EFFECTIVENESS OF BOBATH APPROACH ON TRUNK BALANCE IN PATIENTS WITH STROKE

Dissertation submitted to

The Tamil Nadu Dr. M.G.R. Medical University

Chennai

In partial fulfillment of the requirements for the degree of

MASTER OF PHYSIOTHERAPY

(Advanced Physiotherapy in Neurology)

Reg. No. 271720003

May – 2019

COLLEGE OF PHYSIOTHERAPY

SRI RAMAKRISHNA INSTITUTE OF PARAMEDICAL SCIENCES

COIMBATORE – 641044

CERTIFICATE

This is to certify that the dissertation work entitled **"Effectiveness of Bobath approach on trunk balance in patients with stroke"** was carried out by the candidate bearing the **Register No. 271720003 (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).**

Prof. B. SANKAR MANI, MPT (Sports)., MBA.,
Principal
College of Physiotherapy
SRIPMS
Coimbatore – 641044

Place: Coimbatore

Date:

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Prof . R. PORKODI, MPT (Neurology).,
Guide
College of physiotherapy
SRIPMS
Coimbatore – 641044

Place: Coimbatore

Date:

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INTERNAL EXAMINER **EXTERNAL EXAMINER**

Place:

Date:

ACKNOWLEDGEMENT

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.

From the bottom of my heart, I thank **my dear Parents**, **my Brothers** and **friends** for their concern and endless love for me in every part of my life.

With great honor, I dedicate this study to my guide **Prof. R. Porkodi, MPT (Neurology).,** College of Physiotherapy, SRIPMS, Coimbatore**,** without whom this venture would have been impracticable. I am grateful to his inevitable role in organizing and completing the study with full support and patience.

My sincere thanks to **Professor Mr.B.Sankarmani, MPT (Sports)., MBA., Principal**, College of Physiotherapy, SRIPMS, Coimbatore, who provided me the opportunity to perform the study.

I extend my sense of gratitude to all **the Staffs** of College of Physiotherapy, SRIPMS, for their timely help and valuable information for the betterment of my study.

I am propitious to have such a great bunch of **Parents, Caregivers** and **Staff Nurses** who made me trustworthy to involve their precisions and no words could be enough to convey my boundless love to each of the **little Ones** who made the study colorful.

My sincere gratification to all the **Non-teaching staffs** of College of Physiotherapy, SRIPMS, who have been a part of this study.

A token of appreciation to my **Friends** and my **Classmates** for their helping hands at the right time.

I thank **Saraswathi Computer Centre,** Coimbatore, in particular for their defined and orderly execution of the dissertation work.

CONTENTS

Abstract

ABSTRACT

Aim:

The aim of the study was to find out the effectiveness of bobath approach along with conventional physiotherapy and conventional physiotherapy on trunk balance in stroke patients.

Methods:

The study was designed as a controlled experimental design. The 30 subjects with stroke who fullfilled the selection of criteria were selected and they conveniently divided in two groups: experimental group was given bobath approach alongwith conventional physiotherapy and control group was given conventional physiotherapy alone. Trunk balance was assessed with trunk impairment scale. Both groups underwent therapy for 4 weeks, 4 days a weekly and 40 minutes for each session.

Results:

Significant improvement in trunk balance was seen in both the groups. Bobath approach shows more superior improvement on TIS than in conventional physiotherapy. Bobath approach showed intervention at the level 0.05% with p value <0.05.

Conclusion:

The study confirmed the effects of bobath approach along with conventional physiotherapy on trunk balance in stroke patients is significantly more when compared to control group.

Key words: *stroke, bobath approach, conventional physiotherapy, trunk impairment scale.*

Introduction

1.INTRODUCTION

Stroke is one the leading cause of death and disability in India. The estimated adjusted prevalence rate of stroke range 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.[1]

In India prevalence of stroke is estimated to be 203 per 100000 people and it is projected to rank as the fourth leading cause of disability by the year of 2020.[2]

There were almost 17 million incidences of first time stroke worldwide in 2010. Stroke is the second common cause of death in the world causing around 6.7 million deaths each year, taking a life every few seconds. Men are higher risk of having a stroke at a younger age than women.[3]

Type of stroke is significant in determining survival of death. Hemorrhagic stroke accounts for the largest number of deaths, with mortality rates of 37 to 38 of one month whereas ischemic stroke have a mortality of only 8 to 12 of one month.[4]

Stroke is defined by the **World Health Organizations**
A clinical syndrome consisting of rapidly developing clinical signs of focal (or global in case of coma) disturbance of cerebral function lasting more than 24 hours or leading to death with no apparent cause other than avascular origin.[5]

There are two types of stroke one is ischemic and another one hemorrhage. The brain depends from moment to moment on a more adequate supply of oxygenated blood compare to other organs. In human complete stoppage of blood flow for longer than 5 min produces irreversible damage.

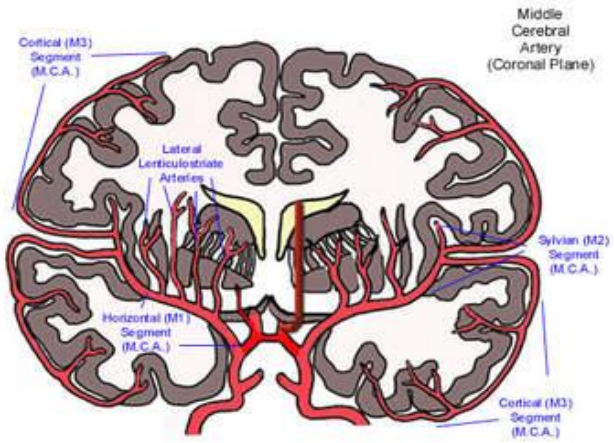
The major risk factors for stroke are hypertension, heart disease, atrial fibrillation and diabetes mellitus. The modifiable risk factors include cigarette smoking, physical inactivity and obesity.[4,6]

Clinically, a variety of focal deficit are possible including charges in the level of consciousness and impairment of motor, sensory, cognitive, perceptual of larger function.

Loss of consciousness at stroke onset size, persistent severe hemiplegia, multiple neurological benefits and history of previous stroke is also important prediction of mortality.[4]

Common deficiency in stroke include spasticity, weakness and loss of equilibrium on the affected side causing inability to maintain postural alignment.[2] The trunk is considered as the central key point to allow the body to remain at right and adjust weight shifts during static and dynamic postural alignment.[7]

The middle cerebral artery is the most commonly affected. MCA is the largest branch of the internal carotid artery and it supplies entire lateral aspect of the cerebral hemisphere such as frontal, temporal and parietal, occipital as well as insula and subcortical structures including internal capsule, corona radiata, Globus pallidus, caudate nucleus and putamen. These areas are large parts of the motor and sensory cortices including the area of representation for the trunk which lies between arm and leg.[4,6]



Following stroke one side of the upper and lower limbs are affected but trunk muscles are affected on both the sides leading to insufficient trunk rotation, difficulty in maintaining balance and gait.[2]

Poor trunk control result in poor sitting, standing balance and loss of ability to perform functional activities. Trunk control is necessary inorder to change the body position to control movements against gravity and to shift the weight to free the limbs for function. In sitting, normal trunk control maintains the stability of trunk and enables us to shift weight and balance and to reach with the arms.[2]

Trunk muscles play an important role on the support of our bodies in antigravity posterior, such as sitting and standing in the stabilization of proximal body parts during voluntary limb movements. The muscles of the trunk and pelvis are responsible for dynamic stability of the trunk in functional activities. The segments of the trunk and pelvis are interconnected and interdependent in human functional movement because most of the deep and superficial muscles of the back and abdomen attach the trunk to the pelvis and spine.[8]

Trunk control is a crucial component to perform activities of daily living (ADL) and trunk control in early stage could predict ADL outcome at a late stage in patients after stroke. Assessment and management of trunk control at an early stage after stroke are recommended.[9]

Restoration of trunk control and balance is one of the main goals in stroke rehabilitation. The emphasis is on correcting alignment of body segments with normal base of support during the performance task, teaching the patient to make appropriate adjustment of posture during movement or displacement of any segment of the body and retraining of balance.[2]

Trunk impairment, functional performance and muscle activity in patients with a stroke are a special interest to physical therapists because numerous trunk exercises performed in the early stage of rehabilitation may improve the functional performance in the later stage.

Motor rehabilitation in stroke patients uses a number of physiotherapy approaches developed by authors such as Bobath, Rood, Kabat, Brunnstorm and Perfetti. The Bobath concept, also known as neurodevelopmental treatment is a widely used approach in the rehabilitation of hemiparetic subjects in many countries.

Neurodevelopmental approach is developed in the 1940 through 1960 by **Dr. Karel Bobath and Berta Bobath.** Neurodevelopmental therapy uses physical handling techniques and key points of control directed at supporting body segments and assisting the patient in achieving active control. Sensory stimulation is used during treatment.

Postural alignment and stability are facilitated while excessive tone and abnormal movements are inhibited. In patients with stroke, abnormal synergy movements are restricted while out of synergy movements are facilitated.[4]

There are so many assessment tools available to assess the trunk performance and balance; for example's trunk control test, trunk impairment scale. Since the trunk impairment scale valid tool to assess the static, dynamic and coordination of trunk balance respectively.

The trunk impairment scale consists of three subscales static sitting balance and dynamic sitting balance and co-ordination. The score ranges from a minimum of 0 to a maximum of 23.[10]

1.1 NEED FOR THE STUDY

The trunk muscles are impaired in stroke patients, but in comparison to limb muscle weakness on one side of the body, the trunk muscles are impaired in both ipsilateral and contralateral side of the body. Weakness in the trunk muscles leads to loss of balance, stability, increased postural sway and functional disability. The trunk control is one of the most important indicators of the functional recovery after stroke. Trunk control is the ability of the trunk muscles to allow the body to remain upright, adjust weight shift and perform selective movements of the trunk so as to maintain the center of mass with in the base of support during static and dynamic adjustments. So the aim of the study is focus to work on trunk balance in patients with stroke. Hence the need is raised to evaluate the effectiveness of bobath approach on trunk balance with stroke.

1.2 OBJECTIVE OF THE STUDY

To compare the effectiveness of Bobath approach along with conventional physiotherapy and conventional physiotherapy alone on trunk balance in patients with stroke.

1.3 HYPOTHESIS

Null hypothesis:

There was no significant difference between effectiveness of Bobath approach along with conventional physiotherapy alone on trunk balance in patients with stroke.

Alternate hypothesis:

There was significant difference between effectiveness of Bobath approach along with conventional physiotherapy and conventional physiotherapy alone on trunk balance in patients with stroke.

Review of Literature

2. REVIEW OF THE LITERATURE

1. **Matra Sideway, et al (2017)** found that Trunk Impairment scale is the only well-validated tool to examine a patient with hemiparesis taking into account qualitative and quantitative assessment of the trunk deficit. This scale consists of three subscales: Static balance in sitting, dynamic balance sitting and co-ordination. The scale supports clinical reasoning in terms of structure and function, body disorders and activity limitation of patients with stroke hemiplegia may not only affect the expansion of detailed documentation of motor deficits, but to support planning and carrying out appropriate physiotherapy strategies.

2. **G Varadharajulu et al (2017)** suggested that Bobath improved the quality of life in post stroke hemiplegic individual when compared with conventional physiotherapy approaches.

3. **Kilinc M, et al (2016)** concluded that individually developed exercise programs in the Bobath concept improve trunk performance, balance and walking ability in stroke patient's more than do conventional exercises.

4. **Julee Das, et al (2016)** concluded that following 5weeks of trunk rehabilitation programme, the increased scores of trunk impairment scale and forward reach distance measured using's it and reach test signifies that the trunk control and dynamic sitting.

5. **Bansari J, et al (2016)** concluded that though conventional exercises improves balance and gait speed, additional trunk stabilization exercises are more effective compared to conventional exercises in improving balance and gait speed but improvement in gait symmetry is not changed by additional trunk stabilization exercises except improvement in step length and stride length of nonparetic side of limb additional trunk stabilization exercises should be considered not only to improve trunk control but also to improve gait and balance as well.

6. **Emilia Mikalajewska (2015)** concluded that, Bobath concept for young adults considered an effective form of post stroke rehabilitation in young adults.

7. **Tha Joo Kim et al (2015)** concluded that there is strong relationship between trunk performance and functional outcomes in patients with stroke emphasises the importance of trunk rehabilitation.

8. **Viji, J. S, Multani N.K (2012)** based on this study, addition of neurodevelopmental therapy-based gait training is more effective in gait correction and reeducation of gait of post stroke hemiparetic patients. Neuro developmental therapy further helps in normalizing the gait pattern and as well as increasing the symmetry of gait in these patients.

9. **S. Karthikbabu et al (2011)** discussed the exercises consisted of selective trunk movement of the upper and the lower part of trunk had shown larger effect size index for trunk control and balance than for gait in patients with chronic stroke.

10. **Atsushi im Ai et al (2010)** present study demonstrated that muscle activity differs, depending on surface stability, except for back bridge exercise. In particular, the activity of the more global trunk muscles, such as the EO, was greater with the unstable surface.

11. **Greet Verheydenet al (2007)** concluded that this study emphasises the important of trunk performance, especially static sitting balance, when predicting functional outcome after stroke.

12. **Wang RY et al (2005)** randomized controlled study on efficacy of Bobath versus orthopedic approach on impairment and functional different motor recovery stages after stroke, to investigate the effectiveness of Bobath on stroke patients at different motor stages by comparing their treatment with orthopedic treatment. They concluded that Bobath or orthopedic treatment paired with spontaneous recovery resulted in improvements in impairment and functional levels for patient with stroke. Patients benefit more from the

Bobath treatment in motor assessment scale and stroke impact scales cores than from the orthopedic treatment program regardless of their motor recovery stages.

13. **Tetsuya Tsuji et al (2003)** based on the study, contralateral paravertebral muscle cross sectional area was larger than the ipsilateral ones, and this was related to the degree of impairment and functional limitations.

14. **Verheyden G. et al (2003)** founded that, trunk impairment scale, a clinical test to measure motor impairment of the stroke. Its measure Static, Dynamic and co-ordination. This assessment can be used as a clinical practice of a guideline for treatment and quality of trunk movement and as well as in research.

15. **Richard W Bohannon et al (1995)** Concluded that, analysis of variance procedures showed trunk strength, whether lateral or forward, to be decreased significantly in the patients relative to controls. The greatest difference between groups was in forward flexion strength. The patients also demonstrated weakness of the trunk on the paretic relative to the nonparetic side. The results show that trunk muscle strength is impaired multidirectionally in patients with stroke. Such impairments have the potential to affect function.

Methodology

3. METHODOLOGY

3.1 STUDY DESIGN

The study design is pre and post-test experimental design.

3.2 STUDY SETTING

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

3.3 STUDY DURATION

The study duration will be one year.

3.4 TREATMENT DURATION

Treatment was given 4 days a week for 4 weeks and the time duration is 40 minutes for each session.

3.5 SAMPLE SIZE

The total of 30 subjects with stroke was assigned in two groups with 15 subjects in each group.

Experimental group: Group A received **Bobath approach along with conventional physiotherapy.**

Control group: Group B was received **conventional physiotherapy alone.**

3.6 SAMPLE DESIGN

The study design in convenience sampling.

3.7 MATERIALS

Assessment chart

Plinth

Stool

Pillows

3.8 SELECTION OF CRITERIA

Inclusion criteria:

Age 40 to70 years

Gender both male and female

Hemiplegia caused by cerebral hemisphere stroke other than trauma, brain tumor or secondary etiology

Patients with MCA stroke

Patient able to sit 10 seconds

Subjects with good cooperation

Exclusion criteria:

Medically unstable patients

Suffering from cardio pulmonary disease

Other peripheral or central nervous system dysfunction

Psychiatric patients

Orthopedic pathological condition and fracture

3.9 VARIABLES:

Independent variables:

Bobath approach

Conventional physiotherapy

Dependent variables:

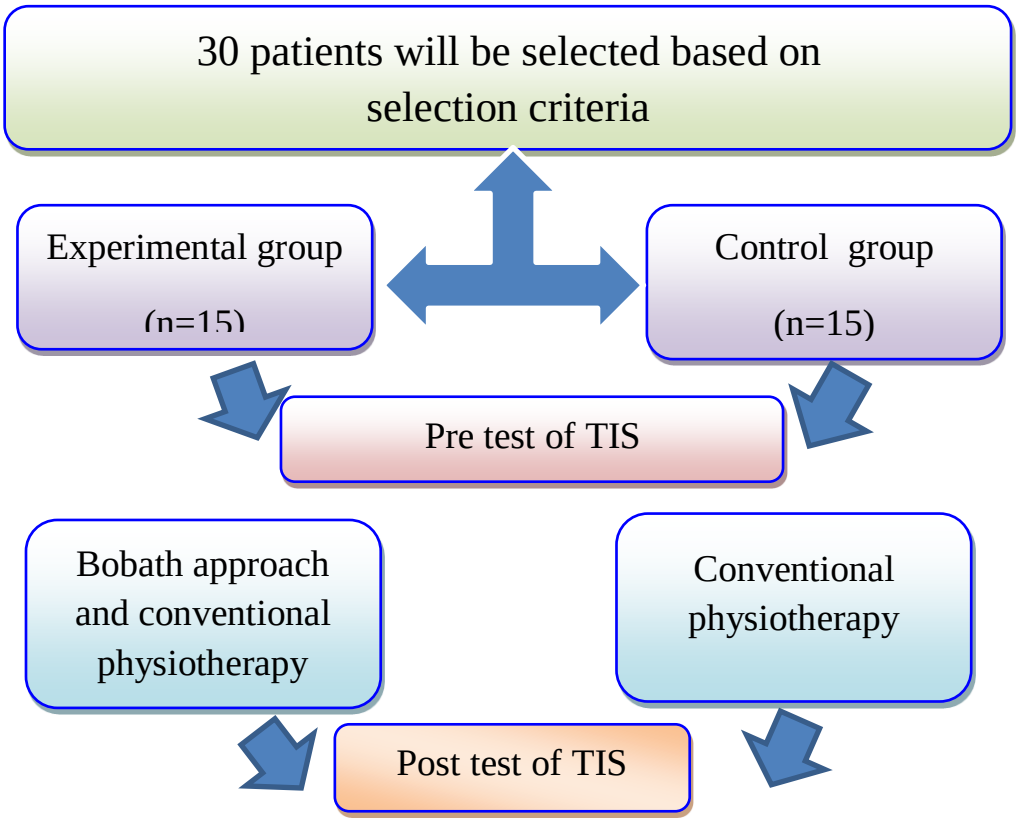
Trunk Balance

3.10 OUTCOME MEASURE

Trunk impairment scale (TIS) is a tool to measure static and dynamic balance and coordination of the trunk after stroke.

3.11 STATISTICS

Descriptive and inferential statistics.



PROCEDURE

Procedure was explained to the all patients and patients consent was obtained in consent form before treatment. Treatment was given 4 days a week for 4 weeks and the time duration is 40 minutes for each session.

EXPERIMENTAL GROUP:

Bobath approach:

The technique was developed during the 1940's by a couple and their work focused on patients with neurological dysfunction and stroke. These approaches emphasize on retrieving postural control and normalizing an impaired muscle tone. Postural alignment and stability are facilitated while excessive tone and abnormal movements are inhibited. Sensory stimulation used as facilitation and inhibition via proprioceptive and tactile inputs is needed during a treatment.

1. Position of the patient in sitting
2. Strengthening of abdominal muscles
3. Facilitate trunk extension
4. Training of the lumbar spine stabilizers
5. Rotation and counter-rotation of right and left hip with trunk extended
6. Functional reach of shoulder – anterior, right and left

Position of the patient in sitting:

Position of the patient's adequate postural support to appropriate alignment and stability of the trunk and limbs. Use towel fold under the affected side pelvis, thigh and upper limb. These are reduced fixation and improve the trunk activity. Its provide proprioceptive and sensory input to facilitate the exploration of postural movement control within an improvement alignment and interaction of base of support.

Strengthening of abdominal muscles:

The exercise was performed in the patient in crook lying and the therapist sits on in front of the patient. Therapist hand grasp over the patient hands and the patient lift the head and upper thorax. In this position is maintain for our individuality and then relax.

Facilitate trunk extension:

Trunk facilitation was given with slight downward compression in upper and mid thoracic area and lumbar region to increase trunk extension until therapist hand could be withdrawn and patient could stabilize independently.

Training of lumbar spine stabilizers:

Assisting the patient to do the pelvic bridging helps them to achieve selective independent bridging and also increases stability at the pelvis which allow him to improve control in forward translation of the knee that provides stability to knees and ankle together with activation of proximal hamstrings, gluteal muscles and abdominal muscles.

Functional reach out:

Functional reach out was given in the right, left and anterior directions. Functional reach out was done with clasping the hand in front of him, and elbow extended. In forward reaching the therapist stand in hemiplegic side of the patient and right and left reach out therapist in front of the patient and stabilize the patient legs to prevent compensatory movement. Reach out should be done in the shoulder level.

Rotation and counter-rotation:

Patient is made to lye in crook lying, therapist supports the affected leg and stands in front of the foot. Patient is asked to move the legs right and left.

CONTROL GROUP:

Conventional physiotherapy:

Unilateral bridging:

Here pelvic bridging is done with the affected leg by flexing the affected leg to perform bridging wheares the unaffected leg remains extended and relaxed.

Weight transfers from side to side:

The therapist sits on the patients affected side and pull the body toward the therapist so the body weight passes through the affected side of the patient hip and lengthening of trunk. Then the patient body weight shifted to unaffected hip.

Bridging with rotation of the pelvis:

The patient is asked to lye in crook lying and then asked to perform bridging by lifting the pelvis off the floor and then by maintaining good extension at the hips the patient rotates his pelvis equally to either side while preventing any associated movement in their affected leg. The therapist stands on the affected side in side stance position.

Rotation with each side:

With their affected arm in abduction, the patient is asked to lift their head and bring their non-affected arm across to touch their other hand. Instruct them to lift their non-affected leg across his affected leg without pushing off from the bed

The patients affected leg is guided over their other leg with less and less assistance until patient can perform the action them self. Patient can clasp both hands together and rotate their upper trunk by moving both arms to the nonaffected side.

Data Analysis And Interpretation

4. DATA ANALYSIS AND INTERPRETATION

The study was conducted with two groups Group A and Group B. Group A Treated with Bobath approach along with conventional physiotherapy. Group B Treated with conventional physiotherapy alone.

Pre-test and post-test were taken by using this parameter.

Trunk impairment scale:

Static sitting balance

Dynamic sitting balance

Co-ordination.

The data collected on selected variables was analyzed using independent 't' test. 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

Table 1: Trunk impairment scale for Group A

S.No	Pre - test	Post test	X_1-X_1^1	$(X_1-X_1^1)^2$
1	7	11	1.06	1.12
2	9	14	2.27	5.15
3	6	10	1.73	2.99
4	6	11	1.06	1.12
5	10	14	2.27	5.15
6	9	13	1.27	1.61
7	7	10	1.73	2.99
8	6	10	1.73	2.99
9	9	13	1.27	1.61
10	10	14	2.27	5.15
11	7	11	1.06	1.12
12	6	10	1.73	2.99
13	6	11	1.06	1.12
14	9	13	1.27	1.61
15	7	11	1.06	1.12
				37.84

Table 2: Trunk impairment scale for Group A

Outcome Measure	Test	Mean	Standard Deviation (SD)
Trunk impairment scale	Pre-test	7.6	1.58
	Post-test	11.73	

Graph 1 : Trunk impairment scale for Group A

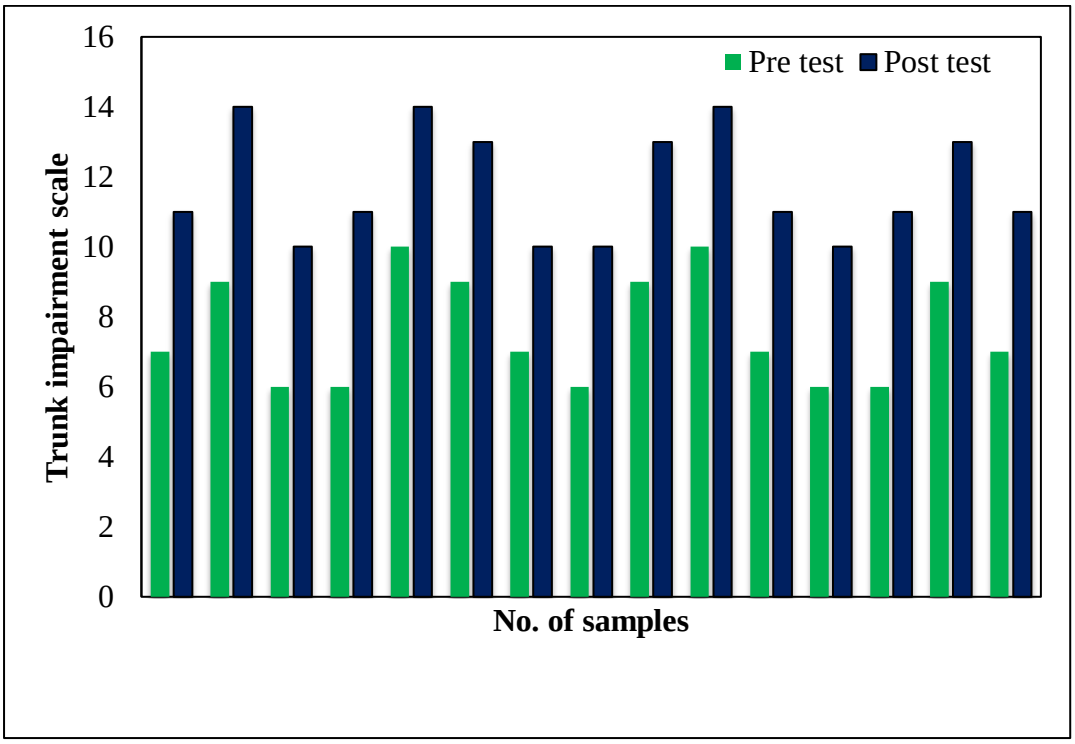


Table 3: Trunk impairment scale for Group B

S.No	Pre - test	Post test	$X_2-X_2^1$	$(X_2-X_2^1)^2$
1	7	10	0.13	0.01
2	6	8	2.13	4.53
3	9	12	-1.87	3.49
4	9	11	-0.87	0.75
5	6	9	1.13	1.27
6	10	12	-1.87	3.49
7	10	13	-2.87	8.23
8	7	10	0.13	0.01
9	6	8	2.13	4.53
10	10	12	-1.87	3.49
11	9	11	-0.87	0.75
12	6	8	2.13	4.53
13	6	9	1.13	1.27
14	7	9	1.13	1.27
15	8	10	0.13	0.01
				37.63

Table 4: Trunk impairment scale for Group B

Outcome measure	Test	Mean	Standard Deviation (SD)
Trunk impairment scale	Pre-test	7.73	1.64
	Post-test	10.13	

Graph 2 : Trunk impairment scale for Group B

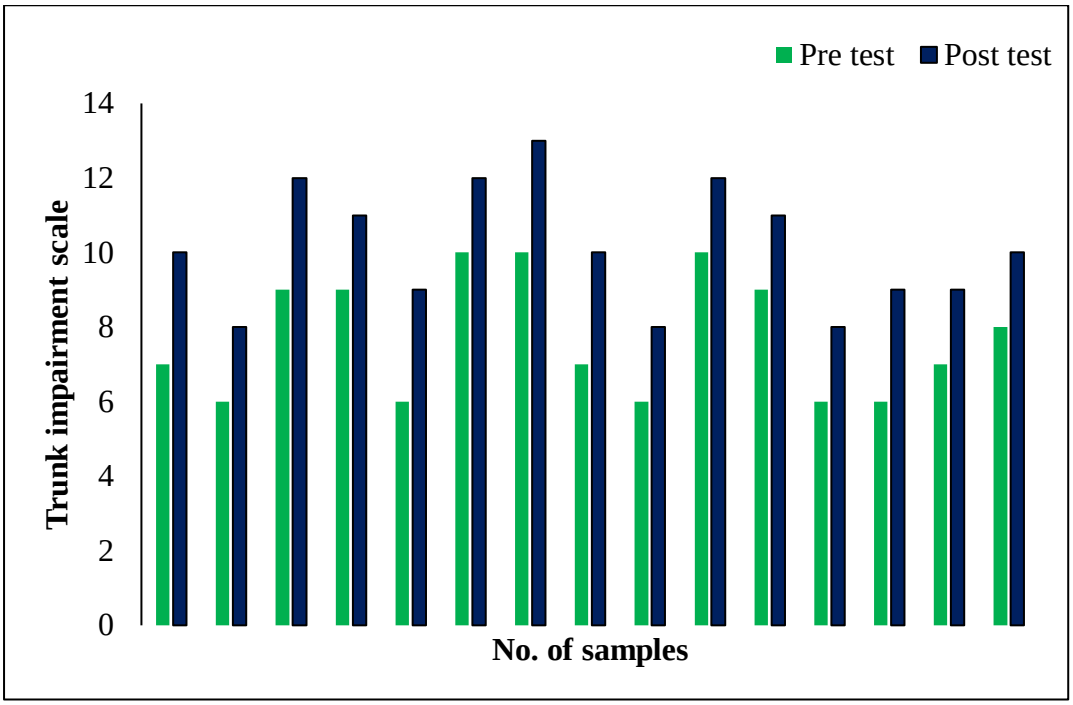
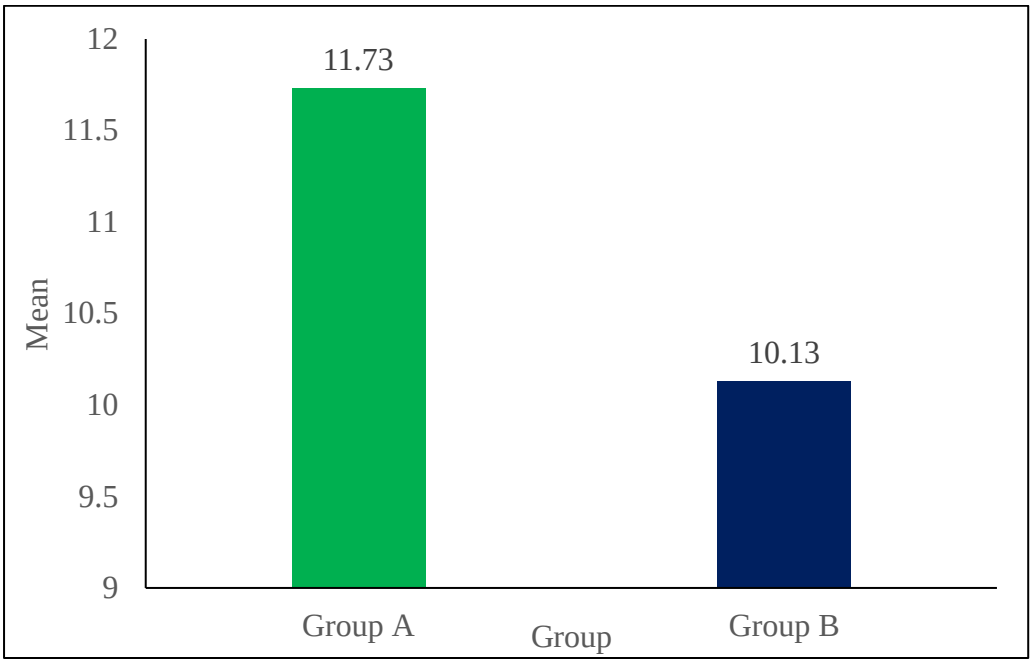


Table 5: Comparison of Group A and Group B

Outcome measure	Groups	Mean	Standard Deviation (SD)	't' value	p value
Trunk impairment scale	Conventional	10.13	1.64	2.7200	0.01
	Experimental	11.73			

Graph 3

Comparison between Group A versus Group B



Discussion

5. DISCUSSION

This study is aimed to assess "The effectiveness of bobath approach on trunk balance in patients with stroke".

The main problems of the hemiplegic patient were considered to be abnormal coordination of movement patterns combined with abnormal posture tone caused by neurophysiological dysfunction. Trunk comprises a major part of the body mass which explains why good trunk control is essential when maintaining balance. [2]

Trunk control is an important component of ability to activate the appropriate muscle either to accelerate the trunk or to resist external forces in any direction. Antigravity control in unsupported sitting is provided mainly through extensor activity at the pelvis, hip, and lumbar spine.[7]

Neuroplasticity as the main rationale underlying Bobath's concept for treatment of brain damage has been suggested by Valvano et al (1991). Also, Bobath therapy focuses on preparing and practicing components of movement in order to improve tone and re-educate normal movement patterns.[2]

Recent studies on posturographic analysis observed that stroke patients tend to avoid shifting their center of pressure towards hemiplegic side in sitting and standing. [7]

The study involved 30 patients selected on basis of convenient sampling. Group A were treated with Bobath approach along with conventional physiotherapy. Group B patients were treated with conventional physiotherapy. Both group A and B treated for 4 days s week, for 4 weeks with time duration of 40 minutes of each session.

In patients with poor alignment is improved by a position of the patient and facilitation with key points of control. In sitting, trunk balance is improved by a lumbar stabilization exercise and reaches out in anterior, left and right side and also facilitation of the trunk. Co-ordination movements of the trunk are rotation in both sides. Abdominal muscles are improved by abdominal strengthening exercise.

Pre and post assessment trunk balance was evaluated with the Trunk Impairment Scale. This consists of a total of 17 items: three regarding static sitting balance, 10 regarding dynamic sitting balance, and four about coordination.

Trunk balance in experimental group A pre test mean value is 7.6 and post test mean value is 11.73 and conventional group B pre test is 7.73 and post test is 10.13. Improvement in group A is compared with group B. The mean value of group A is (11.73) and group B is (10.13). While comparing the group A and group B, group A shows effective improvement in trunk balance, using the independent 't' test and the 't' value is 2.7200 and p value is 0.01 respectively.

All the results of this study are significant at the level of 0.05%.

Conclusion

6. CONCLUSION

The result of this study has been concluded that "There is a significant improvement in trunk balance in group A stroke patients".

So, the Null Hypothesis (H_0) is rejected and the Alternate Hypothesis (H_1) is accepted which states that **"There is a significant difference between application of bobath approach along with conventional therapy and conventional therapy alone on trunk balance in patients with stroke".**

6.1 LIMITATIONS

1) Long term effect of the intervention was not assessed.
2) The sample size was small
3) Specific gait training exercise and limb exercise are not concentrated

6.2 RECOMMENDATIONS

1) This study can be carried out with larger sample size.
2) Longer duration of intervention with long term follow up, so that long lasting effects can be studied.
3) Other cerebral artery stroke can be included.

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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:
- Judgement:
- 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

The Trunk Impairment Scale was developed to evaluate motor impairment of trunk after stroke[37]. Test scores on a range from 0-23.TIS assess static and dynamic sitting balance and trunk coordination in a sitting position.

Starting position for all items: Sitting, thighs horizontal and feet flat on support, knees 90° flexed, no back support, hands and forearms resting on the thighs. The subject gets 3 attempts for each item. The best performance is scored. The observer may give feedback between the tests. Instructions can be verbal and nonverbal (demonstration).

	Task Description	**Score Description**	**Score**	**Remarks**
	Static Sitting Balance			
1.	Keep starting position for 10 s	Falls or needs arm support	0	If 0, total TIS score is 0
		Maintains position for 10 s	2	
2.	Therapist crosses strongest leg over weakest leg, keep position for 10 s	Falls or needs arm support	0	
		Maintains position for 10 s	2	
3.	Patient crosses strongest leg over weakest leg	Falls	0	
		Needs arm support	1	
		Displaces trunk 10 cm or assists with arm	2	
		Moves without trunk or arm compensation	3	
			/7	
	Dynamic Sitting Balance			
1.	Touch seat with right elbow, return to starting position (task achieved or not)	Does not reach seat, falls, or uses arm	0	If 0, items 2 3 are also 0
		Touches seat without help	1	

2.	Repeat item 1 (evaluate trunk movement)	No appropriate trunk movement	0	If 0, item 3 is also 0
		Appropriate trunk movement (shortening	1	
		right side, lengthening left side)		
3.	Repeat item 1 (compensation strategies used or not)	Compensation used (arm, hip, knee, foot)	0	
		No compensation strategy used	1	
4.	Touch seat with left elbow, return to starting position (task achieved or not)	Does not reach seat, falls, or uses arm	0	If 0, items 5 6 are also 0
		Touches seat without help	1	
5.	Repeat item 4 (evaluate trunk movement)	No appropriate trunk movement	0	If 0, item 6 is also 0
		Appropriate trunk movement (shortening	1	
		left side, lengthening right side)		
6.	Repeat item 4 (compensation strategies used or not)	Compensation used (arm, hip, knee, foot)	0	
		No compensatory strategy used	1	
7	Lift right side of pelvis from seat, return to starting position (evaluate trunk movement)	No appropriate trunk movement	0	If 0, item 8 is also 0
		Appropriate trunk movement (shortening	1	
		right side, lengthening left side)		
8.	Repeat item 7 (compensation strategies used or not)	Compensation used (arm, hip, knee, foot)	0	
		No compensation strategy used	1	
9.	Lift left side of pelvis from seat, return to starting position (evaluate trunk movement)	No appropriate trunk movement	0	If 0, item 10 is also 0

		Appropriate trunk movement (shortening	1	
		left side, lengthening right side)		
10.	Repeat item 9 (compensation strategies used or not)	Compensation used (arm, hip, knee, foot)	0	
		No compensation strategy used	1	
			/10	
	Coordination			
1.	Rotate shoulder girdle 6 times (move each shoulder 3 times forward)	Does not move right side 3 times	0	If 0, item 2 of also 0
		Asymmetric rotation	1	
		Symmetric rotation	2	
2.	Repeat item 1, perform within 6 s	Asymmetric rotation	0	
		Symmetric rotation	1	
3.	Rotate pelvis girdle 6 times (move each knee 3 times forward)	Does not move right side 3 times	0	If 0, item 4 is also 0
		Asymmetric rotation	1	
		Symmetric rotation	2	
4.	Repeat item 3, perform within 6 s	Asymmetric rotation	0	
		Symmetric rotation	1	
			/6	
		Total Trunk Impairment Scale	**/23**	

APPENDIX III

INFORMED CONSENT FORM

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

I acknowledge that the research study on "The effectiveness of Bobath approach on trunk balance in patients with 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 with draw at any stage of the research.

Contact address: Signature of the patient/caregiver:

Date: Signature of the investigator: