A STUDY ON THE EFFECT OF TRUNK EXERCISES IN IMPROVING BALANCE IN STROKE PATIENTS

Dissertation

Submitted To

The Tamilnadu Dr.MGR Medical University

In partial fulfillment for the degree of

MASTER OF PHYSIOTHERAPY

271520162

CHERRAAN'S COLLEGE OF PHYSIOTHERAY

CHERAN INSTITUTE OF HEALTH SCIENCES

Coimbatore ,Tamilnadu ,India

OCTOBER 2017

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CERTIFICATE

The work embodied in the thesis entitled " **A STUDY ON THE EFFECT OF TRUNK EXERCISES IN IMPROVING BALANCE IN STROKE PATIENTS''** submitted to the **Tamilnadu Dr.MGR Medical University, Chennai** in the partial fulfilment of the degree of Bachelor of physiotherapy, was carried out by candidate bearing register number of 271520162 at Cherraan's Collage of physiotherapy, Coimbatore under my supervision. This is original work done by her and has not been submitted in part or full for any degree/diploma at this or any or any other university/institute. The thesis is fit to be considered for evaluation for award of the degree of Master of physiotherapy.

……. …...……

Signature of guide **Signature of principal**

Mr. GOBINATH M.P.T, **Mrs.SELVARANI MPT(NEURO)**

(**Professor**) **(Professor & Principal)**

Date :…… Date:…….

Internal Examiner…… External Examiner…….

Project work evaluated on ……

DECLARATION BY THE STUDENT

I hereby declare and present my project work entitled

“A STUDY ON THE EFFECT OF TRUNK EXERCISES IN IMPROVING BALANCE IN STROKE PATIENTS’’.

The outcome of the original research work undertaken and carried out by me, under the guidance of professor, **MR.V.GOBINATH M.P.T** Cherraan’s Collage of Physiotherapy, Coimbatore.

I also declare that the material of the project work has not formed in any way the basis for the award of any other degree previously form the Tamil Nadu Dr. M.G.R Medical University.

…… ……

Signature of the supervisor **Signature of the student**

Date:

Place:

ACKNOWLEDGEMENT

I thank the Almighty God who laid the foundation for knowledge and wisdom and has always been my source of strength and inspiration and who guides me through out.

I would like to express my deep sense of gratitude to Mr. Gobinath, assistant professor, Department of physiotherapy, cherraan's college, Tamil Nadu, for being my guide and bringing out the best in me and marking this study perfect with his valuable guidance. I am extremely thankful for his constant encouragement and inspiration during the course of this study.

I wish to express my thanks to our co-ordinator Mrs. Jency, assistant professor, department of physiotherapy, cherraan's college for her valuable help and guidance throughout the study that enlightened my courage in completing this dissertation successfully.

I am outmost thankful to Mr. Karthik assistant professor, Department of physiotherapy, for support in the fulfillment of my task.

I am thankful to our respected principal Mrs. Selvarani and the management of cherraan's college of physiotherapy.

I express my thanks to DMS hospital and its management for all the facilities extended to me for the study. And also thanks to co-operative patients .

I extend my sincere thanks to Mr.Deljith for helping me in statistical analysis .

I am very much grateful to my parents Mr.Sivadasan M.K. and Ms. Suseela for their keen interest in my academic excellence, who taught me to never ever give up in life and to spread happiness everywhere.

I extend my gratitude to my friends who where always there to help me with my research studies. My sincere thanks to all the contributors whose name I have not mentioned but though they all deserve my gratitude . Last but not the least I would like to thank all the subjects of my study without whom this task would not have been possible

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LIST OF TABLE

LIST OF FIGURES

LIST OF ANNEXURE

ABSTRACT

OBJECTIVE –To find out the effectiveness of trunk exercise along with conventional therapy in improving balance in stroke patients.

METHOD - The study conducted was an experimental comparative approach. Sample of thirty subjects satisfying the criteria were divided into two groups ,experimental group (Group A)and control group (Group B). Control group received range of motion exercise ,strengthening exercise ,balance training , and gate training .For experimental growth in addition to conventional therapy ,trunk exercises were given. Treatment was given for five weeks .

OUTCOME MEASURES - The outcome measures are BBS and TIS.

RESULT - The test used for statistical analysis were paired and unpaired t test. The statistical analysis showed significant improvement in experimental group than control group.

CONCLUSION - The trunk exercises seem to be beneficial in improving balance in stroke patients.

INTRODUCTION

INTRODUCTION

Stroke or brain attack is the sudden loss of neurological function caused by an interruption of the blood flow to the brain.

Stroke is a major cause of disability and handicap in adult. Stroke renders patients with different impairments in the physiological systems involving postural control which leads to problem with balance and overall performance of the patients.

Balance impairment is an important problem after stroke since it leads to increased number of falls which leads to several other pathological events. Trunk control has also been identified as an important early predictor of functional outcome after a stroke.

A cross sectional study demonstrated that trunk control is related to measures of balance, gait and functional ability in patient with stroke. Trunk control requires appropriate sensory motor ability of the trunk in order to provide a stable foundation for balance functions in patients with stroke. It is the ability of the trunk muscles to allow the body to remain upright, adjust weight shifts and perform selective movements of trunk that maintains the base of support during static and dynamic postural adjustment. It has been found that selective movements of the upper and lower trunk are impaired after a stroke.

Balance impairment and trunk disabilities must be appropriately addressed to improve the quality of life of the stroke subjects. Impairments alone cannot describe functional deficits. Balance gains can be mediated by improved stabilization of the head and trunk, better muscular compensation through the unaffected leg, improved multisensory integration, and progressive and increased self confidence. Evaluation approaches can focus on impairments or functional activities and include observational scores (clinical scales) and laboratory measurements.

Different methods have been developed to evaluate balance and trunk control in patients with stroke. Exercise interventions in the form of task oriented exercise programs are now recognized as a new strategy to improve the functional status of stoke individuals. Following several weeks of functional training, stoke subjects have shown significant improvements in functional mobility, walking speed and endurance and in clinical measures of balance.

Significance of the study:

Physiotherapists have a major role in hospital based rehabilitation settings and in the community based rehabilitation settings. Re-education of motor and functional abilities are the main targets of the treatment by physiotherapist.

After stroke, patients have balance impairment and trunk disabilities. Most of the therapist will focus only on improving limb balance. Only very few focus on improving their trunk balance. This is study objected towards TRUNK EXERCISES ON IMPROVING BALANCE IN STROKE PATIENTS.

Aim of the study:

- To find the effectiveness of trunk exercise on improving balance in stroke patients.

Objectives of the study:

- To find the effectiveness of conventional exercises on balance score of stroke patients.
- To find the effectiveness of trunk exercises along with conventional exercises on balance score of stroke patients.
- To compare the mean balance scores of conventional group and Experimental group.

HYPOTHESES:

Hypotheses to test objective 1:

- There is a statistically significant improvement in balance score of stroke patients following the use of conventional exercises.

- There is no statistically significant improvement in balance score of stroke patients following the use of conventional exercises.

Hypotheses to test objective 2 :

- There is a statistically significant improvement in balance score of stroke patients following the use of trunk exercises along with conventional exercises.
- There is no statistically significant improvement in balance score of stroke patients following the use of trunk exercises along with conventional exercises.

Hypotheses to test objective 3:

- There is a statistically significant difference between the mean balance scores of Experimental group and Control group.
- There is no statistically significant difference between the mean balance scores of Experimental group and Control group.

REVIEW OF LITERATURE

REVIEW OF LITERATURE

Stroke:

World health organization:

Stroke is defined as signs of focal or global disturbance of cerebral functions, lasting more than 24 hours or leading to death, with no apparent cause of other than of vascular origin.

Clarissa Barros de olivera et al

Stroke renders patients with different impairments in the physiological system involved in postural control including sensory afferents, movement strategies and perception of verticality there by affecting balance and trunk performance. The quality of life of the stroke subjects can be improved by appropriately training balance impairments and trunk disabilities.

G. Verheyden et al

A cross sectional study demonstrated that there was a positive association between trunk control and balance after an acute stroke. Proximal trunk control improvement influences the functional balance involved in activities such as standing and stepping, so trunk control is related to measures of balance, gait and functional ability in patients with stroke.

Karatas M, Cetin N et al

There was a significant positive correlation between trunk muscle strength and Berg Balance Scale Score. The findings indicate that trunk flexion and extension muscle weakness in stroke patients, can interfere with balance, stability and functional ability.

Jean-Francosis Bayouk et al,

In balance training following stoke 2006 the decreased ability to maintain static and dynamic balance after stroke could be related to the inability to select reliable sensory information to produce the proper motor action necessary to maintain postural stability.

Berg Balance Scale:

Wood-Dauphinee et al

Berg balance scale which is an objective measure of static and dynamic balance abilities consisting of 14 functional tasks performed in everyday life is stated to be valid and reliable scale.

Blum L, Korner-Bitensky N

Usefulness of the berg balance scale (BBS) in stroke rehabilitation: a systemic review concluded that BBS is a psychometrically sound measure of balance impairment for use in post stroke assessment.

Wee JY, Wong H, Palepu A

Validation of the berg balance scale as a predictor of length of stay and discharge destination in stroke rehabilitation.

Smith PS, Hembree JA, Thompson ME,

Berg balance scale and functional reach determining the best clinical tool for individuals post acute stroke.

Z Wick D, Rochelle A, Choksi A, Domo Wicz J

Evaluation and treatment of balance in the elderly: a review of the efficacy of the berg balance test

Juliet Rosie and Denise taylor

A highly variable population of older adult with mobility limitations, low intensity functional home exercise of repeated sit to stands improved berg balance scale score while low intensity progressive resistance training did not. While statistically significant, the improvement in berg balance scale score was modest raising the issue of what extent of change in score is clinically significant in this population.

Trunk impairment scale:

G. Verheyden et al

Trunk Impairment Scale (TIS) which is a tool to measure motor impairment of the trunk after stroke as a reliable score. The TIS scores, on a range from 0 to 23 , static and dynamic sitting balance as well as trunk co-ordination.

Hsieh CL et al,

Trunk control is an early predictor of comprehensive activities of daily living function in stroke patients 2002, trunk control has also been identified as an important early predictor of functional outcome after a stroke.

A. Van de Winckel and Wde Weerdt

Discriminates ability of the Trunk Impairment scale: a comparison between stroke patients and healthy individuals, 2005, concluded that the TIS discriminates between stroke subject and healthy individuals and selective movements of the upper and lower trunk are impaired after a stroke.

E Duarte, E. Marco, J.M. Muniesa et al

Trunk Control Test as a functional predictor in stroke concluded that trunk balance in the acute stage of stroke is a functional outcome predictor.

Nieuwboer, Baert et al,

Trunk performance after stroke: An eye catching predictor of functional outcome, 2007 concluded that trunk control has been identified as an early predictor of functional outcome after stroke.

Trunk exercises:

Susan Ryerson et al

Altered trunk position sense and its relation to balance function in people post-stroke, 2008, concluded that trunk control requires appropriate sensory motor ability of the trunk in order to provide a stable foundation for balance functions in patients with stoke.

Truijen S et al

Additionl exercise improve trunk performance after stroke: a randomized controlled trial.

Lehmon G, Hoda W

It is the ability of the trunk muscles which allows the body to remain upright, adjust weight shifts and perform selective movements of the trunk that maintains the base of support during static and dynamic postural adjustments.

Oliver S

Evaluation of Trunk muscle activity doing bridging exercise on and off a swiss ball.

Messier S,Chern JS et al

Evaluation of Postural control during trunk bending and reaching healthy adults and stroke patients.

Bourbonnais D ,Vereeck L et al

Trunk performance after stroke and relationship with balance, gait andfunctional ability.

Conventional physiotherapy:

Alain Leroux et al

The addition of a multisensory training component to the regular exercise program was required to obtain a significant improvement in standing balance of stroke subjects. In the absence of sensory training, very limited changes were observed for both static and dynamic balance tasks.

Langharne p, Legg L, Pollock A et al

Evidence based stroke rehabilitation.

Outpatient Serviece trialist

Therapy based rehabilitation services of stroke patient at home.

American physical therapy association

Guide to physical therapist practice.

Kwakkel G, Wagenaar RC, Koelman TW et al

Effect of intensity of rehabilitation after stroke. A reserch synthesis stroke

Foongchomcheay A,

Efficacy of electrical stimulation in preventing or reducing subluxation of the shoulder after stroke.

Langhorne P, Wagenaar R, Partridge C

Physiotherapy after stroke: more is better

Van der Lee Jh, Snels IA, Beckerman H et al

Exercise therapy for arm function in stroke patients: a systemic review of randomized controlled trials.

Pomeroy VM, Tallis RC

Physical therapy to improve movement performance functional ability post stroke. Part 1 existing evidence.

METHODOLOGY

III METHODOLOGY

3.1 STUDY DESIGN:

The study was a pre-test and post- test experimental design comparative in nature.

3.2 STUDY SETTING:

The study was conducted in DMS HOSPITAL, Malappuram.

3.3 STUDY DURATION:

The study was conducted for a period of 3 months.

3.4 SAMPLE METHODS:

The study was conducted by simple random sampling methods.

3.5 SUBJECTS:

A total number of thirty subjects were selected by who fulfilled inclusion criteria for this study. Out of them 15 were randomly assigned to group A for capsular stretching and the other 15 were assigned to group B for maitland mobilization.

3.6 SELECTION CRITERIA:

- Sub acute stroke patients
- Patients with MCA stroke
- First time stroke patients
- Medically stable patients
- Psychologically stable patients
- Patients with previous history of stroke were not included
- Non co-operative patients too were not included

3.7 PARAMETERS:

- Trunk Impairment Scale
- Berg Balance Scale

3.8 VARIABLES:

Dependent variables:

- Trunk exercise and conventional exercise

Independent variables:

- BBS and TIS

ORIENTATION OF THE SUBJECTS:

Before the treatment all the subjects were explained about this study and the procedure to be applied. They were asked to inform if they feel any discomfort during the course of study. Written consent was obtained from the subjects.

3.9 OUTCOME MEASURES:

BERG BALANCE SCALE:

The Berg Balance Scale (BBS) measures balance among older people with impairment in balance function by assessing the performance of functional tasks. It consists of 14 sets of functional tasks. Each scoring from 0-4 . The maximum score being 56 . The Berg Balance Scale is considered the good standard assessment of balance with good intra-rater reliability, inter-rater reliability and good internal validity.

TRUNK IMPAIRMENT SCALE:

Trunk impairment scale (TIS) evaluates motor impairment of the trunk after stroke. The TIS scores on a range from 0 to 23 , ie 23 being the maximum score. It measures static and dynamic sitting balance as well as trunk co-ordination. It also aims to score the quality of trunk movement and to be a guide for treatment.

3.10 STUDY PROCEDURE:

A true experimental research approach is adopted for the present study, which evaluated the effectiveness of trunk exercise to improve balance and functional activities of stroke patients.

The study was carried out in the outpatient of DMS Hospital, Chelari. Population of the study was chosen from the patients who were reffered for physiotherapy by neurologist and diagnosed as middle cerebral artery stroke. Both female and male patients were included.

30 stroke patients were elected using selection criteria. These patients were grouped into two equal numbers (Group A/ experimental group, Group B/control group) by random sampling method. These randomization was done by a person who was not involved in the assessment or treatment of the patient. 15 participants were assigned to the experimental group (conventional rehabilitation program 5 weeks and additional 10 hours of trunk exercise over a period of 5 weeks) and other 15 were assigned to the control group (conventional rehabilitation program 5 weeks).

In addition to the conventional treatment, patients from the experimental group received 30 minutes of extra training 4 times a week, for 5 weeks. In total 10 hours of additional training were given.

Exercises were gradually introduced and the number of repetition was determined by the therapist on the basis of the patient's performance. Patients were allowed convenient rest period in between. Exercises were continued for 5 weeks.

There were no dropouts during the course of the study. Assessment was taken on the 1st day and on completion of treatment after 5 weeks. The outcome measures used were Trunk Impairment Scale and Berg Balance Scale.

Methodology

Pre-test:

Prior to treatment the individual were assessed by using BBS and TIS.

Control group:

- Range of motion exercises
- Strengthening exercises
- Balance training
- Gait training

On course of the training program active assisted movements were progressed to active movement depending on improvement shown by the patient.

- Range of motion exercises
- In supine lying

Joint	Movement	
Shoulder	Flexion-Extension	10 Repetition
	Abduction-Adduction	10 Repetition
	Medial- Lateral Rotation	10 Repetition
Elbow	Flexion-Extension	10 Repetition
Wrist	Flexion-Extension	10 Repetition
Hip	Flexion-extension	10 Repetition
	Abduction-Adduction	10 Repetition
Knee	Flexion-Extension	10 Repetition
Ankle	Dorsiflexion-Plantarflexion	10 Repetition

Strengthening exercise:

Squats – Are the most common exercise for building the quadriceps and other leg thigh muscles. But squats must be done carefully to avoid knee injury.

Squats can be done without weights simply by standing with your back against the wall just lower yourself a few inches by bending your legs and stand up again. Never go all the way down into a crunch.

Shoulder muscle – Start by lying on your back grasping bar with both hand together. Push the bar straight up towards the celing. At the end of each push lift your entire shoulder off the bed.

- Shoulder shrugs to strengthen trapezius.
- By using weight to form biceps and triceps muscle.

Experimental group:

In addition to the treatment given to control group, the experimental group receive trunk exercise for 30 minutes.

Trunk exercise are,

- Trunk rotation (twist) from a seated position place your right hand on the put side of your left thigh.
- Lateral trunk flexion
- Forward punches
- Knee to chest
- Trunk extension

Post-test:

After giving the treatment the individual is assessed using BBS and TIS.

DATA PRESENTATION AND ANALYSIS

Table 1.Comparing Means of Pre-test and Post-test BBS Score of Group A / Experimental Group.

MEAN		't' calculated value	't' table value
Pre test	Post test		
26.47	31.07	24.18	2.14

Figure 1. Comparison of mean pre-test and post-test BBS scores of group A

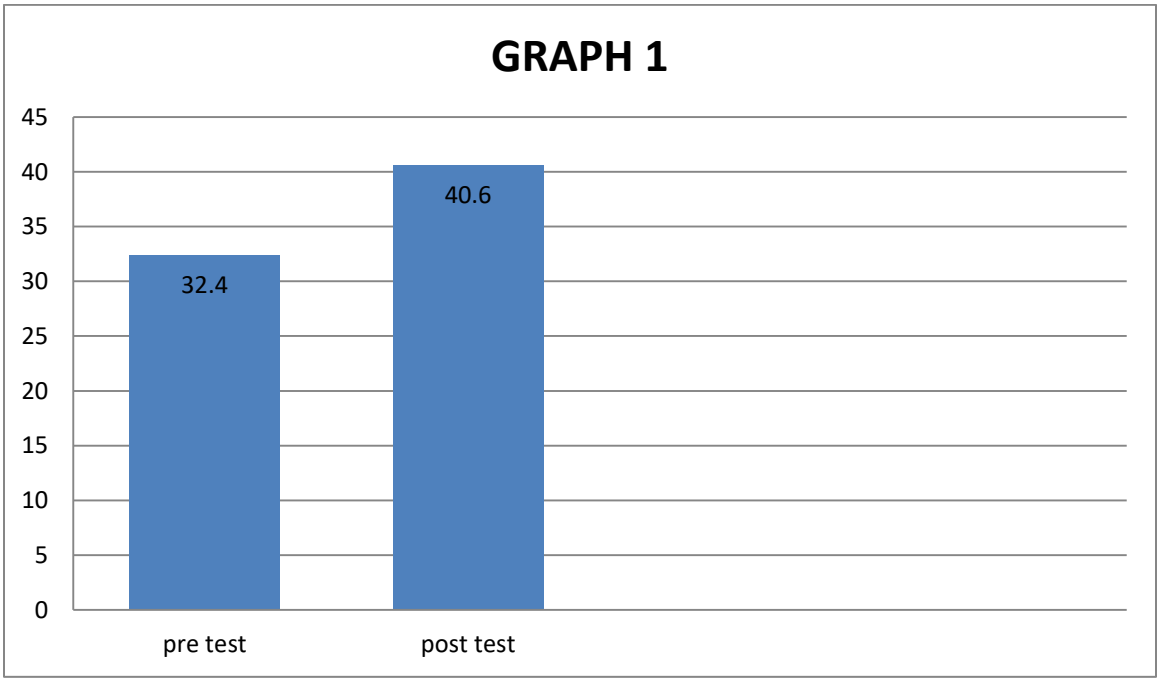


Table 2.Comparing Mean of pre-test and post-test BBS Scores of Group B/Control Group

MEAN		't' calculated value	't' table value
Pre test	Post test		
26.47	31.07	24.18	2.14

Figure 2 .Comparison of mean difference in pre-test and post-test BBS score of group B

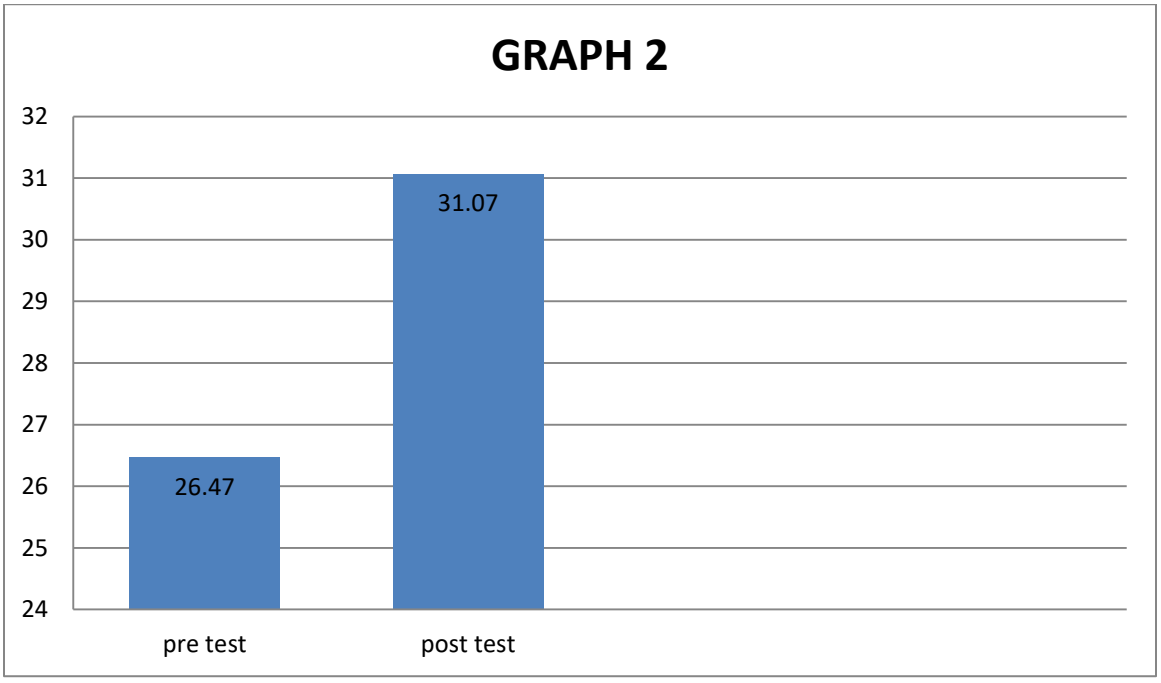
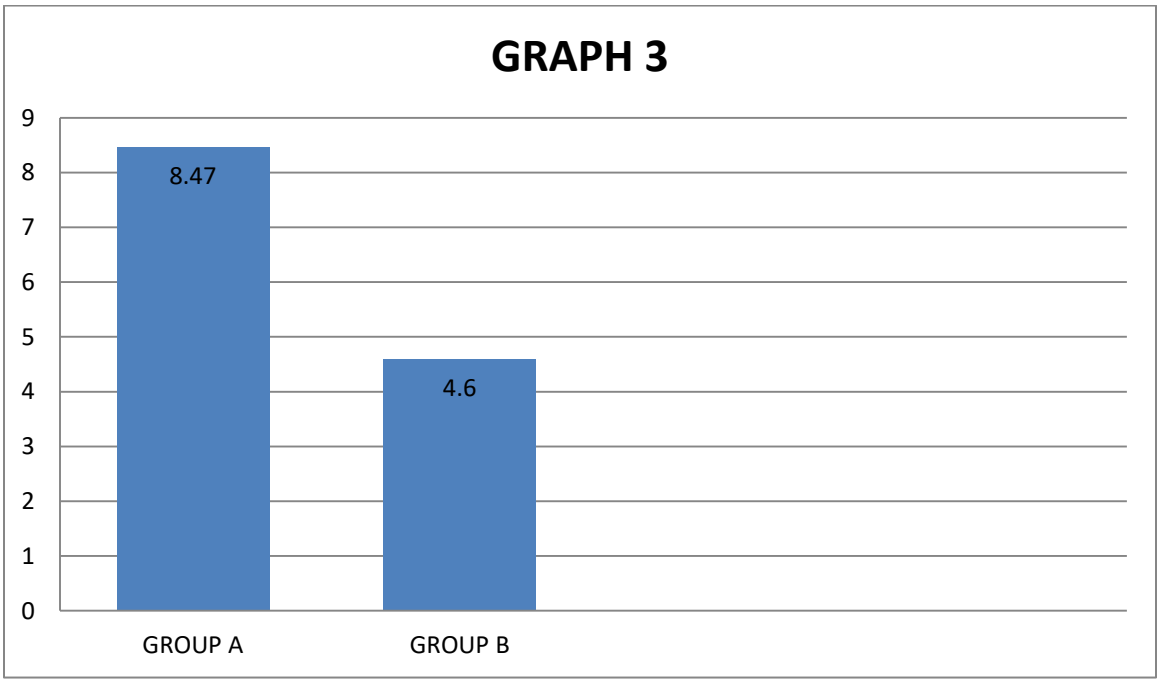


Table 3. Comparing Mean difference of BBS score of Group A and B

	Mean Difference	calculated 't' value	't'table value
Group A / Experimental group	8.47	4.65	2.048
Group B / Control group	4.60		

Figure3. Comparison of difference in BBS score of Group A and Group B



TIS SCORES

Using paired t-test

Comparing Mean of Pre-test and Post-test TIS scores of Group A/Experimental

MEAN		't' calculated value	't' table value
Pre test	Post test		
12.47	17.4	19.87	2.14

Figure 4 .Comparison of mean difference in pre-test and post-test TIS score of group A

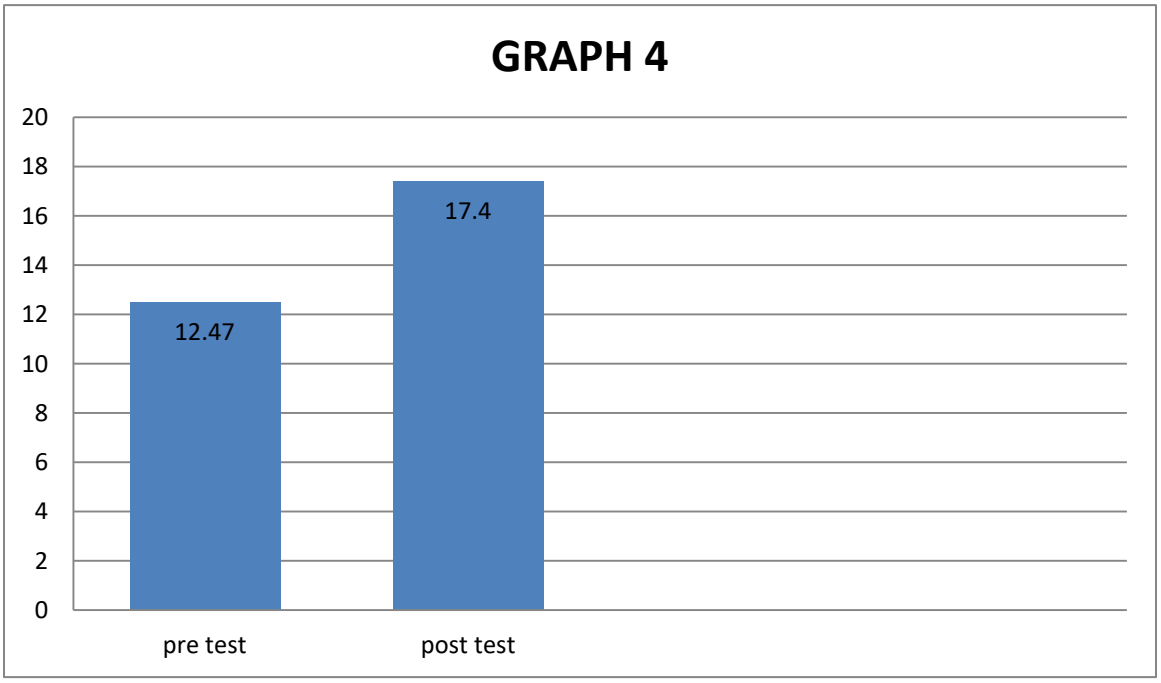


Table 5. Comparing the Mean Pre-test and Post-test TIS scores of Group B

MEAN		't' calculated value	't' table value
Pre test	Post test		
10.8	14.3	13.2	2.14

Figure 5 .Comparison of mean difference in pre-test and post-test BBS score of group B

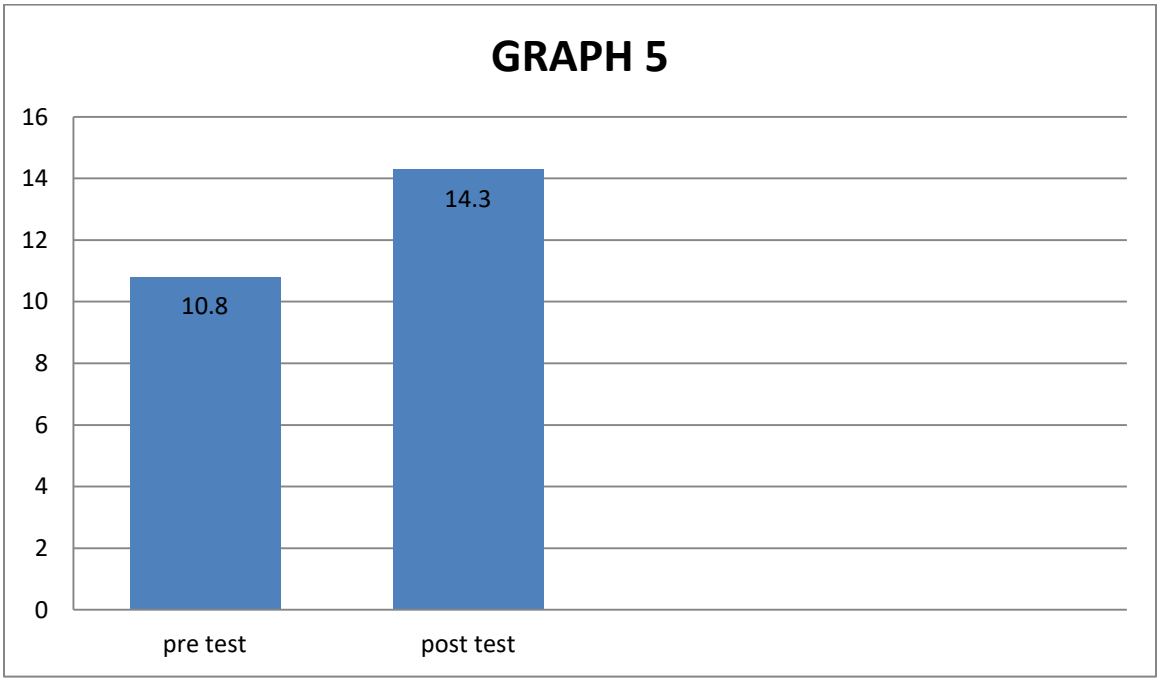
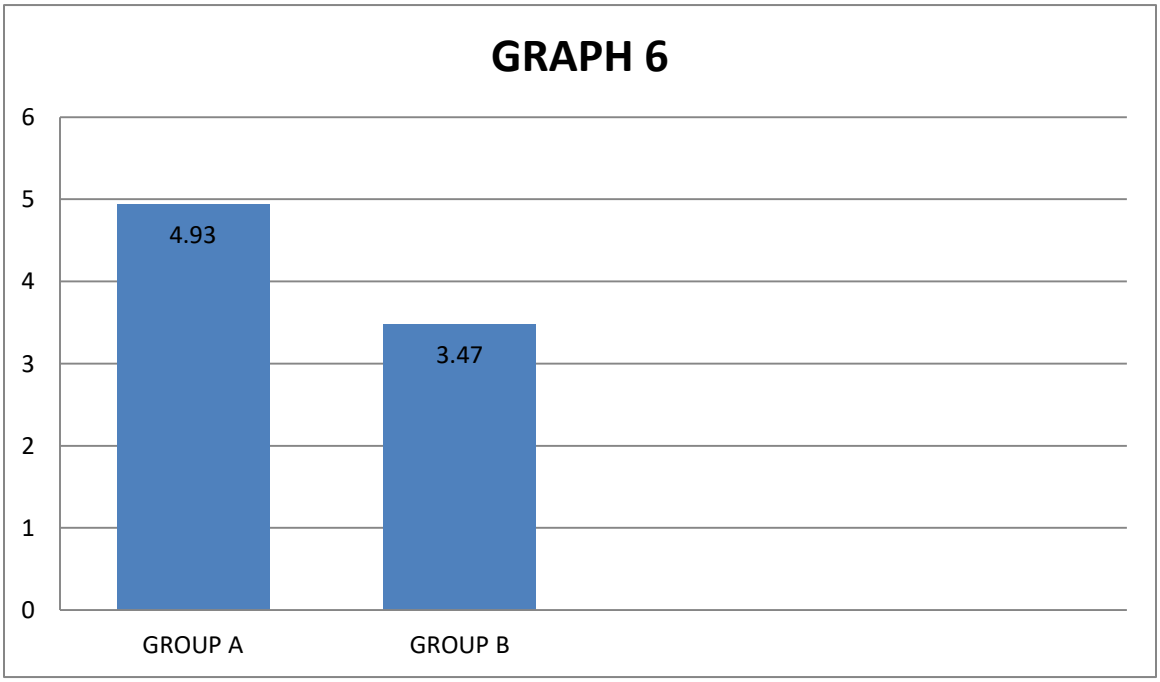


Table 6. TIS Comparision of mean differences of Group A and B

	Mean Difference	't' calculated value	't' table value
Group A	4.93	4.27	2.048
Group B	3.47		

Figure 6. TIS Comparision of mean differences of Group A and B



RESULTS AND DISCUSSION

RESULTS

1. There is a statistically significant improvement in balance score of stroke patients following the use of conventional exercises.

2. There is a statistically significant improvement in balance score of stroke patients following the use of trunk exercises along with conventional exercises.

3. There is a statistically significant difference between the mean balance scores of Experimental group and Control group.

Discussion

The analysis and interpretation of the mean value of post test scores of BBS of group A was 40.26 and group B was 32.86. On analyzing the data t value is 5.81 and the p value is 0.005 which shows that there is a significant difference between post test BBS value of group A and group B.

The mean value of post test scores of TIS of group A was 17.4 and group B was 16. On analyzing the data t value is 2.27 and the p value is 0.005 which shows that there is significant difference between post test value of group A and group B.

Patients in the experimental group improved significantly better compared to the control group. There is a improvement in balance and trunk performance in patients which in turn improved their quality of life and reduced fall risks.

SUMMARY AND CONCLUSION

SUMMARY:

The purpose of the study determines effectiveness of trunk exercise on improve balance in stoke patients. For the study an experimental approach to pre-test and post test in control group design was used. Total 30 patients were selected by random sampling method. They were grouped in to two groups, an experimental group(group A) and a control group(group B) of 15 subject each. The tool selected for measuring outcome was BBS and TIS.

The data was collected before and after administration of treatment program. Duration of the treatment program was five weeks. Control group was given conventional physiotherapy and experimental group was given 10 hours of trunk exercises in addition to conventional physiotherapy. The data obtained were analysed by using t test.

CONCLUSION:

The result of statistical analyses showed significant improvement in the experimental group over the control group. Thus it can be concluded that trunk exercises are effective in improving balance and functional activities in stroke patients which in turn improves the quality of the life of the stoke patients.

LIMITATIONS AND RECOMMENDATIONS

LIMITATIONS OF THE STUDY:

- Sample size was small.
- All measurements were taken manually and this may introduce human error which could treat the study reliability.
- Study was conducted for a short period of time
- The study assessed only term progress of the patient.
- No follow-ups could be done.

RECOMMENDATIONS:

- To establish efficacy of the treatment a large sample size study is required.
- To make the results more valid a long term study may be carried out.
- A study with a follow up of at least three more months can be done to assess the long lasting effects of the training can be done
- A study can be done with a large population size

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ANNEXURES

ANNEXURE- I

CONSENT FORM

I……..aged…….yrs, voluntarily consent to participate the research named **" A STUDY ON THE EFFECT OF TRUNK EXERCISES IN IMPROVING BALANCE IN STROKE PATIENTS''**.The researcher has explained me the treatment approach in brief, risk of participation and has answered all the questions pertaining to the study to my satisfaction.

Signature of Subject **Signature of Researcher**

Signature of Witness

ANNEXURE – 2

Evaluation Form

Demographic data

Name

Age

Sex

Occupation

- **History**

Past medical history

- CVI
- TIA
- Completed stroke
- Hypertension yes/no

Duration detected now /years

Medication yes/no regular/irregular

Present status controlled/uncontrolled

- Cardiac disease

Congenital/valvular

Ischemic heart disease

Duration

- Peripheral vascular disease

Duration

Site

Treatment

- Diabetes mellitus yes/no

Duration

Treatment regular/irregular

Present status Controlled/uncontrolled

Present medical history:

Onset sudden/gradual

Duration

Symptoms:

- Headache
- Vomiting
- Convulsion
- Unconsciousness
- Paralysis

Partial/total

Face

Upper limb

Lower limb

Sensory distribution yes/no

Language distribution yes/no

Swallowing difficulty yes/no

Gait distribution

Family History:

- History of ischemic heart disease
- Myocardial infarction
- Hypertension
- Cerebrovascular accident

Personal History:

- Physical activities active/inactive
- Smocking
- Alcoholic intake yes/no
- Personality type calm/anxious

General Examination:

- General physical examination

  Built

  Nutrition good/fair/bad

- Vital signs

  Heart rate

  Blood pressure

  Respiratory rate

  Temperature

Neurological Examination:

- Level of consciousness
- Higher mental function
- Minimental status examination (MMSE)

  Orientation

  Registration

  Attention and calculation

  Recall

  Language

- Sensory assessment

Superficial sensation

Deep sensation

Cortical sensation

- Motor assessment

Power

Upper limb proximal distal

Lower limb proximal distal

Tone

Upper limb

Lower limb

Reflexes

Superficial reflex

Deep tendon reflex

- Gait

Type: normal/spastic/ataxic/hemiplegic

Cadence: symmetrical/asymmetrical

Arm swing

Base: narrow/broad

Stride length: short/asymmetrical

- Cranial nerve examination
- Cerebellar signs yes/no
- Bladder and bowel function
- Hand function: normal/partial affected/moderately affected/fully affected

APPENDIX 3

Outcome measures description

Berg balance scale

Sitting to standing

Instructions : Please stand up . Try not use your hand for support .

( )4 able to stand without using hands and steabilise independently

( )3 able to stand independently using hands

( )2 able to stand using hands after several tries

( )1 needs minimal aid to stand or steabilise

( )0 needs moderate or maximal assist to stand

Standing unsupported

Instructions: Please stand for two minutes without holding.

( ) 4 able to stand safely for two minutes.

( )3 able to stand two minutes with supervision

( )2able to stand for thirty seconds unsupported

( )1needs several tries to stand unsupported thirty seconds

( ) 0unable to stand thirty seconds without support

Sitting with back unsupported but Feet supported on floor or on a stool

Instructions : Please sit with arms folded for two minutes

( )4 able to sit safely and securely for two minutes

( )3able to sit two minutes with supervision

( )2 able to sit thirty seconds

( )1 able to sit ten seconds

( )0unable to sit without support ten seconds

Standing to sit

Instructions: Please sit down

( )4 sit safely with minimum use of hand

( )3 controls descent by using by hands

( )2 uses back of legs against chair to control descent

( )1 sits independently ,but has uncontrolled descent

( )0needs assistance to sit.

Transfers

Instructions: arrange chairs for pivot transfer . Ask the patient to transfer one way toward a seat without armrest and one way toward a seat with arms. You may use two chairs(one with and one without armrest) or a bed and a chair.

( )4able to transfer safely with minor use of hands

( ) 3 able to transfer safely definite need of hands

( )2able to transfer with verbal cuing and /or supervision

( )1needs one person to assist

( )0needs two people to assist or supervise to be safe

Standing unsupported with eye closed

Instructions: Please close your eyes and stand still for ten seconds .

( ) 4able to stand ten seconds safely

( ) 3 able to stand ten seconds with supervision

( ) 2 able to stand three seconds

( )1 unable to keep eyes closed three seconds but stand safely

( ) 0needs help to keep from falling.

Standing unsupported with feet together

Instructions: Place your feet together and stand without holding

( ) 4 able to place feet together independently and stand one minute safely

( )3 able to place feet together independently and stand one minute with supervision

( )2 able to place feet together independently but unable to hold for thirty seconds

( ) 1needs to help to attain position but able to stand fifteen seconds feet together

( ) 0needs help to attain position and unable to stand for fifteen seconds

Reaching forward with outstretched arm while standing

Instructions: Lift arm to 90 degree. Stretch out your fingers and reach forward as far as you can . (Examiner place a ruler at the tip of outstretched fingers subject should not touch the ruler when reaching).Distance recorded is from the fingertips with the subject in the most forward position. The subject should use both hands when possible to avoid trunk rotation.

( )4can reach forward confidentally 20-30cm (10inches)

( )3 can reach forward safely 12 cm (5 inches)

( ) 2 can reach forward safely 5 cm(2 inches)

( ) 1 reaches forward but needs supervision

( ) 0 loses balance while trying ,requires external support

Pick up object from the floor from a standing position

Instruction: Pick up the shoe/slipper,which is placed infront of your feet.

() 4 able to pick up slipper safely and easily

() 3 able to pick up slipper but needs supervision

() 2 unable to pick up the slipper but reaches 2-5 cm(1-2inches) from slipper and keep balance independently

() 1 unable to pick up and needs supervision while trying

() 0 unable to try/needs assist to keep from losing balance or falling

Turning to look behind over your left and right shoulders while standing

Instruction: Turn to look directly behind you over toward the left shoulder. Repeat to the right. Examiner may pick an object to look at directly behind the subject to encourage a better twist.

() 4 looks behind from both sides and weight shifts well

() 3 look behind one side only other side shows less weight shift

() 2 turn side ways only but maintains balance

() 1 need close supervision or verbal cuing

() 0 need assistance while turning

Turn 360 degrees

Instruction: Turn completely around in a full circle. Pause, then turn a full circle in the other direction.

() 4 able to turn 360 degree safely in 4 seconds or less

() 3 able to turn 360 degree safely,one side only 4 seconds or less

() 2 able to turn 360 degree safely, but slowly

() 1 need close supervision or verbal cuing

() 0 needs assistance while turning

Place alternate foot on step or stool while standing unsupported

Instructio: Place each foot alternately on the step/stool.Continue until each foot has touched the step/stool 4 times

() 4 able to stand independently and safely and complete 8 steps in 20 seconds

() 3 able to stand independently and complete 8 steps in >20 seconds

() 2 able to complete 4 steps without aid with supervision

() 1 able to complete >2 steps need minimal assistance

() 0 need assistance to keep from falling/ unable to try

Standing unsupported one foot in front

Instructions: Place one foot directly in front of the other. If you feel that you cannot place your foot directly in front, try and step far enough ahead that the feel of your forward foot is ahead of the toes of the other foot. To score 3 points, the length of the step should exceed the length of the other foot and the width of the stance should approximate the subject's normal stride width.

() 4 able to plce foot tandem independently and hold 30 seconds

() 3 able to place foot ahead independently and hold 30 seconds

() 2 able to take small step independently and hold 30 seconds

() 1 needs help to step but can hold 15 seconds

() 0 loses balance while stepping or standing

Standing on one leg

Instructin: Stand on one leg as long as you can without holding

() 4 able to lift leg independently and hold >10 seconds

() 3 able to lift leg independently and hold 5-10 seconds

() 2 able to lift leg independently and hold >2 seconds

() 1 tries to lift leg unable to held 3 seconds but remains standing independently

() 0 unable to try or needs assistance to prevent fall

Total score (maximum = 56)

Trunk Impairment Scale (TIS)

The starting position for each item is the same. Sitting, thighs horizontal and feet flat on support, knees 90 degree flexed, no back support, hands and forearms resting on the thighs. The subject get 3 attempts for each item. The best performance is scored. The observer may give feedback between the tests. Instruction can be verbal or nonverbal (demonstration).

Item	Task description	Score description	Score	Remark
	STATIC SITTING			
1	**BALANCE** Keep starting position for 10 second	Falls or need arm support Maintains position for 10 second	0 2	If 0, total TIS score is 0
2	Therapist crosses strongest leg over weakest leg, keep position for 10 second	Falls or need arm support Maintains position for 10 second	0 2	
3	Patient crosses strongest leg over weakest leg	Falls Need arm support Displace trunk >10 cm or assist with arm moves without trunk or arm compensation	0 1 3	
		TOTAL	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 Touches seat without help	0 1	If 0, items 2+3 are also 0
2	Repeat item 1(evaluate Trunk movement)	No appropriate trunk movement Appropriate trunk movement (shortening right side, lengthening left side)	0 1	If 0, item3 is also 0

3	Repeat item 1 (compensation strategies used)	Compensation used(arm, hip ,knee, foot) No compensation strategies used	0 1	
4	Touch seat with left elbow, return to starting position (task achieved or not)	Does not reach seat, falls, or uses arm Touches seat without help	0 1 0	If 0, item5+6 are also 0
5	Repeat item 4 (evaluate Trunk movement)	No appropriate trunk movement Appropriate trunk movement (shortening left side, lengthening right side)	1 0	If 0, item 6 is also 0
6	Repeat item 4(compensation strategies used or not)	Compensation used (arm, hip ,knee, foot) No compensation strategies used	1 0	
7	Lift right side of pelvis from seat, return to starting position (evaluate trunk movement)	No appropriate trunk movement appropriate trunk movement (shortening right side, lengthening left side)	1 0	If 0, item 8 is also 0
8	Repeat item 7(compensation strategies used or not)	Compensation used (arm, hip ,knee, foot) No compensation strategies used	1 0	
9	Lift left side of pelvis from seat, return to starting position (evaluate trunk movement)	No appropriate trunk movement appropriate trunk movement (shortening left side, lengthening right side)	1 0	If 0, item 10 is also 0
10	Repeat item 7(compensation strategies used or not)	Compensation used (arm, hip ,knee, foot)	0	

		No compensation strategies used TOTAL	1 10	
	CO-ORDINATION			
1	Rotate shoulder girdle 6 times (moves each shoulder 3 times forward)	Does not move right side 3 times Asymmetric rotation Symmetric rotation	0 1 2	If 0, item 2 is also 0
2	Repeat item 1, perform within 6 second	Asymmetric rotation Symmetric rotation	0 1	
3	Rotate pelvic girdle 6 times (moves each knee 3 times forward	Does not move right side 3 times Asymmetric rotation Symmetric rotation	0 1 2	If 0, item 4 is also 0
4	Repeat item 3, perform within 6 second	Asymmetric rotation Symmetric rotation TOTAL	1 2 6	
		TOTAL TIS SCORE	**23**	

APPENDIX 4

Master Chart

BERG BALANCE SCALE			
Experimental		Control	
Pre-test	**Post-test**	**Pre-test**	**Post-test**
25	30	24	28
28	42	20	24
30	36	25	30
32	41	21	26
26	36	22	27
38	46	26	31
40	46	27	32
23	29	20	25
29	34	22	27
41	48	25	30
34	47	30	34
32	39	31	35
33	46	36	42
42	50	40	44
33	40	28	31

TRUNK IMPAIRMENT SCALE			
Experimental		Control	
Pre-test	**Post-test**	**Pre-test**	**Post-test**
13	17	10	12
11	18	11	14
12	17	12	15
9	14	12	14
14	18	11	15
9	13	9	13
15	20	13	16
15	19	12	14
13	19	13	15
14	18	8	12
13	19	10	14
10	16	11	15
9	13	8	13
15	20	11	15
15	20	11	15