

Effectiveness of Bobath Approach Along with Core Stability Training in Stroke Patient

Shiksha Verma¹, Niraj Kumar², A. Patra³

How to cite this article:

Shiksha Verma, Niraj Kumar, A. Patra/Effectiveness of Bobath Approach Along with Core Stability Training in Stroke Patient/Physiotherapy and Occupational Therapy Journal. 2023;16(2): 85-96.

ABSTRACT

Introduction: Physiologically stroke is an acute, focal injury of the central nervous system of a vascular origin, contributing to a local or systemic neurological insult.

Stroke one side of the upper and lower limbs are affected but trunk muscle are affected on both sides leading to insufficient trunk rotation and difficulty in maintain balance. Restoration of trunk control and balance is one of the important goals in rehabilitation of stroke patients.

Neuro developmental therapy (NDT) is one of the preferred methods of stroke rehabilitation, also known as bobath concept. With the fine control and proper weight transfer, it is possible to secure and protect the body in upright posture and in the achievement distal functional movements.

Purpose of Study: In comparison to limb muscles weakness, trunk muscle are also impaired in both ipsilateral and contralateral side of the body, thus weakness of the trunk muscle leads to loss of balance, stability and increase functional disability. This limits the patient's activities, such as rolling in bed, transferring, putting on a shirt and bending to reach his feet to put on shoes and socks, etc. So my aim is to focus on the trunk function and balance in stroke patient in order to eliminate individual trunk impairment affecting various functions performed by the patients. Hence the purpose of the study to evaluate the effectiveness of the stroke patient.

Methodology: Total 15 patients were included in the study by simple random sampling method. Group A (Experimental group) was received bobath approach and core stability training exercises.

Conclusion: Bobath approach along with core stability training shows more improvement in trunk function and sitting balance after 4 week therapy.

Keywords: Stroke; Bobath Approach; TIS; BBS; Core Stability.

Author Affiliation: ¹Assistant Professor, Shri Ram Murti Institute of Paramedical Sciences, Atalbihari University, Lucknow 243202, Uttar Pradesh, India, ²Professor, ³Associate Professor, Shri Guru Ram Rai Institute of Medical & Health Science, Shri Guru Rai University, Dehradun 248001, Uttarakhand, India.

Corresponding Author: Niraj Kumar, Professor, Shri Guru Ram Rai Institute of Medical & Health Science, Shri Guru Rai University, Dehradun 248001, Uttarakhand, India.

E-mail: chdrnirajkumar25@gmail.com

Received on 13.05.2023

Accepted on 05.06.2023

INTRODUCTION

Stroke is a major disease that can cause disability in adults and is the second leading cause of death in the world.¹

The term stroke was coined by the William Cole in the last 17th century. Physiologically stroke is an acute, focal injury of the central nervous system of a vascular origin, contributing to a local or systemic

neurological insult.²

Stroke survivors often have multiple dysfunctions which seriously affect their daily life, work and social communication. Following stroke one side of the upper and lower limbs are affected but trunk muscle are affected on both sides leading to insufficient trunk rotation and difficulty in maintain balance.³

Trunk impairment, restricted balance and impaired postural control in patient with stroke are correlated with increasing risk of falls and impaired mobility. This creates disability and dependency in their activities of daily living. Sitting balance and trunk control are strong predictors for functional outcome after stroke.^{4,5}

Core acts as an anatomical basis for motion of distal segment. Core stability involves the ability to control motion of trunk over pelvis and lower limb in order to maintain stability of spine. Training of the stability of core muscles can improve the balance function of stroke patient. Core stability is defined as the ability of the lumbopelvic-hip complex to prevent the buckling of vertebral column and return it to equilibrium following perturbation. In general core stability involves the muscular control required around the lumbar spine to maintain functional stability.⁶

Today Neuro developmental therapy (NDT) is one of the preferred methods of stroke rehabilitation, also known as bobath concept. NDT approach was developed in the 1940 through 1960 by Dr. Karel Bobath and Berta Bobath. NDT uses physical handling techniques and key points of control directed at supporting body segments and assisting the point in achieving active control. The trunk is at the heart of the treatment program for hemiplegic patient using the bobath concept. With the fine control and proper weight transfer, it is possible to secure and protect the body in upright posture and in the achievement distal functional movements.⁷

Approximately 15% strokes are hemorrhagic (including intra-cerebral hemorrhage and sub-arachnoid hemorrhage) and 85% are ischemic. The mortality rate for hemorrhagic stroke can be as high as 50% and is approximately 20% for ischemic strokes of all types, but ultimate outcome and function are related to the sub-type of stroke.⁸

Stroke, with a high prevalence and long term disabilities is a major health problem in the world and it was reported that about 2 million people suffer from stroke each year. Impairment including loss of strength, sensation and coordination

abilities, which results in walking difficulties, balance disorders, and limb function disturbances, occur in 70-80% of stroke patient.⁹

Niraj Kumar *et al.* showed decrease Anxiety & Depression, increase Quality Of Life and Mindfulness than Group-B study. When we compared with Mean \pm SD it was found that 0 week showed in significant, 4 week showed significant and 8 week showed highly significant in diabetic frozen shoulder patients.¹⁰

Hypertension was the leading risk factor followed by diabetes, hypercholesterolaemia, and cardiopathies. Patients with ischaemic stroke had a higher prevalence of hypercholesterolaemia and cardiopathies, especially atrial fibrillation, Patients with intracerebral haemorrhage were more likely to be heavy drinkers and those with sub arachnoid haemorrhage to be smokers, although these two risk factors are probably underreported as is usually the case. The frequency of previous primary preventive medication use for vascular risk factors was low in this high risk population.¹¹

The management comprises of 4 week intervention of core stability training along with bobath approach and conventional therapy with the help of trunk impairment scale and berg balance scale were used as outcome measure to assess trunk function and standing balance in patient, pre treatment and after 4 weeks of intervention.

The core is the central to almost all kinetic chains in human body. The core is describe as a box in the trunk with the abdominals, paraspinal, and gluteals; diaphragm and pelvic floor and hip girdle musculature serving as the front wall, back wall, roof and bottom, respectively, makes up the largest part of the body and controlling movement of daily living.¹²

A strong and stable trunk provides a solid foundation for the torques generated by the limb. At present, core muscular training is often used as a clinical treatment for stroke and can potentially improve neuromuscular control of the trunk and lower limb.¹³

One of the studies was reported that core stability enhancing exercises are effective in improving muscle activities of the lower trunk, which are affected by stroke. At present; core stability training is often used as a clinical treatment for stroke. Core muscle training can potentially improve the neuromuscular control of the trunk and lower limb.¹⁴

One of the effects of CNS damage is often increased/decreased muscle tone, influencing the

motor possibilities of the patient. Rehabilitation using NDT-Bobath method can be effective way to solve patient's problems in this area.¹⁵

The bobath concept is currently defined as a problem solving approach to the assessment and treatment of individual and disturbances of function, movement and postural control due to lesion in CNS. The concept provides a way of observing, analysis and interpreting tasks performance.¹⁶

Operational Definition

Stroke

Stroke is defined by the World Health Organizations A clinical syndrome consisting of rapidly developing clinical signs of focal (global) disturbances of cerebral function lasting more than 24 hours or leading to death with no apparent cause other than avascular origin.¹⁷

Core stability training

Core stability is defined as the ability to control the position and motion of the trunk over the pelvis to allow optimum production, transfer and control of force and motion.¹⁸

Bobath approach

The bobath concept is defined as a problem solving approach to the assessment and treatment of individuals with disturbances of function, movement, and postural control due to lesion of the central nervous system.¹⁹

Aims

The aim of the study is to see the effectiveness of bobath approach along with core stability training on trunk function and sitting balance in stroke patients.

Objectives

To find the effect of bobath approach along with core stability training in improving trunk function and sitting balance in stroke patient.

To find which treatment is better in improving the trunk function and sitting balance in stroke patient.

Need of the Study

The need of study is to improve the effect of treatment with core stability training along with bobath approach in stroke patient. Although many studies has been done on core stability but none has done the comparative study between bobath approach along with core stability training on trunk function and sitting balance in stroke patients.

Hypothesis

Experimental hypothesis

There may be significant difference between the effectiveness of bobath approach along with core stability training on trunk function and sitting balance in stroke patient.

Null hypothesis

There may not be significant difference between effectiveness of bobath approach along with core stability training on trunk function and sitting balance in stroke patient.

2. Review of Literature

Thromboembolic stroke may occur at any moment in the human life cycle. It is a principal cause of morbidity and death in middle and late life. The clinical diagnosis and treatment of stroke, as well as investigations into the underlying pathophysiology of the disease, hinge on inferences from the anatomy of the stroke lesion.²⁰

Vertebral and Basilar Artery

The VAs supply the posterior circulation of the brainstem, cerebellar hemispheres, and posterior cerebral hemispheres. These arteries typically arise from the SCAs bilaterally. The BA supplies the anterior inferior cerebellar arteries, the brainstem perforators, the superior cerebellar arteries, and finally the PCAs.²¹

Arterial supply of different areas:

a. *Cerebral Cortex:* Cerebral cortex is supplied by branches of all three cerebral arteries.

All the three surfaces receive branches from all three arteries.

- Middle cerebral is main artery on superolateral surface.
- Anterior cerebral artery is chief artery on medial surface.
- Posterior cerebral is principal artery on inferior surface.

b. *Cerebellum:* The little brain is supplied by:

- Superior cerebellar, anterior inferior cerebellar, posterior inferior cerebellar arteries.

c. *Blood supply of the brain stem:*

- The mid brain is supplied by branches from the posterior cerebral arteries, including their central branches, both posteromedial and posterolateral.
- The pons is supplied by the pontine

branches of basilar artery.

- The medulla is supplied by the medullary branches of the vertebral artery and

branches from the posterior inferior cerebellar artery.²² (Fig. 1)

Strokes are classified by etiological categories

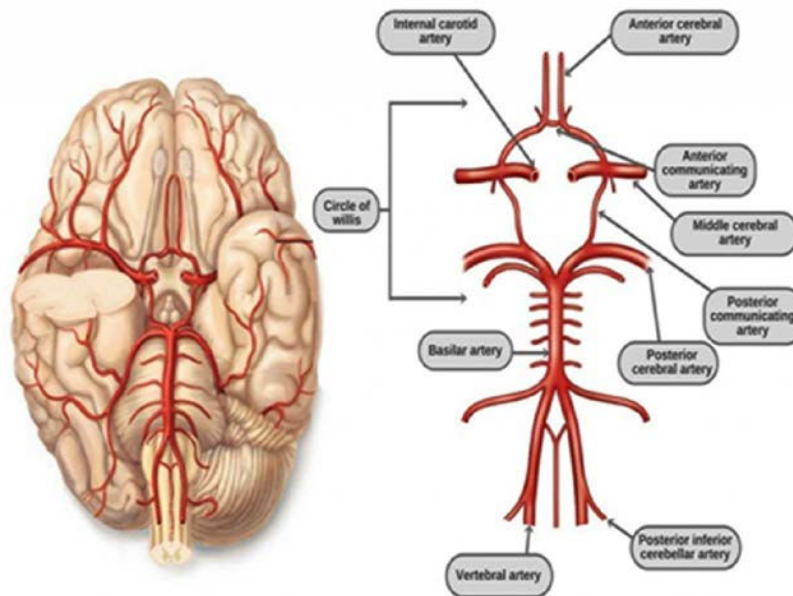


Fig. 1: Blood Supply of Brain

(thrombosis, embolus, or hemorrhage), specific vascular territory (anterior cerebral artery syndrome, middle cerebral artery syndrome, and

so forth), and management categories (transient ischemic attack, minor stroke, major stroke, deteriorating stroke, young stroke). (Fig. 2)

Two Types of Stroke

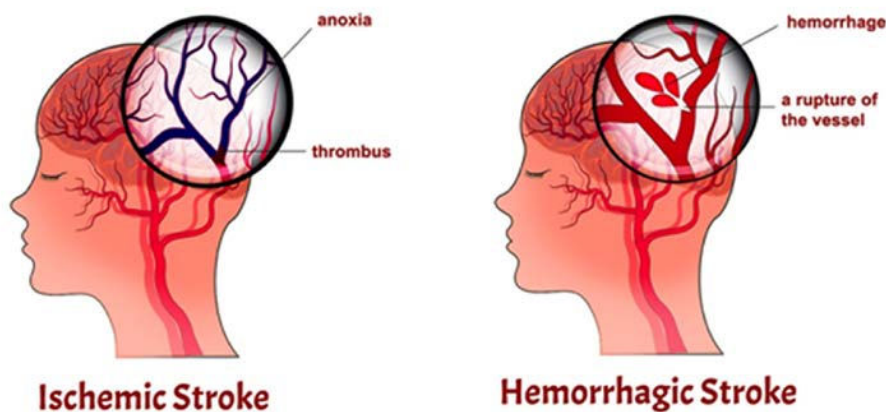


Fig. 2: Types of Stroke

Author's Study Description

Tamaya Van, Steven Truijen (Jan 2019) *et al.* Conducted a study on the effectiveness of trunk training on trunk control, sitting and standing balance and mobility in post stroke patient.

CONCLUSION

There is a strong amount of evidence showing that trunk training is able to improve trunk control,

sitting and standing balance.²³

Xiaofeng Chen, Zhuohui Gan (Dec 2019) *et al.* Conducted study on the effect of rehabilitation training of core muscle stability on stroke patient with hemiplegia. The patient divided into two groups: control group and observational group. Both group received conventional group and in addition observational group received core muscle stability training. The patient were assessed pre and post intervention through Berg Balance Scale (BBS), Brunnstrom staging and fugl-meyer motor assessment scale and 10 minute walk test. rehabilitation training of core muscle stability can effectively improve the balance function and walking speed of stroke patients.²⁴

G Varadharajulu (mar 2017) *et al.* conducted a study on the effect of bobath concept and conventional approach on the, functional outcome in the Post stroke Hemiplegic Individuals and suggested that Bobath improved the quality of life in post stroke hemiplegic individual when compared with conventional physiotherapy approaches.²⁵

Seung-heon (2017) *et al.* Conducted a study on the effect of trunk exercise on mobility, balance and trunk control of stroke patients. A randomized pre-test and post-test control group design was initially used, with subjects randomly assigned to the selective trunk exercise group (n=15) and a control group (n=14). All groups underwent physical therapy based on the neuro-developmental therapy (NDT) for 30 minutes a day, five times per week for four weeks. Additionally, the Selective Trunk Exercise (STE) group did the trunk exercise for 30 minutes a day, three times per week for four weeks. The timed up and go tests (TUG), Berg Balance scale (BBS) and Trunk Impairment Scale (TIS) were used for assessment. The combined STE and NDT showed improvements in measures of mobility, balance and trunk control in chronic stroke patients. These results suggest that STE should be considered to be included in the treatment program for patients with chronic stroke.²⁶

Julee Das, Dr. R Raja (Dec 2016) *et al.* concluded that following 5 weeks of trunk rehabilitation programme, the increased scores of trunk impairment scale and forward reach distance measured using sit and reach test signifies that the trunk control and dynamic sitting. following 5 weeks of trunk rehabilitation programme, the increased scores of trunk impairment scale and forward reach distance measured using sit and reach test signifies that the trunk control and dynamic sitting.²⁷

Muhammed kilinic, Fatmaavcu (Oct 2016) *et al.* Conducted a study on the effectiveness of bobath based trunk exercise on trunk control, functional capacity, balance and gait. The patient were divided into two group, study groups performed individual training program and in control group only conventional therapy were given. The patients were assessed pre and post intervention Scale (BBG), functional reach test (FRT), time up and go test (TUG). Individual developed exercise programs in the Bobath concept significant improve trunk performance, balance and walking ability in stroke patient.²⁸

Raikan Buyukavec, Fusum Sahin (Oct 2015) *et al.* Conducted a study on the impact of additional trunk balance exercises on balance, functional condition and ambulation in early stroke patients. A total of 65 patients were included in this double blinded randomized controlled study. Patients were assigned to two groups as experimental group (n=32) who performed trunk exercises two hours/day/ three weeks accompanied by conventional exercise program, control group (n=32) who received only conventional exercise program during the three weeks. Balance, trunk balance, functional level and ambulation were assessed by Berg Balance Scale, Trunk Impairment Scale, Functional Independence Measurement, Revirmead Mobility Index respectively. Conclusion: according to the result of the study, in early stroke patients conventional exercises or conventional exercises plus trunk balance can provide significant improvement in balance, functional condition and ambulation. However, the level of the improvement is better for the group which was applied trunk balance exercises to conventional exercise.²⁹

Rosa cabanas-Valdes, Caritat Bagur-Calafat (Oct 2015) *et al.* Conducted randomized control trail on the effect of additional core stability exercise on improving dynamic sitting balance and trunk control for sub-acute stroke patient. Eighty patients were randomly assigned into two groups. Both groups underwent conventional therapy and in addition experimental group performed core stability exercises. The patient were assessed before and after intervention through trunk impairment scale (TIS), function in a sitting test, berg balance scale, tinetti, brunel balance assessment, postural assessment scale and barthel index. Core stability exercise in addition to conventional therapy improves trunk control, dynamic sitting balance, standing balance, gait and ADLs in stroke patient.³⁰

Hanan Helmy, Tamer Emara (July 2014) *et al.* Conducted the study on impact of of trunk control

on balance and functional abilities in chronic stroke patients. Forty adult post stroke ambulant patients participated in this study. The testing protocol included assessment of trunk control by Trunk Impairment Scale (TIS), evaluation of balance ability by Biodex Balance System and assessment of functional performance by Functional Independence Measure (Motor subscale). The trunk performance is still impaired in most of the chronic stroke patients and it strongly affects their balance and functional abilities. The dynamic sitting balance component of the TIS is a reliable clinical indicator of balance and functional recovery.³¹

Niraj Kumar *et al.* The Numerical Pain Rating Scale is a subjective measure in which individuals rate their pain on an eleven point numerical scale. The scale is composed of 0 (no pain at all) to 10 (worst imaginable pain). It has been shown that a composite scoring system including best, worse, and current level of pain over the last 24 hours was sufficient to pick up changes in pain intensity with maximal reliability.³²

Seong-Hun yu (June 2013) *et al.* Conducted the study on the effect of core stability strength exercise on muscle activity and trunk impairment scale in stroke patients. The control group (n=10) underwent standard exercise therapy, while the experimental group underwent both the core stability enhancing exercise and standard exercise therapy simultaneously. The standard exercise therapy applied to the two groups included weight bearing and weight shifts and joint movement to improve flexibility and the range of motion. The core stability enhancing exercise was performed 5 times a week for 30 min over a period of 4 weeks. The activity and stability of the core muscles were measured using surface electromyography and trunk impairment scale (TIS). Core stability enhancing exercise is effective in improving muscle activity of the lower trunk, which is affected by hemiplegia.³³

SudhaDhami, Niraj Kumar, Niranjan Kumar *et al.* (2019) did study on mirror therapy and repetitive facilitation was found to be effective in improving functional independence in upper limb post sub-acute stroke. When mirror therapy and repetitive is administered to patient suffering from sub-acute stroke over a period of 4 weeks, it results in an improvement in reaching forwards, grasping, manipulating objects and also improves other motor functions of the hand.³⁴

Niraj Kumar, Navneet Badoni², Siddhartha Sen *et al.* (2022) did study on Mindfulness Based Stress Reduction (MBSR) program, Stabilization Exercise

and Moist Heat Therapy (MHT) showed significant improvement in Anxiety & Depression, Quality of Life and Mindfulness in 4th week & 8th week of treatment programme but 8 weeks results showing extremely significant as compared to 4 weeks at p values.³⁵

METHODOLOGY

Study Design

The total of 15 subjects with stroke. Group A (experimental group): received core stability training along with bobath approach. Each patient was received the treatment for 5 days a week for 4 weeks. The time duration will be given 40 minutes for each session. All the participants took part in the experiments on a voluntary basis after signing the consent form and a demographic data was collected from each subject. The purpose of the study was explained to all the subjects. In this study simple random sampling technique was used. These subjects were solicited from the Shri Mahant Indresh Hospital, Department of Physiotherapy, Patel Nagar, Dehradun (Uttarakhand) and selected according to inclusion and exclusion criteria. Inclusion Criteria - Age 40-65, Both genders, Definite diagnosis of stroke on CT and/or MRI, A supratentorial lesion and hemispheric lesion, More than 1 month or less than 6 months since onset of stroke, GCS: 13-15, MMSE: More than 24, Exclusion criteria, Medically unstable patient, Psychiatric patients, Any orthopaedic pathological condition and fracture, Other peripheral and CNS dysfunction. *Outcome Measures*- Trunk Impairment Scale (TIS) Berg Balance Scale (BBS). Material used as Couch, Chair, Pillow, Data collection sheet and recording and Patient consent form.

Procedure:

15 patients between the age group of 40-65 year were included in study after a written consent form either the patient or the relatives. Patients were made aware of the research study & the procedure to be followed. Group A would receive bobath approach along with core stability training on trunk balance. Both groups were undergone rehabilitative exercise programme. The study was of 4 weeks, 5 days per week at department of neurology in Indresh hospital, during hospitalization of patient. Examination included assessment which was performed on first and last day of treatment & data was recorded.

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.

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. It provide proprioceptive and sensory input to facilitate the exploration of postural movement control within an improvement alignment and interaction of base of support.

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 with drawn 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 (Fig. 3 & 4).

Core stability training:

1. The core stability enhancing program was



Fig. 3: Functional reach out



Fig. 4: Trunk Extension Facilitation

performed as follows. Patient was lying rightly on the bed. After extending the hip and knee joints, both the hip and knees were supported by a pillow to maintain this posture. Next, the blade bone was retracted such that the shoulder girdle is positioned in abduction, and a towel was placed below the blade bone to prevent the pectoralis major from performing a compensatory action via relaxing both shoulders. Another preparatory step is enhancing the stability of the neck region. For this, the head was lifted and held in this position by flexing the abdominal region. At the same time, the neck was pulled down to prevent the column from bending. Maintaining this posture, the upper part of the back was lifted as much as possible and twisted slightly in a diagonal direction so that the right hand can face the left knee. This position was maintained for a moment before lowering the back. At this moment, the left arm was aligned, and therapists lead them in right direction and provide minimum help for patients who have difficulty in doing it due to weak abdominal muscle in order that they can control it by themselves. This exercise was repeated; only this time the left hand faced the right knee for enhancing the abdominal muscles on the left. While maintaining this position, the jaw should be on the middle of the chest, and care should be taken that the jaw is not twisted. All these exercises enhanced the stability of core muscles.

2. Abdominal drawing in maneuver (ADIM)-patients were instructed to draw the lower part of the abdomen up and in towards spine, without movement of trunk or pelvis while continuing to breath normally. It was performed in a crook lying position, then in a static sitting and dynamic sitting (anterior-posterior tilt; lateral tilt and transverse

rotation) position.

All these exercises holds for 5,10, 15, 20 sec which enhanced the stability of core muscles (Fig. 5 & 6).

Data Analysis

This chapter deals with the statistical analysis



Fig. 5: ADIM with trunk rotation



Fig. 6: Core Strengthening Exercises

of the 2 outcome measures that are TIS and BBS, between group A and within group A. The data was analyzed by SPSS software version.²⁰ Paired t-test used to compare pre and post treatment scores of TIS and BBS within group A.

RESULT

This chapter deals with the result of data analysis of the data of two outcome measures that is TIS and BBS, within group A and between group A. The score were analyzed and interpreted to determine which intervention is more effective in improving trunk function and sitting balance in stroke patients.

Paired t-test was used to analyze and compare pre and post treatment score within the group A

and group B. Significant level of 0.05 was used for data analysis.

Explanation:

From the above table we can check the value of mean is less in Pre TIS. It shows that improvement in trunk function and sitting balance in Post TIS as

Table 1. T-Test

Paired Samples Correlations				
		N	Correlation	Sig.
Pair 1	Egpretis & Egposttis	15	.773	.001

Table 6.1: Comparison of Tis Eg (Group A)

Paired Samples Test									
		Paired Differences				T	df	Sig. (2-tailed)	
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	Egpretis - Egposttis	-4.867	1.727	.446	-5.823	-3.911	-10.917	14	.000

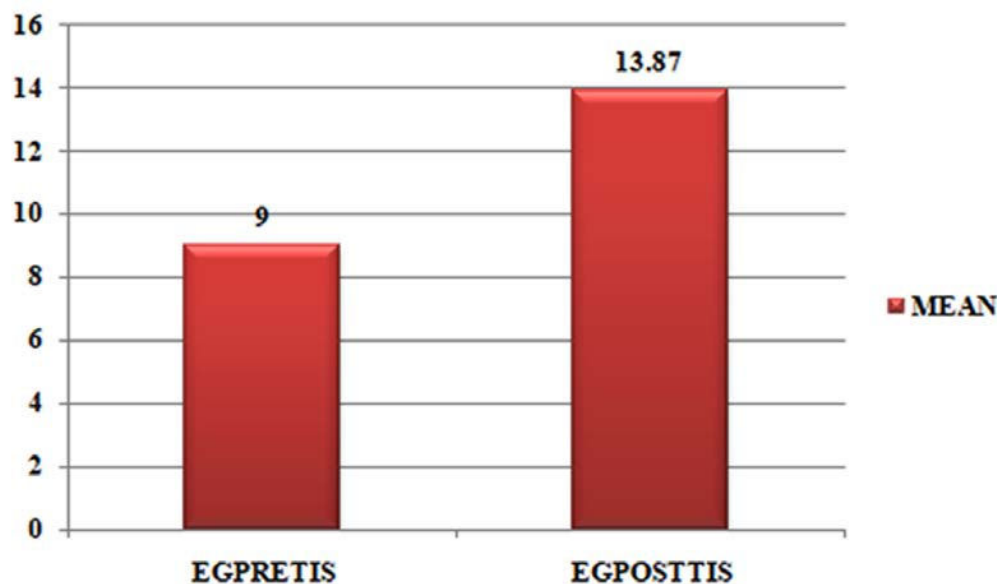


Fig 7: Comparison of Tis Eg (Group A)

compared to PRE TIS in experimental group of TIS (Group A).

Analyzing TIS revealed significant difference in group A post treatment (experimental group), Mean and standard error of mean (13.07±0.703) when compared to group A pre treatment, Mean and standard error of mean (9.00±0.543).

DISCUSSION

The study was conducted to effectiveness of bobath approach along with core stability training on trunk function and balance in stroke patients. The study was conducted on 30 subjects with the age group of 40-65 according to inclusion criteria and was randomly divided into two groups: group A (Experimental group) and group B (Control) group. Based on random sampling method. Group A received bobath based trunk exercises along with core stability exercises and group B received bobath

based trunk exercise along with conventional therapy.

The result of the present study showed that bobath approach along with core stability training improves trunk function and have a positive impact on balance and mobility. In the literature, there are many studies of the Bobath concept in stroke patients. One of the review state that there are 15 well-designed RCT or CT studies of the Bobath concept, but none of them investigated trunk function. Additionally, since 2003, there has only been the study by Verheyden, which used neuro developmental therapy on the trunk. However, Verheyden used a standard treatment protocol and not an individualized approach.

This study is based on the on the trunk training of stroke patients in which individual treatment was planned and implemented on the base of the Bobath concept. In addition, performing the trunk exercises not just for the trunk but also for the upper and lower extremities, balance, and gait performance to reach a higher quality of function, makes this study different from others. In this regard, it can be suggested that individually developed exercise programs according to the Bobath concept improve trunk performance, balance, and walking activities in stroke patients.

The effects of trunk training on sitting balance and trunk performance were evaluated by TIS. The TIS as a primary outcome showed a significant change in total score and suggest improvements in comprehensive functions.

In our study, core stability training also improved trunk balance and mobility. Van Nes *et al.* reported that lateral trunk control might be a primary target for rehabilitation, since lateral balance was more affected by stroke than that balance in anterior posterior direction and shoed the strong association with the berg balance scale (BBS).

Additionally, spine stability depends not only on muscular strength but also sensory input that alters the central nervous system about interactions between the body and environment, providing constant feedback allowing refinement of movements. Previous studies have added 10 hours of core stability exercises in their intervention group, and the result were of a similar magnitude to this study, leading us to conclude that core stability exercises are relevant factor to explain the benefits observed in this study.

Thus, the results showed improved trunk function, increased balanced and mobility. These results offer evidence that intervention aimed at

trunk muscle activation based on bobath approach and core stability theory results in positive effect for patient with stroke.

Limitation of Study

The duration of the study was only 4 weeks due to covid 19 pandemic; patients are hospitalized only for short period of time. So further prognosis and long term effects of intervention could not be recorded.

The sample size was small i.e., 15 patients & Specific gait training exercises and limb exercises are not concentrated.

Proper follow-up was not done due to covid 19 pandemic.

Future Research

Further studies are recommended to minimize the limitation in such a way that large sample size of both sexes that include various age groups of people can be studied.

Longer duration of intervention with long term follow-up, so that long lasting effect can be studied. Duration of the study can be increased.

CONCLUSION

This study concluded that significant improvement in trunk function and sitting balance in stroke patients. Thus, the alternate hypothesis that the effectiveness of core stability training along with bobath approach on trunk function and sitting balance in stroke patient is accepted.

REFERENCES

1. Hye-Jin Lee, Tae-Woo Kang, *et al.* (2018). Effects of diaphragm and deep abdominal muscle exercise on walking and balance ability in patients with hemiplegia due to stroke. *Journal of exercise rehabilitation* 2018, volume 14 (4): page no. 648-653; doi.org/10.12965/jer.1836252.
2. Puthenpurakala and Crussel J (2017) Stroke 1: definition, burden, riskfactors and diagnosis. *Nursing time*, vol.113, pp43-47.
3. Fujita T, Sato A, *et al.* (2015). Contribution of abdominal muscle strength to various activities of daily living of stroke patients with mild paralysis. *J PhysTher Sci.* 2015;27(3):815-818. Doi:10.1589/jpts.27.815.
4. Horak FB. postural orientation and equilibrium: what do we need to know about neutral control

- of balance to prevent falls? Age Ageing.2006;35 :ii7ii11:doi:10.1093/ageing/af1077.
5. Evelyne Wiskerke *et al.* maximum weight shifts in non-ambulatory people with stroke are related to trunk control and balance: a cross sectional study. Epub 2020; 83:121-126. Doi:10.1016/j.gaitpost.2020.10.007.
 6. Vishal Sharma, Jaskirat Kaur (2017). Effect of core strengthening with pelvic proprioceptive neuromuscular facilitation on trunk, balance, gait and function in chronic stroke. Journal of exercise rehabilitation 2017;13(2):200-205; doi:10.12965/jer.1734892.446.
 7. Mudie m, Winzeler-Mercay, *et al.* training symmetry of weight distribution after stroke: a randomized controlled pilot study comparing task related reach. Bobath and feedback training approaches. Clin Rehab. 2002;16(6):582-592. Doi:10.1191/0269215502cr527oa.
 8. Panel, J.P.Mohar, Gregory W *et al.* 2017. Etiology of stroke. Stroke; vol.28(7):pp1501-06.
 9. Xibo Sun, MD, Qian Gao *et al.* 2016. Which is better in the rehabilitation of stroke patients, core stability exercises or conventional exercises? The journal of physical sciences. vol:28;pp:1131-1133; doi:10.1589/jpts.28.1131.
 10. Niraj Kumar¹, Navneet Badoni², Siddhartha Sen³, Anirban Patra⁴, Shobit Garg⁵, Kanchan Joshi⁶ (2022), Effectiveness of Mindfulness Based Stress Reduction Therapy (MBSRT) on Anxiety and depression, Quality of Life and Mindfulness in Diabetic Frozen Shoulder Conditions, Journal of Positive School Psychology, Volume-6, Issue-2, Pages 2291 – 2308, <http://journalppw.com>.
 11. Pablo M Lavados, *et al.* (2021). Incidence, risk factors, prognosis, and health-related quality of life after stroke in a low-resource community in Chile (NANDU): a prospective population-based study, volume 9, issue 3, E340-351, March 01, 2021; doi:10.1016/S22140-109X(20)30470-8.
 12. Yu SH, Park SD: The effects of core stability strength exercise on muscle activity and trunk impairment scale in stroke patients. J Exer Rehabil, 2013, 9: 362-367.
 13. Ayuko Kaji, Shun Sasagawa, *et al.* (2010). Transient effect of core stability exercises on postural sway during quiet standing. Journal of strength and conditioning research; vol:24(2); pp:382-388; doi: 10.1519/JSC.0b013e3181c06bdd.
 14. Shizuka Sasaki, Eiichi Tsuda, *et al.* (2019). Core-muscle training and neuromuscular control of the lower limb and trunk. Journal of athletics training; 2019;54(9):959-969; doi:10.4085/1062-6050-113-17.
 15. Barnes MP. An overview of the clinical management of spasticity. In: upper motor neuron syndrome and spasticity: clinical management and neurophysiology. Eds: Barnes MP, Johnson GTR. Cambridge University Press 2001.
 16. Julie Vaughan Graham, Catherine Eustace, *et al.* The bobath concept in contemporary clinical practice. Top stroke Rehabil 2009;16(1):57-68; doi: 10.1310/trs1601-57.
 17. Alwin Puthenpurakal, *et al.* Stroke 1: definition, burden, risk factors and diagnosis. 2011 vol 113 issue 11.
 18. Jyotisharma, Niraj Kumar, Shashank Kumar. Comparison of the effectiveness of core strengthening exercise and McKenzie exercise on the pain functional disability in lumbar PIVD condition. Physiotherapy and occupational therapy Journal Volume 11 Number 2, April-June 2018 DOI: <http://dx.doi.org/10.21088/potj.0974.5777.11218.4>.
 19. Raine S. Defining the Bobath concept using the Delphi technique. Physio Res Int. 2006; 11:4-13.
 20. V. S. Caviness, Dphil N. Makris, (2002) *et al.* Anatomy of stroke part I, Stroke; vol:33: pp2549-56.
 21. Ethan A. Prince and Sun Ho Ahn, (2013) Basic Vascular Neuroanatomy of the Brain and Spine: What the General Interventional Radiologist Needs to Know, Semin Intervent Radiol; vol:30: pp234-239.
 22. B. D Chaurasia's, Human anatomy vol.3, 6th edition; pp455-61.
 23. Tamaya Van Criekeing, Steven Truijen, *et al.* The effectiveness of trunk training on trunk control, sitting and standing balance and mobility post-stroke: a systematic review and meta-analysis. Sagepub.com/journals-permissions. DOI: 10.1177/0269215519830159.
 24. Chen X, Gan Z, Tian W, Lv Y. effect of rehabilitation training of core muscle stability on stroke patient with hemiplegia. Pak J Med SCI. 2020;36(3): 461-466. DOI: <https://doi.org/10.12669/pjms.36.3.1466>.
 25. G Varadharajulu, Lathika Shetty, Kulamani Sahoo. The effect of bobath concept and conventional approach on the functional outcome in the Post stroke Hemiplegic Individuals. IOSR Journal of sports and Physical Education (IOSR-JSPE) e-ISSN: 2347-6737, p-ISSN: 2347-6745, Volume 4, Issue 2, (Mar.-Apr.), PP10-14.
 26. Seung-heon (2017) *et al.* The effect of trunk exercise on mobility, balance and trunk control of stroke patients. J Korean Soc Phys Med, 2017; 12(1) : 25-27. doi:10.13066/kspm.2017.12.1.25.

27. Julee Das, R. Raja, R. Vedavathi. A Study to Assess the Effectiveness of Trunk Rehabilitation Programme on Trunk Control And Balance in Acute Ischemic Hemiparetic Stroke Patients. IOSR Journal of Dental and Medical Sciences (IOSR-JDMS) e-ISSN: 2279-0853, p-ISSN: 2279-0861. Volume15, Issue12. Ver. VIII (December.2016), PP72-8.
28. Muhammed KilinicAvcu, *et al.* (2016). The effects of Bobath-based trunk exercises on trunk control, functional capacity, balance, and gait: a pilot randomized controlled trial, topics in stroke rehabilitation, 23:1, 50-58, DOI:10.1179/1945511915Y.0000000011.
29. Raikan Buyukavec, Fusum Sahin (Oct 2015) *et al.* The impact of additional trunk balance exercises on balance, functional condition and ambulation in early stroke patients. Turk J Phys Med Rehab 2016;62(3):248-256; doi: 10.5606/tftrd.2016.84770.
30. Rosa Cabanas-Valdes, Caritat Bagur-Calafat, *et al.* The effect of core stability exercises on improving dynamic sitting balance and trunk control for sub-acute stroke patient: A randomized controlled trial. Sagepub.co.uk/journals Permission.nav;DOI:10.1177/0269215515609414.
31. Hanan Helmy, Tamer Emara (July 2014) *et al.* Impact of of trunk control on balance and functional abilities in chronic stroke patients. Egypt J Neurol Psychiat Neurosurg.; july 2014;vol:5;issue 3.
32. Niraj Kumar, Siddhartha Sen, Navneet Badoni Anirban Patra Sobhit Garg (2022) International Journal of Health Sciences, Volume-6, Issue, S1, Pages-2630-2645.https://doi.org/10.53730/ijhs.v6nS1.5338.
33. Seong-Hun yu (June 2013) *et al.* The effect of core stability strength exercise on muscle activity and trunk impairment scale in stroke patients. J exercRehabil. 2013 jun;9(3):362-367; doi: 10.12965/jer.130042.
34. SudhaDhami, Niraj Kumar, Niranjan Kumar *et al.* (2019) Mirror Therapy and Repetitive Facilitation Exercise Improve the Upper Extremity Motor Recovery in Hemiparesis Patients, Physiotherapy and Occupational Therapy Journal, Volume 12 Number 1, PP- 58-67 DOI:http://dx.doi.org/10.21088/potj.0974.5777.12119.8.
35. Niraj Kumar, Navneet Badoni2, Siddhartha Sen *et al.* (2022) Effectiveness of Mindfulness Based Stress Reduction Therapy (MBSRT) on Anxiety and depression, Quality of Life and Mindfulness in Diabetic Frozen Shoulder Conditions. Vol. 6, No. 2, PP-2291 - 2308 http://journalppw.com.

