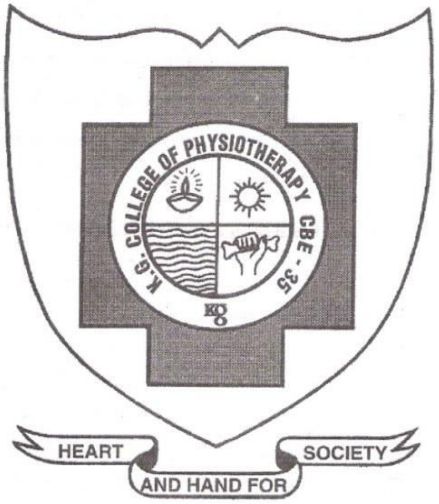
"EFFECT OF SHOE RAISE ALONG WITH MOTOR RELEARNING PROGRAM FOR IMPROVING BALANCE AND GAIT FOR PATIENTS WITH CHRONIC STROKE"



REGISTER NO : 271720301

ELECTIVE : PHYSIOTHERAPY IN NEUROLOGY

A DISSERTATION SUBMITTED TO THE TAMILNADU

Dr. M.G.R MEDICALUNIVERSITY, CHENNAI

AS PARTIAL FULFILLMENT OF THE

MASTER OF PHYSIOTHERAPY DEGREE

MAY 2019

CERTIFICATE

Certified that this is the bonafide work of **Ms. ANJU JACOB** of K.G. College of Physiotherapy, Coimbatore submitted in partial fulfilment of the requirements for the Master of Physiotherapy Degree course from the Tamil Nadu Dr.M.G.R. Medical University under the **Registration No:271720301**for the May 2019 Examination.

Date: Principal:

A Dissertation on

"EFFECT OF SHOE RAISE ALONG WITH MOTOR RELEARNING PROGRAM FOR IMPROVING BALANCE AND GAIT FOR PATIENTS WITH CHRONIC STROKE"

Has been submitted in partial fulfillment for the requirement of the Master of Physiotherapy degree,

MAY 2019

_____ _____

Internal Examiner **External Examiner**

"EFFECT OF SHOE RAISE ALONG WITH MOTOR RELEARNING PROGRAM FOR IMPROVING BALANCE AND GAIT FOR PATIENTS WITH CHRONIC STROKE"

Principal: ……...

Dr. B. ARUN, MPT, PhD

Principal,

K.G. College of Physiotherapy,

K.G .Hospital,

Coimbatore - 641035.

Under the guidance of ……

Dr. K.Mohanraj, M.P.T, PhD

Vice Principal,

K.G. College of Physiotherapy.

K.G. Hospital,

Coimbatore-641035.

A DISSERTATION SUBMITTED TO THE TAMILNADU Dr. M.G.R MEDICAL UNIVERSITY, CHENNAI, AS PARTIAL FULFILLMENT OF THE MASTER OF PHYSIOTHERAPY DEGREE,

MAY 2019

ACKNOWLEDGEMENT

With a humble and grateful heart, I thank **ALMIGHTY GOD** who has granted me this good opportunity to experience his abundant blessing and gracious mercy to be a fruitful throughout this venture.

With due respect, I would like to express my sincere thanks to **Padmashree Dr. G. Bakthavathsalam,** Chairman, K.G. Hospital for permitting to conduct the study by providing a wonderful environment and necessary infrastructure.

With sincere and a honest heart full of gratitude I would like to thank madam, **Mrs. Vaijayanthi Mohandas**, CEO of Education, K.G. College of Health Sciences for her enthusiasm and concern for all the well being of students.

I humbly submit my thanks to my principal **Dr. B. Arun, MPT, PhD.,** Principal for her valuable teaching and guidance. He has always given me his support and timely help in all possible manners in successfully carrying out and completing this project.

It gives me immense pleasure to express my gratitude to my Vice-Principal and also my project guide **Dr. K. Mohanraj, MPT, PhD.,** for rendering valuable suggestions, constant guidance and support for the progress of my work and fruitful outcome of this study.

I sincerely thank my coordinator **Prof. C.H. Anand Chellappa, MPT,** Professor, K.G. College of Physiotherapy for his valuable suggestion and help.

I express my sincere gratitude to **Prof. V. Mohan Gandhi, MPT.,**CEO-Rehabilitation, K.G. Hospital, Coimbatore for his valuable support and guidance.

I am extremely pleased to thank all Staffs K.G. College of Physiotherapy, and All Staffs Department of Physiotherapy, K.G. Hospital, Coimbatore, for their valuable suggestions which greatly enhanced the contents.

I would like to thanks to **Librarian Mr. Kadhirvadivelu, MLISC** for allowing me to utilize the library materials.

I also express my sincere thanks to **ALL SUBJECTS** for having consented to participate in this study and their co-operation in making this study a successful one.

I am very much grateful to my **FAMILY MEMBERS and FRIENDS** for their support and interest in my excellence.

CONTENTS

CONTENTS

LIST OF TABLES

LIST OF GRAPHS

I INTRODUCTION

Stroke is defined as rapidly developing clinical signs of focal or global disturbances of cerebral blood function with symptom lasting for 24 hours or longer or leading to death. Stroke is a non-communicable disease of increasing socio economic importance in ageing populations.

According to WHO, stroke was the second commonest cause of worldwide mortality in 1990 and, the third commonest cause of mortality in more developed countries; it was responsible for about 4.4 million deaths worldwide (WHO 1990). Stroke causes 5.7 million deaths in 2005 and 87% of these deaths were in low income and middle income countries. Without any intervention, the no. of deaths are projected to rise in 6.5 million in 2015 and to 7.8 million in 2030 (Colin Mathers 2007).

Stroke is a common neuromuscular disorder due to abnormal blood circulation in the brain. It is a major cause of impairment of being paralyzed on the unilateral side including the trunk, reduction in muscle control and body movements, balance, inability to perform functional task, inability to stand and walk. In 2005 it was recorded that about 5-7 millions were affected with stroke and 87% of these death occurred in underdeveloped countries (Katheleen et al., 2007).

To maintain balance in activities of daily living postural control is essential, while motor, sensory and higher brain cognitive facilities all contribute to postural control. Following stroke, patients lose functions of the motor, sensory and higher brain cognitive faculties of various degrees which leads to diminished balance (Shumway-cook A, 1988).

Gait or human locomotion may be described as a translator progression of the body as a whole produced by coordinated, rotator movements of body segments (Cynthia .C. Norkin 2012).

Human gait is defined as a manner of walking or moving foot. Gait is composed of two primary phases - stance phase, swing phase. It is clinically divided into 8 separate sub-phases which are: Initial contact, Loading response, Mid-stance, Terminal stance, Pre - swing, Initial - swing, Mid - swing, Terminal - swing.

Normal gait requires adequate strength and range of motion of all participating joints, proprioception and balance. The common features of gait after stroke include decreased gait velocity and asymmetrical gait pattern. In the acute phase more than half of the people with stroke are unable to walk and walking impairments are still present even after three months (Raymond 2006).

Motor Relearning Program (MRP) focuses on improvement of functional recovery, walking, motor function, balance, and quality of life in acute and sub-acute stroke patients (B Langhammer J K Stanghella et al 2016).

Motor relearning programs can be defined as a set of internal processes associated with practice experience leading to relatively permanent changes in the capability of skilled behavior. Motor relearning program is associated with task-oriented training strategies. Motor relearning programs theory describes motor patterns can be acquired and modified through learning (Millikin CH et al., 2016).

Shoe raise also known as shoe insert focuses on loading of the bodyweight towards the affected lower extremity during treatment and daily activities which helps in overcoming learned disuse of affected lower limb (Jeba C et al., 2015) .

Compelled body weight shift therapy is defined as the prolonged lift of unaffected lower extremity through the use of shoe insert which forces loading of bodyweight towards the affected lower extremity during treatment and daily activities thus helping in overcoming learned disuse of affected lower limb(Gajanan Bhalerao et al., 2015**).**

Postural control is an essential component which helps in improving balance. Motor, sensory and higher brain cognitive functions all contribute to postural control. Patients lose functions of the motor, sensory and higher brain

cognitive functions to various degrees which may lead to balance problems following stroke. The various balance problems include increased postural sway, asymmetric weight distribution, impaired weight shifting ability and decreased stability capacity (Horak FB et al., 2002).

Berg Balance Scale and Dynamic Gait Index scale are the central components of physical therapy evaluation to identify the balance and gait in patients suffering from stroke. These two scales are used to measure the change in functional mobility of walking (Romero S 2011).

Berg Balance Scale is a 14-item scale that quantitatively assesses balance and risk for falls in older community-dwelling adults through direct observation of their performance. The scale requires 10 to 20 minutes to complete and measure the patient's ability to maintain balance either statically or while performing various functional movements for a specified duration of time. The items are scored from 0 to 4, with a score of 0 representing an inability to complete the task and a score of 4 representing independent item completion. A global score is calculated out of 56 possible points. Scores of 0 to 20 represent balance impairment, 21 to 40 represent acceptable balance and 41 to 56 represent good balance. The Berg Balance Scale measures both static and dynamic aspects of balance. The ease with which the Berg Balance Scale can be administered makes it an attractive measure for clinicians; it involves minimal equipment (chair,

stopwatch, ruler, step) and space and requires no specialized training. (Lisa Blum Nicol Korner-Bitensky et al 2008)

The Dynamic Gait Index (DGI) was developed by Shumway-Cook and Woollacot to evaluate functional stability during gait activities in older people and to evaluate their risk of falling. The Dynamic Gait Index includes items such as walking while changing speed and turning the head, gait with pivot turn, walking over and around obstacles, and stair climbing. People with stroke tend to have problems with sensory and neuromotor organization and with controlling momentum during movement.

A scale such as the Dynamic Gait Index might be useful in capturing problems that cannot be detected with more static balance measures. Further, the use of the Dynamic Gait Index for the stroke population may allow a simple evaluation of falls risk in that population. The Dynamic Gait Index has been found to be reliable and valid in other populations including older adults, people with multiple sclerosis, and people with vestibular dysfunction. (Davide Cattaneo et al., 2007)

1.1 NEED FOR STUDY

The poor walking ability, affects the quality of life of the patient. The main problems faced by these patients are lifelong dependency over their caretakers. Therefore being able to walk independently is their ultimate goal.

There are lots of studies done for stroke rehabilitation, but for a complete rehabilitation process motor relearning program could be combined with foot wear modification. There are no previous study combining the effects of motor relearning program along with shoe raise for improving balance and gait. Therefore the need of the study is to analyze the effect of shoe raise along with motor relearning program for improving balance and gait for patients with chronic stroke.

1.2 AIM OF THE STUDY

The aim of the study is to analyze the effect of shoe raise along with motor relearning program for improving balance and gait for patients with chronic stroke.

1.3 KEY WORDS:

- Stroke
- Motor relearning program
- Balance and gait

- Shoe raise
- Dynamic gait index
- Berg balance scale

1.4 OBJECTIVE OF THE STUDY

- To find out the effectiveness of shoe raise on improving balance and gait in patients with chronic stroke.
- To find out the effectiveness of motor relearning program on improving balance and gait in patients with chronic stroke.
- To find out the effectiveness of shoe raise along with motor relearning program on improving balance and gait in patients with chronic stroke.

1.5 HYPOTHESIS

1.5.1 NULL HYPOTHESIS

There will be no significant difference on the effect of shoe raise and motor relearning program in patients with chronic stroke.

1.5.2 ALTERNATE HYPOTHESIS

There will be a significant difference on the effect of shoe raise and motor relearning program in patients with chronic stroke.

II REVIEW OF LITERATURE

REVIEWS FOR STROKE REHABILITATION

Dally J et al., (2000):

Stroke is one of the most common neurological disorder that represent a major cause of disability. It is an enormous and serious public health and the third leading cause of death, after ischemic heart disease and cancer. Most of death from stroke occurred in the less developed countries. There are various rehabilitation techniques evolving to improve walking endurance, gait speed , functional balance and mobility .

Ferrarello F et al., (2011):

Stroke is one of the main causes of disability and mortality in the adult population in the developed world. The loss of motor control, abnormal movement pattern, tone disorder, coordination difficulties, and sensory dysfunction of the lower extremities which arise post- stroke period reduces motor function. In spite of this, the patients experience to walk from the early period, but their walking pattern is slow, inefficient, unstable and in co-ordination. Consequently, learned misuse develops for the lower limb function in stroke patients.

Catherine E et al., (2002):

Stroke is an acute, neurological event that is caused by an alteration in blood flow to the brain. The traditional definition of stroke, devised by WHO in 1970s is a neurological deficit of cerebrovascular cause that persist beyond 24 hours or is interrupted by death within 24hours. Many patients experience chronic motor impairment and limitation in activities of daily living even after extensive neurological rehabilitation. They often result in long-term dependence at a considerable cost to the careers and health services. Loss of independence of upper limb function contributes enormously to functional disability, affecting quality of life and independence in basic and instrumental activities of daily living.

Jeyaraj D et al., (2013):

The estimated prevalence rate of stroke range from 84-262/ 100000 in rural and 334-424/100000 in urban areas. The incidence rate is 119- 145/100000 based on the recent population based studies. There is also a wide variation in case fatality rate with the highest being 42% in Kolkata.

James McLntosh et al., (2017):

During a stroke the brain does not receive enough oxygen or nutrient causing brain cell to die. Stroke need to be diagnosed and treated as quickly as possible to minimize brain damage. Treatment depends on the type of stroke. The

most effective way to prevent stroke is through maintaining a healthy life style and treating the risk factors.

REVIEWS FOR SHOE RAISE

Enas Elsayed et al., (2016):

A study on the effect of shoe insert on weight bearing symmetry in 20 stroke patients and concluded that use of shoe insert in the non-affected lower extremity in addition to the conventional physical therapy program, is effective in improving weight bearing symmetry and motor function in patients with stroke.

Aruin AS et al., (2002):

The effect of shoe wedges and lifts on symmetry of stance and weight bearing in hemiparetic individuals. Shoe wedges and shoe lifts under the unaffected limb induced compelled weight shift toward the paretic limb, resulting in improved symmetry of stance of individuals with mild hemiparesis. that improved symmetry of bipedal standing obtained with a shoe wedge or a shoe lift applied to the unaffected limb can help overcome the learned disuse of the affected limb.

Chaudhari S et al., (2014):

Hemiplegic patient cannot shorten the leg in swing-phase, this can be done by increasing the length of opposite leg using shoe raise. Hence by increasing the length of unaffected leg with shoe raise of 1 cm, the affected leg is relatively

shortened. The effort of walking needed during swing phase is consequently reduced. This make the foot clearance on the affected leg easy improving the step and stride length. There is equal weight bearing on bilateral lower extremities which corrects the asymmetry and improves balance.

Gajanan Bhalerao et al., (2016):

An additional shoe-raise of 1 cm on the unaffected side while ambulating during therapy as well as at home along with motor relearning program on ambulation in chronic stroke subjects faces less sedentary lifestyle due to various impairments, such as muscle weakness, pain, spasticity, and poor balance. Thus, loss of independent ambulation especially outdoors is generally observed in them. There were significant improvement seen in almost all the spatio-temporal gait parameters and RVGA score in within group analysis. Whereas on between group the results from between group comparison suggests that subjects in MRP with shoe-raise group showed better results in spatio-temporal parameters of gait than subjects receiving MRP alone.

Alexander S. Aruin et al., (2012):

A shoe lift on the unaffected side during rehabilitation improves the symmetry of weight bearing and gait velocity. Motor relearning techniques such as Sit-to-stand and stand-to-sit maneuvers with emphasis on equal weight bearing on

both the sides. Balance exercises included weight shifts on the affected side and pre-gait activities such as stepping forward, sideways, and stepping on a stool. Gait activities involved walking using the patient's own assistive device. Both, the patients and their caregivers were trained on how to perform these exercises at home and were required to perform them daily for 60 minutes. Copies of all of the prescribed exercises were given to the patients and their caregivers, and they were required to provide a time log of their daily exercise activity at home. Each subject had a bathroom scale and a mirror at home and used them daily. The shoe lift maintained the improvement in symmetrical weight bearing and gait.

REVIEWS FOR MOTOR RELEARNING PROGRAMME

Carr JH et al., (2007):

The motor relearning program can significantly improve the functions of patient with brain ischemia, and can produce neuroprotective effect. The motor relearning program promote neural regeneration and angiogenesis, and to examine the relationship between motor relearning program with brain functional reconstruction, neural regeneration and angiogenesis.

Del-Zoppo GJ et al., (2010):

The motor relearning program effectively improve neurological function of rhesus macaque with brain ischemia, potentially because of positive effect on

neural regeneration, angiogenesis and cerebral blood flow in the regions surrounding the ischemic lesion. From the preserved motor function with proper motor relearning program , gait and balance can be improved to the maximum. Motor relearning program will be applied according to the adaptation of the regeneration of brain.

Dora YL et al., (2013):

The efficacy of the motor relearning approach in promoting physical function and task performance for patients after a stroke. The motor relearning programme was found to be effective for enhancing functional recovery of patients who had a stroke. Both 'sequential' and 'function-based' concepts are important in applying the motor relearning approach to the rehabilitation of stroke patients.

Bhojan Kannabrian et al., (2016):

A motor relearning program and bobath technique with motor relearning program in improving functional activities among hemiplegic patients. 30 subjects were selected according to the selection criteria. Statistical analysis was done by using student t test and independent t test showed that there was significant improvement in subjects who received bobath technique with motor relearning program.

B Langhammer JK et al., (2000):

Motor relearning program (MRP) studies show considerable improvement in functional recovery, walking, motor function, balance and quality of life in acute and sub acute stroke patients. It can significantly improve various functional disturbance induced by ischemic cerebrovascular disease. In injured brain tissue, glia fibrillary acidic protein and neurofilament protein changes can reflect the conditions of injured neurons and astrocytes , while vascular endothelial growth factors and basics fibroblast growth factor changes can indicate angiogenesis.

Krisciunas A et al., 2003

In motor relearning program physical therapist guides patient's body on key-points at work stimulating normal postural reactions, and training normal movement pattern based on movement science, biomechanics and training of functional movement. Program is based on idea that movement pattern shouldn't be trained; it must be relearned

REVIEWS FOR BALANCE AND GAIT

Tae- Ho Kim et al., (2017):

Repeated gait training can induce improvement of dynamic balancing ability, regardless of the type of ground, repeated gait training is necessary for patient with stroke gait training can improve dynamic balancing ability, as long as

patient can walk, regardless of whether they walk in a correct way or walk well, repeated gait training makes the patients to regain balance and stability while walking.

Chang Gung et al., (2002):

The effects of balance training program on hemiplegic stroke patients by visual feedback balance training , Significant improvements in dynamic balance. The ability of self-care and sphincter control also improved for patients . Dynamic balance function of patients in the visual feedback training had significant improvements . Activities of daily living (ADL) function in self-care also had significant improvements.

Bohanon RW et al., (2002):

Gait is an essential part of daily activity and allows participants as a member of a community. Even though many patients have experienced some restoration of independent gait when they leave rehabilitation centers, many gait problems persist. Decreased gait velocity is a major limitation of community dwelling activity. Therefore the restoring of gait independence in stroke patients as important as restoring balance.

Seung Ho Shin et al., (2014):

Gait training with additional weight improves balance ability and gait ability in stroke patients this gait training method is effective and suitable for stroke patients to increase the abilities of functional performance.

Reported that muscle activation increased as load increased, and that muscle activation around the hip and knee was increased by forward and downward manual approximation on the pelvic area. Additional weight might improve balance ability based on the results of a previous study that muscle activation and balance ability increased with additional weight.

Gait velocity is related to many motor function factors in stroke patients, especially weakness in the affected lower limb, which is a manifestation of a decreased number of motor units and activation. The activations of hip extensors, knee extensors, and ankle plantar flexors on the affected side are significantly related to maintaining or increasing movement velocity, and thus, an increase in gait velocity reflects an improvement in overall gait abilities.

Gunes Yavozer et al., (2006):

Balance training using force platform biofeedback in addition to a conventional inpatients stroke rehabilitation program is beneficial in improving postural control and weight bearing on the paretic side while walking late after stroke. Step length, stride length, and single support percentage of the affected side

were measured to determine the average change of spatial gait variables before and after 6 weeks of gait training. Gait in stroke patients is characterized by a decrease in stride length, duration of stance phase of the affected side, single support percentages, and by an increase in duration of the swing phase of the affected side

REVIEWS FOR BERG BALANCE SCALE

Major MJ et al., 2013

The berg balance scale (BBS) appear to be a valid and reliable clinical instrument for assessing balance in individuals with lower- limb amputation, but it may not be able to discriminate between individuals with greater or lesser fall risk.

Berg K et al., 2008

Berg balance scale that addresses various static and dynamic functional capabilities in sitting and standing. Although originally developed with older adults, this tool may be beneficial for other population with balance deficits.

Sahin F et al., 2008

The berg balance scale is a well-established clinical outcome measure originally designed to assess the balance of elderly individuals. The berg balance scale is confirmed with good validity and reliability for the use of older adults and individuals with balance disturbance such as stroke.

Samira Tatiyama et al., 2004

The study was conducted to translate and adapt the Berg balance scale which is an instrument for functional balance assessment. Forty patients older than 65 years and forty therapists were included in the adaptation phase. Reliability of the measure was assessed twice by one physical therapist and once by one independent physical therapist. The study concluded that the berg balance scale is a reliable instrument to be used in balance assessment of elderly patients.

Nicol korner- Bitensky et al., (2008)

The study was conducted to find out the usefulness of the Berg Balance scale in stroke rehabilitation which was conducted as a systemic review. Twenty-one studies examining the psychometric properties of the BBS with a stroke population were retrieved. The study concluded that the BBS is a psychometrically sound measure of balance impairment for use in post stroke assessment.

Korner-Bitensky N et al., (2008)

The study concluded that 655 physiotherapist working with stroke population , identified that Berg Balance scale is most commonly used assessment tool across the continuum of stroke rehabilitation. The purpose of the study was to review the psychometric properties of the Berg Balance scale specific to stroke and to identify the strength and weakness in its usefulness for stroke rehablilitation.

Twenty one studies examined the psychometric properties of Berg Balance scale and 16 studies examined on validity of Berg Balance scale with a stroke population were retrieved. Berg Balance scale is psychometrically sound measure of balance impairment using post stroke assessment.

REVIEWS FOR DYNAMIC GAIT INDEX

Johanna Jonsdottir et al., (2007)

Dynamic Gait Index in persons with chronic stroke test-retest and interrater reliability as well as concurrent construct validity of the Dynamic Gait Index (DGI) as a measure for dynamic balance in people with chronic stroke was also done through. Dynamic Gait Index showed high reliability and showed evidence of concurrent validity with other balance and mobility scales. Dynamic Gait Index is a useful clinical tool for evaluating dynamic balance in ambulatory people with chronic stroke.

Deanna C et al., (2013)

The validity of the Dynamic Gait Index in a balance clinic disorders to determine whether the patient features such as dizziness or fall history influence the measurement characteristic of the Dynamic Gait Index.

Alghwiri AA et al., (2014)

The study was conducted to assess the reliability and validity of the Dynamic Gait Index in people post stroke. Patients with stroke aged 64 were enrolled the A-DGI score reflected high agreement for both interrater reliability and correlated moderately but significantly with the Glascow Coma Scale, Beck depression inventory, and stroke impact scale-16 version. The A-DGI reflected high reliability and validity in the stroke population. The availability of a reliable and valid A-DGI facilitates its use among therapists from which will enrich the rehabilitation process in the clinical practice.

III METHODOLOGY

3.1 STUDY DESIGN:

Pre - test and post - test experimental study design.

3.2 STUDY SETTING:

The study was conducted in Physiotherapy outpatient department, K.G. Hospital, Coimbatore.

3.3 STUDY DURATION:

6 months duration, individual treatment duration of 6 weeks.

Frequency – 6 days/ week

Duration – 60 minutes/ day

3.4 STUDY SAMPLING:

The sample size was determined based on a pilot study 10 participants were divided randomly into two equal parts, and the main part of the study was conducted on them. The mean and SD for the parameters for his pilot study with $\alpha = 0.05$ and 90% power were used to calculate the sample size of N=30.

A total of about 30 post stroke patients were selected according to the selection criteria and they were allotted into 2 groups by simple random sampling method with 15 subjects in each group.

3.5 CRITERIA FOR SELECTION

3.5.1 INCLUSION CRITERIA:

- Both sexes are included in the study.
- Age group between 45- 65 years.
- Chronic stroke patients (>6months) with Functional Ambulatory Category score ≥2 and ability to walk a distance of at least 10 meters.
- Subjects with ability to understand therapist direction and communication.
- Subjects with no disease affecting balance.

3.5.2 EXCLUSION CRITERIA:

- Subjects with loss of sensation.
- Subjects with hypersensitivity.
- Brain tumor.
- History of diseases with vertigo or vestibular dysfunctions.
- Subjects with cognitive impairments.
- Traumatic brain injury.

- Uncontrolled diabetes mellitus, hypertension and postural hypotension.
- Subjects with musculoskeletal problems.
- Visual impairments and hearing deficits.
- Subjects with psychiatric illness.

3.6 VARIABLES

3.6.1 INDEPENDENT VARIABLES:

- Motor Relearning Program
- Shoe Raise

3.6.2 DEPENDENT VARIABLES:

- Balance
- Gait

3.7 OUTCOME MEASURES:

- Berg Balance Scale
- Dynamic Gait Index

3.8 ORIENTATION OF THE SUBJECTS

Before treatment, all the subjects were explained about the study and procedure to be applied and were asked to inform if they felt any discomfort during

the course of the treatment. All the subjects who were interested to participate in the study were asked to sign the consent form before the treatment.

3.9 PROCEDURE

Based on the selection criteria 30 chronic stroke subjects were selected. They were assigned into 2 groups by Simple Random Sampling method, with 15 subjects in each group. All 30 subjects were involved in pre-test assessment for balance ability and gait. 6 weeks treatment program was given for 60minutes, 6 times a week for 6 weeks for each individual.

GROUP A:

- Warm up exercise for 5minutes.
- Motor Relearning Program for 60minutes, 6times a week for 6 weeks.
- Shoe Raise used for gait training.
- Cool down exercise for 5minutes.

GROUP B:

- Warm up exercise for 5minutes.
- Motor Relearning Program for 60minutes, 6times a week for 6 weeks.
- Cool down exercise for 5minutes.

TRANSFERING FROM WHEEL CHAIR:

GAIT TRAINING WITH SHOE RAISE:

3.10 STATISTICAL TOOLS:

Statistical analysis was done by using student‘t’ test. Paired‘t’ test was used to find out the improvement within the group. Unpaired‘t’ test was used to find out the difference between two groups.

Formula of paired ‘t’ test:

The paired t-test was used to compare the Pre and Post - test values of pain from Group - A and Group - B.

$$S=\sqrt{\frac{\sum d^2-\frac{\sum_d{}^2}{n}}{n-1}}$$

$$t=\frac{\bar{d}\sqrt{n}}{s}$$

where,

d = difference between the pre-test versus post test

$\bar{d}$ = mean difference

n = total number of subjects

s = standard deviation

$\sum d^2$ = sum of the squared deviation

Formula of unpaired 't' test:

The unpaired 't' test was used to explore the gait competency between Group - A and Group - B.

$$S = \sqrt{\frac{\sum(x_{1-\overline{x_2}})^2 + (x_2 - \bar{x}_2)^2}{n_{1+}n_2 - 2}}$$

$$T = \frac{\overline{x_1} - \overline{x_2}}{S} \sqrt{\frac{n_1 n_2}{n_1 + n_2}}$$

Where,

n_1 = total number of subjects in Group - A

n_2 = total number of subjects in Group - B

x_1 =difference between pre-test versus post-test of Group - A

$\overline{x_1}$ =mean of Group - A

x_2=difference between pre-test versus post-test of Group - B

$\overline{x_2}$ = mean of Group - B

S = Standard deviation

LEVEL OF SIGNIFICANCE=5%

IV DATA ANALYSIS AND INTERPRETATION

TABLE I

PRE - TEST AND POST - TEST- BERG BALANCE SCALE

GROUP - A

S.NO	GROUP - A	MEAN	STANDARD DEVIATION	MEAN DIFFERENCE	't' VALUE
1.	PRE - TEST	38.45	2.72	11.08	22.92
2.	POST- TEST	49.53	2.36		

The comparison of pre-test and post-test values of berg balance scale for Group - A showed that the calculated 't' value 22.92 is significantly greater than the tabulated 't' value 2.145 at 5% level of significance. This shows that there is a significant improvement in balance following motor relearning program and shoe raise.

GRAPH- I

PRE - TEST AND POST - TEST- BERG BALANCE SCALE

GROUP - A

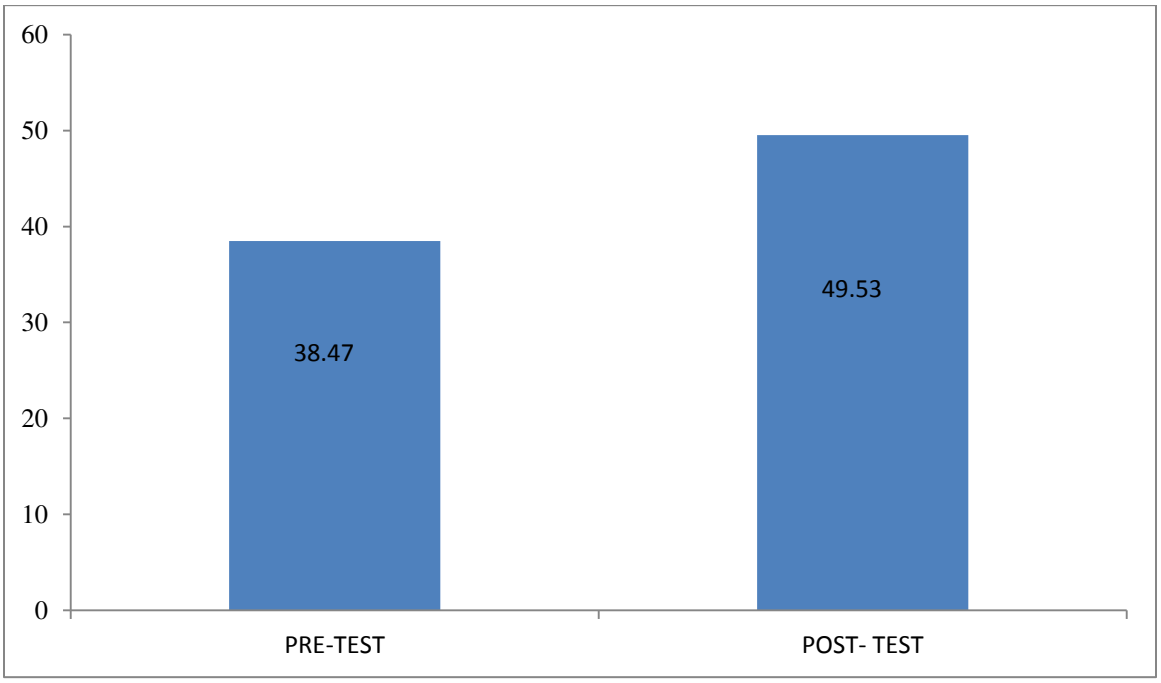


TABLE-II

BERG BALANCE SCALE

PRE - TEST AND POST - TEST VALUES OF GROUP - B

S.NO	GROUP - B	MEAN	STANDARD DEVIATION	MEAN DIFFERENCE	't' VALUE
1.	PRE - TEST	38	2.59	8.47	13.31
2.	POST - TEST	46.47	1.68		

The comparison of pre-test and post-test values of berg balance scale for Group - B showed that the calculated 't' value 13.31 is significantly greater than the tabulated 't' value 2.145 at 5% level of significance. This shows that there is a significant improvement in balance following motor relearning program.

GRAPH-II

PRE - TEST AND POST - TEST VALUES OF GROUP - B

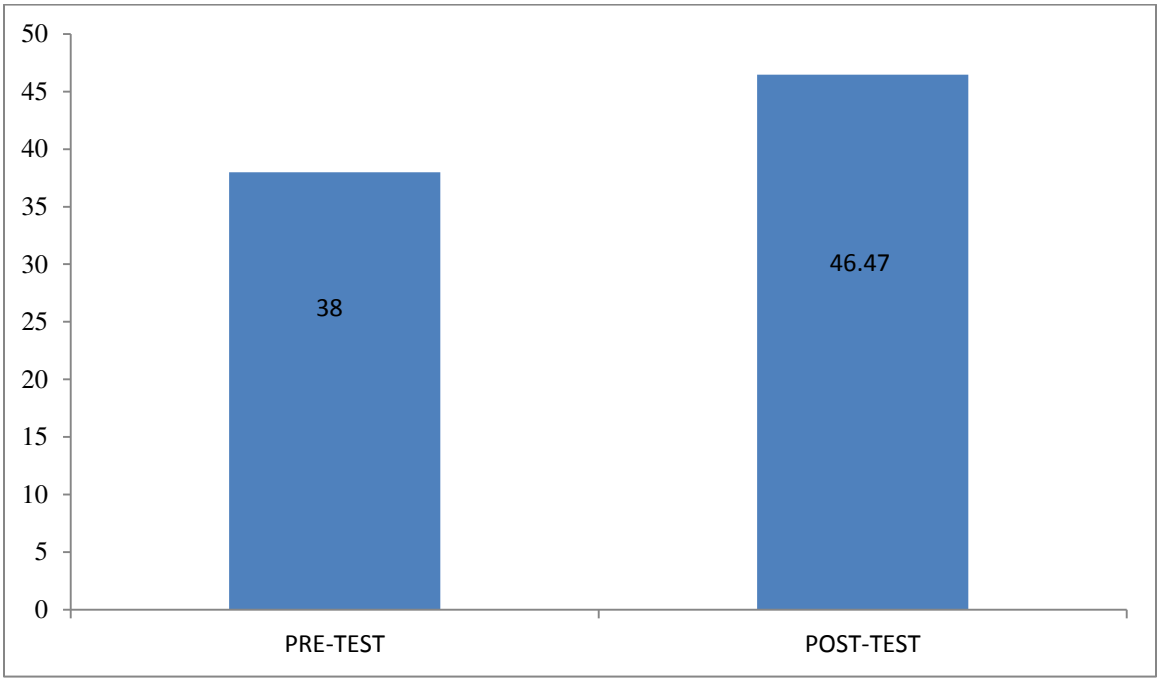


TABLE-III

BERG BALANCE SCALE

POST-TEST VALUES OF GROUP - A AND GROUP - B

S.NO	GROUPS	MEAN	STANDARD DEVIATION	MEAN DIFFERENCE	't' VALUE
1.	GROUP - A	49.54	2.36	3.07	4.20
2.	GROUP - B	46.47	1.55		

The comparison of post-test values of Berg balance between Group - A and Group - B showed that the calculated't' value 4.20 is significantly greater than the tabulated 't' value 2.048 at 5% level of significance. This shows that there is a significant improvement on balance in Group - A than Group - B

GRAPH-III

BERG BALANCE SCALE

POST - TEST VALUES OF GROUP - A AND GROUP - B

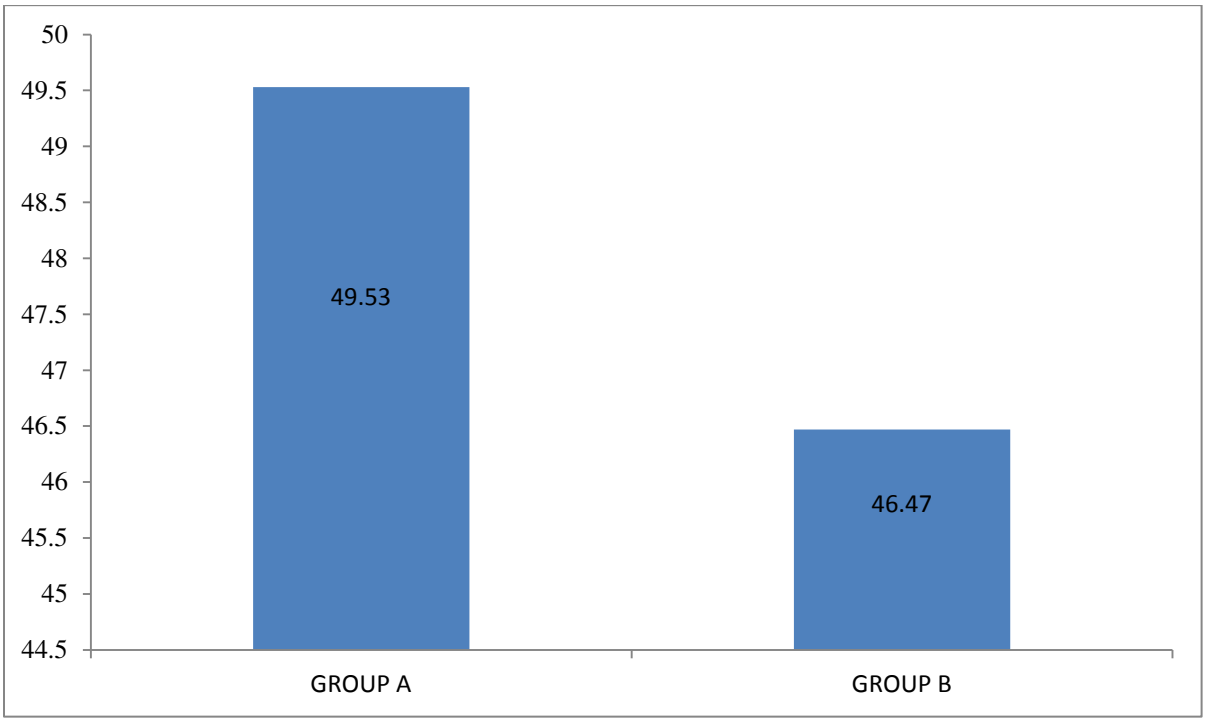


TABLE- IV

DYNAMIC GAIT INDEX

PRE - TEST AND POST - TEST VALUES OF GROUP - A

S.NO	GROUP - A	MEAN	STANDARD DEVIATION	MEAN DIFFERENCE	't' VALUE
1.	PRE - TEST	17.93	0.8	3.47	26
2.	POST - TEST	21.4	1.12		

The comparison of pre-test and post-test values of Dynamic Gait Index scale for Group - A showed that the calculated 't' value 26 is significantly greater than the tabulated 't' value 2.145 at 5% level of significance. This shows that there is a significant improvement in gait following motor relearning program and shoe raise.

GRAPH-IV

DYNAMIC GAIT INDEX

PRE - TEST AND POST - TEST VALUES OF GROUP - A

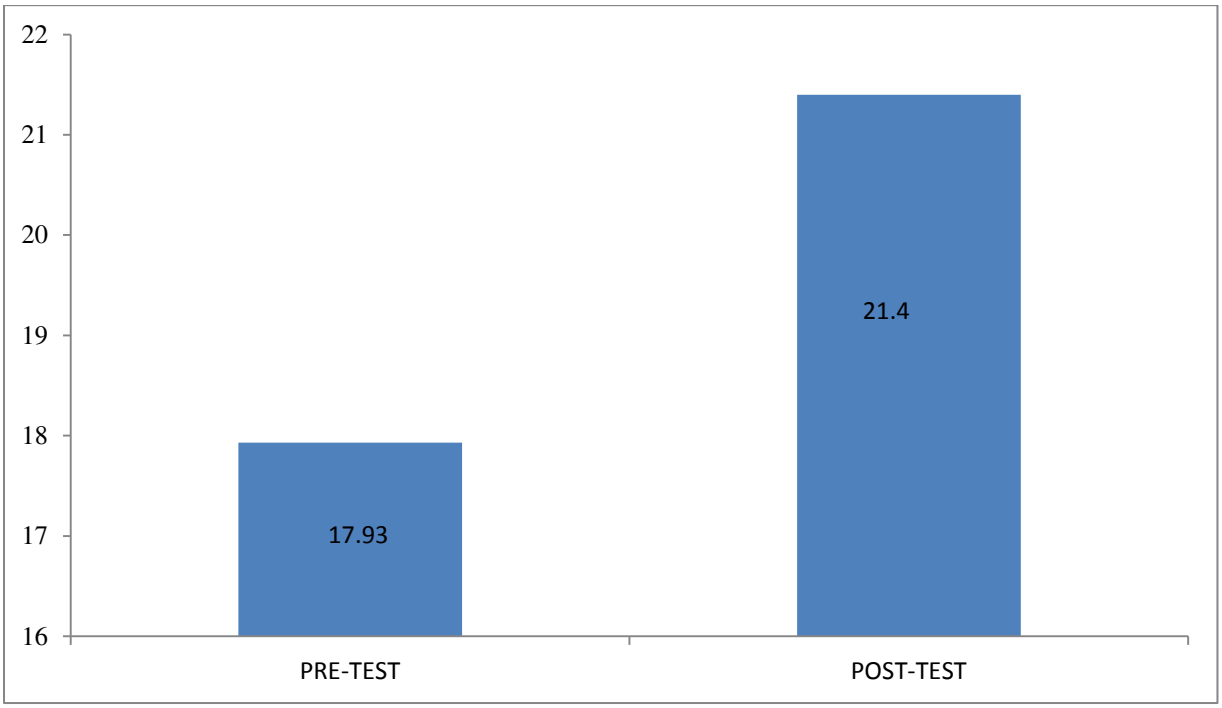


TABLE-V

DYNAMIC GAIT INDEX

PRE - TEST AND POST - TEST VALUES OF GROUP - B

S.NO	GROUP - B	MEAN	STANDARD DEVIATION	MEAN DIFFERENCE	't' VALUE
1.	PRE - TEST	17.93	0.80	1.8	16.8
2.	POST - TEST	19.73	0.70		

The comparison of pre-test and post-test values of Dynamic Gait Index for Group - B showed that the calculated 't' value 16.8 is significantly greater than the tabulated 't' value 2.145 at 5% level of significance. This shows that there is a significant improvement in gait following motor relearning program.

GRAPH-V

DYNAMIC GAIT INDEX

PRE - TEST AND POST - TEST VALUES OF GROUP - B

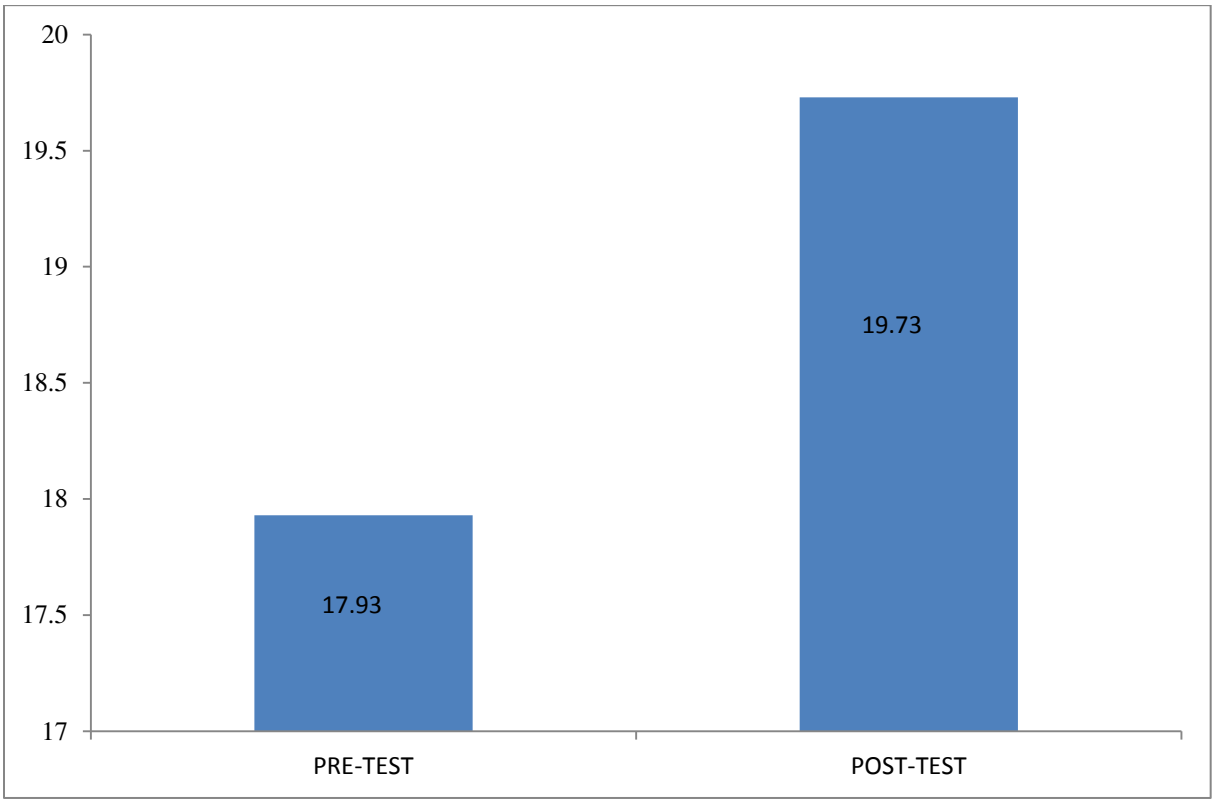


TABLE-VI

DYNAMIC GAIT INDEX

POST - TEST VALUES OF GROUP - B

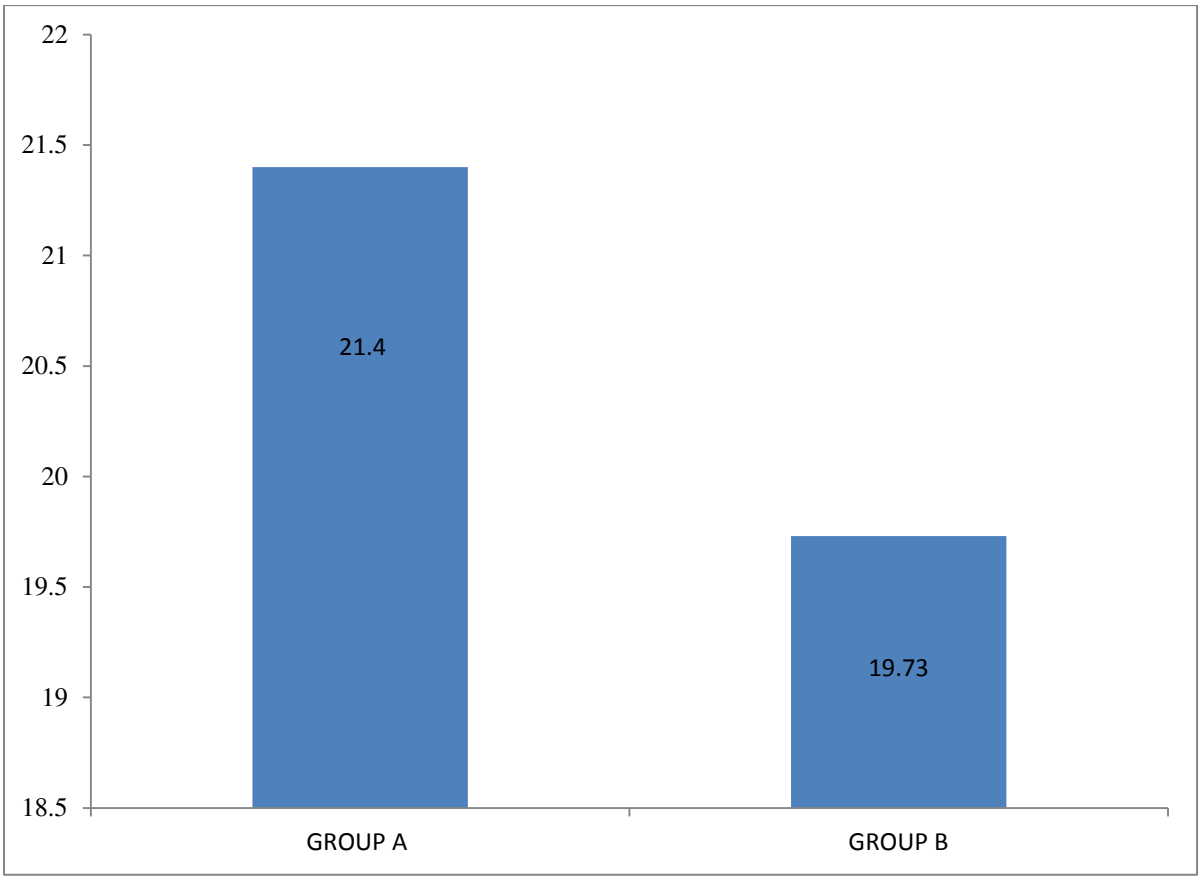
S.NO	GROUPS	MEAN	STANDARD DEVIATION	MEAN DIFFERENCE	't' VALUE
1.	GROUP - A	21.4	1.12	1.67	4.87
2.	GROUP - B	19.73	0.73		

The comparison of post-test values of Dynamic Gait Index between Group-A and Group - B showed that the calculated 't' value 4.87 is significantly greater than the tabulated 't' value 2.048 at 5% level of significance. This shows that there is a significant improvement on gait in Group - A than Group - B.

GRAPH-VI

DYNAMIC GAIT INDEX

POST - TEST VALUES OF GROUP - A AND GROUP - B



V RESULT

The paired ‘t’ test analysis for the pre-test and post-test variables of Berg Balance Scale for the Group - A and Group - B patients with chronic stroke which was shown in tables I and II. Both the groups show significant difference in the pre-test and post-test values. The ‘t’ value for the Group - A is 22.92 and the ‘t’ value for the Group - B is 13.31.

The unpaired ‘t’ test analysis for the post test variables of both the groups for Berg balance scale for measuring balance in patients is shown in table III. There is significant difference shown between the group. Subjects in Group - A show more improvement than subjects in Group - B. The unpaired ‘t’ value for the post test variables for both the groups in 4.20.

The paired ‘t’ test analysis for the pre-test and post-test variables for Dynamic gait index for measuring gait in patients with chronic stroke is shown in table IV and V. Both the groups show significant difference in the pre-test and post-test values. The ‘t’ value for the Group - A is 23, the ‘t’ value for Group - B is 16.8.

The unpaired ‘t’ test analysis for the post test variables for the both the groups for Dynamic gait Index in patients with chronic stroke is shown in table VI. There is significant difference shown between the groups. Subjects in Groups - A

showed more improvement than subjects in Group - B. The ‘t’ value for the post test variables for both the Groups is 4.87.

Statistical analysis revealed that there was statistically significant improvement in both the groups in Berg Balance Scale and Dynamic Gait Index, and showed that there is more improvement in Group - A than Group - B.

VI DISCUSSION

Successful rehabilitation of chronic stroke patients is the major goal for successful rehabilitation. This is achieved when the patients perform routine activities which is strongly associated with walking which in turn depends on balance.

30 patients with chronic stroke who fulfilled the pre-determined inclusive and exclusive criteria were selected and divided in two equal groups, 15 patients in each group. Group - A underwent motor relearning program along with shoe raise and Group - B underwent motor relearning program alone.

Outcome for both the groups were measured by using operational tools before and after the treatment duration 6 weeks. The Berg Balance Scale was used to measure balance and Dynamic Gait index was used to calculate the gait.

Student ‘t’ test was used to find out the difference between the pre-test outcome as well as the difference between the two groups. Based on this statistical analysis both Group - A and Group - B showed significant difference in walking ability and pain-free walking distance.

This study concluded the effectiveness of motor relearning program and shoe rise for chronic stroke patients to improve gait and balance. Analysis of pre-

test for both the groups, Group - A and Group - B revealed that there is no significant difference between the two groups indicating that they are unmatched groups of subjects undergoing different treatment protocol but were selected from the same population.

Stroke subjects life usually end up to sedentary lifestyle due to various impairments like muscle weakness, pain, tone abnormalities and poor balance. (Michael K M et al 2005 and Janice J Eng et al 2007). Thus, loss of ambulation is usually seen in them. So this study is to find out the effect of motor relearning program with shoe raise on improving balance and gait in patients with chronic stroke.

Reduced ability to do hip knee flexion in swing phase leads to inability to shorten the leg, giving rise to a circumduction gait, excessive shifting of weight on unaffected side, hip hiking, short stepping, wide base, excessive out toeing and toe drag of affected side. If chronic stroke patients can't shorten the leg in swing phase, then this can be done by increasing the length of opposite leg using shoe raise. Hence by increasing the length of unaffected leg with shoe-raise of 1 cm the affected leg is relatively shortened, the effort of walking needed during swing phase is consequently reduced.[Chaudhari S, Chitra J et al2014].

The motor relearning program can significantly improve the functions of patient with brain ischemia, and can produce neuroprotective effect. The motor relearning program promote neural regeneration and angiogenesis, and to examine the relationship between motor relearning program with brain functional reconstruction, neural regeneration and angiogenesis. [Carr JH, Shepherd R, Beijing et al (2007)].

Use of shoe raise on unaffected side causes forced shifting of weight on affected leg. This helps in improving equal weight bearing on both legs, reduce the non-use phenomenon of affected lower leg during walking. The improvement of the step length and stride step length of the affected side can be attributed to the correction of weight bearing asymmetry, due to lack of weight bearing on affected side the distance covered by unaffected leg while walking is less.[Chitra J and Mishra S 2014].

Motor relearning program (MRP) studies show considerable improvement in functional recovery, walking, motor function, balance and quality of life in acute and sub acute stroke patients [B langhammer jk stanghella et al (2000)].

This study thus proposes the use of 1 cm shoe raise on the unaffected side in order to improve the affected gait cycle of stroke patients. The affected leg relatively lengthens causing the patient to walk with a hicking or a circumduction

gait. Increasing the height of the unaffected side can help to relatively shorten the affected lower extremity, shifting weight on affected side in stance helping symmetrical weight bearing, foot clearance in swing and reduce the effort of walking [Aruin A S, Rodriguer G M, 2002].

Therefore motor relearning along with shoe raise improve balance and gait in patients with chronic stroke than motor relearning alone.

VII SUMMARY AND CONCLUSION

Aim of the study was to compare the effect of motor relearning program along with shoe raise and motor relearning alone on balance and gait in patients with chronic stroke.

This study was to find out the effectiveness of motor relearning program and shoe raise to improve balance and gait in chronic stroke patients and concluded from the statistical analysis that motor relearning along with shoe raise will improve balance ad gait and is more effective than motor relearning program alone.

VIII LIMITATIONS AND RECOMMENDATIONS

LIMITATIONS:

- The period allotted for the study was found to be insufficient for the inclusion of greater number of subjects.
- Influence of drug, nutritional, psychological state and climate cannot be controlled.
- The difference in individual interest shown to the treatment sessions and further practices.
- Small sample size
- 30 subjects were only included in the study.

RECOMMENDATION:

- Study with more patients is recommended.
- Further analysis in balance and gait training could be done by using EMG Biofeed back.
- Study can be done in subjects with different age groups.
- The study can be extended to al other types of stroke.
- Follow-up study can be done to know the long term affects.

IX BIBLIOGRAPHY

BOOKS

1. Susan. B. O. Sullivan and Thomas J Schmitz, Physical Rehabilitation; and treatment, IV Edition, Jaypee Brothers. 2001.
2. Richard Snell, Clinical neuroanatomy for medical students, III Edition 1992.
3. Glady Samuel Raj, Physiotherapy in Neuro conditions, I Editions 2006.
4. Kenneth W Linsay, Ian Bone, Neurological and Neuro –surgery Illustrated IV, Edition 2005.
5. P. S .S Sundar Rao and J Richard, Introduction to biostatistics III Edition 2001.
6. Raymond D Adams and Maurice Victor, Principles of Neurology VII Editions 2005.
7. Cynthia C Norkin, Pamela K Levangie, Joint Structure and Function, second edition, 2012.

JOURNALS

1. Foulkes M, Wolf P, Price T, Mohr J, Hier D. The Stroke Data Bank: design, methods and baseline characteristics. Stroke 1988; 19:547-54.

2. Brandstater M. Stroke rehabilitation. In: DeLisa JA, Gans BM, editors. Rehabilitation medicine, principles and practice. 3rd ed. Philadelphia: Lippincott-Raven; 1998. p 1184-8.

3. Seliktar R, Susak Z, Najenson T, Solzi P. Dynamic features of standing and their correlation with neurological disorders. Scand J Rehabil Med 1978;10:59-64.

4. Dickstein R, Nissan M, Pillar T, Scheer D. Foot-ground pressure pattern of standing hemiplegic patients: major characteristics and patterns of improvement. Phys Ther 1984;64:19-23.

5. Bohannon RW, Tinti-Wald D. Accuracy of weight-bearing estimation by stroke versus healthy subjects. Percept Mot Skills 1991;72:935-41.

6. Wall J, Turnbull G. Gait asymmetries in residual hemiplegia. Arch Phys Med Rehabil 1986;67:550-3.

7. Wing A, Allison S, Jenner J. Retaining and retraining balance after stroke. Baillieres Clin Neurol 1993;2:87-120.

8. Turnbull G, Charteris J, Wall J. Deficiencies in standing weight shifts by ambulant hemiplegic subjects. Arch Phys Med Rehabil 1996;77:356-62.

9. Laufer Y, Dickstein R, Resnik S, Marcovitz E. Weight-bearing shifts of hemiparetic and healthy adults upon stepping on stairs of various heights. Clin Rehabil 2000;14:125-9.

10. Arcan M, Brull MA, Najenson T, Solzi P. FGP assessment of postural disorders during process of rehabilitation. Scand J Rehabil Med 1977;9:165-

11. Hamrin E, Eklund G, Hillgren AK, Borges O, Hall J, Hellstrom O. Muscle strength and balance in post stroke patients. Ups J Med Sci 1982;87:11-26.

12. Keenan M, Perry J, Jordan C. Factors affecting balance and ambulation following stroke. Clin Orthop 1984;182:165-71.

13. Aruin A, Hanke T, Chaudhuri G, Harvey R, Rao N. Compelled weight bearing in patients with hemiparesis following stroke: the effect of a lift insert and goal-directed balance exercise. J Rehabil Res Dev 2000;37:66-72.

14. Taub E, Goldberg JA, Taub P. Deafferentation in monkeys: pointing at a target without visual feedback. Exp Neurol 1975;46:178- 86.

15. Taub E, Ellman SJ, Berman AJ. Deafferentation in monkeys: effect on conditioned grasp response. Science 1966;151:593-4.

16. Taub E, Wolf S. Constrain induced movement techniques to facilitate upper extremity use in stroke patients. Top Stroke Rehabil 1997;3:38-61.

17. Ostendorf C, Wolf S. Effect of forced use of the upper extremity of a hemiplegic patient on changes in function. Phys Ther 1981; 61:1022-8.

18. Visintin M, Barbeau H, Korner-Bitensky N, Mayo NE. A new approach to retrain gait in stroke patients through body weight support and treadmill stimulation. Stroke 1998;29:1122-8.

19. Hesse S, Bertelt C, Jahnke MT, et al. Treadmill training with partial body weight support compared with physiotherapy in nonambulatory hemiparetic patients. Stroke 1995;26:976-81.

20.Bohannon R W: Comfortable and maximum walking speed of adults aged 20–79 years: reference values and determinants. Age and Ageing 1997, 26(1):15-9.

21.Enright P L, Sherrill D: Reference equations for the six-minutewalk in healthy adults. Am J RespirCrit Care Med. 1998, 158(5 Pt1):1384-1387.

22.Geiger R A, Allen J B,O' Keefe J, Hicks R R. Balance and mobility following stroke : effects of physical therapy interventions with and without biofeedback/force plate training. Phys Ther. 2001;81(4):995-1005.

23. Solomon N A, Glick H A, Russo C J, Lee J, Schulman K A. Patient preferences for stroke outcomes. Stroke. 1994, 25(9):1721-1725.

24. B Langhammer J K Stanghella, Bobath or Motor Relearning Programme? A comparison of two different approaches of physiotherapy in stroke rehabilitation: a randomized controlled study. Clinical Rehabilitaion. 2000;14:361-369

25.B Langhammer J K Stanghella, Bobath or Motor Relearning Programme? A follow-up one and four years post stroke Clinical Rehabilitation. Clin Rehabil. 2003 Nov;17(7):731-4.

26.Bhalerao G, Kulkarni V ,Doshi C, Rairikar S, Shyam A, Sancheti P. Comparison of MRP vs Bobath Approach at every 2 weeks interval for improving Activities of daily living and Ambulation in Stroke Rehabilitation, Int J of Basic and Applied Medical Sciences. 2013;3(3):70-77.

27. Aruin A S , Hanke T ,Chaudhari G, Harvey R, Rao N. Compelled weight bearing in persons with hemiparesis following stroke :The effect of a lift insert and goal directed balance exercises. J of Rehabilitation Research and Development.2000; 37(1):65-72.

28. Rodriguer G M, Alexander A S. The effect of shoe wedges and lifts on symmetry of stance and weight bearing in hemiparetic individuals. Arch Phys Med Rehabil. 2002 Apr;83(4):478-82.

29.Carr JH, Shepherd RB. A Motor Relearning Programme for stroke. 2nd edition; 1987.

30. Mohapatra S, Evioto A C, Ringquist K L ,Muthukrishnan S R, Aruin A S Compelled Body Weight Shift Technique to facilitate rehabilitation of individuals with acute stroke. Int Scholarly Research Network Rehabil. Volume 2012, Article ID 328018, 7 page

31. Chaudhari S, Aruin A S. The effect of shoe lifts on static and dynamic postural control in individuals with hemiparesis. Arch Phys Med Rehabil. 2000 Nov;81(11):1498-503.

32.Chitra J, Mishra S. Effect of Compelled Body Weight Shift Technique on weight bearing symmetry and balance in post stroke patients: An experimental Pre- Post study. Int J Physiother Res. 2014;2:6.

33.Shumway-Cook A, Anson D, Haller S. Postural sway biofeedback: its effect on reestablishing stance stability in hemiplegic patients. Arch Phys Med Rehabil 1988;69: 395-400.

34. Nashner LM. Fixed patterns of rapid postural responses among leg muscles during stance. Exp Brain Res 1977; 30:13-24.

35. Nashner LM. Adaptation of human movement to altered environments. Trends Neurosci 1982;5:358-61.

36. Shumway-Cook A, Horak FB. Assessing influence of sensory interaction on balance: Suggestion from field. Phys Ther 1986;66:1548-50.

37. Rode G, Tiliket C, Boisson D. Predominance of postural imbalance in left hemiparetic patients. Scand J Rehab Med 1997;29:11-6.

38. Goldie PA, Matyas TA, Evans OM. Maximum voluntary weight bearing by the affected and unaffected legs in standing following stroke. Clin Biomech 1996;11:333-42.

39. Dettmann MA, Linder MT, Sepic SB. Relationships among walking performance, posture stability, and functional assessments of the hemiplegic patient. Am J Phys Med 1987;66:77-90.

40. Badke MB, Duncan PW. Patterns of rapid motor responses during postural adjustments when standing in healthy subjects and hemiplegic patients. Phys Ther 1983;63:13- 20.

41. Horak FB, Esselman P, Anderson ME, Lynch MK. The effects of movement velocity, mass displaced, and task certainty on associated postural adjustments made by normal and hemiplegic individuals. J Neurol Neurosurg Psychiatry 1984;47:1020-8.

42.Wood-Dauphinee S, Berg K, Bravo G, Williams JI: The Balance Scale: Responding to clinicallymeaningful changes. Canadian Journal of Rehabilitation, 10: 35-50,1997.

43.Berg K, Wood-Dauphinee S, Williams JI: The Balance Scale: Reliability assessment for elderlyresidents and patients with an acute stroke. Scand J Rehab Med, 27:27-36, 1995.

44..Herdman SJ. ***Vestibular Rehabilitation***. 2nd ed. Philadelphia, PA: F.A.Davis Co; 2000.

45. Shumway-Cook A, Woollacott M. *Motor Control Theory and Applications*, Williams and Wilkins Baltimore, 1995: 323-324

46.Berg K, Maki B, Williams JI, Holliday P, Wood-Dauphinee S: A comparison of clinical andlaboratory measures of postural balance in an elderly population. Arch Phys Med Rehabil, 73:1073-1083, 1992.

47. Lisa Blum Nicol Korner-Bitensky Usefulness of the Berg Balance Scale in Stroke Rehabilitation: A Systematic Review Physical Therapy, Volume 88,Issue5, 1 May 2008, Pages 559–566,https://doi.org/10.2522/ptj.20070205

48. Davide Cattaneo et al., Reliability and Validity of the Dynamic Gait Index in Persons With Chronic StrokeLaRiCE: Clinical Laboratory on Posture and Gait, DonGnocchi Foundation I.R.C.C.S., Milan, Italy.https://doi.org/10.1016/j.apmr.2007.08.109

X APPENDIX

APPENDIX - I

PATIENT PROFILE

SUBJECTIVE ASSESSMENT

Name:

Age:

Sex:

Occupation:

Date of assessment:

Date of admission:

Chief complaints:

History

Past medical history:

Present medical history:

Surgical history:

Family history:

Socio-economic history:

Family history:

Drug history:

Associated problem:

Vital signs:

OBJECTIVE ASSESSMENT

ON OBSERVATION:

Built:

Posture:

Deformity:

Attitude of limbs:

Pattern of movements:

Tropical changes:

External applications:

External devices:

ON PALPATION:

Muscle tone:

edema:

Tenderness:

Warmth:

Temperature:

On examination

Level of consciousness:

Orientation:

Attention:

Memory:

Speech:

Intellectual function:

Vision:

Hearing:

Emotional changes:

Higher cortical function:

Cognition:

Perception:

Cranial nerve examination:

Sensory examination

Superficial sensation:

Deep sensation:

Combined cortical sensation:

SPINO MOTOR ASSESSMENT:

Muscle tone:

Muscle power:

Muscle girth

Functional Range of Motion:

REFLEXES:

Superficial cutaneous reflex:

Deep tendon reflex:

Primitive and tonic reflex:

Voluntary control of movement:

Co-ordination:

Involuntary movements:

Balance:

Static balance

Dynamic balance

Balance reactions

Gait:

Hand function:

Activities of daily living:

CARDIO PULMONARY ASSESSMENT

Air entry:

breathe sound:

Cardiac sound:

Type of breathing:

Pattern of breathing:

Depth of breathing:

Integumentry system

Bladder function

Bowel function

Functional assessment

INVESTIGATION:

DIAGNOSIS:

AIMS:

MEANS:

APPENDIX-II

BERG BALANCE TESTS AND RATING SCALE

PatientName

_____

_

Date

_____

___

Location

_____

Rater

_____

__

ITEM DESCRIPTION SCORE (0-4) Sitting to standing _____ Standing unsupported _____ Sitting

unsupported _____ Standing to sitting _____ Transfers _____ Standing with eyes closed _____

Standing with feet together _____ Reaching forward with outstretched arm _____ Retrieving object

from floor _____ Turning to look behind _____ Turning 360 degrees _____ Placing alternate foot

on stool _____ Standing with one foot in front _____ Standing on one foot _____ TOTAL _____

GENERAL INSTRUCTIONS

Please demonstrate each task and/or give instructions as written. When scoring, please record the

lowest response category that applies for each item.

In most items, the subject is asked to maintain a given position for a specific time. Progressively

more points are deducted if the time or distance requirements are not met, if the subject's

performance warrants supervision, or if the subject touches an external support or receives

assistance from the examiner. Subjects should understand that they must maintain their balance

while attempting the tasks. The choices of which leg to stand on or how far to reach are left to the

subject. Poor judgment will adversely influence the performance and the scoring.

Equipment required for testing are a stopwatch or watch with a second hand, and a ruler or other

indicator of 2, 5 and 10 inches (5, 12 and 25 cm). Chairs used during testing should be of

reasonable height. Either a step or a stool (of average step height) may be used for item #12.

1. SITTING TO STANDING

INSTRUCTIONS: Please stand up. Try not to use your hands for support.

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

( ) 3 able to stand independently using hands

( ) 2 able to stand using hands after several tries

( ) 1 needs minimal aid to stand or to stabilize

( ) 0 needs moderate or maximal assist to stand

2. STANDING UNSUPPORTED

INSTRUCTIONS: Please stand for two minutes without holding.

( ) 4 able to stand safely 2 minutes

( ) 3 able to stand 2 minutes with supervision

( ) 2 able to stand 30 seconds unsupported

( ) 1 needs several tries to stand 30 seconds unsupported

( ) 0 unable to stand 30 seconds unassisted

If a subject is able to stand 2 minutes unsupported, score full points for sitting unsupported.

Proceed to item #4.

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

STOOL

INSTRUCTIONS: Please sit with arms folded for 2 minutes.

( ) 4 able to sit safely and securely 2 minutes

( ) 3 able to sit 2 minutes under supervision

( ) 2 able to sit 30 seconds

( ) 1 able to sit 10 seconds

( ) 0 unable to sit without support 10 seconds

4. STANDING TO SITTING

INSTRUCTIONS: Please sit down.

( ) 4 sits safely with minimal use of hands

( ) 3 controls descent by using hands

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

( ) 1 sits independently but has uncontrolled descent

( ) 0 needs assistance to sit

5. TRANSFERS

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

seat with armrests and one way toward a seat without armrests. You may use two chairs (one with

and one without armrests) or a bed and a chair.

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

( ) 3 able to transfer safely definite need of hands

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

( ) 1 needs one person to assist

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

6. STANDING UNSUPPORTED WITH EYES CLOSED

INSTRUCTIONS: Please close your eyes and stand still for 10 seconds.

( ) 4 able to stand 10 seconds safely

( ) 3 able to stand 10 seconds with supervision

( ) 2 able to stand 3 seconds

( ) 1 unable to keep eyes closed 3 seconds but stays steady

( ) 0 needs help to keep from falling

7. STANDING UNSUPPORTED WITH FEET TOGETHER

INSTRUCTIONS: Place your feet together and stand without holding.

( ) 4 able to place feet together independently and stand 1 minute safely

( ) 3 able to place feet together independently and stand for 1 minute with supervision

( ) 2 able to place feet together independently but unable to hold for 30 seconds

( ) 1 needs help to attain position but able to stand 15 seconds with feet together

( ) 0 needs help to attain position and unable to hold for 15 seconds

8. REACHING FORWARD WITH OUTSTRETCHED ARM WHILE STANDING

INSTRUCTIONS: Lift arm to 90 degrees. Stretch out your fingers and reach forward as far as you

can. (Examiner places a ruler at end of fingertips when arm is at 90 degrees. Fingers should not

touch the ruler while reaching forward. The recorded measure is the distance forward that the

finger reaches while the subject is in the most forward lean position. When possible, ask subject to

use both arms when reaching to avoid rotation of the trunk.)

( ) 4 can reach forward confidently >25 cm (10 inches)

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

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

( ) 1 reaches forward but needs supervision

( ) 0 loses balance while trying/requires external support

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

INSTRUCTIONS: Pick up the shoe/slipper which is placed in front of your feet.

( ) 4 able to pick up slipper safely and easily

( ) 3 able to pick up slipper but needs supervision

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

independently

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

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

10. TURNING TO LOOK BEHIND OVER LEFT AND RIGHT SHOULDERS WHILE STANDING

INSTRUCTIONS: Turn to look directly behind you over toward left shoulder. Repeat to the right.

Examiner may pick an object to look at directly behind the subject to encourage a better twist turn.

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

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

( ) 2 turns sideways only but maintains balance

( ) 1 needs supervision when turning

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

11. TURN 360 DEGREES

INSTRUCTIONS: Turn completely around in a full circle. Pause. Then turn a full circle in the other

direction.

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

( ) 3 able to turn 360 degrees safely one side only in 4 seconds or less

( ) 2 able to turn 360 degrees safely but slowly

( ) 1 needs close supervision or verbal cueing

( ) 0 needs assistance while turning

12. PLACING ALTERNATE FOOT ON STEP OR STOOL WHILE STANDING UNSUPPORTED

INSTRUCTIONS: Place each foot alternately on the step/stool. Continue until each foot has

touched the step/stool four 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 needs minimal assist

( ) 0 needs assistance to keep from falling/unable to try.

13. STANDING UNSUPPORTED ONE FOOT IN FRONT

INSTRUCTIONS: (DEMONSTRATE TO SUBJECT) Place one foot directly in front of the other. If

you feel that you cannot place your foot directly in front, try to step far enough ahead that the heel

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 place foot tandem independently and hold 30 seconds

( ) 3 able to place foot ahead of other 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

14. STANDING ON ONE LEG

INSTRUCTIONS: 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 = or >3 seconds

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

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

TOTAL SCORE (Maximum = 56: _____

APPENDIX-III

DYNAMIC GAIT INDEX

Description:

Developed to assess the likelihood of falling in older adults. Designed to test eight facets of gait.

Equipment needed: Box (Shoebox), Cones (2), Stairs, 20' walkway, 15" wide

Completion:

Time: 15 minutes

Scoring: A four-point ordinal scale, ranging from 0-3. "0" indicates the lowest level of

function and "3" the highest level of function.

Total Score = 24

Interpretation: < 19/24 = predictive of falls in the elderly

> 22/24 = safe ambulators

1. Gait level surface _____

Instructions: Walk at your normal speed from here to the next mark (20')

Grading: Mark the lowest category that applies.

(3) Normal: Walks 20', no assistive devices, good sped, no evidence for imbalance, normal gait pattern

(2) Mild Impairment: Walks 20', uses assistive devices, slower speed, mild gait deviations.

(1) Moderate Impairment: Walks 20', slow speed, abnormal gait pattern, evidence for imbalance.

(0) Severe Impairment: Cannot walk 20' without assistance, severe gait deviations or imbalance.

2. Change in gait speed _____

Instructions: Begin walking at your normal pace (for 5'), when I tell you "go," walk as fast as you can (for

5'). When I tell you "slow," walk as slowly as you can (for 5').

Grading: Mark the lowest category that applies.

(3) Normal: Able to smoothly change walking speed without loss of balance or gait deviation. Shows a

significant difference in walking speeds between normal, fast and slow speeds.

(2) Mild Impairment: Is able to change speed but demonstrates mild gait deviations, or not gait

deviations but unable to achieve a significant change in velocity, or uses an assistive device.

(1) Moderate Impairment: Makes only minor adjustments to walking speed, or accomplishes a change

in speed with significant gait deviations, or changes speed but has significant gait deviations, or

changes speed but loses balance but is able to recover and continue walking.

(0) Severe Impairment: Cannot change speeds, or loses balance and has to reach for wall or be caught.

3. Gait with horizontal head turns _____

Instructions: Begin walking at your normal pace. When I tell you to "look right," keep walking straight, but

turn your head to the right. Keep looking to the right until I tell you, "look left," then keep walking straight

and turn your head to the left. Keep your head to the left until I tell you "look straight," then keep walking

straight, but return your head to the center.

Grading: Mark the lowest category that applies.

(3) Normal: Performs head turns smoothly with no change in gait.

(2) Mild Impairment: Performs head turns smoothly with slight change in gait velocity, i.e., minor

disruption to smooth gait path or uses walking aid.

(1) Moderate Impairment: Performs head turns with moderate change in gait velocity, slows down,

staggers but recovers, can continue to walk.

(0) Severe Impairment: Performs task with severe disruption of gait, i.e., staggers outside 15" path, loses balance, stops, reaches for wall.

Page 2 of 2

4. Gait with vertical head turns _____

Instructions: Begin walking at your normal pace. When I tell you to "look up," keep walking straight, but tip

your head up. Keep looking up until I tell you, "look down," then keep walking straight and tip your head

down. Keep your head down until I tell you "look straight," then keep walking straight, but return your head

to the center.

Grading: Mark the lowest category that applies.

(3) Normal: Performs head turns smoothly with no change in gait.

(2) Mild Impairment: Performs head turns smoothly with slight change in gait velocity, i.e., minor

disruption to smooth gait path or uses walking aid.

(1) Moderate Impairment: Performs head turns with moderate change in gait velocity, slows down,

staggers but recovers, can continue to walk.

(0) Severe Impairment: Performs task with severe disruption of gait, i.e., staggers outside 15” path, loses balance, stops, reaches for wall.

5. Gait and pivot turn _____

Instructions: Begin walking at your normal pace. When I tell you, “turn and stop,” turn as quickly as you can

to face the opposite direction and stop.

Grading: Mark the lowest category that applies.

(3) Normal: Pivot turns safely within 3 seconds and stops quickly with no loss of balance.

(2) Mild Impairment: Pivot turns safely in > 3 seconds and stops with no loss of balance.

(1) Moderate Impairment: Turns slowly, requires verbal cueing, requires several small steps to catch

balance following turn and stop.

(0) Severe Impairment: Cannot turn safely, requires assistance to turn and stop.

6. Step over obstacle ____

Instructions: Begin walking at your normal speed. When you come to the shoebox, step over it, not around it,

and keep walking.

Grading: Mark the lowest category that applies.

(3) Normal: Is able to step over the box without changing gait speed, no evidence of imbalance.

(2) Mild Impairment: Is able to step over box, but must slow down and adjust steps to clear box safely.

(1) Moderate Impairment: Is able to step over box but must stop, then step over. May require verbal

cueing.

(0) Severe Impairment: Cannot perform without assistance.

7. Step around obstacles _____

Instructions: Begin walking at normal speed. When you come to the first cone (about 6' away), walk around

the right side of it. When you come to the second cone (6' past first cone), walk around it to the left.

Grading: Mark the lowest category that applies.

(3) Normal: Is able to walk around cones safely without changing gait speed; no evidence of

imbalance.

(2) Mild Impairment: Is able to step around both cones, but must slow down and adjust steps to clear

cones.

(1) Moderate Impairment: Is able to clear cones but must significantly slow, speed to accomplish task,

or requires verbal cueing.

(0) Severe Impairment: Unable to clear cones, walks into one or both cones, or requires physical

assistance.

8. Steps _____

Instructions: Walk up these stairs as you would at home, i.e., using the railing if necessary. At the top, turn

around and walk down.

Grading: Mark the lowest category that applies.

(3) Normal: Alternating feet, no rail.

(2) Mild Impairment: Alternating feet, must use rail.

(1) Moderate Impairment: Two feet to a stair, must use rail.

(0) Severe Impairment: Cannot do safely.

TOTAL SCORE: ___ / 24

APPENDIX-IV

MOTOR RELEARNING PROGRAM TO IMPROVE LOWER EXTREMITY MOTOR PERFORMANCE

Lower extremity motor performance can be improved by improving his activity in various positions such as sitting to standing, standing and walking.

1. Standing-up and sitting-down

Analysis of standing up and sitting down

- Observation of body alignment.
- Analysis of ability to shift weight to his affected extremity.

Practice of missing components

- Sitting, feet flat on the floor, patient practices including trunk forward by flexing at hip with neck and trunk extended with enough momentum to push knee forward.
- Patient aims to push down and backward through feet.

Practice of task(standing up and sitting down)

- With his shoulder and knee forward, patient practices standing up. The therapist can give him idea of pushing down through his affected knees along the line of his shank while moving it forward.
- For sitting down, therapist helps the patient with forward movement of shoulders and knees at the beginning of movement and keeps the

weight on the affected leg as patient sit down by pushing through his knee.

- To increase complexity patient practices standing up and sitting down, stopping in different parts of the range, changing directions and altering speed.

Transference of training

- Transferring from chair to chair.
- Getting up to go to toilet.

2. Standing

There are four steps involved in training of standing using motor relearning program.

- Analysis of standing
- Observation of patients alignment in balanced standing.
- Analysis of his ability to adjust to self-initiated movement of limbs, trunk and head.

3. Practice of standing

To train hip alignment

- Supine, leg over the side of bed, patient practices small range of hip extension.
- Patient stands with weight on both feet and hip extended.

To prevent knee flexion

- Use of splint.

To elicit quadriceps contraction

- Standing- knee supported in extension, patient practices moving his knee cap and sustaining contraction as long as possible.
- Sitting- knee held in extension by therapist, patient tries to prevent foot from falling to the ground and or let his foot down slowly when the therapist lets go of his leg.

To train postural adjustments to shifts in centre of gravity

- Standing with feet few inches apart, patients look up at the ceiling.
- Standing- feet a few inches apart patient turns his head and trunk to look behind him, returns to mid position. This can be progressed by doing this with one foot in front.
- Standing patients practice reaching forward, backward and sideways to take any object from a table and variety of reaching and pointing tasks offering a degree of challenge.
- Step forward with the intact leg, then backward.
- Standing with back against wall feet a few inches away from it, he hold arm in front with hand together. Therapist holds hand, patient moves his hip away from wall and therapist gives assistance or

resistance to guide the movement and ensure that his weight remains backward. During the forward and backward movement the therapist look for a point at which dorsiflexor acivity is elicited and then confines the patients to active movements around this point.

- Complexity is increased with the patient catching a ball in such a way that it requires him to reach side ways , forward and downward ant to step-out to catch it.

Transferring of training

- Standing up with assistance- chair of suitable height firmness should be used.
- Standing at a table for short periods during the day

4. Walking

Analysis of task (walking)

- It involves analysis in two phases.

Stance phase

- The major problems in stance phase are :
- Lack of hip extension and dorsiflexion at ankles.
- Lack of controlled knee flexion-extension from 0-15 degree.
- Excessive lateral horizontal shift to pelvis.

- Excessive downward pelvic tilt on the intact associated with excessive lateral pelvic shift to the affected side.

Swing phase of affected side

- Problems in swing phase
- Lack of knee flexion at toe-off.
- Lack of hip flexion.
- Lack of knee extension plus ankle dorsiflexion on heel strike.

Practice of missing component

Stance phase

- To train hip extension throughout stance phase.
- Standing with hip in correct alignment, patient steps forward and then backward with intact leg, making sure he extends his affected hip he steps forward.
- To train knee control for stance phase
- Sitting-knee straight, therapist applies firm through heel to knee of the patient.
- Practices controlled an eccentric and concentric concentration of the quadriceps through a range of 15 degree.
- Attempt to keep knees straight pressure through heel must be as firm as possible to prevent knee from flexing.

- Standing- patient practices stepping forward and backward with the intact leg.
- Standing- intact leg in front of affected leg. Patient practices moving his leg backward and forward over the intact leg, while maintaining knee extension of the affected leg.
- Patient practices stepping on and off as 8cm step.
- Patients stand with affected foot on step. Patient steps upon to the steps and back down again with the intact leg.
- To train lateral horizontal pelvic shift
- Standing- hip in front of the ankle, patient practices shifting his weight from one foot to another with the therapist guiding him.
- Standing- hip over feet, patient practices stepping forward in intact leg.
- Patient practice walking sideways.

Swing phase

- To train flexion of knee at start of swing phase
- Patient in prone. Therapist flexes knee to below right angle. Patient has to practice I) controlling his knee flexors both eccentrically and concentrically through a small range of movement. II) Holding his

knee in different part of the range, sustaining muscle activity to counting.

- Patient standing (erect) therapist holds knee in some flexion and patient practice controlled eccentric and concentric knee flexion.
- Patient walks backward. Therapist gives knee flexion and foot dorsiflexion.
- To train knee extension and foot dorsiflexion at heel strike
- Patient stance in intact leg therapist holds the patients affected foot in dorsiflexion. Patient moves his weight forward on to heel.

5. Practice of task(walking)

Patient practices

- Stepping with intact leg while being steadied at the upper arm by therapist patient stops when he is off- balance and cannot correct this as he walks.
- To increase complexity: patient practice stepping over object of different height.
- Walking combined with other activities as carrying objects.
- Varying speed of walking and the spatial confines within which the person walks.
- Walking in and out of the elevator.

6. Transference of training

- Patient walks at least part of the way to his next appointment with therapist.
- Patient practice with himself and with relatives.
- Suitable chair is provided to the patient allow him stand up easily.
- Proper written instructions of what he should be given to the patient.

APPENDIX-V

SHOE RAISE

- Additional shoe-raise of 1cm on the unaffected side while ambulating during therapy as well as at home.
- Shoe to be used in the experiment was a pair of floaters. A raise with height of 1 cm was prepared according to the shoe base shape. Material of the raise was light weight cork.
- The patient was given all the advices and all questions were cleared.
- The importance of this shoe was told to the care taker.
- The patient was asked to wear this shoe continuously in home and also in outside so that its benefit is completely acquired.
- Only the group - A subjects are adviced to wear this shoe.

APPENDIX-IV

PATIENT CONSENT FORM

This is to certify that I ……. freely and voluntarily agree to participate in the study **"EFFECT OF SHOE RAISE ALONG WITH MOTOR RELEARNING PROGRAM FOR IMPROVING BALANCE AND GAIT FOR PATIENTS WITH CHRONIC STROKE".**

I have been explained about the procedures and the risk that would occur during the study. Questions have been answered to my satisfaction**.**

Participant :

Witness :

Date :

I have explained and defined the procedures to which the subject has consented to participate.

Researcher :

Date :