUCTIONS: Please sit with arms folded for 2 minutes.
( ) 4 able to sit safely and securely 2 minutes
( ) 3 able to sit 2 minutes under supervision
( ) 2 able to sit 30 seconds
( ) 1 able to sit 10 seconds
( ) 0 unable to sit without support 10 seconds

4. STANDING TO SITTING

INSTRUCTIONS: Please sit down.
( ) 4 sits safely with minimal use of hands
( ) 3 controls descent by using hands
( ) 2 uses back of legs against chair to control descent
( ) 1 sits independently but has uncontrolled descent
( ) 0 needs assistance to sit

5. TRANSFERS

INSTRUCTIONS: Arrange chairs(s) for a pivot transfer. Ask subject to transfer one

way toward a
seat with armrests and one way toward a seat without armrests. You may use two chairs (one with
and one without armrests) or 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. STANDING UNSUPPORTED WITH EYES CLOSED

INSTRUCTIONS: Please close your eyes and stand still for 10 seconds.
( ) 4 able to stand 10 seconds safely
( ) 3 able to stand 10 seconds with supervision
( ) 2 able to stand 3 seconds
( ) 1 unable to keep eyes closed 3 seconds but stays steady
( ) 0 needs help to keep from falling

7. STANDING UNSUPPORTED WITH FEET TOGETHER

INSTRUCTIONS: Place your feet together and stand without holding.
( ) 4 able to place feet together independently and stand 1 minute safely
( ) 3 able to place feet together independently and stand for 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 with feet together
( ) 0 needs help to attain position and unable to hold for 15 seconds
Page 3

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. (Examiner places a ruler at end of fingertips when arm is at 90 degrees. Fingers should not
touch the ruler while reaching forward. The recorded measure is the distance forward that the
finger reaches while the subject is in the most forward lean position. When possible, ask 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 safely (5 inches)
( ) 2 can reach forward >5 cm safely (2 inches)
( ) 1 reaches forward but needs supervision
( ) 0 loses balance while trying/requires external support

9. PICK UP OBJECT FROM THE FLOOR FROM A STANDING POSITION

INSTRUCTIONS: Pick up the shoe/slipper which is placed in front of your feet.
( ) 4 able to pick up slipper safely and easily
( ) 3 able to pick up slipper but needs supervision
( ) 2 unable to pick up but reaches 2-5cm (1-2 inches) from slipper and keeps balance
independently
( ) 1 unable to pick up and needs supervision while trying

Appendix H: Functional Independence measure FIM

6- Functional Independence Measure (FIM) Instrument [To be filled by the researcher]

	Before	After
Self-Care		
A. Eating		
B. Grooming		
C. Bathing		
D. Dressing - Upper Body		
E. Dressing - Lower Body		
F. Toileting		
Sphincter Control		
G. Bladder Management		
H. Bowel Management		
Transfers		
I. Bed, Chair, Wheelchair		
J. Toilet		
K. Tub, Shower		
Locomotion		
L. Walk/Wheelchair		
M. Stairs		
Motor Subtotal Score		
Communication		
N. Comprehension		
O. Expression		
Social Cognition		
P. Social Interaction		
Q. Problem Solving		
R. Memory		
Cognitive Subtotal Score		
TOTAL FIM Score		

L E V E L S	**Independent** 7 Complete Independence (Timely, Safely) 6 Modified Independence (Device)	**NO HELPER**
	Modified Dependence 5 Supervision (Subject = 100%+) 4 Minimal Assist (Subject = 75%+) 3 Moderate Assist (Subject = 50%+) **Complete Dependence** 2 Maximal Assist (Subject = 25%+) 1 Total Assist (Subject = less than 25%)	**HELPER**
	Note: Leave no blanks. Enter 1 if patient is not testable due to risk.	

Appendix I: Data Collection

1- Personal information [To be filled by the patient]	
1- Age	<20 years
	21-35 years
	36-50 years
	51-65 years
	>65 years
2- Gender	Male
	Female
3- Highest level of education	Primary
	Secondary
	University degree
4- Hypertensive?	Yes
	No
5- Diabetic?	Yes
	No
6- Which side is affected by the stroke?	Right
	Left
	Both
7- Type of stroke	Subarachnoid hemorrhage
	Intracerebral hemorrhage
	Cerebral infarction
	Stroke, not specified
8- Height (cm)	
9- Weight (kg)	
10- Stroke onset time (weeks)	
11- Stroke location (if applicable, to be filled by the healthcare provider, can choose more than one)	Corona radiate
	Putamen
	Pons
	Thalamus
	Basal ganglion
	Frontal–temporal lobe
	Parieto-occipital lobe
	Others

المستخلص

المقدمة: التوازن أثناء الجلوس والقدرة على أداء حركات الجذع الانتقائية هي مؤشرات مهمة للتنبؤ بالنتائج الوظيفية بعد السكتة الدماغية. المرضى الذين يعانون من حركة العضلات الغير متناسقه وضعف التحكم في حركة عضلات الجذع يؤدي إلى صعوبة في الحركة والأداء اليومي. بالاضافه الى انه يعاني المرضى المصابون بالسكتة الدماغية من ضعف عضلات الساق وانخفاض التوازن ، مما يؤدي إلى تغييرات تعويضية. لاستعادة التوازن لدى هؤلاء المرضى ،لذلك يلزم وضع استراتيجية وضعية وتدريب وظيفي. إن الدراسات التي تبحث في تأثير تمارين جذع العلاج الطبيعي مع إستراتيجية تدريب الورك بهدف تحسين التوازن وكذلك زيادة مستوى الاستقلال بعد السكتة الدماغية محدودة **الهدف**: تهدف هذه الدراسة إلى استكشاف تأثير تمارين الجذع الانتقائية مع التدريب على استراتيجية الورك في تحسين التوازن لدى مرضى السكتة الدماغية وكذلك مستوى الاستقلال. **الطريقة:** شارك ستة واربعين شخصا في إعادة تأهيل مرضى السكتة الدماغية في مراكز متعددة. لديهم تاريخ من السكتة الدماغية تم توزيعهم بشكل عشوائي من أجل المقارنة مع مجموعة تجريبية بالغ عددهم 23 ومجموعه مجموعة لاتخضع للتجربه عددهم 23. بالإضافة إلى العلاج التقليدي ، تلقت المجموعة التجريبية تمارين الجذع انتقائية إضافية مع التدريب على إستراتيجية الورك. خضعت جميع المجموعات للعلاج الطبيعي أربع مرات في الأسبوع لمدة ستة أسابيع. تم تقييم توازن الجلوس الثابت والديناميكي وكذلك تنسيق حركة الجذع من خلال مقياس ضعف الجذع (TIS) ، وتم تقييم قدرات التوازن الوظيفي الثابت والديناميكي من خلال مقياس توازن (BBS) ، ومقياس الاستقلال الوظيفي (FIM) تم استخدامه لقياس الوضع الوظيفي ومستوى الاستقلال. تم قياسها قبل وبعد 6 أسابيع من العلاج. . **النتائج**: بناءً على نتائج القياسات المأخوذة من المرضى بعد التدخل العلاجي في المجموعة التجريبية كانت أعلى بكثير من تلك في المجموعة الضابطة. أظهر مقياس ضعف الجذع مقياس TIS ، ومقياسه الفرعي للمجموعة التجريبية تحسنًا أكبر بكثير من تلك الخاصة بالمجموعة الضابطة. كما تحسنت درجة ميزان بيرج (BBS) بشكل ملحوظ في المجموعة التجريبية. بالإضافة إلى ذلك ، كانت هذه التحسينات أعلى بشكل ملحوظ في مقياس الاستقلال الوظيفي (FIM) في المجموعة التجريبية **الخلاصة:** أظهرت هذه الدراسة أن إضافة تمارين جذع انتقائية بالتزامن مع تدريب استراتيجية الورك للمرضى بعد أن يكون لها تأثير إيجابي في التحكم في الجذع أثناء الجلوس الثابت والديناميكي التوازن والتوازن الوظيفي ومستوى الاستقلال. التي تكون فعالة في إعادة التأهيل بعد السكتة الدماغية

الكلمات المفتاحية: السكتة الدماغية ، الجذع ، إستراتيجية الورك ، التوازن. الاستقلال الوظيفي ، إعادة التأهيل

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قسم العلاج الطبيعي والتأهيل الصحي

تأثير تمارين الجذع مع استراتيجية تدريب الورك لزيادة مستوى الإستقلالية والتوازن لمرضى السكتة الدماغية

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