EFFECTIVENESS OF SELECTIVE TRUNK BALANCE EXERCISES VERSUS CONVENTIONAL THERAPY ON TRUNK PERFORMANCE AND FUNCTIONAL SITTING BALANCE IN PATIENTS WITH ACUTE HEMIPARETIC STROKE

Dissertation submitted to

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COLLEGE OF PHYSIOTHERAPY

SRI RAMAKRISHNA INSTITUTE OF PARAMEDICAL SCIENCES

COIMBATORE – 641044

CERTIFICATE

This is to certify that the dissertation work entitled **"Effectiveness of Selective Trunk Balance Exercises versus Conventional therapy on Trunk Performance and Functional Sitting Balance in Patients with Acute Hemiparetic Stroke"** was carried out by the candidate bearing the **Register No. 271720002 (May 2019)** in College of Physiotherapy, SRIPMS, Coimbatore, affiliated to the Tamil Nadu Dr. M.G.R Medical University, Chennai towards partial fulfillment of the **Master of Physiotherapy (Neurology).**

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INTERNAL EXAMINER **EXTERNAL EXAMINER**

Place:
Date:

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With great privilege I express my deep sense of gratitude to the **God Almighty** for his blessings, love and care for me and who have always been my source of inner strength and courage throughout my life.

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ABBREVATIONS

- **TIS (F)** – Trunk impairment scale (Fujiwara)
- **MFRT** – Modified Functional Reach Test

ABSTRACT

Introduction: After stroke, recovery of functional sitting balance is important because it is essential to obtain independence in vital functions of personal daily tasks and ability to reach for a variety of objects. Thus, regaining trunk control has been a major focus of stroke rehabilitation. In this study, the head to head comparison of selective trunk balance exercises and the conventional treatment for assessing trunk control and balance on the Trunk Impairment Scale and Modified Functional Reach Test in acute hemiparetic stroke patients has been done.

Objective of the study: To compare the effectiveness of selective trunk balance exercises and conventional therapy on trunk performance and functional sitting balance in patients with acute hemiparetic stroke.

Study setting: Department of Physiotherapy and Neurology ward, Sri Ramakrishna Hospital.

Intervention: 30 subjects with acute stroke, aged between 30-60years were selected and assigned in two groups, receiving selective trunk balance exercises (Group A) and conventional physical therapy (Group B). Patients of both the groups received treatment session for 5 days per week for 3 weeks.

Outcome measures: Trunk Impairment Scale (Fujiwara) and Modified Functional Reach Test (Forward, paretic and non-paretic lateral reaches) were used to evaluate pre and post therapy outcome.

Results: Significant improvement in trunk performance and functional sitting balance was seen in both the groups. Selective trunk balance exercises shows more superior improvement on TIS F and MFRT than in conventional physiotherapy. Selective trunk balance exercises showed intervention at the level 0.05% with the p value <0.05.

Conclusion: Both Selective Trunk Balance Exercises and Conventional therapy can improve on Trunk Performance and Functional Sitting Balance in Patients with Acute Hemiparetic Stroke. However, Selective Trunk Balance Exercises has shown a better effect than the conventional therapy.

Key words: *Stroke, Selective trunk balance exercises, Conventional therapy, TIS (F) and MFRT*

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Introduction

1. INTRODUCTION

"Ghosts or Vampires can't scare me, I'm a stroke survivor" could be the best words of relief of any person, who have won the battle against the leading death causing and disability producing **STROKE.**

A stroke is a central nervous system disease that has a serious impact on individual's lives. It is a leading cause of disability worldwide that affects mostly elderly people and it is one of the commonest life threatening neurological disorder all over world.[1,2] The greatest impact of stroke on both patients and families are the long term disability, including impairments, limitation of activity and participation restriction in life situation.[3]

Worldwide 15 million people suffer a stroke each year. Of these 5 million die each year and another 5 million live with permanent disability. [4]

In India, the estimated adjusted prevalence rate of stroke ranges, 84-262/100,000 in rural and 334-424/ 100,000 in urban areas. The incidence rate is about 119-145/100,000 based on the recent population based studies in 2013 and the prevalence estimated to be 203 per 1, 00,000 people and it is projected to rank as the fourth leading cause of disability by the year of 2020. [5]

The highest fatality rate of 42% was reported in Kolkata. In India, stroke incidence is certain to increase in the coming years due to

- Increase in population
- Increase in life-expectancy
- Rapid urbanization from migration of villagers to the cities
- Changing lifestyle involving sedentary lifestyles, smoking, excess alcohol use, etc
- Rising stress levels.[5,6]

The WHO definition of stroke is ***"rapidly developing clinical signs of focal or global disturbance of cerebral function with symptoms lasting 24 hours or longer or leading to death with no apparent cause other than of vascular origin".***[7]

It is caused by complete cerebral circulatory arrest resulting in irreversible cellular damage with a core area of focal infarction within minutes. [8] Stroke is essentially a preventable disease with known manageable risk factors. The established risk factors for stroke are hypertension, cardio vascular disease, cigarette smoking, obesity, elevated serum fibrinogen levels, diabetes, and a sedentary lifestyle and the use of contraceptives with high doses of estrogen. [9]

The middle cerebral artery (MCA) is most common site for stroke. The blood supply to the brain comes from the internal carotid and the vertebral arteries. MCA is the largest branch of internal carotid artery and is the main supplier to the hemisphere's convexity including the frontal, parietal and temporal lobes as well as the insula. These areas include large parts of motor and sensory cortices including the area of representation for the trunk which lies between the arm and leg areas. [10]

The symptoms are contralateral voluntary movements are impaired as well as language disturbance and impaired spatial perception depending on which hemisphere is involved. In MCA stroke the upper limb is more affected than the lower limb and the trunk tend to be represented bilaterally. This is due to the involvement of pre-motor area 6 of the primary motor cortex which controls the anticipatory postural changes. [11]

The clinical features and the effect of stroke are variable. It is determined by lesion location, size and the extend of subsequent recovery. The lesions in multiple locations and tended to display poorer trunk control than the single lesion location. The trunk control between single right and left M5 lesion locations with right hemispheric lesion demonstrating poorer trunk control than the left. [12]

The national guidelines have also recommended at least 30 minutes of moderate intensity physical activity on all days of the week to reduce the risk of stroke. [13] One of the most important functions of the central nervous system is to coordinate posture and movement to stabilize the body during movements and perturbations. The various body segments are linked together in a functional kinematic chain connecting the eyes to the feet, in which the trunk serves at the centre.[14,15] Trunk control is a central aspect of postural control for balance, walking and other functional activities and has been found to be impaired after stroke. The segments of the trunk and pelvis are interconnected and independent in human functional movement as most of the deep and superficial muscles of the back and abdomen attached the trunk to the pelvis and spine. [16]

The human trunk is bilaterally innervated and a postural role for muscles on both sides of the trunk during limb movement. In stroke, the trunk muscles are impaired on both ipsilateral and contralateral side of body to that of lesion this is because the trunk muscle functions are synchrony so that trunk muscle strength was impaired multidirectional in the stroke population. [17] The muscles of the trunk and pelvis are responsible for dynamic stability of the trunk in functional activities. [18]

Loss of trunk control commonly occurs in patients who had stroke and persists into the chronic stage of recovery. Impairments in trunk control include weakness, loss of stability, stiffness, and loss of proprioception and may lead to [9]

- Dysfunction in upper and lower limb control
- Increased risk of falls
- Potential for spinal deformity and contracture
- Impaired ability to interact with the environment
- Decreased independence in activities of daily living (ADL)
- Decreased sitting and standing tolerance, balance, and function

The recovery of functional sitting balance is important because it is essential to obtain independence in vital functions of personal daily tasks and ability to reach for a variety of objects located both within and beyond arm's length. Sitting is the first upright posture to be restored after stroke, about 93% of patients in the stroke population can achieve 1-minute independent sitting balance within 6 days of stroke onset. [19]

Physiotherapy is the most common rehabilitation intervention and role of physiotherapy is mainly focused on improvement in motor function at both impairment and activity levels. Neuro rehabilitation is important for reducing the long term consequence of stroke, aiming to achieve an optimal functional recovery for home and community reintegration. [20] Various studies have demonstrated the effects of therapeutic approaches used after stroke e.g. motor learning, strengthening exercises of limb muscles and these studies are mainly concerned with the lower or upper extremity.

The altered trunk movements are a challenge for the maintenance of the body equilibrium, and restoration of normal movements of the trunk and of the pelvis in patients with stroke. [21] The trunk performance is considered to be the important predictor for balance and functional performance. Regaining trunk control has been a major focus of stroke rehabilitation. [9]

Several scales and tests have been demonstrated to be valid for assessing trunk performance in stroke including the Trunk Control Test (TCT), Trunk Impairment Scale (TIS v & TIS F), Postural Assessment Scale for Stroke (PASS), Ottawa Sitting Scale (OSS), Modified Functional Reach Test (MFRT), Function in Sitting Test (FIST), Physical Ability Scale (PAS), Trunk Recovery Scale (TRS), Balance Assessment in Sitting and Standing Positions (BASSP) and Sitting-Rising Test (SRT).[22]

In this study, the head to head comparison of selective trunk balance exercises and the conventional treatment for assessing trunk control and balance on the trunk impairment scale (TIS F) and modified functional reach test in acute hemiparetic stroke patients.

1.1 NEED FOR THE STUDY

The trunk is the biggest part of our body and plays an important role in the stabilization and movement of body segments. Trunk control requires appropriate sensoriomotor ability of the trunk in order to provide a stable foundation for balance functions in patients with stroke. After stroke, the trunk performance should be determined in order to establish appropriate treatment strategies for balance and mobility functioning. Following stroke, the bed mobility and sitting balance capacity are largely dependent on the recovery of trunk control.

Many patients with stroke tend to demonstrate insufficient trunk control affecting their functional ability in many activities. Therefore, the aim of the study is to compare the effectiveness of the selective trunk balance exercises and conventional therapy on trunk performance and functional sitting balance in acute stroke.

1.2 AIM OF THE STUDY

The aim of the study is to compare the effectiveness of selective trunk balance exercises and conventional therapy on trunk performance and functional sitting balance in patients with acute hemiparetic stroke.

1.3 OBJECTIVE OF THE STUDY

- To find of the effectiveness of selective trunk balance exercises on trunk performance and functional sitting balance in patients with acute hemiparetic stroke
- To find of the effectiveness of conventional exercises on trunk performance and functional sitting balance in patients with acute hemiparetic stroke
- To compare the effectiveness of selective trunk balance exercises and conventional therapy on trunk performance and functional sitting balance in patients with acute hemiparetic stroke.

1.4 HYPOTHESIS

Null Hypothesis (H_0)

There will be no significant difference between the effectiveness of selective trunk balance exercises and conventional physical therapy in the treatment of acute hemiparetic stroke.

Alternate Hypothesis (H_1)

There will be significant difference between the effectiveness of selective trunk balance exercises and conventional physical therapy in the treatment of acute hemiparetic stroke.

Review of Literature

2. REVIEW OF LITERATURE

- **Koshiro Haruyama et al (2017),**[23] stated that the trunk function is important for standing balance, mobility, and functional outcome after stroke and concluded that core stability training improved balance and mobility in addition to trunk function more than the conventional physical therapy program in stroke patients.

- **Felix Renald .S et al (2016),**[24] conducted a study to compare the efficacy of trunk exercises on Swiss ball with trunk exercises performed on bed in improving trunk control among hemiparetic patients and concluded that Swiss ball training gives more significant improvement in trunk control than bed exercises and the trunk coordination improves more when trained on Swiss ball than on bed.

- **Julee Das et al (2016),**[25] conducted a study to analyze the trunk rehabilitation program in addressing one of the most common impairment after stroke and concluded that the trunk rehabilitation intervention which was implemented to improve trunk control and balance in acute hemiparetic ischemic stroke patients showed clinically and statistically significant improvement in their trunk control and dynamic sitting balance compared from day 1 and at the end of 3rd week.

- **Seung-HeonAn et al (2016),**[26] stated that the combined STE and NDT program showed improvements in measures of mobility, balance, and trunk control in chronic stroke patients, as the results suggest that STE should be considered to be included in the treatment program for patients with chronic stroke.

- **Bae SH et al (2013),**[27] stated that the potential activation of trunk muscles is greater when trunk exercises are performed on a Swiss ball because it is an unstable surface which provides an postural perturbation to which the trunk muscles has to respond in order to maintain the desired posture

- **Rosa Cabanaset al (2013),**[28] evaluated the effect of trunk training exercises (TTE) for improving trunk performances and sitting balance and related to keeping balance in the sitting position. Trunk exercises performed with unstable or stable surface can be one method of rehabilitation training in both sub-acute and chronic stroke. The TTE may affect time adjustments and improve trunk performance and dynamic sitting balance in stroke subjects. This indicates the importance of trunk exercises in the rehabilitation of stroke patients.

- **Sea Hyun Bae, MSc, PT et al (2013),**[29] concluded that exercise on the unstable support surface enhanced the size of the cross-sectional area of the trunk muscles and balance ability significantly more than exercise on the stable support surface.

- **Akshatha Nayak et al (2012),**[30] concluded that task specific trunk exercises performed on Swiss ball provided significant improvement in dynamic sitting balance and trunk coordination in stroke patients.

- **Karthikbabu .S et al (2011),**[31] examined whether task-specific trunk exercises performed on the physio ball are more beneficial than similar exercises performed on the plinth and concluded that the Task-specific trunk exercises using physio ball is superior to similar exercises performed on plinth in improving trunk control and functional balance in patients with acute stroke.

- **Michal Katz-Leurer et al (2009),**[32] evaluated the within-session reliability of sitting balance measures by assessing forward and lateral reach while sitting in both healthy subjects and patients after stroke. Result in Acquisition of functional skills is the primary focus of any physical therapy program and a forward lean is a component of many functional skills (getting up, dressing, wheelchair propulsion). The study concluded that the MFRT while sitting can be reliably measured and may serve as a useful outcome measure in individuals with 2 – 8 weeks of post-event stroke. The MFRT in all directions on both occasions exhibited high reliability (intra-class correlation coefficient range, 0.90 – 0.97).

- **Duncan M et al (2009),**[33] stated that trunk muscle activity was greater when trunk exercises are performed on a Swiss ball in comparison to similar exercises performed on stable surface in healthy adults.

- **Geert Verheyden, et al (2009),**[34]evaluated the effect of additional trunk exercises on trunk performance after stroke, results suggest that extra task-specific exercises aiming to improve trunk performance than the conventional therapy only and concluded that conventional therapy plus trunk exercises improving sitting balance and selective trunk movements after stroke

- **Paula Teixeira de Aguiar et al (2008),**[35] stated that Fujiwara's TIS is the only scale found that contains items of muscular strength assessment, confirming the assertion that there are outcomes that demonstrate an association between muscular strength and trunk control. Fujiwara's TIS also presented a prognostic value through the FIM. Concluded that the clinical evaluation of trunk control, through the use of scales (TCT, PASS and TIS V &TIS F) is an important tool for the prognosis of the functional capacity of hemiparetic patients after a stroke and for the planning of a specific and differentiated treatment of these patients

- **Catherine M Dean et al (2007),**[36] stated that the sitting training protocol was both feasible and effective in improving sitting and standing up early after stroke and somewhat effective six months later. The experimental group significantly improved sitting ability as measured by the average maximum reach distance during forward and across reaches compared with the control group.

- **Geert Verheyden et al (2007),**[37] reviewed clinical tools to assess trunk performance after stroke. Based on four biomedical databases, articles were selected which included the development or use of a clinical scale. And it was concluded that Standardized clinical measures are the Trunk Control Test and two Trunk Impairment Scales (TIS V &TIS F)

- **Fujiwara T et al (2004),**[38] investigated that the trunk impairment from a behavioral perspective. It was stated that while complementing instrumental investigations it can be easily administered at bedside in any clinical setting and concluded that newly developed TIS is a useful adjunct in stroke outcome research, with satisfactory psychometric properties. (Inter-rater Reliability: weighted Kappa's for each of the seven items were 0.89 for verticality, 0.81 for abdominal muscle strength, 1.00 for PTV, 0.86 for ROT-A, 0.66 for ROT-U, 0.89 for RR-A, and 0.88 for RR-U).

Methodology

3. METHODOLOGY

3.1 MATERIALS USED

- Assessment charts
- Plinth
- Stool
- Swiss ball
- Pillows

3.2 METHODS OF THE STUDY

3.2.1 Study Design:

The study design is a comparative design.

3.2.2 Study Setting:

The study was conducted at the Department of Physiotherapy and Neurology ward, Sri Ramakrishna Hospital, under the supervision of the guide, College of Physiotherapy, SRIPMS, Coimbatore.

3.2.3 Study Duration:

The study duration was 6 months.

3.2.4 Sample

30 subjects with acute stroke were selected and assigned in two groups based on simple random sample technique.

GROUP A: This group received selective trunk balance exercises

GROUP B: This group received conventional physical therapy

3.3 CRITERIA FOR SAMPLE SELECTION

3.3.1 Inclusion Criteria

- Age between 20 to 60 years
- Patients with middle cerebral artery stroke (Ischaemic or haemorrhagic cause)
- Medically stable patients
- 5-15days of stroke
- Able to sit independently
- Able to understand the verbal commands

3.3.2 Exclusion Criteria

- Severe cardiopulmonary disease
- Psychosocial problems like depression, anxiety
- Previous stroke and additional lesions in the brain
- Musculoskeletal disorders such as low backache, arthritis or degenerative diseases

3.3.3 Orientation of Subjects

- The consent form was dated and with clear explanation about evaluation methods and different therapeutic techniques to be applied was signed by patients and obtained before the study.

3.3.4 Collection of Data

- The source of data was gathered from Sri Ramakrishna Hospital, Coimbatore.

3.4 VARIABLES

3.4.1 Dependent variables

- Trunk control
- Functional sitting balance

3.4.2 Independent variables

- Selective trunk balance exercise
- Conventional physiotherapy

3.5 OUTCOME MEASURES

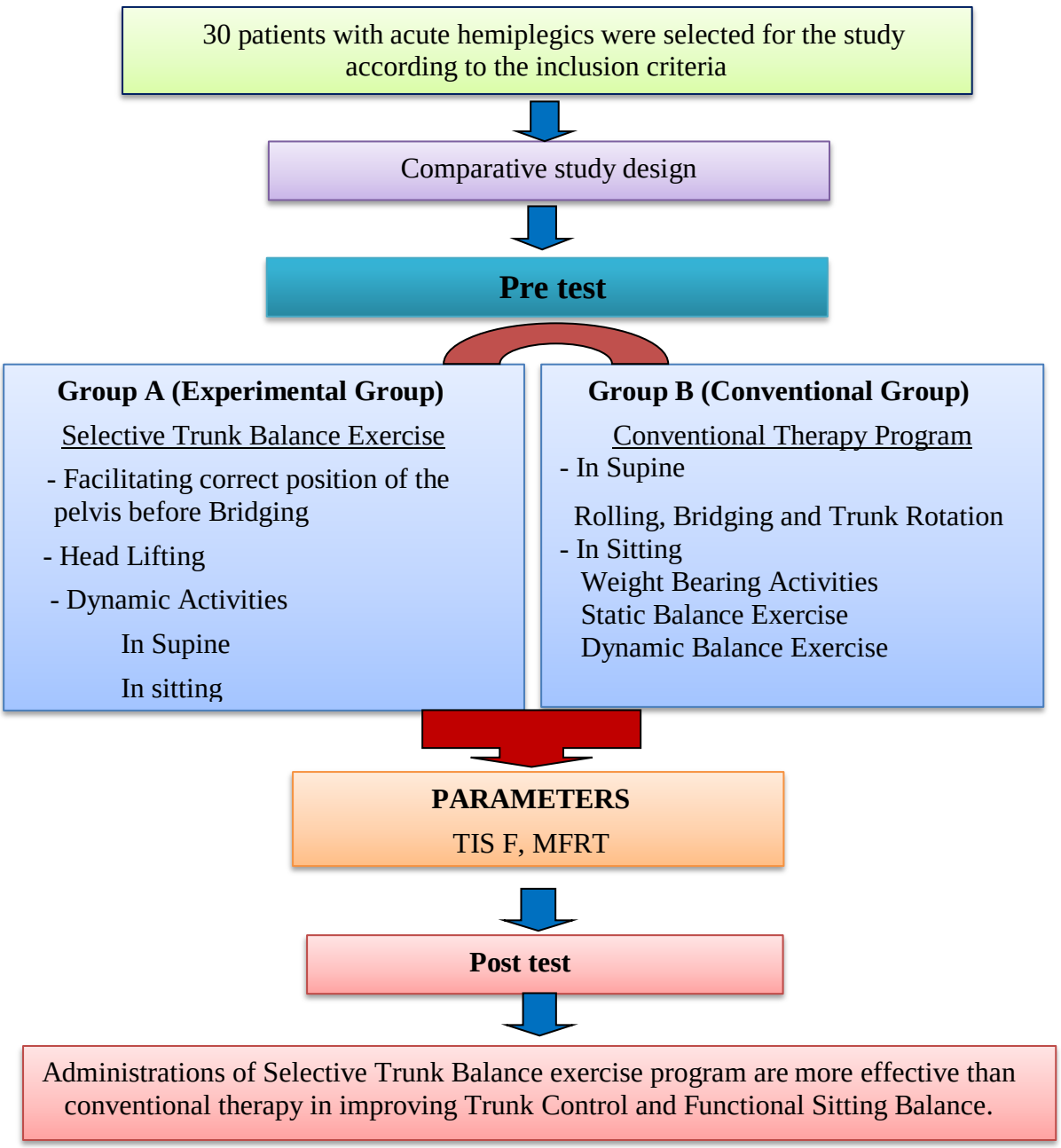
3.5.1 Primary outcome measure

- Trunk Impairment Scale (Fujiwara)

3.5.2 Secondary outcome measure

- Modified Functional Reach Test

3.6 FLOW CHART



3.7 INTERVENTION PROTOCOL

Patients of both the groups received treatment session for 5 days per week for 3 weeks. The duration of treatment period was 45 minutes per each session and each exercise for 20 repetitions with interval of 30 seconds after each10 repetitions.

GROUP A (Selective Trunk Balance Exercises)

In this group, selective trunk balance exercises were administered in supine lying and sitting position.

- **Supine Lying**

In the early stages after the onset of hemiplegia, the patient has little control over the movements of his trunk, the exercises in lying is preparation for moving against gravity.

Facilitating the correct position of the pelvis before bridging

To make the movement more selective, the therapist taught the patient to tilt the pelvis up in the front by contracting his/her lower abdominal muscles. Therapist facilitated the correct movement by placing one hand over the patient's sound buttock and drawing the pelvis forwards and upwards. With the other hand guides the umbilicus downwards and indicates the fulcrum around which the movement took place.

Fig: 1 Facilitating the correct position of the pelvis before bridging

Head lifting

The therapist moved the upper trunk into the fullest degree of flexion with rotation which is possible then asked the patient to lift the head. Therapist assisted the movement of patient head with one hand placing it in the correct position so that patient chin is pointing towards the middle of the chest and the head held actively with some lateral flexion towards the uppermost side. The therapist encouraged the patient to hold the position of his/her trunk and head actively as therapist gave less and less support with the hand which is behind his/her scapula.

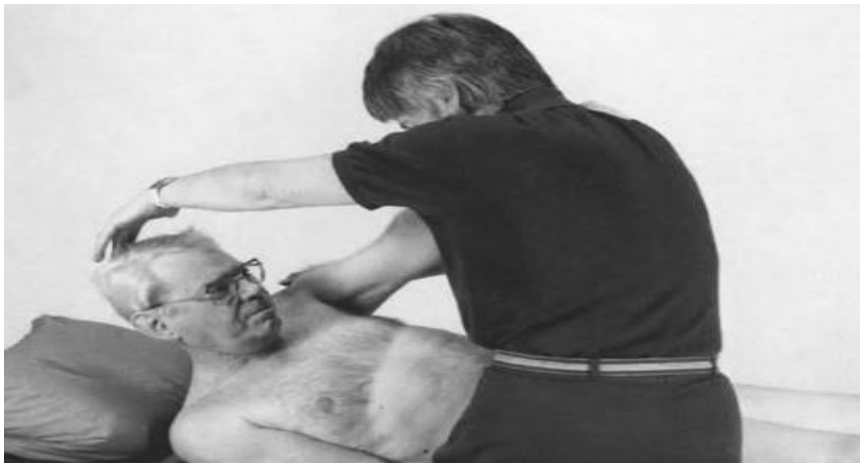


Fig: 2 Head lifting

Dynamic Activities

Gymnastic ball formed a useful part of the treatment program. During the development of adult motor patterns, most people have at some time sat on a ball, lain on a ball, thrown, caught, bounced and kicked a ball. The experience can therefore be said to have formed an integral part of our motor learning. The ball can be beneficial for the treatment for several reasons. The ball provides the patient with information from his surroundings helping him to carry out the movement correctly. The resulting muscle activity still adheres to the principles of the tentacle and the bridge. The tentacle is that part of the body which moves in space from the part supported on the ball. The bridge is the part of the body supported between the ball and the floor.

Bridging

The patient was lying on the back, the ball was placed nearer to the patient's knees at first and arms remain at sides. As the patient's control improved, the ball was placed gradually further and further away from patient until it is beneath heels directly in line with the long axis of his/her body. The therapist guided the patient's legs appropriately, so that patient can feel the correction.

Fig: 3 Bridging

The patient was asked to raise the sound arm to about 90° flexion at the shoulder and the hemiplegic arm was moved passively. The amount of trunk activity was increased when his/her arm is not pressing against the floor to stabilize the ball.

Unilateral bridging

The patient was lying on the back, the ball was placed near to the patient's knees at first and arms remain at sides. Ask the patient to lift the uninvolved leg off the ball, with therapist supporting the involved leg

Fig: 4 Unilateral bridging

Abducting and Adducting One Leg with the Other Leg Supported on the Ball

The patient's trunk and head lie supported on the plinth. Patient arms were in abducted position and remained in contact with the floor, the palms were facing downwards. The therapist helped the patient to place their hemiplegic leg on the ball in a relaxed position and instructed to lift the sound foot into the air. Maintaining an angle of more than 90° of hip flexion, the therapist then instructed the patient to do adduction and abduction of the sound leg, the therapist assisted the hemiplegic leg to move with the ball in the contralateral direction simultaneously.

Fig: 5 Abducting and Adducting One Leg with the Other Leg Supported on the Ball

The patient was asked to clasp the hand at the chest level, maintaining the angle of more than 90° of hip flexion, the therapist then instructed the patient to do abduction and adduction of the sound leg and assisted the hemiplegic leg to move with the ball in the contralateral direction simultaneously. The therapist assisted the arm in the correct position and gradually reduced the amount of support.

The same activity was practiced with the sound leg resting on the ball and the therapist rhythmically moved the hemiplegic leg from adduction to abduction.

Rotation

Lower trunk rotation

The patient was asked to turn the legs to one side until the lateral border of the leg was in contact with the ball. The other leg was supported on the leg below, and the patient tried not to let his/her pelvis sag towards the floor.

Fig: 6 Lower trunk rotations

Sitting

Holding - rhythmic stabilization

The patient sat with the head and trunk vertical both hips and knees flexed to 90^0 and feet flat on the floor. Posture is symmetrical with equal weight bearing over both buttocks and feet.

The patient is asked to hold the sitting position while the therapist applies rotational resistance to the upper trunk one hand placed on the posterior trunk of one side (lower axillary border of the scapula) pushing forward, while the other hand on the opposite side, anterior upper trunk pulling back. The therapist hands are then reversed for the opposite movement.

Fig 7: Rhythmic stabilization

Static sitting balance

The patient sat on the Swiss ball, trunk was upright and legs were slightly abducted. The therapist stood behind the patient to adjust the position, to give an adequate support and to control the ball with the legs.

Patients were made to sit on the Swiss ball with the foot kept flat on the floor the therapist gives visual and verbal feedback and ask the patient to maintain correct back posture and balance to maintain the upright sitting position.

Fig: 8 Static sitting balance

Weight shifts

While sitting on Swiss ball, the patient shifted body weight on either side of the body by moving forward, backward and laterally.

Forward and backward

The patient drew the ball forwards between legs while maintaining extension of thoracic spine. The therapist assisted the patient to stabilize the thorax, using one arm supporting the front of chest and other hand assisting extension from behind. With one leg moves the ball forwards in the required direction.

Fig: 9 Forward and backward

Lateral Flexion

The therapist stood lateral to the patient and used the arms to stabilize the thorax and take some of the weight of patients' trunk. Therapist used the knees to move the ball to the other side and the patients moved it back to the neutral.

The therapist stood on the other side of the patient and repeated the same movement to the opposite side.

Fig: 10 Lateral Flexion

Dynamic sitting balance

Forward reach out

Patients were seated on the Swiss ball with support, and they were asked to bend the trunk forward and backward with upper limb maintained in clasped hand position with shoulder in forward flexion at 90 degree.

Fig: 11 Forward reach out

Lateral reach out (affected and unaffected side)

Patients were seated on the Swiss ball, they were asked to lift the sound arm sideways and touch the target point, and on the affected side, they were asked to place hands on thighs and reach the target point with the acromion process of the shoulder.

Fig: 12 Lateral reach out (unaffected and affected side

Upper trunk rotation

Patients were seated on the Swiss ball, they were asked to rotate upper trunk on either side with the upper limb maintained in clasped hand position with shoulder in forward flexion at 90 degree.

Fig: 13 Upper trunk rotation sitting

Marching in place

Patients were seated on the ball, they were asked to lift the sound knee then place foot in same place. The therapist stood behind the patient to adjust position, to give an adequate support and to control the ball with the legs.

Fig: 14 ***Marching in place***

GROUP- B (Conventional Physiotherapy):

The patient allotted in this group received the following treatment

In supine lying

Rolling: In supine modified crook lying with the foot flat on the mat to assist the roll and ask patient to clasp both hands and asked to let move the arms up and roll supine to side lying to right/left, therapist assist the patient further progressed by giving resistance during rolling by the therapist.

Pelvic bridging: In supine lying both the patient's legs are placed on the bed and asked to lift the pelvis off the bed.

Unilateral bridging: Performed by lifting the uninvolved leg off the bed while maintaining the pelvic bridge position.

Trunk rotation: In crook lying the patient was performed to rotate his/her upper trunk by clasping both hands and moving towards right and left without the involvement of pelvis. The lower trunk rotation was performed in crook lying position by rotating the pelvis to both right and left side with the affected limb being supported by the therapist.

In Sitting

The patient sat with the head and trunk vertical both hips and knees flexed to 90^0 and feet flat on the floor. Posture is symmetrical with equal weight bearing over both buttocks and feet.

Weight Bearing Activities

The patient is in sitting position and asked to place upper extremity away from the body in extended and then weight is transferred to the hand. The therapist holds one hand over the dorsum of hand to prevent finger flexion while other hand on top of shoulder applying approximation further progression by moving to both the sides and then forward and backward.

Static Balance Exercise

The patient is made to sit on stool with both feet flat on the floor and the therapist gives visual and verbal feedback to maintain the upright sitting position further progressed with tactile and verbal feedback in closed eyes position.

Dynamic Balance Exercise

The patient made to sit on stool with both feet flat on the floor and both upper extremities across the chest and arms cradled position, the therapist sit in front of the stool with placing the patients affected leg between the therapist legs and then assists the forward and backward movement of the trunk without thoracic flexion

3.8 STATISTICAL TOOL

It is a comparative study design in which pre-test and post-test were performed for conventional Group and experimental Group. The data collected on selected variables was analyzed using independent t test. The calculated t value is compared with table t value to find out whether a significant difference exists between groups. If calculated t value is less than the table t value then Null Hypothesis is accepted. If calculated t value is greater than the table t value then the Alternative Hypothesis is accepted. All statistical analysis was computed at 0.05 level of significance.

INDEPENDENT 't' TEST:

$$\mathbf{S} = \sqrt{\frac{\sum(X_1 - X_1')^2 + \sum(X_2 - X_2')^2}{n_1 + n_2 - 2}}$$

$$\mathbf{t} = \frac{\overline{x_1} - \overline{x_2}}{s} \sqrt{\frac{n_1 n_2}{n_1 + n_2}}$$

X_1 = Post test values of Group A

X_2 = Post test values of Group B

X'_1 = Post test mean value of Group A

X'_2 = Post test mean value of Group B

n_1 = Number of samples in Group A

n_2 = Number of samples in Group B

S = Combined Standard Deviation

t = Calculated t value

Data Analysis And Interpretation

4. DATA ANALYSIS AND INTERPRETATION

4.1 TRUNK IMPAIRMENT SCALE [TIS F]

GROUP A

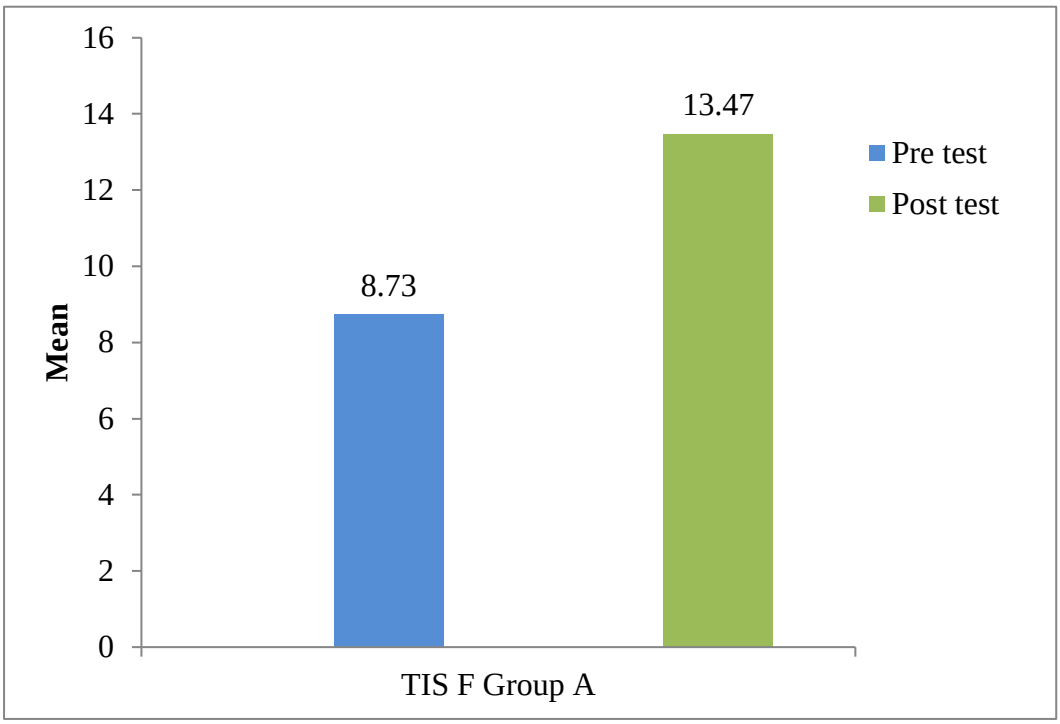
TABLE – 4.1.1

S.no	Pre test	Post test (X_1)	X_1-X_1^1	$(X_1$-$X^1)^2$
1.	10	14	0.53	0.28
2.	9	13	-0.47	0.22
3.	10	15	1.53	2.34
4.	8	11	-2.47	6.10
5.	7	12	-1.47	2.16
6.	11	15	1.53	2.34
7.	9	13	-0.47	0.22
8.	10	15	1.53	2.34
9.	8	13	-0.47	0.22
10.	9	11	-2.47	6.10
11.	7	13	-0.47	0.22
12.	6	14	0.53	0.28
13.	10	16	2.53	6.40
14.	9	15	1.53	2.34
15.	8	12	-1.47	2.16

$\sum(X_1 - X_1')^2 = 35.72$

GRAPH 1

COMPARISON OF (TIS F) PRE & POST TEST BETWEEN GROUP A



Statistical	Pre test	Post test
Mean	**8.73**	**13.47**
Standard deviation	**1.39**	**1.55**

TRUNK IMPAIRMENT SCALE [TIS F]

GROUP B

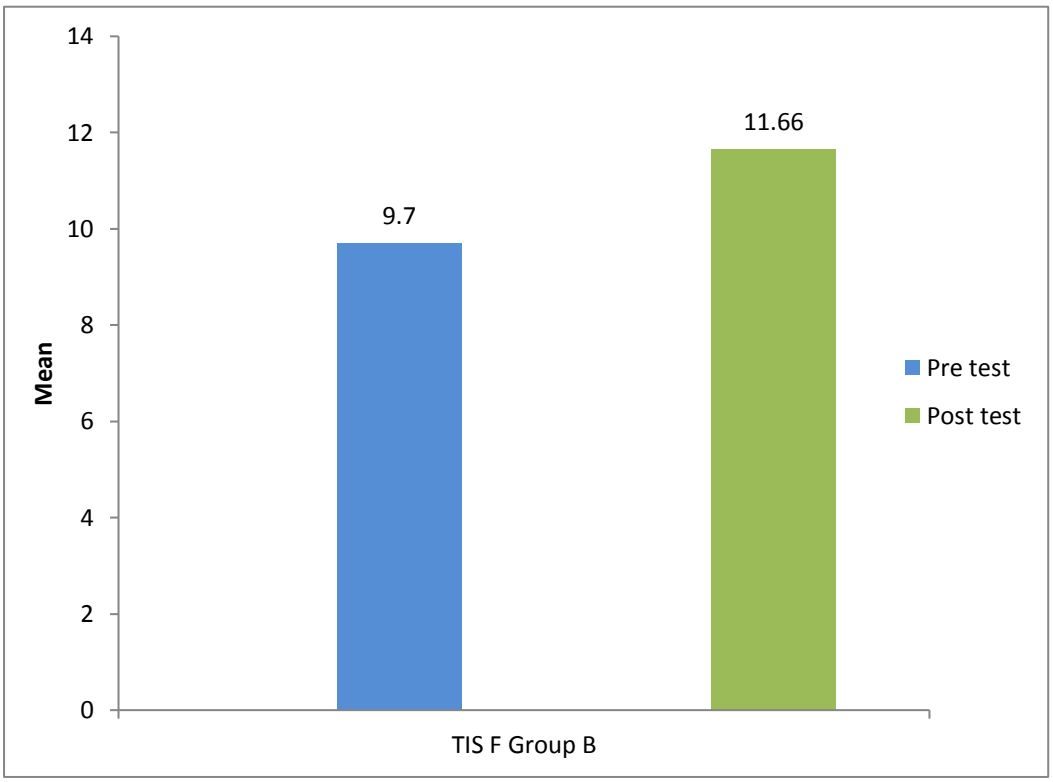
TABLE – 4.1.2

S.no	Pre test	Post test (X_2)	X_2-X_2^1	$(X_2$-$X_2^1)^2$
1.	13	15	3.34	11.16
2.	10	12	0.34	0.12
3.	6	9	-2.66	7.08
4.	10	13	1.34	1.80
5.	6	8	-3.66	13.40
6.	10	14	2.34	5.48
7.	10	11	-0.66	0.44
8.	6	9	-2.66	7.08
9.	5	7	-4.66	21.72
10.	8	11	-0.66	0.44
11.	13	15	3.34	11.16
12.	9	9	-2.66	7.08
13.	15	17	5.34	28.52
14.	11	12	0.34	0.12
15.	10	13	1.34	1.80

$\sum(X_2 - X_2')^2$ = 117.4

GRAPH 2

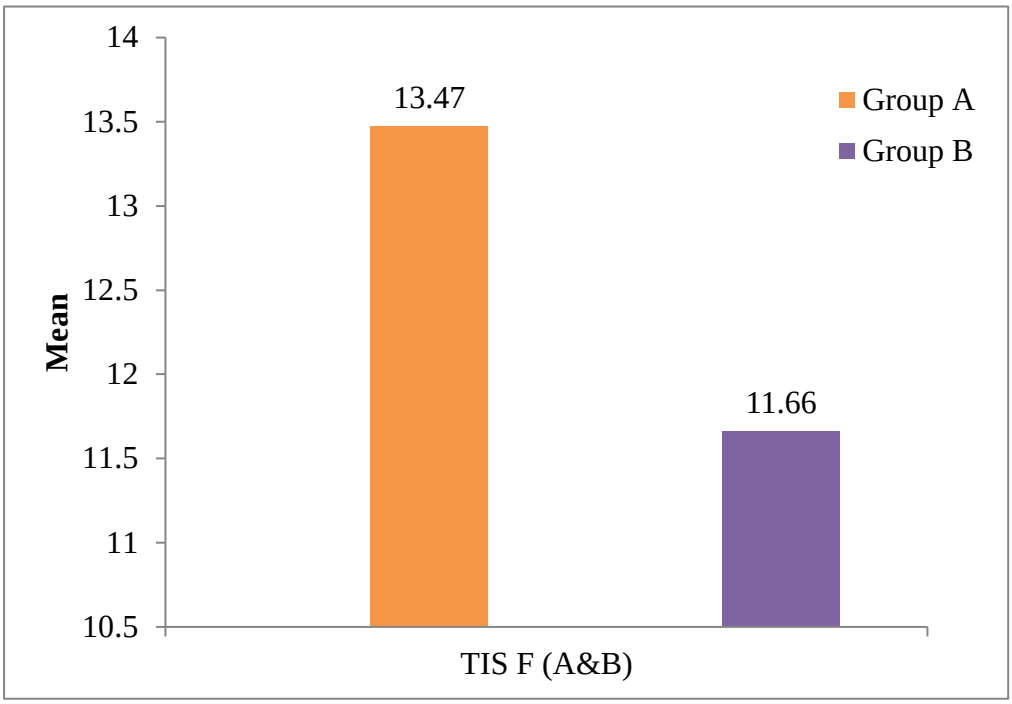
COMPARISON OF (TIS F) PRE & POST TEST BETWEEN GROUP B



Statistical	Pre test	Post test
Mean	9.7	11.66
Standard deviation	2.90	2.89

GRAPH 3

COMPARISON OF POST TEST BETWEEN GROUP A & B (TIS F)



Mean		SD	t value	P value
Group A	Group B			
13.47	11.66	2.34	2.119	0.043

4.2 MODIFIED FUNCTIONAL REACH TEST

MFRT FORWARD

GROUP A

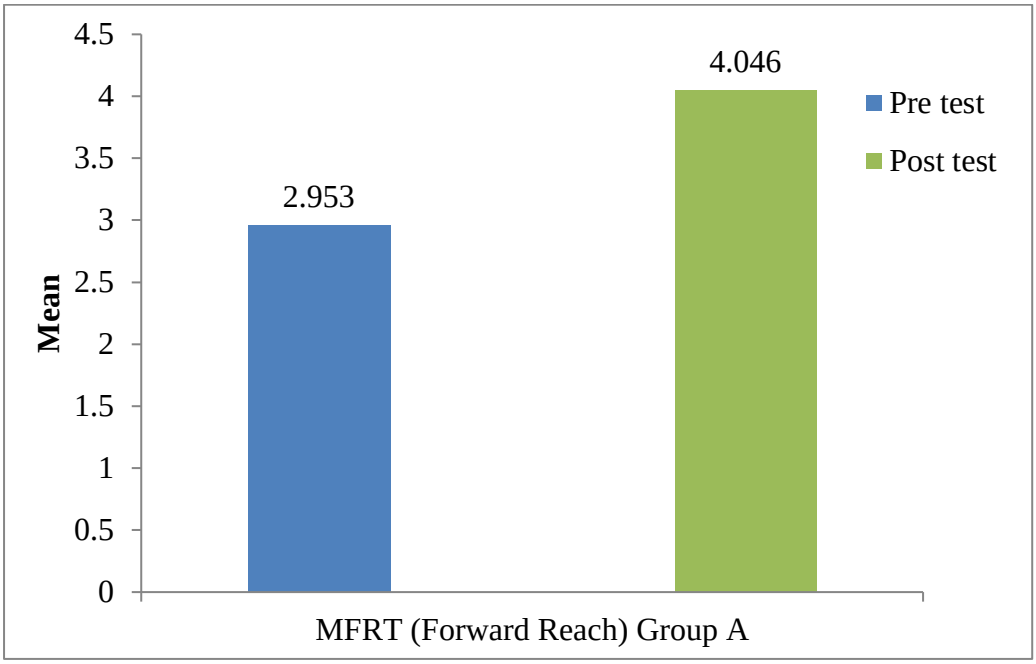
TABLE – 4.2.1

S.no	Pre test (cm)	Post test (cm) (X_1)	X_1-X_1^1	$(X_1-X_1^1)^2$
1.	3.5	4.8	0.75	0.56
2.	2.9	3.8	-0.25	0.06
3.	3.1	4.2	0.15	0.02
4.	2.7	4.2	0.15	0.02
5.	3.3	4.3	0.25	0.06
6.	3.2	4.1	0.05	0.00
7.	2.6	3.9	-0.15	0.02
8.	2.6	3.8	-0.25	0.06
9.	2.7	3.7	-0.35	0.12
10.	2.9	4.1	0.05	0.00
11.	3.1	4.2	0.15	0.02
12.	3.3	4.0	-0.05	0.02
13.	2.9	3.9	-0.15	0.02
14.	2.7	3.6	-0.45	0.20
15.	2.8	4.1	0.05	0.00

$\sum(X_1 - X_1')^2 = 1.18$

GRAPH 4

COMPARISON OF MFRT (Forward) PRE & POST TEST BETWEEN GROUP A



Statistical	Pre test	Post test
Mean	**2.953**	**4.046**
Standard deviation	**0.283**	**0.292**

MFRT FORWARD

GROUP B

TABLE – 4.2.2

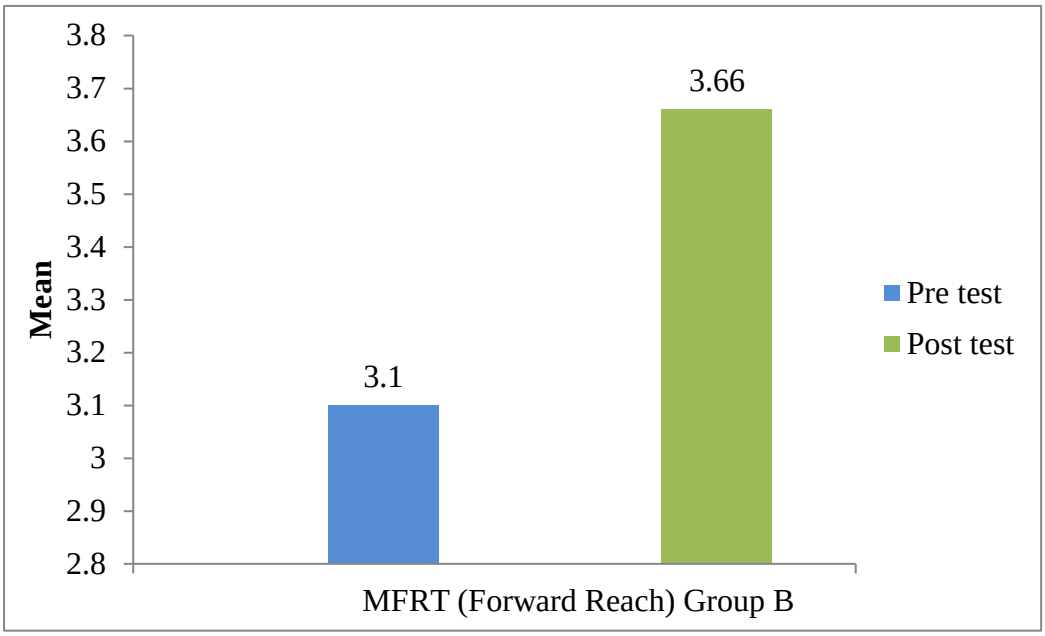
S.No	Pre test (cm)	Post test (cm) (X_2)	X_2-X_2^1	$(X_2$-$X_2^1)^2$
1.	3.2	3.6	-0.06	0.00
2.	2.6	3.0	-0.66	0.43
3.	2.8	3.4	-0.26	0.07
4.	3.1	3.9	0.24	0.57
5.	3.3	3.9	0.24	0.57
6.	3.5	4.0	0.34	0.11
7.	2.9	3.8	0.14	0.02
8.	3.1	3.9	0.24	0.57
9.	3.5	3.7	0.04	0.00
10.	3.5	4.1	0.44	0.19
11.	3.1	3.6	-0.06	0.00
12.	3.4	3.9	0.24	0.57
13.	2.8	3.6	0.06	0.00
14.	2.6	3.0	0.66	0.43
15.	3.1	3.5	-0.16	0.03

$\sum(X_2 - X_2')^2 = 3.56$

GRAPH 5

COMPARISON OF MFRT (Forward)

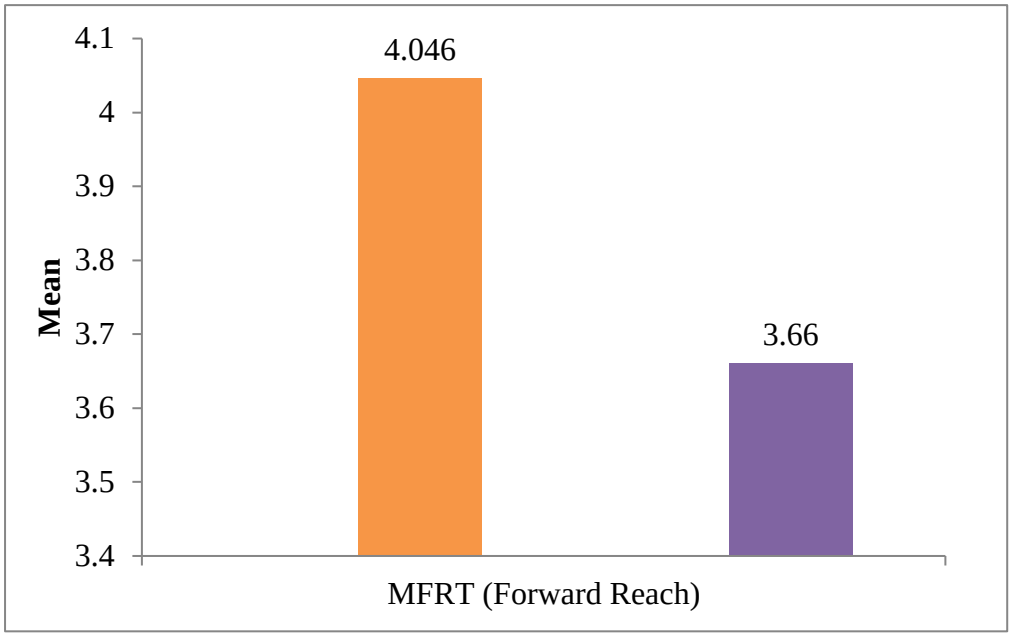
PRE & POST TEST BETWEEN GROUP B



Statistical	Pre test	Post test
Mean	**3.100**	**3.660**
Standard deviation	**0.309**	**0.331**

GRAPH 6

COMPARISON OF MFRT (Forward Reach) POST TEST BETWEEN GROUP A & B



Mean		SD	't' value	P value
Group A	Group B			
4.046	3.660	0.412	2.567	0.002

MFRT PARETIC SIDE

GROUP A

TABLE – 4.2.3

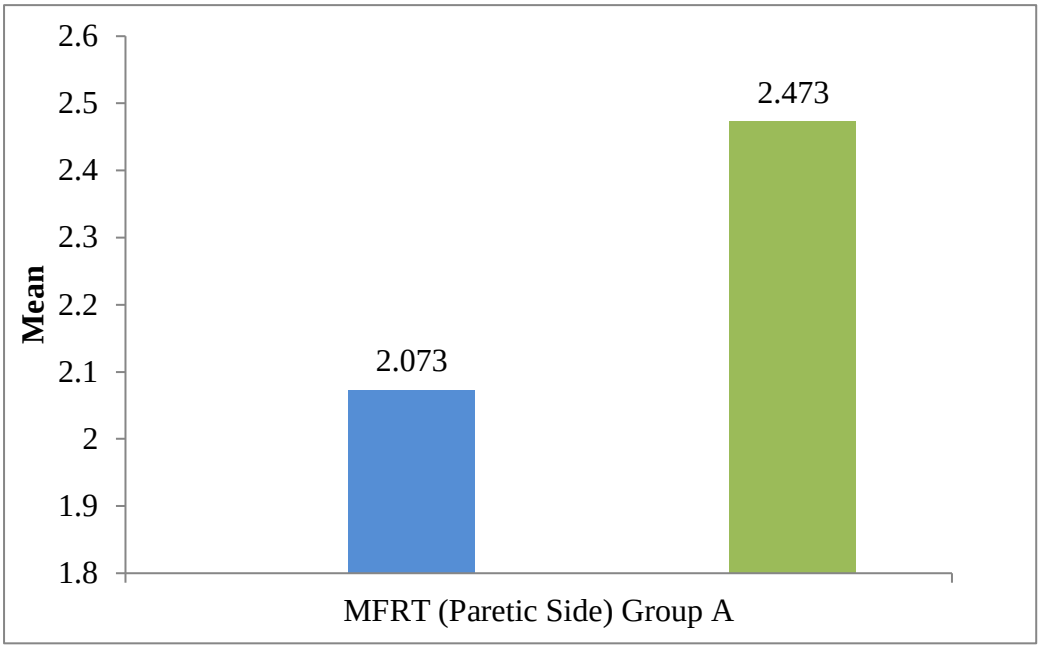
S.no	Pre test (cm)	Post test (cm) (X_1)	X_1-X_1^1	$(X_1-X_1^1)^2$
1.	2.2	2.4	-0.03	0.00
2.	2.3	2.6	0.13	0.02
3.	2.1	2.5	0.03	0.00
4.	2.2	2.6	0.13	0.02
5.	1.8	2.4	-0.03	0.00
6.	1.9	2.3	-0.17	0.03
7.	2.1	2.5	0.03	0.00
8.	1.7	2.2	-0.27	0.07
9.	1.9	2.3	-0.17	0.03
10.	2.1	2.5	0.03	0.00
11.	2.2	2.5	0.03	0.00
12.	2.3	2.6	0.13	0.02
13.	2.4	2.9	0.43	0.18
14.	1.9	2.3	-0.17	0.03
15.	2.1	2.5	0.03	0.00

$$\sum(X_1 - X_1')^2 = 0.4$$

GRAPH 7

COMPARISON OF MFRT (Paretic Side)

PRE & POST TEST BETWEEN GROUP A



Statistical	Pre test	Post test
Mean	**2.073**	**2.473**
Standard deviation	**0.194**	**0.171**

MFRT - PARETIC SIDE

GROUP B

TABLE 4.2.4

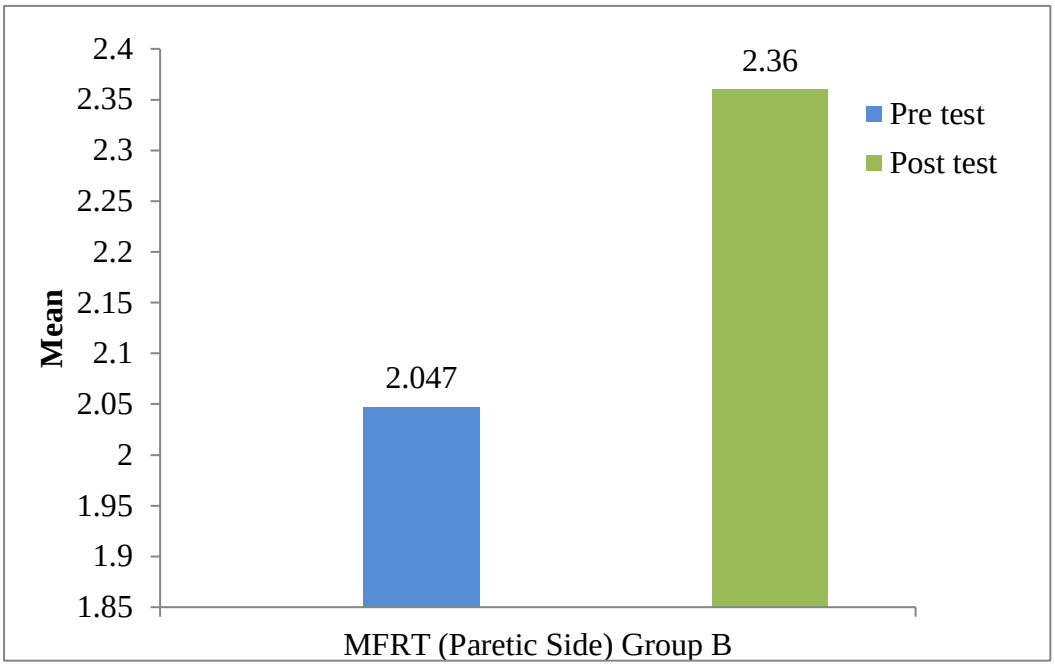
S.No	Pre test (cm)	Post test (cm) (X_2)	X_2-X_2^1	$(X_2$-$X_2^1)^2$
1.	2.1	2.4	0.04	0.00
2.	2.1	2.5	0.14	0.02
3.	2.3	2.5	0.14	0.02
4.	2.2	2.6	0.24	0.06
5.	1.6	1.9	-0.46	0.21
6.	1.7	2.1	-0.26	0.07
7.	1.9	2.2	-0.16	0.03
8.	2.1	2.4	0.04	0.00
9.	2.3	2.6	0.24	0.06
10.	2.1	2.4	0.04	0.00
11.	2.1	2.3	-0.06	0.00
12.	1.9	2.3	-0.06	0.00
13.	1.8	2.2	-0.16	0.03
14.	2.2	2.5	0.14	0.02
15.	2.3	2.5	0.14	0.02

$\sum(X_2 - X_2')^2 = 0.54$

GRAPH 8

COMPARISON OF MFRT (Paretic Side) PRE &

POST TEST BETWEEEN GROUP B

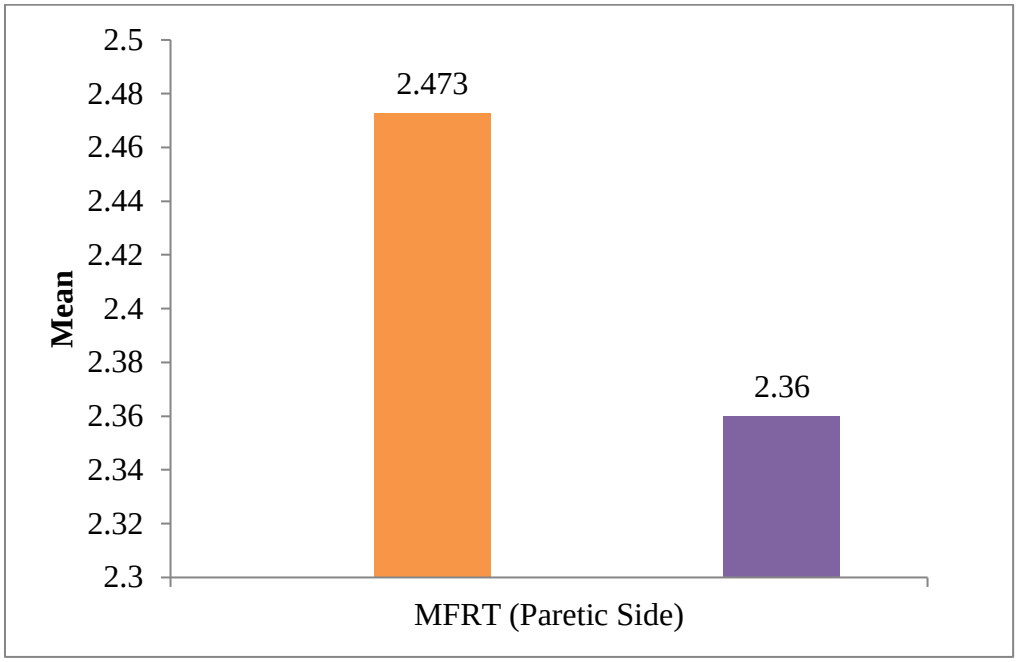


Statistical	Pre test	Post test
Mean	**2.047**	**2.360**
Standard deviation	**0.220**	**0.196**

GRAPH 9

COMPARISON OF MFRT (Paretic Side)

POST TEST BETWEEN GROUP A & B



Mean		SD	P value	t value
Group A	Group B			
2.473	2.360	0.034	0.1023	1.6892

MFRT – NON PARETIC SIDE

GROUP A

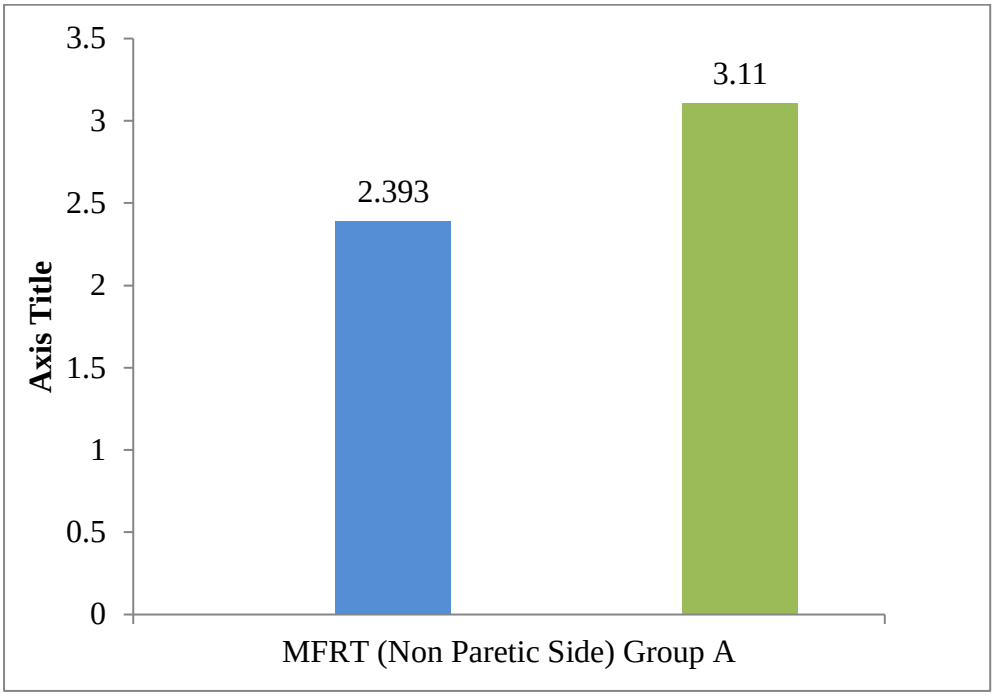
TABLE 4.2.5

S.No	Pre test	Post test (X_1)	X_1-X_1^1	$(X_1$-$X_1^1)^2$
1.	2.6	3.4	0.29	0.08
2.	2.7	3.6	0.49	0.24
3.	2.5	3.1	-0.01	0.00
4.	2.4	2.9	-0.21	0.04
5.	2.3	3.2	0.09	0.00
6.	2.2	2.9	-0.21	0.04
7.	2.4	2.9	-0.21	0.04
8.	2.3	3.0	-0.11	0.01
9.	2.4	3.3	0.19	0.04
10.	2.2	2.8	-0.31	0.10
11.	2.3	2.9	-0.21	0.04
12.	2.4	3.1	-0.01	0.00
13.	2.3	2.9	-0.21	0.04
14.	2.1	2.8	-0.31	0.10
15.	2.8	3.8	0.69	0.48

$$\sum(X_1 - X_1')^2 = 1.25$$

GRAPH 10

COMPARISON OF MFRT (Non Paretic Side) PRE & POST TEST BETWEEN GROUP A



Statistical	Pre test	Post test
Mean	2.393	3.11
Standard deviation	0.191	0.301

MFRT - NON PARETIC SIDE

GROUP B

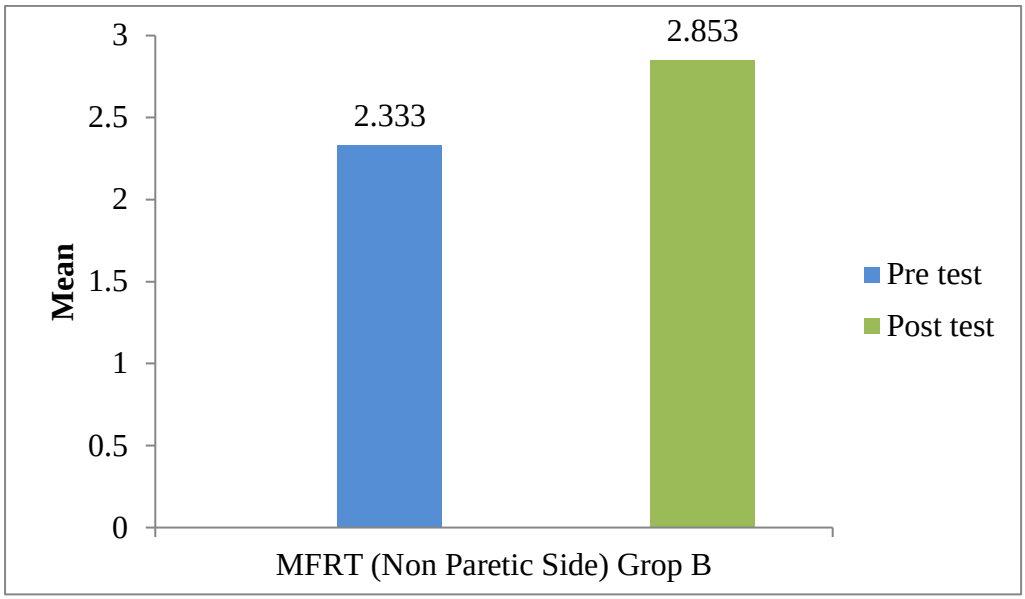
TABLE 4.2.6

S.No	Pre test	Post test (X_2)	X_2-X_2^1	$(X_2$-$X_2^1)^2$
1.	2.2	2.9	0.05	0.00
2.	2.3	2.8	-0.05	0.00
3.	2.4	2.9	0.05	0.00
4.	2.5	3.1	0.25	0.06
5.	2.1	2.6	-0.25	0.06
6.	2.4	2.9	0.05	0.00
7.	2.3	2.8	-0.05	0.00
8.	2.4	2.8	-0.05	0.00
9.	2.2	2.7	-0.15	0.02
10.	2.2	2.8	-0.05	0.00
11.	2.3	2.8	-0.05	0.00
12.	2.1	2.6	-0.25	0.06
13.	2.6	3.1	0.25	0.06
14.	2.5	3.1	0.25	0.06
15.	2.5	2.9	0.05	0.00

$$\sum(X_2 - X_2')^2 = 0.32$$

GRAPH 11

COMPARISON OF MFRT (Non Paretic Side) PRE & POST TEST BETWEEN GROUP B

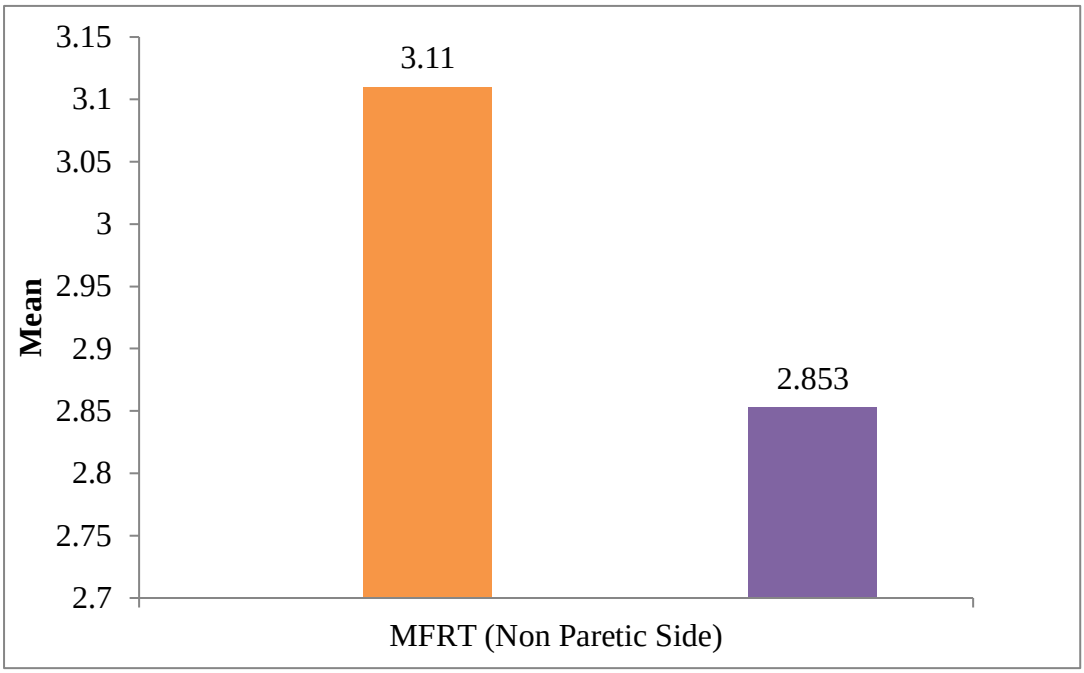


Statistical	Pre test	Post test
Mean	**2.333**	**2.853**
Standard deviation	**0.154**	**0.160**

GRAPH 12

COMPARISON OF MFRT (Non Paretic Side)

POST TEST BETWEEN GROUP A & B



Mean		SD	P value	t value
Group A	Group B			
3.11	2.853	0.57	0.0076	2.8784

4.3 COMPARISON OF RESULTS

Parameter	Groups	Mean	SD	p Value	Calculated 't' value	Table 't' value
TIS F	GROUP A	13.47	2.34	0.043	2.119	2.048
	GROUP B	11.66				

Parameter	Groups	Mean	SD	P Value	Calculated 't' value	Table 't' value
MFRT FORWARD	GROUP A	4.046	0.412	0.0021	2.567	2.048
	GROUP B	3.660				
PARETIC	GROUP A	2.473	0.034	0.1023	1.6892	2.048
	GROUP B	2.360				
NON PARETIC	GROUP A	3.107	0.57	0.0076	2.8784	2.048
	GROUP B	2.853				

Discussion

5. DISCUSSION

The aim of the study was to examine whether selective trunk balance exercises are more beneficial than conventional therapy on trunk performance and functional sitting balance in patients with acute hemiparetic stroke.

The study results showed that selective trunk balance exercises are more effective than conventional therapy program for improving trunk performance as measured by Trunk Impairment Scale (TIS F), respectively. Furthermore, the experimental group showed greater improvement in functional sitting balance component of the Modified Functional Reach Test than the control group, suggesting a carry-over effect with trunk rehabilitation.

Another finding of this study was that selective trunk balance exercises had a carry-over effect in improving functional balance such as sitting and the better weight shift ability towards the hemiplegic side.

A study done by Karthikbabu et al 2011 suggested that task-specific trunk exercises practiced in a challenging environmental field (i.e. a stable as against an unstable surface) provided a gradual biomechanical demand on the trunk muscles. Those treatment techniques were based on the ecological motor control theory and through this, the patient achieved a new skill. [31]

A study by Julee Daset al 2016 concluded that trunk performance and dynamic sitting balance could be improved early in the rehabilitation process, better functional improvement after stroke might be expected. Trunk rehabilitation exercises also showed a transfer effect on standing balance and ambulation. These findings might be explained by exercises implemented as soon as possible in functional tasks such as reaching and rolling. [25]

The simple action of sitting upright on the ball and keeping it stationary stimulates co-ordinate activity in the muscles of the trunk.

Muscle activity is stimulated in three different ways:

a. The patient moves the ball in a specific direction.

b. The patient maintains a certain position and prevents movement of the ball.

c. The ball moves or is moved and the patient reacts. [39]

In this study, results showed that selective trunk balance exercises had improvement of the trunk performance (Perception of Trunk Verticality, Rotation [affected and unaffected], Stroke impairment assessment set verticality and Abdominal Muscle Strength), as measured Trunk Impairment Scale Fujiwara as compared with the improvement registered by the control group. In TIS F the righting reflex of the trunk not that much different. Functional sitting balance also improved except paretic side.

In this study, a large portion of trunk rehabilitation program was focused on selective trunk muscle strengthening, such as lifting the pelvis, shoulder girdle and rotating of both abdominal and back muscles. Trunk exercises performed under different conditions of manipulation of sensory input for improving balance with an unstable surface as used in the present study (using Swiss ball) indicates that these type of trunk training significantly improves dynamic sitting balance in acute hemiparetic stroke patients.

The statistical analysis of the study showed that there is a significant difference between the groups in TIS F and MFRT with a ‘t’ value of **TIS F was 2.1223 and in MFRT for forward teach 3.3892, paretic reach 1.6892 and non paretic reach 2.878.**

All the results of this study are significant at the level of **0.05%** except paretic side reach.

Conclusion

6. CONCLUSION

The conclusion of this study is based on the post mean measures of TIS and MFRT of both Group A and Group B and concluded that there is a significant improvement on trunk performance and functional sitting balance in acute stroke patients in Group A, in comparison with the patients in Group B.

As per Data analysis and Interpretation, Null Hypothesis (H_0) is rejected and the Alternate Hypothesis (H_1) is accepted which states that **"There is a significant difference between the effectiveness of selective trunk balance exercises than conventional physical therapy in the treatment of acute hemiparetic stroke".**

6.1 LIMITATIONS

1. Long term effect of the intervention was not assessed.
2. The sample size was small.

6.2 RECOMMENDATIONS

1. Longer duration of intervention with long term follows up, so that long lasting effects can be studied.
2. Other cerebral artery stroke can be included.
3. Larger sample size.

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Appendices

APPENDICES

APPENDIX – I

NEUROLOGICAL ASSESSMENT PERFOMA

SUBJECTIVE EXAMINATION

Name:

Age/ sex:

Occupation:

Address:

Date of admission:

Date of assessment:

Handedness:

Chief complaints:

History:

Present history:

Past history:

Personal history:

Surgical history:

Familial history:

Social history:

Associated problems:

OBJECTIVE EXAMINATION

General examination:

Vitals: BP: Temperature: PR: HR:

On observation:

Body built:

Attitude of limb:

Swelling, redness:

Deformity:

Posture:

Gait:

External appliances:

On palpation:

Muscle firmness:

Swelling:

Warmth:

Tenderness:

NEUROLOGICAL EXAMINATION:

Higher mental function:

Level of consciousness:

Attention:

Orientation:

Memory:

Language:

Calculation:

Judgment:

Proverb interpretation:

Cranial nerve examination:

Sensory examination:

Superficial:

Touch

Pain

Temperature

Pressure

Deep:

Joint position

Kinesthetic sensation

Vibration

Cortical:

Touch localization

Two point discrimination

Stereognosis

Baragnosis

Motor examination:

Muscle tone:

Muscle power:

Reflexes:

Superficial:

Plantar reflex

Abdominal reflex

Anal reflex

Bulbo cavernous reflex

Cremasteric reflex

Deep:

Upper extremity: biceps, triceps, supinator, fingers.

Lower extremity: quadriceps, hamstrings, achilles tendon.

Muscle girth:

Range of motion:

Active ROM:

Passive ROM:

Coordination:

Posture:

Balance:

Gait:

Activity of daily living:

INVESTIGATION:

Blood test:

CSF examination:

Other medical investigation:

Anatomical study: X-Ray, CT scan, MRI

Physiological study: NCV, EMG, SD Curve

DIFFERENTIAL DIAGNOSIS:

PROVISIONAL DIAGNOSIS:

FUNCTIONAL DIAGNOSIS:

Impairment:

- Structural
- Functional

Activity limitation

Participation restriction

APPENDIX – II

Trunk Impairment Scale (Fujiwara)

Trunk Impairment Scale (TIS) designed to assess trunk function at the impairment level.

This tool consists of seven items. Abdominal muscle strength and verticality items were derived from the Stroke Impairment Assessment Set(SIAS), and the other five items consist of the perception of trunk verticality, trunk rotation muscle strength on the affected and the unaffected sides, and righting reflexes both on the affected and the unaffected sides.

TIS attempts to assess trunk function at the impairment level (PTV, righting reflexes and trunk rotator muscle strength).

The rationales for the selection of these TIS items are the perception of the trunk verticality is considered necessary to keep vertical position, the ability to elicit righting reflexes is supposedly necessary for dynamic sitting balance, and abdominal muscle strength is regarded as indispensable in sitting up from the supine position and in rolling the body.

To maintain a sitting posture the perception of trunk verticality and the righting reflex plays an important role to stabilize the body. To roll over and to sit up from a supine position, it is necessary to activate abdominal muscles as the main agonists of trunk flexion, within a chain including postural synergists.

No of items: 7

Score of each item: 0-3 (0 indicating poor performance and 3 indicating best performance)

Score range: 0-21 (a higher score indicating a better performance)

Trunk Impairment Scale Items and Criteria for Scoring:

Perception of Trunk Verticality The examiner then records the degree of trunk angle deviation from the vertical line drawn from the midpoint of the Jacoby line.

While the patient is sitting on the edge of a bed or on a chair without a backrest, with the feet off the ground, the examiner holds both sides of the patient's shoulders and makes the patient's trunk deviate to the right and left. The examiner asks the patient to indicate when he or she feels the trunk is in a vertical Position.

- 0 = The angle is ≥30 degrees.
- 1 = The angle is <30 degrees and ≥20 degrees.
- 2 = The angle is <20 degrees and ≥10 degrees.
- 3 = The angle is <10 degrees.

Trunk Rotation Muscle Strength on the Affected Side

The patient is asked to roll the body from the supine position to the unaffected side. The arms should be crossed in front of the chest and legs kept extended. The patient is asked to roll his or her body without pushing the floor with his or her limbs or pulling on the bed clothes. Isometric contractions for stabilization and other muscles than external oblique (e.g., pectoralis major) activation during rolling are allowed.

- 0 = No contraction is noted in external oblique muscles on the affected side.
- 1 = External oblique muscle contraction is visible on the affected side, but the patient cannot roll his or her body.
- 2 = The patient can lift the affected side scapula but cannot fully rotate the body.
- 3 = The patient can fully rotate the body.

Trunk Rotation Muscle Strength on the Unaffected Side

The patient is asked to roll the body from the supine position to the affected side. Scoring is the same as for the trunk rotation muscle strength on the unaffected side.

Right Reflex on the Affected Side

The patient sits on the edge of a bed or a chair without a backrest. The examiner pushes the patient's shoulder laterally (about 30 degrees) to the unaffected side and scores according to the degree of the reflex elicited on the affected side of the patient's trunk.

- 0 = No reflex is elicited.
- 1 = The reflex is poorly elicited, and the patient cannot bring his or her body back to the erect position as before.
- 2 = The reflex is not strong, but the patient can bring his or her body back to the erect position almost as before.
- 3 = The reflex is strong enough, and the patient can immediately bring his or her body back to the erect position as before.

Righting Reflex on the Unaffected Side

The examiner pushes the patient's shoulder laterally (about 30 degrees) to the affected side. Scoring is the same as for the righting reflex on the affected side.

Stroke Impairment Assessment Set Verticality

- 0 = The patient cannot maintain a sitting position.
- 1 = A sitting position can only be maintained while tilting to one side, and the patient is unable to correct the posture to an erect position.
- 2 = The patient can sit vertically when reminded to do so.
- 3 = The patient can sit vertically in a normal manner.

Stroke Impairment Assessment Set Abdominal Muscle Strength

Stroke Impairment Assessment Set abdominal muscle strength is evaluated with the patient resting in a 45-degree semi reclining position in either a wheelchair or a high back chair. The patient is asked to raise the shoulders off the back of the chair and assume a sitting position.

- 0 = Unable to sit up
- 1= The patient can sit up provided there is no resistance to the movement.
- 2 = The patient can come to a sitting position despite pressure on the sternum by the examiner.
- 3 = The patient has good strength in the abdominal muscles and is able to sit up against considerable resistance.

APPENDIX – III

Modified Functional Reach Test

The MFRT is adapted for individuals who are unable to stand.

Performed with a leveled yardstick that has been mounted on the wall at the height of the patients acromion level in the non-affected arm while sitting in a chair

Hips, knees and ankles positioned are at 90 degree of flexion, with feet positioned flat on the floor

The initial reach is measured with the patient sitting against the back of the chair with the upper-extremity flexed to 90 degrees measure was taken from the distal end of the third metacarpal along the yardstick.

Consists of three conditions over three trials

1. Sitting with the unaffected side near the wall and leaning forward.
2. Sitting with the back to the wall and leaning right.
3. Sitting with the back to the wall leaning left.

Instructions

- Leaning as far as possible in each direction without rotation and without touching the wall and without taking a step.
- Record the distance in centimeters covered in each direction.
- If the patient is unable to raise the affected arm, the distance covered by the acromion during leaning is recorded.
- First trial in each direction is a practice trial and should not include in the final result.
- A 15 second rest break should be allowed between trials.

Equipment required

- A yardstick and duck tap will be needed for the assessment.
- The yardstick should be affixed to the wall at the level of the patient's acromion.

No of items: 3

Assessment type: Performance measure

Score range: Average value of 2&3

Score Sheet

Date	Trial One (Practice)	Trial Two	Trial Three	Total (Average of Trial 2 and 3 only)

APPENDIX – IV

INFORMED CONSENT FORM

I _____ agree to take part in the project study , conducted by _____ , Post graduate student (MPT) , Sri Ramakrishna Institute of Paramedical Sciences ,College of Physiotherapy, DR. M.G.R Medical University.

I acknowledge that the research study on Effectiveness of Selective Trunk Balance Exercises versus Conventional therapy on Trunk Performance and Functional Sitting Balance in Patients with Acute Hemiparetic Stroke has been explained to me and I understand that agreeing to participate in the research means that I am willing to,

- Provide information about my health status to the researcher.
- Allow the researcher to have access to my medical records ,pertaining to the purpose of the study
- Participate in the analysis and treatment program. Make myself available for further analysis if required.

I have been informed about the purpose, procedures and measurements involved in the research and my queries towards the research have been clarified. I understand that my participation is voluntary and can withdraw at any stage of the research.

Contacts address Signature of the patient /care giver

Date Signature of the investigator