EFFICACY OF FUNCTIONAL ACTIVITY BASED EXERCISE AND ADDED SIT TO STAND EXERCISE ON THE FUNCTIONAL AMBULATION IN CHRONIC HEMIPARETIC STROKE PATIENTS -AN EXPERIMENTAL STUDY

Dissertation submitted to

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

Chennai

In partial fulfillment of the requirements for the degree of

MASTER OF PHYSIOTHERAPY

(Advanced Physiotherapy in Neurology)

Reg. No. 271620002

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COLLEGE OF PHYSIOTHERAPY
SRI RAMAKRISHNA INSTITUTE OF PARAMEDICAL SCIENCES
COIMBATORE – 641044

CERTIFICATE

This is to certify that the dissertation work entitled **"Efficacy of Functional Activity Based Exercise and added Sit to Stand Exercise on the Functional Ambulation in Chronic Hemiparetic Stroke Patients -An Experimental Study"** was carried out by the candidate bearing the **Register No. 271620002 (May 2018)** in College of Physiotherapy, SRIPMS, Coimbatore, affiliated to the Tamil Nadu Dr. M.G.R Medical University, Chennai towards partial fulfillment of the **Master of Physiotherapy (Advanced Physiotherapy in Neurology).**

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

Place: Coimbatore

Date:

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Prof . Dr. K. Shantha Kumar, MPT (Neurology).,
Guide
College of physiotherapy
SRIPMS
Coimbatore – 641044

Place: Coimbatore

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INTERNAL EXAMINER **EXTERNAL EXAMINER**

Place:

Date:

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CONTENTS

ABBREVIATIONS

AI	**:**	Asymmetry Index
CNS	**:**	Central Nervous System
EMG	**:**	Electromyography
FMA	**:**	Fugl-Meyer Stroke Assessment Scale
FRSS	**:**	Five repetitions sit to stand
ICH	**:**	Intracerebral Haemorrhage
MCID	**:**	Minimum Clinically Important Difference
MDC	**:**	Minimal Detectable Change
MTUG	**:**	Modified Time Up and Go Test
MS	**:**	Multiple Sclerosis
MND	**:**	Motor Neuron Disease
MMSE	**:**	Mini Mental State Examination
MI	**:**	Mental Imaginary
NAS	**:**	Non Affected Side
SD	**:**	Standard Deviation
5XSTS	**:**	Five Repetitions Sit-to Stand

1. INTRODUCTION

Stroke is characterized as a neurological condition attributed to an acute focal injury of the central nervous system (CNS) by a vascular cause, including cerebral infarction, intracerebral haemorrhage (ICH), and is a major cause of disability. Stroke is one of the leading causes of death in the worldwide population.

Stroke or Cerebrovascular Accident is defined as “Rapidly developing clinical signs of focal or global disturbance of cerebral function, lasting more than 24 hours or leading to death with no other apparent cause other than vascular origin” (Park's Preventive Medicine, 2011).

Stroke has two parts Ischaemic stroke and haemorrhagic stroke. Ischaemic stroke is most common type which is caused by blood clot that plugs blood vessels in the brain. Haemorrhagic stroke caused by the breakage of blood vessel leads to bleeding in to the brain. Transient Ischaemic Attack happens by the briefly interruption of the blood supply. (Sullivan, 2001)

According to WHO, the most common symptom of stroke is impairment of sensory, motor, perceptual and language function that is the sudden weakness or numbness of the face, arm or leg, most often on one side of the body, dizziness, loss of balance or coordination, severe headache with unknown cause fainting or unconsciousness. The deficits are characterized by paralysis (Hemiplegia) or weakness (Hemiparesis) on the side of the body opposite the site of lesions.

According to Jeyraj Pandian and Paulina, Stroke is one of the leading cause of death and disability in India as well as industrialized nations.

According to Dr. Subhash Kaul, DM in Neurology from PGIMER in India, estimated adjusted prevalence range 84 -262 / 100,000 in rural and 334-424/100,00 in urban areas. There is also a wide variation in case of fatality rate with the highest being in Kolkata 42%.

Prevalence rate for hemiplegia in South India was reported to be 56.9 per 100,000 population as compared to 150 to 186 per 100,000 population for USA and Europe.

Incidence rate of stroke varies with age and gender difference. In young people of less than 35 years of stroke incidence is very low. The rate is slightly higher in women than men. While in people over the age of 40yrs the incidence is higher in men than women.

The estimated adjusted prevalence rate of stroke range, 84-262/100,000 in rural and 334-424/100,000 in urban areas. The incidence rate is 119-145/100,000 based on the recent population studies. The prevalence of stroke in India shows a huge variation of 147-922/100,000 across diverse community based studies. WHO conducted a study in 12 countries showed that the stroke incidence rate range from 0.2-2.5 per 1000 population/ year. (Preventive and Social Medicine 2002).

Stroke rehabilitation is an organized program to help patients to maximize all opportunities for returning to an active lifestyle (Gresham et al. 199, Aichner et al. 2002). Neurological rehabilitation is a method for relearning a previously learned task in a systematic and more effective way.

Individuals who are affected with stroke continued to have a deficit in symmetrical stance and weight shifting abilities despite the improvements in motor selectivity of the paretic limb and in balance and walking skills. Both static and dynamic aspects of postural symmetry may remain impaired. Initially, following stroke individual with hemiparesis may be unable to bear much weight on paretic limb when significant paresis exists. Later stage of rehabilitation, individual with stroke with continued with weight bearing on paretic limb. In stroke individuals, there is decrease gait speed, asymmetric gait patterns are commonly observed. Asymmetric gait patterns are often characterized by

- Decrease duration of single stance of impaired limb.
- Difference in step-length
- Decrease step-length of unaffected limb versus the affected limb.
- Stride length are significantly reduced

In the functional activity orientated approaches, movement as an interaction between many systems in the brain and is organized around a goal and constrained by the environment (Shumway Cook and Woollacott 2001).

Functional activity training includes a wide range of intervention such as treadmill training, walking on the ground, bicycling activities, endurance training, circuit training, sit-to-stand exercises and reaching task for improving balance. For upper limb, functional tasks such as grasping objects, Constrained-induced movement therapy (CIMT) and mental imagery (MI).

Thomas et al., (2010) conducted the study to determine that does repetitive exercise training improve functional activity after stroke. The results of this study were statistically significant improvement in walking distance, walking speed, sit-to-stand and activities of daily life.

Sit to stand exercises is means of weight bearing exercises on the paretic limb which increase lower limb neuromuscular coordination. Vicki Stemmons Mercer et al. examined the limb-loading and weight- transfer abilities in stroke patients concluded that stand up test performed with the non-paretic leg as the stepping leg is a valid measure of paretic- limb loading during recovery.

1.1 NEED OF THE STUDY

Current treatment approaches primarily focus on the functional strengthening methods. Sit to stand exercise training is a new concept applied as functional strengthening application in stroke clients. The quantitative analysis in terms of improvement brought about in functional performance in stroke clients between task-specific exercise and functional strengthening exercises have not been clearly delineated.

1.2 STATEMENT OF THE PROBLEM

- The aim of the study is to determine the effectiveness of functional activity on activity of daily living of lower extremity among the stroke clients.
- Aim of the study to determine the effectiveness of functional integrated exercises with added sit to stand exercise on functional performance of lower extremity among the stroke clients.

- The aim of the study is to determine the effectiveness of functional productivity with added sit to stand exercise in relation to overall ability along with functional performance of lower-extremity among the stroke clients.

1.3 HYPOTHESES

- The first hypothesis of the investigator states that functional activities may improve the integrated performance of lower extremity of stroke clients.
- The second hypothesis of the investigator states that task-specific with added stepping-up exercise may improve the functional performance of lower extremity of stroke clients.
- The third hypothesis of the investigator states that there may be significant difference between functional activities with added sit to stand exercise on total outcome measures of lower extremity in stroke clients.

1.4 DEPENDENT VARIABLES

- FUGL-MEYER MOTOR ASSESSMENT SCALE
- FIVE REPETITION SIT-TO-STAND TEST
- MODIFIED TIME UP AND GO TEST

1.5 OPERATIONAL DEFINITION

STROKE: Stroke occur due to the blockage blood supply is blocked or a blood vessel within the brain get ruptures.

FUNCTIONAL ACTIVITY: Repetitive movements of specific exercises which are performed by the individuals in the everyday life eg. Sit-to stand, walking, log rolling etc.

SIT TO STAND EXERCISE: Wooden block is used as step and the patient climbs up in forward and sideways.

FUGL-MEYER ASSESSMENT SCALE : Fugl-Meyer Assessment of motor recovery after stroke is used to evaluate and measure recovery in post stroke hemiplegic patients.

FIVE REPETITIONS SIT TO STAND: The five repetitions sit to stand is a test of lower limb function that measures the fastest time taken to stand five times from the chair with arm folded.

MODIFIED TIMED UP AND GO TEST: Timed up and go test is a quick test used in clinical practice as an outcome measure to assess functional ambulatory mobility or dynamic balance in adults.

2. REVIEW OF LITERATURE

The source for the literature review for this study collected from the Journal, articles (International Journal Of Physiotherapy and Research Elsevier, Evidenced Based Review of Stroke Rehabilitation, Austrialian Physiotherapy Journal of Article), Books (Suzan O' Sullivan, Cynthia Norkin, WEBB,2008 etc), Articles, Theses and Dessertations, Web sources (Pubmed, Sage, Medline, Scholarly Articles)

Michael et al (2016) proposed that sit-to-stand-and-walk task dynamics are maintained during rising from a seat in acute stroke clients. The participants performed STS and STSW from a standardised position. Five trials of each task were completed. Four force-plates and optical motion capture delineated key movement events and phases witch determined by 2-way ANOVA within tasks. Therefore the end result improved functional mobility in acute hemiparetic stroke survivors.

France et al(2015) conducted the determinants of sit-to-stand tasks in individuals with hemiparesis post stroke: a review. The ability to rise from a chair to reach a standing position is impaired after stroke. During STS, most individuals with hemiparesis able to stand independently presented several changes such as lateral deviation of the trunk towards the unaffected side, asymmetrical weight bearing (WB) and asymmetry of knee moment forces. Then rehabilitation interventions were effective in improving STS duration, WB symmetry and the ability to stand independently with repeated practice. Therefore the effects of specific training protocols and pursue better understanding of this complex and demanding task, particularly for stroke patients who need assistance during this transfer.

Jin Chen et al (2015) studied that the efficacy of modified sit to stand training on balance control in hemiplegic stroke patients. Authors included 50 hemiplegic patients with stroke were randomly assigned to the control and experimental groups ($n = 25$ for each group). Patients in the control group received the sit-to-stand training with symmetrical foot position, while patients in the experimental group were given the modified sit-to-stand training in which the paretic foot placed posterior. Subjects in both groups received 30 minutes of sit-to-stand training, five times a week, for four weeks. The data showed significant improvements in standing balance and the sit-to-stand movement for two groups in the post-training compared with the pre-training.

Hyung et al. (2014) conducted the study on the effects of task- specific exercise program on Balance, Mobility and Muscle Strength in elderly. Authors included 30 elderly individuals over 65 years and randomly assigned into two groups – falling groups and non-falling groups. These individuals experience of falling over 2 times within the past 6 months were included in falling group. The task specific program consists of 3 stages (weeks 1-2, 3-4, and 5-6). The outcome measures was taken with the help of Korean Version of the Activities – Specific Balance Confidence Scale and Performace- Oriented Mobility Assessment .Authors concluded that the task specific exercise program has a positive effect on a balance ability and muscle strength related to falls in the elderly.

Khallaf et al. (2014) studied the effect of task specific exercise, gait training and visual biofeedback on equinovarus gait among individuals with stroke – Randomized controlled study. Authors included 16 subjects with ischaemic stroke and were randomly divided into two groups experimental group (G1) and control group (G2. All the participants at the stage 4 of Motor recovery of foot

according to Chedoke – McMaster stroke assessment without any cognitive dysfunction. G1 –experimental group received task specific exercises, gait training and visual biofeedback. G2 – control group received the traditional physical therapy program.

The treatment session occurs for 8 weeks. The outcome measures was taken by E-med pedography to measure contact time as well as force underneath hind and forefoot during walking. The result of this study showed that there was significant improvement in experimental group than control group. The study concluded that there was an positive long lasting effect of task specific exercises, gait training and visual biofeedback on equinovarus gait pattern among individuals with stroke.

Manju (2013) studied the efficacy of Task Specific set up exercises on the gait parameters of chronic hemiparetic stroke individuals. Authors included 30 individuals, who had a stroke for more than 6 months and able to ambulate independently, were included in the study. Participants were randomly assigned to step up exercises group (n=15) or control group (n= 15). Participants were evaluated at baseline and after 4 weeks of intervention for gait measures like step-length in affected and unaffected side, stride length affected and unaffected side natural velocity and cadence. The experimental group performed forward, lateral, backward set up exercises and the control group performed conventional balance and gait training for 30 min/ session, 5days / week. The result of this study showed that both group improved significantly in all outcome measures. However step up group demonstrated a significantly greater improvement in all gait measures when compared with the control group.

Rabbani Farqalit et al(2013) introduced the effect of foot position during sit-to-stand (STS) training on balance and upright mobility in patients with chronic stroke. Forty patients (29 men, 11 women) with chronic stroke participated in the study. Patients were randomly placed into two experimental groups with 20 patients in each group. Participants in Group A performed STS training with the affected foot position behind the unaffected foot (asymmetrical foot position), whereas Group B performed STS training with the affected foot position alongside the unaffected foot (symmetrical foot position). On comparing the mean difference values of STS performance, Berg balance scale score, and timed up-and-go test between the two groups, there was a significant difference at the end of Week 4.Therefore asymmetrical foot position during STS training resulted in improved balance and upright mobility in patients with chronic stroke as compared to the symmetrical foot position.

Crosbie et al (2010) conducted that the Muscle synergies and joint linkages in sit-to-stand under two initial foot positions. The purpose of the study was to investigate the activation pattern of six lower limb muscles during standing up from two initial foot positions and to examine relationships between the onsets of muscle activity and the dynamics of the action. When the foot gets forward there were significant increases in movement duration, displacement and velocity of trunk segment flexion at the hips reflecting the increased distance. Different muscle linkages utilised in the lower limb to coordinate the sit-to-stand action under different functional demands.

Salmela et al (2009) established the Effects of Foot Position on the Performance of the Sit-To-Stand Movement with Chronic Stroke Subjects. Twelve acute stroke patients were taken. Differential latency and electromyography (EMG) activity of the tibialis anterior, soleus, quadriceps, and hamstring muscles of the affected leg as well as the movement time, time of seat-off, weight symmetry, and rising index were obtained while the subjects performed the STS movements by using 4 different strategies: spontaneous; symmetric; asymmetric-1, with the affected foot behind; and asymmetric-2, with the unaffected foot behind. The asymmetric 2 strategy appeared to be the least favourable, whereas the spontaneous and the symmetric strategies appeared to be more favourable in improving the STS performance.

Sullivan et al. (2007) was conducted a study to determine the study on effects of task-specific locomotor and strength training in adults who were ambulatory after stroke. Authors included 80 adults who were ambulatory 4 months to 5 years after a unilateral stroke. The interruption consisted of body-weight-supported treadmill training (BWSTT), limb-loaded resistance leg cycling, LE muscle specific progressive resistance exercise (LE-Ex) and UE ergometry. Exercise sessions 6 weeks (total 24 sessions) 4 times per week. Outcome measures was taken with self-selected walking speed, fast walking speed and 6 minute walk test. Authors concluded the study that the task- specific training during treadmill walking with body-weight support is more effective in improving walking speed and maintaining these gains at 6 months than resisted leg cycling alone.

Sullivan et al. (2006) conducting the study on the combined task- specific training and strengthening effects on locomotor recovery post stroke: A case study. Authors included the participant who was 38 years old female with right middle cerebral artery stroke evaluated 15 months post onset. Authors implemented interventions body-weight supported treadmill training and a limb loaded cycling exercise given alternatively over 24 treatment sessions (4 times / weeks for 6 weeks). Outcomes measures were used instrument gait analysis and motion analysis with fine –wire EMG recordings of lower extremity muscle activity. Measurements were taken before and after treatments and 6 months follow up was done. The result of this study shown that the gait and motion analysis revealed that functional locomotor recovery was associated with increase in magnitude of paretic leg gluteus maximus and medius activation during gait. Motion analysis confirmed that the increase in hip and knee extension motion throughout stance and swing. The study concluded that the there is a possible mechanism associated with response to therapy were related to improved motor unit activation associated with increase strength in key muscle in gait which improves walking function associated with combined therapeutic program which include task specific and lower extremity strength training.

Blennerhasset et al. (2004), studied that additional task related practice improves mobility and upper limb function early after stroke- Randomized Controlled Trial. This is a prospective, randomized, single blind clinical trial and author recruited 30 stroke subjects in to either an upper limb or a mobility group. All subjects received their usual rehabilitation and additional session of task

related practice using a circuit class format. Outcome measures used were 3 items of the Jebesen Taylor Hand function test (JTHFT), two arms items of the motor assessment scale and three mobility measures, the timed up and go test (TUGT), step test and six minute test (6 MNT). The result of this study shows that both group improved significantly between pre and post-test on all the mobility measures, however only the upper limb group made a significant improvement on the JTHFT and MAS upper arm item. Following the 4 weeks training, the mobility group had better locomotor ability than the upper limb group. The study concluded that the circuit class format was practiced and effectiveness to provide supervised additional practice that lead to significant and meaningful function gain and also supports the use of additional task related practice during inpatient stroke rehabilitation.

Janssen et al (2002) in a comprehensive review concluded that use of arms, chairs height, speed and foot position substantially influenced STS performance. Therefore the parameters were standardised for all measurements.

Gladstone et al.,(2002) states that the Fugl Meyer Assessment of motor recovery after stroke: critical review of its measurement properties. The FUGL-MEYER Scale was developed as the first quantitative evaluating instrument for measuring sensorimotor stroke recovery, based on Twitchell and Brunnstrom's concept of sequential stages of motor return in the hemiplegia stroke patients. Authors said that FUGL-MEYER is well designed, feasible and efficient clinical examination method that has been tested widely in the stroke population. Authors stated that the excellent interrator and interartor reliability and construct validity have been demonstrated and preliminary evidence suggests that the FUGL-

MEYER assessment is responsive to change. Authors concluded that the FUGL-MEYER scale is recommended highly significant as a clinical in motor impairment following stroke.

Gregson et al., (1999) establish the study on reliability of the Tone Assessment scale and Modified Ashworth Scale as clinical tools for assessing post stroke spasticity. Authors included 32 patients with both scales on the same occasion by two raters (Interrator comparison) and on two occasions by one rater (intrarater comparison). The result of the study concluded that the reliability of the Tone Assessment Scale was not as strong the Modified Ashworth Scale. Authors concluded the study that the Modified Ashworth Scale is reliable.

3. MATERIALS AND METHODOLOGY

METHODOLOGY

- **Study Design :** An experimental study design
- **Study Setting :** Neuro ward and Special Ward of Sri Ramakrishna Hospital, Coimbatore,
- **Study Duration :** The study was carried out for the period of 4 weeks
- **Sampling :** Convenient Random Sampling
- **Sample Size :** The study includes 30 in-patients (27 males and 3 females) with chronic stroke who has gait impairments was randomly assigned into two groups :

  Group A (control group I): Task-Specific Exercises

  Group B (experimental group II): Task-Specific Exercises with added Stepping-up exercise.

CRITERIA FOR SAMPLE SELECTION

Inclusion Criteria

- Age-45 to 55 years
- Both male and female
- Chronic Stroke patients with gait impairment
- Modified Ashworth Scale of spasticity stage 2

- Patients with mini mental state examination score greater than 23
- Patients who were medically stable
- Able to understand and follow simple verbal instructions
- Ambulatory before stroke

Exclusion Criteria

- Uncooperative patients due to cognitive impairments
- Patients with previous medical history of other neurological impairment eg, MS, mysthenia Grevis, MND
- Any visual defects
- Presence of severe contractures and deformity in lower extremity
- Who has Pusher syndrome

ASSESSMENT TOOLS USED:

- Evaluation chart
- Fugl-Meyer Motor Assessment Scale.
- Five repetition sit-to-stand
- Modified Time Up and Go test

MATERIALS USED:

- Step wooden stool with constant step height of 15cm
- Measurement tape
- Stop-watch
- Plain white sheets
- Blue inkpad for footprint.
- Wooden chair
- Knee Hammer
- Wooden couch
- Marker pen
- Paper and pen

TREATMENT DURATION:

- 6 days per week for 40 minutes
- 20 mins Task-specific exercise with added stepping-up exercise
- 20 mins Task-specific exercise

TREATMENT TECHNIQUE

Procedures and techniques:

- 30 Patients were randomly selected and assigned into two groups who fulfilled the selection criteria.
- The purpose of the study and the procedure was explained to the patients and informed consent was received.
- Group A had 15 patients, preceded with specific functional activity along with the treatment duration of 4 weeks. Group B had 15 patients, preceded with functional activities added with Sit to stand exercises for 4 weeks.
- Pre-test was taken before the treatment using Fugl-Meyer motor assessment scale, five repetition sit-to stand, Modified Time Up and Go test for assessing walking ability of chronic stroke patients.
- This training programme was conducted every one hour for 6 days per 4 weeks in the department of physiotherapy, Sri Ramakrishna Institutes of Paramedical Sciences.

Instruction:

Proper instruction had been given to the clients.

FUNCTIONAL ACTIVITY TRAINING PROGRAMMES FOR CONTROL GROUP I:

Instruction:

Instructed the participants for performing the task from sitting down to standing up and again the sitting down

Standing up

- Proper foot placement
- Inclination of trunk forward by flexion at hips with extended neck and spine.
- Movement of the knees forward.
- Extension of hips and knee for final standing alignment.

Sitting down

- Inclination of trunk forward by flexion at hips with extended neck and spine
- Movement of the knees forward
- Knee flexion

Balanced Standing:

To train the participants for balanced standing

Step 1-

- Observed the patient's alignment in quiet standing.
- Analysing the each patient's ability to adjust to self-initiated movements of limbs, trunk and head as performed as a graded variety of motor tasks.
- The participants was asked to reach forward, sideways and backwards to touch or grasp an object, to stand on one leg, to pick up an object from the floor.

Step 2 and 3 practice of balanced training

1) Participant's stands within the first few days and with weight through both legs. This will help the patient's to adapt training in balancing and walking skills

2) Standing prevents contracture particularly of the calf muscles and hip flexors provide motivation and encouragement and balance gets improved.

To train Hip alignment

- Supine, leg over side of the bed, patient practises small- range hip extension
- Instructions: instructed the patients “Push your heel gently down to the floor and lift your hip up a little” “Don't lift your hip too high”

To elicit Quadriceps contraction

- By keeping the towel roll below the knee joint and instructed the participants to contract as well as hold the contracting stage for 20 counts.

STANDING, REACHING FORWARD, SIDEWAYS AND BACKWARDS

Instructed the participants

"Keep your weight on the affected foot, "Take a step forward with your other foot", "your hip should move in front of your foot" "now step backwards"

FUNCTIONAL AMBULATION

Stance phase of affected leg

- Lack of extension at hip and dorsiflexion at ankles
- Lack of controlled knee flexion-extension from 0-15 degree
- Excessive lateral horizontal shift of pelvis
- Excessive downwards pelvic tilt on the intact side associated with excessive lateral pelvic shift to the affected side

Swing phase of affected leg

- Lack of knee flexion at toe- off
- Lack of hip flexion
- Lack of knee extension plus ankle dorsiflexion on heel strike

To Train Hip Extension in Stance Phase

- Standing with hip in correct alignment, patients practises stepping forward then backwards with intact leg, and ask the patients to extends his affected hip as he steps forward.

NOTE: This should not be too slowly nor should step size be too high. It is to give the patient the idea of standing on affected leg while moving his intact leg. It can be followed by having the patient shift weight on to the intact leg so he can start to walk.

Instructions:

- "Take your weight through your affected leg"
- "Step forward with this intact leg, move forward at your affected ankle"

To Train Knee Control for Stance phase

- Sitting (supine if hamstrings are tight), with knee held straight, therapist gives firm pressure through heel towards knee while patient practices controlling an eccentric and concentric contraction of the quadriceps through a 15 degree range., and attempts to keep knee straight (isometric contraction). Pressure through the heel must be as firm as possible so the quadriceps must contract to prevent the knee from flexing.

Instructions

- "Bend your knee a little- not too much. Now strengthen it."
- " keep your knee straight"

To Train Lateral Horizontal Pelvic Shift

In standing, hips in front of ankles, patient practices shifting his weight from one foot to the other.

Instructions

- " move your weight over on to the right foot"
- " now move it back on your left foot"
- " to move to the right, push down gently through your left foot"

Note: hips and knee remains extended. Participant must not shift his pelvis too far laterally.

In standing, hips over feet, patient practises stepping forward with intact leg.

Walking sideways

To Train Flexion of Knee at start of Swing phase

- To elicit activity in knee flexors, asked the patient lied in prone on bed. Therapist flexed knee to just below a right angle.
- Asked the participants to practises controlling his knee flexors both eccentrically and concentrically throughout a small range of movement, holding his knee in different parts of the range, sustaining muscle activity to counting.

To Train Knee Extension and Foot Dorsiflexion at Heel Strike

- Patient standing on intact leg, therapist holds the patient's affected foot in dorsiflexion with the knee extension.
- Patient moves their weight forward on to the heel.
- This technique gives the patient the idea of this component of the swing phase.

SIT TO STAND EXERCISES ALONG WITH TASK-SPECIFIC EXERCISE FOR EXPERIMENTAL GROUP II

- The exercise session were undertaken by the therapist's supervision and manual guidance.
- The exercise protocol included two main activities: forward step-up exercise and lateral Step-up exercise.
- Step-stool included for step-up exercise of constant step-height of 15cm i.e. 6 inch (length 18 inch and breath 13 inch)
- Progression of step-length after 2 weeks (4inch -10inch) within this 4 weeks of training.
- Commands : Commands given to the clients prior to this task performed by individuals to each repetition

3) 'Ready', 'Step on affected side', then 'Step on unaffected side','Step down;

4) 'Ready', 'Step on unaffected side', then 'Step on affected side', 'Step down'

Each of the above activity step-up exercise was repeated for 2 phase of exercise with a set of 10 repetition in each phase.

- The rest period of 1 minute was given after the end of first phase
- The rest period of 5 minute were given after the end of the one set of training session and progression to next direction (For e.g. Forward Step-up to lateral step-up)

4. DATA ANALYSIS AND INTERPRETATION

Various statistical measures such as mean, standard deviation and test of significance were analysed with a help of paired ‘t’ test and independent ‘t’ test. Paired ‘t’ test was used to compare the pre-test and post-test values of group A and group B.Independent ‘t’ test was used to compare the mean difference of both group A and group B with respect to Fugel-Meyer motor assessment scale, 5 repetition sit-to-stand scale, Modified time Up and Go test.

Paired ‘t’ TEST

$$t = \frac{\bar{d}}{s_d/\sqrt{n}}$$

$$s_d = \sqrt{\frac{\sum d^2 - \frac{(\sum d)^2}{n}}{n-1}}$$

Where,

d = difference between pre-test and post-test values.

$\bar{d}$ = Calculated mean difference of pre-test and post-test values.

SD = Standard deviation.

n = Number of samples.

INDEPENDENT 't' TEST

$$t = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}}$$

Where,

$\overline{X_1}$ = mean of group A

$\overline{X_2}$ = mean of group B

S_1^2 = variance of group A

S_2^2 = variance of group B

n_1 = sample size of group A

n_2 = sample size of group B

Statistical test: **Paired Sample t-test**

Since the groups "lower extremity functional ability before and after treatment are dependent in nature (as the two measures are taken from same sample) it is appropriate to use Paired Sample t-test for this data. Using Excel tool, this test has been performed.

TABLE I

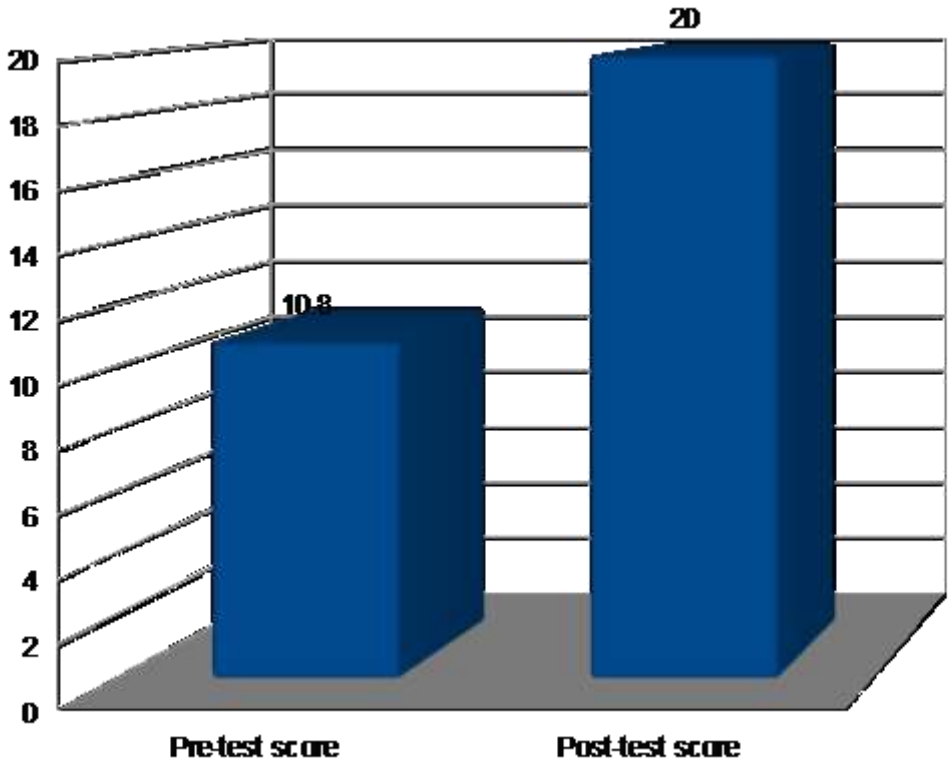
COMPARISON OF PRE-TEST AND POST-TEST MEAN VALUE OF FUGL MEYER MOTOR ASSESSMENT SCALE IN GROUP A

Group	Pre-test mean	Post-test mean	Mean improvement	SD	Calculated 't' value
A	10.8	20	9.2	3.1892	11.1722

The pre intervention mean score of fugl-meyer motor assessment scale in group A was 10.8; the post intervention (4 weeks) mean score was 20. The difference between the pre-test and post-test score was 9.2 in control group who receives only task specific exercises. (S.D= 3.18, t=11.1)

GRAPH I

GROUP A: PRE-TEST AND POST-TEST MEAN VALUE



FUGL MEYER MOTOR ASSESSMENT SCALE

Fig1.1 comparison of Group A pre-test and post-test mean value is 10.8 and 20 for fugl-meyer motor assessment scale respectively.

TABLE II

COMPARISON OF PRE-TEST AND POST-TEST MEAN VALUE OF FUGL MEYER MOTOR ASSESSMENT SCALE IN GROUP A

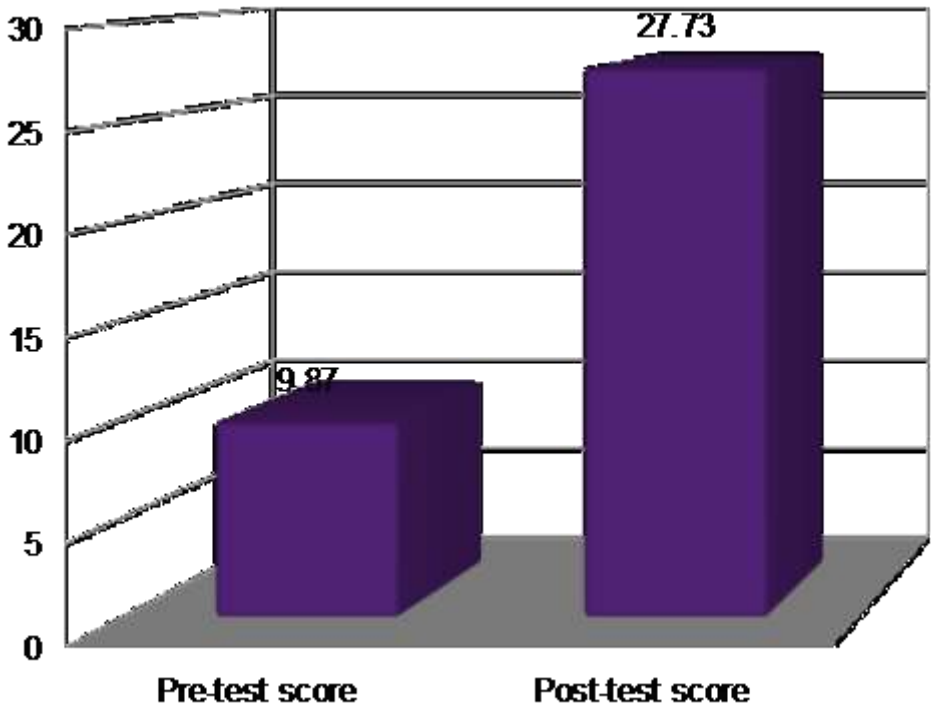
Group	Pre-test mean	Post-test mean	Mean improvement	SD	Calculated 't' value
B	9.87	27.73	17.87	2.88	24.07

The pre intervention mean score of fugl-meyer motor assessment scale in group B was 9.7; the post intervention (4 weeks) mean score was 27.73. The difference between the pre-test and post test score was 17.8 in experimental group who received task specific exercises with added stepping up exercises. (S.D= 2.88, t=24.07).

GRAPH II

GROUP B: PRE-TEST AND POST-TEST MEAN VALUE FOR FUGL MEYER MOTOR ASSESSMENT SCALE

Fig 1.2 Comparison of Group B pre-test and post-test value is 9.87 and 27.73 for



Fugl-meyer motor assessment scale respectively.

TABLE III

COMPARISON OF PRE-TEST AND POST-TEST MEAN VALUE OF 5 REPETITION OF SIT-TO-STAND IN GROUP A

Group	Pre-test Mean	Post-test Mean	Mean improvement	SD	Calculated 't'-value
A	14.07	11.87	2.2	0.41	3.87

The pre intervention mean score of 5 repetition of sit to stand scale in group A was 14.07; the post intervention (4 weeks) mean score was 11.87. The difference between the pre-test and post-test score was 2.2 in control group who received task specific exercises. (S.D= 0.41, t=3.87)

GRAPH III

GROUP-A : Pre-Test And Post-Test Mean Value

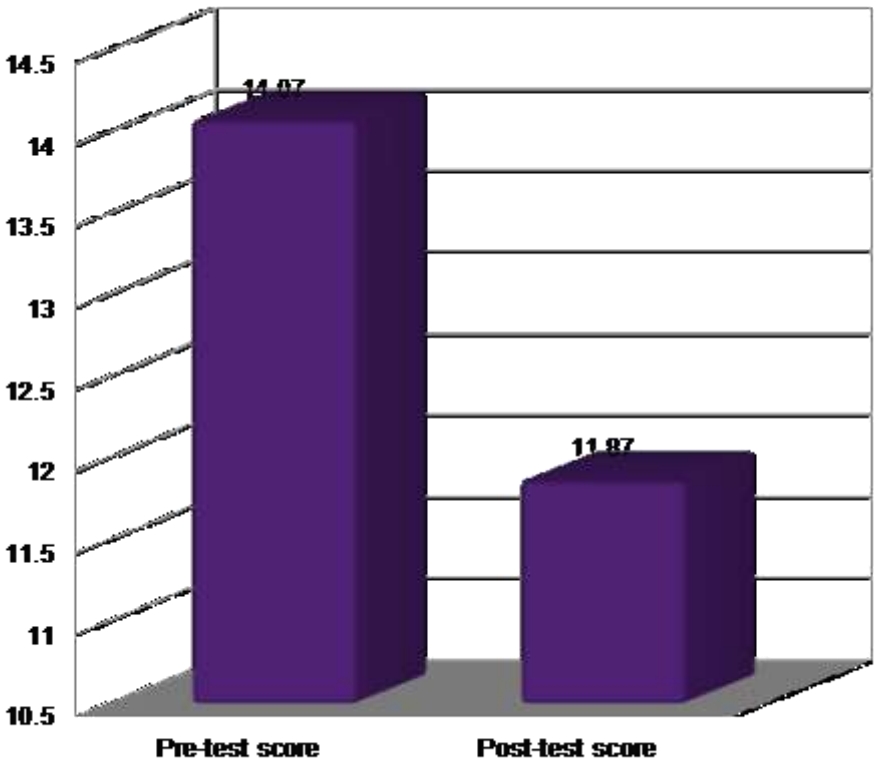


Fig 1.3, shows the comparison between the Group A pre-test and post-test value IS 14.07 and 11.87 for Five repetitions sit-to-stand respectively.

TABLE-IV

COMPARISON OF PRE-TEST AND POST-TEST MEAN VALUE OF 5 REPETITION OF SIT-TO-STAND IN GROUP B

Group	Pre-test Mean	Post-test Mean	Mean improvement	SD	Calculated 't'-value
B	13.9	9.5	4.46	1.125	15.37

The pre intervention mean score of 5 repetition of sit to stand scale in group B was 13.9; the post intervention (4 weeks) mean score was 9.5. The difference between the pre-test and post-test score was 4.46 in experimental group who received task specific exercises with added stepping up exercise. (S.D= 1.125, t=15.37)

GRAPH IV

GROUP B: PRE-TEST AND POST-TEST MEAN VALUE

OF 5 REPETITIONS SIT-TO-STAND

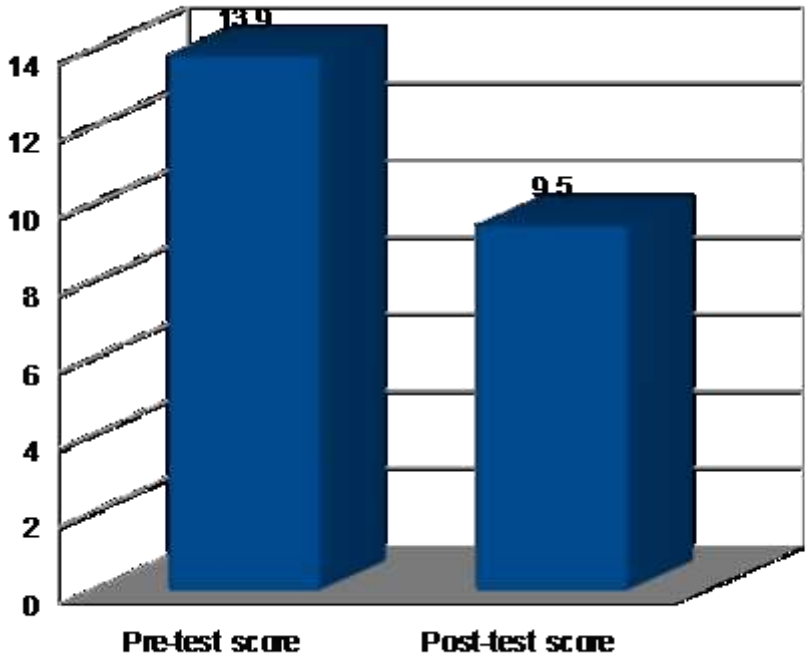


Fig 1.4., shows the comparison of the Group B pre-test and post-test mean value is 13.9 and 9.5 for five repetitions sit-to-stand respectively.

TABLE-V

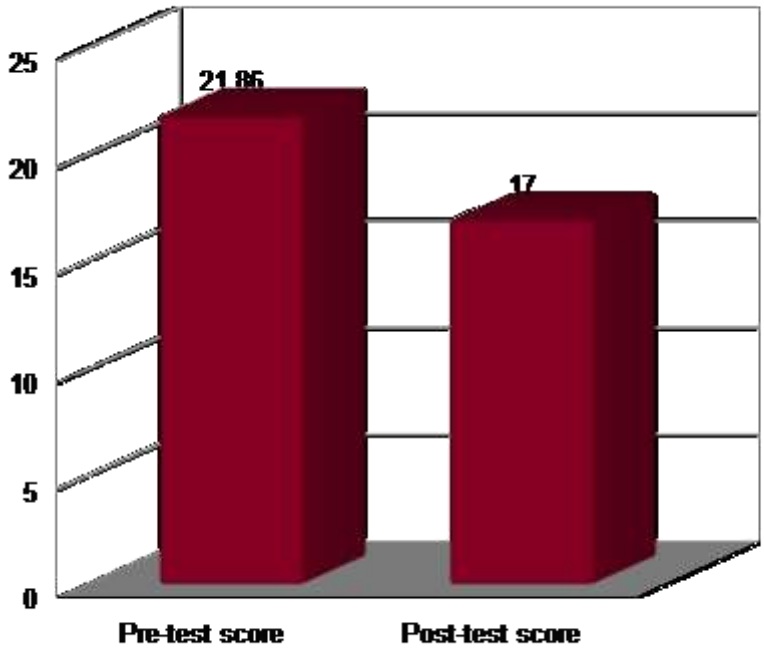
COMPARISON OF PRE-TEST AND POST-TEST MEAN VALUE OF MODIFIED TUG TEST IN GROUP A

Group	Pre-test Mean	Post-test Mean	Mean improvement	SD	Calculated 't'-value
A	21.86	17	4.9	1.187	10.066

The pre intervention mean score of modified TUG TEST in group A was 21.86; the post intervention (4 weeks) mean score was 17. The difference between the pre-test and post-test score was 4.9 in control group who received task specific exercises. (S.D= 1.187, t=10.066)

GRAPH V

GROUP B: PRE-TEST AND POST-TEST MEAN VALUE OF



MODIFIED TUG TEST

Fig. 1.5, shows the comparison between the Group A pre-test and post-test mean value is 21.86 and 17 for the modified time up and go test respectively.

TABLE-VI

COMPARISON OF PRE-TEST AND POST-TEST MEAN VALUE OF MODIFIED TUG TEST IN GROUP B

Group	Pre-test Mean	Post-test Mean	Mean improvement	SD	Calculated 't'-value
B	22.33	12.33	10	2.23	17.320

The pre intervention mean score of 5 repetitions of sit to stand scale in group B was 22.33; the post intervention (4 weeks) mean score was 12.33. The difference between the pre-test and post-test score was 10 in experimental group who received task specific exercises. (S.D= 2.23, t=17.320)

GRAPH VI

GROUP B: PRE-TEST AND POST-TEST MEAN VALUE OF MODIFIED TUG TEST IN GROUP B

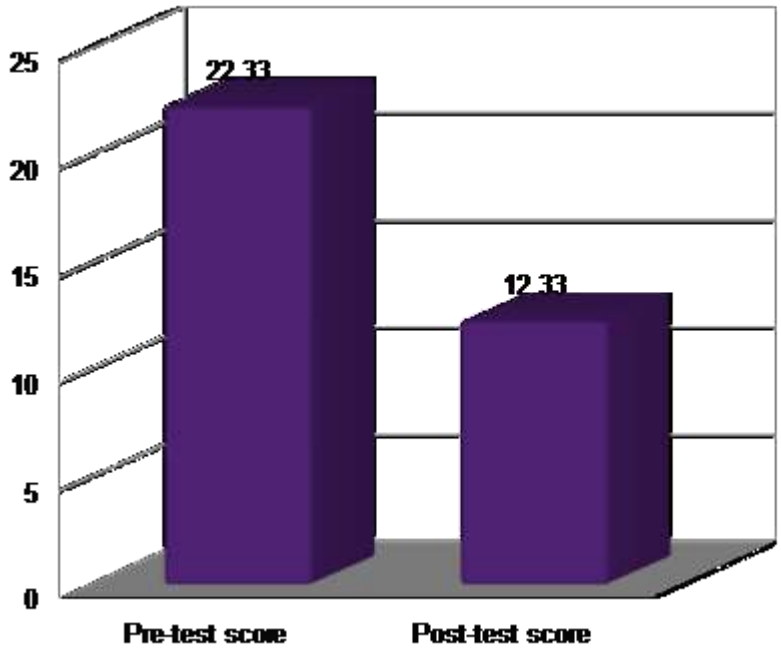


Fig. 1.6, shows the comparison between the Group B pre-test and post-test mean value is 22.33 and 12.33 for modified time up and go test respectively.

TABLE-VII

COMPARISON OF POST-TEST MEAN VALUE OF FUGL-MEYER MOTOR ASSESSMENT SCALE IN GROUP A AND GROUP B

Group	Mean Difference	SD	Calculated 't' value	Table 't' value
Group A	9.2	11.17	7.05	2.05
Group B	17.87	2.88		

Comparing the post-test mean score of both group A and group B with respect to Fugl meyer motor assessment scale shows a mean difference of 7.73 with calculated ‘t' value of 7.05.

GRAPH VII

COMPARISON OF POST MEAN OF BOTH GROUP A AND GROUP B BY FUGL MEYER MOTOR ASSESSMENT SCALE

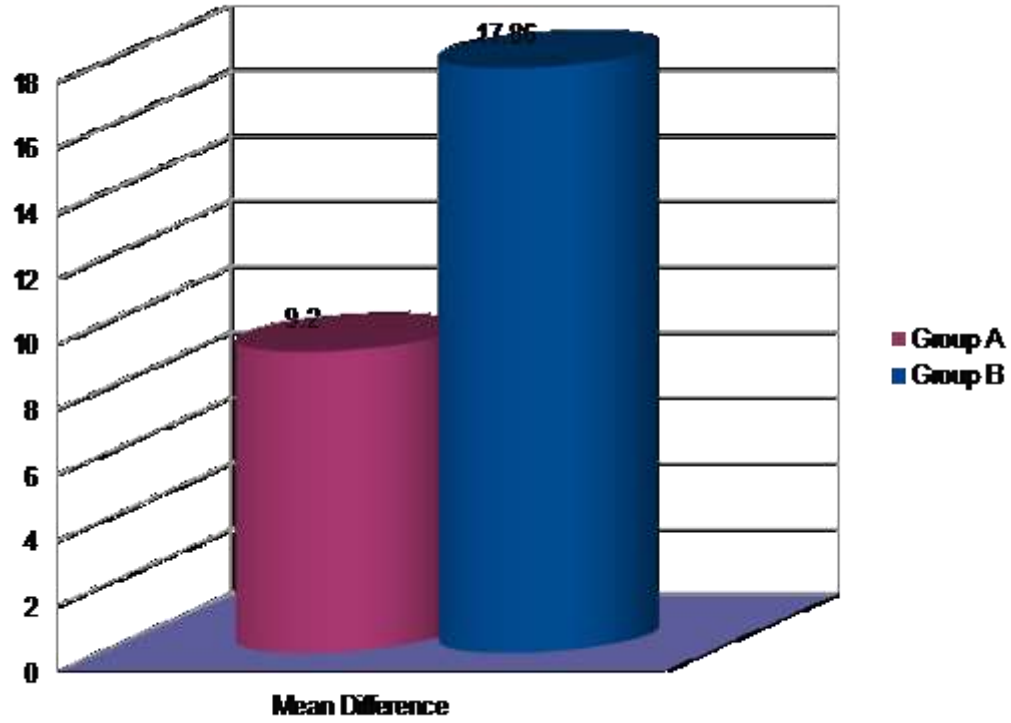


Fig. 2.1, Comparing Mean Difference of Group A (9.2) and Group B (17.86) respectively. The calculated 't' value is more than the table 't' value. Therefore, there is highly significance for Fugl-meyer motor assessment scale.

TABLE-VIII

COMPARISON OF POST-TEST MEAN VALUE OF 5 REPETITION SIT TO STAND IN GROUP A AND GROUP B

Group	Mean Difference	SD	Calculated 't' value	Table 't' value
A	2.2	0.41	6.64	2.05
B	4.46	1.13		

Comparing the Mean Difference score of both group A is 2.2 and group B is 4.46 with respect to 5-repetitions sit-to-stand score shows a difference of 2.36 with calculated 't' value of 6.64

GRAPH VIII

COMPARISON OF POST MEAN OF BOTH GROUP A AND GROUP B BY 5 REPETITIONS SIT-TO-STAND

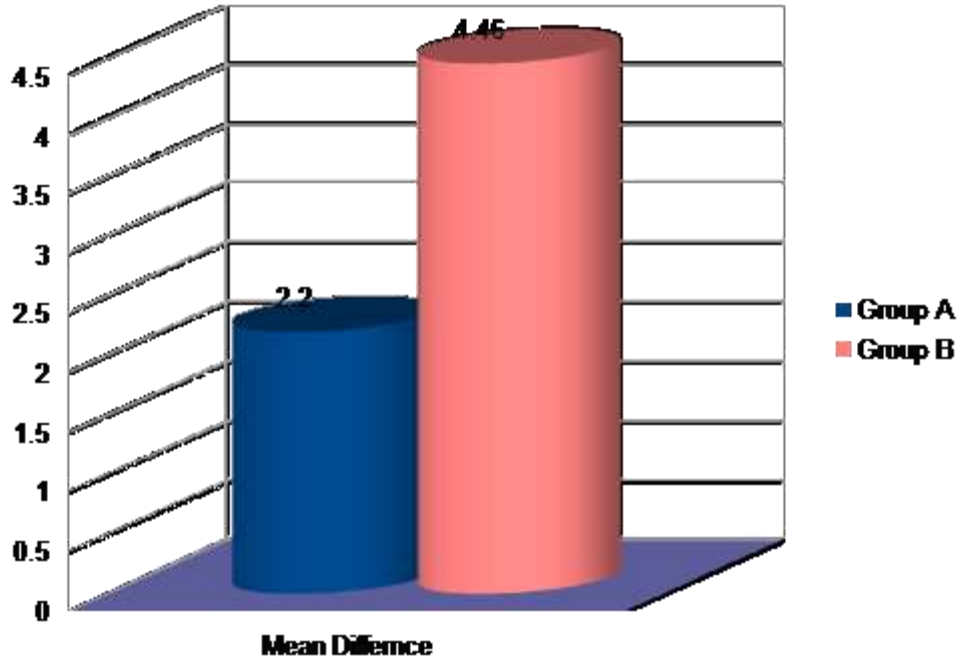


Fig. 2.2, Comparing Mean Difference of Group A (2.2) and Group B (4.46) respectively. The calculated 't' value is more than the table 't' value. Therefore, there is highly significance five repetitions sit-to stand test.

TABLE-IX

COMPARISON OF POST-TEST MEAN VALUE OF MODIFIED TUG TEST IN GROUP A AND GROUP B

Group	Mean Difference	SD	Calculated 't' value	Table 't' value
A	4.87	1.87	1.76	2.05
B	10	2.23		

Comparing the post-test mean score of both group A and group B with respect to Modified time up and go test score shows a mean difference of 4.87 and 10 with S.D of 1.87 and 2.23 with calculated 't' value of 1.76.

GRAPH IX

COMPARISON OF POST MEAN OF BOTH GROUP A AND GROUP B BY MODIFIED TIME AND GO TEST

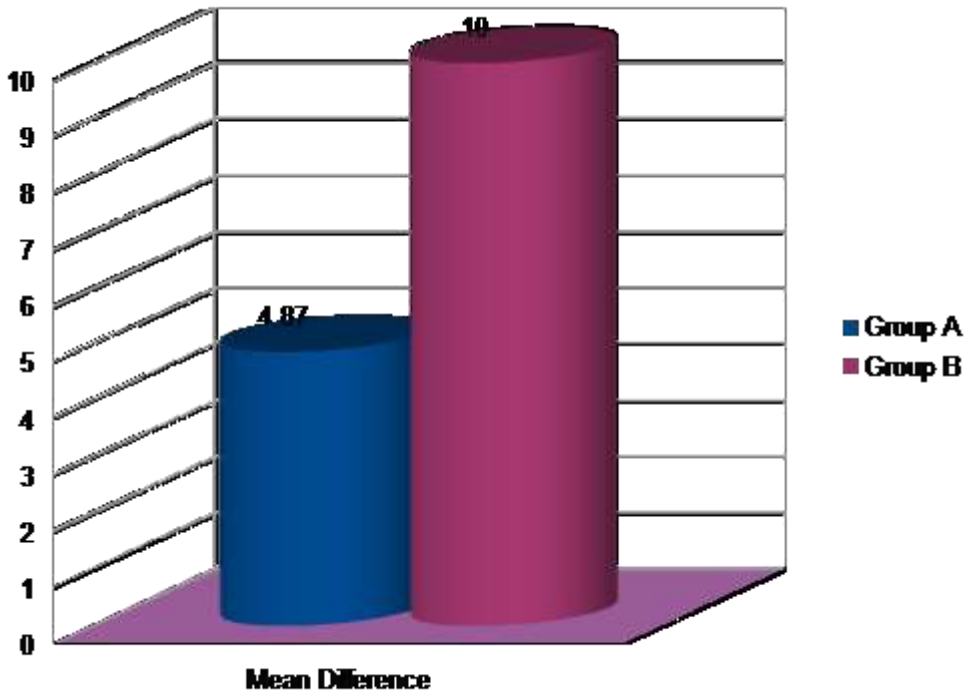


Fig. 2.3, Comparing Mean Difference of Group A (4.87) and Group B (10) respectively. The calculated 't' value is less than the table 't' value. Therefore, there is no beneficial significance for Modified Time 'Up and Go' test.

5. RESULT

By comparing the post-test results of group A and group B with respect to Fugl-meyer motor assessment scale, five repetitions sit-to stand and modified time 'up and go' test, Group B received Sit to Stand exercises along with functional activity based training protocols showed a significant improvement in the gait parameters of chronic hemiparetic stroke individuals.

6. DISCUSSION

Data collected through this study showed improvement in the lower extremity motor integrated activity in patients with chronic stroke. The approaches taken to improve the lower extremity functional performance through functional activity based exercises and functional activities along with added sit to stand exercise. Salmela et al (2009) established the effects of foot position on the performance of the sit-to-stand movement with chronic stroke subjects**.** The asymmetric 2 strategy appeared to be the least favourable, whereas the spontaneous and the symmetric strategies appeared to be more favourable in improving the STS performance. The participants of both the groups showed improvement in walking abilities in chronic stroke individuals. The improvement depends on the regular practice and learning abilities associated with the treatment programmes. There was weakness of paretic hip flexors and extensors, knee flexors, ankle plantarflexors and dorsiflexors. Lateral step-up exercise improved strength in Hip Abductors in patients with stroke and forward step-up improved strength in knee extensors and hip extensors. The functional integrated movements added sit to stand improved balance, strength and limb-loading of the affected limb as well as unaffected limb.

Cheol and Kwon (2008) conducted a study to determine the characteristics of lower-extremity weight bearing in independently ambulatory hemiparetic patients. Authors concluded that the weight bearing on stool 6”(15cm) is loaded more weight than the weight bearing on the ground.

Richard and Patrica (1985) found that the lateral step exercises were found to improve the loading response by influencing the shifting of COG through the enforced encruitment of gluteus medius activity of the supporting leg and adductor longus of stepping leg.

Rabbani Farqalit (2013) introduced the effect of foot position during sit-to-stand (STS) training on balance and upright mobility in patients with chronic stroke. Then the result shows that asymmetrical foot position during STS training improved balance and upright mobility in patients with chronic stroke as compared to the symmetrical foot position.

The improvement based on the therapies given to the participants, the propulsive force generates greater force with Sit to stand interventions than other exercises.

The statistical analysis performed between control group and experimental group showed the improvements in outcome. The mean improvement in motor capabilities when Functional activity based exercise and Functional activities with added sit to stand exercise as evaluated by Fugl-Meyer Assessment is 9.2 and 17.87 respectively. The Hip Abductors, Hip Extensors, Knee extensors strength improved in Experimental group as for as motor function is concerned when compared to Control group.

The functional sit-to stand ability mean improvement is 2.2 and 4.46 between control and experimental groups as evaluated by five repetitions sit- to stand test. The experimental group patients were able to complete the sit to stand in less time than the control group patients. The modified Time and Go test mean improvement is 4.9 and 10 between control group and experimental groups.

The data showed a high degree of consistency at a standard deviation of 3.18 and 2.87 in Fugl-Meyer score between control and experimental groups respectively. The standard deviation of Five repetitions sit-to-stand for control group was 0.414 and experimental group was 1.12 respectively. The standard deviation of modified time and 'up and go' test for control group was 1.187 and for experimental group was 2.23 respectively.

The Independent t- test revealed a value of 7.05 in Fugl-Meyer Assessment scale, 6.64 in Five repetitions sit-to stand test and 1.76 in modified time 'up and go' test. This clearly shows that the Fugl-Meyer assessment scale and Five repetitions sit-to-stand has high significant table 't' value.

DISCUSSION ON HYPOTHESES:

The first hypothesis of the investigator states that the functional activity based exercise improved the balance performance of lower extremity of stroke clients.

Functional integrated exercise applied in stroke patients was able to bring significant improvements in motor function, sit to stand task and timed symmetrical activity. So the first hypothesis is accepted that is the functional activity based exercise brought improvements in overall performance of lower extremity of stroke clients.

The second hypothesis of the investigator states that functional activity based exercise with added sit to stand exercise may improve the functional demands of lower-extremity of stroke clients.

Functional integrated exercise with added sit to stand exercise applied in stroke patients was able to bring significant improvements in motor function, sit-to-stand task and activity of daily living. So the second hypothesis is accepted that is functional activity with added sit to stand exercise brought improvements in functional demands of lower extremity of stroke clients

The third hypothesis of the investigator states that there may be significant difference between functional activities with added sit to stand exercise on functional demands of lower-extremity of stroke clients.

Functional integrated exercise with added sit to stand exercise applied in stroke patients able to bring significant improvements in motor function and sit-to-stand and task specific exercise. So the third hypothesis is accepted that there is a significant difference between functional activity with added sit to stand exercise and functional activity based exercise along on overall productivity of lower-extremity of stroke clients.

7. CONCLUSION

Functional activity based exercise with added sit to stand exercise applied in stroke patients showed that they are highly beneficial than the Functional activity based exercise alone when motor recovery is compared between the two groups for 4 weeks. Both techniques did not contribute the muscle tone at the end of 4 weeks.

LIMITATIONS OF THE STUDY

- Only 30 patients selected for the study.
- Gender differences not made.
- Age restricted to 45-55 years.
- Duration is 4 weeks and its short duration.
- Single centre

RECOMMENDED FOR THE FURTHER STUDY

- Sample size can be increased in the future study.
- Study can be conducted both younger and Elderly stroke clients.
- Long duration study can be performed to asses' long term benefits.
- Multi-centre study to evaluate the reliability of the study.

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APPENDICES

APPENDIX-I

EVALUATION FORM

SUBJECTIVE EXAMINATION

- Name
- Age
- Sex
- Occupation
- IP no
- Referred by Dr.
- Address

Chief complains

History collection

- Past medical history
- Present medical history
- Personal history
- Family history
- Social history
- Drug history

Associated problems

OBJECTIVE EXAMINATION

VITAL SIGNS

- Blood pressure
- Temperature

- Respiratory rate
- Heart rate

ON OBSERVATION

- Built
- Posture
- Deformities
- Attitude of limb
- External appliances

ON PALPATION

- Muscle tone
- Tenderness
- Warmth

RESPIRATORY EXAMINATION

- Respiratory rate
- Type
- Pattern
- Chest expansion

NEUROLOGIAL EXAMINATION

HIGHER MENTAL FUNCTION

- Level of consciousness
- Attention
- Orientation
- Memory
- Language

HIGHER CORTICAL FUNCTION

- Calculation
- Proverb interpretation
- Judgement

CRANIAL NERVE EXAMINATION

SENSORY EXAMINATION

- Superficial
- Deep
- Cortical

MOTOR EXAMINATION

- Muscle tone
- Muscle power
- Reflexes - superficial
  - deep
- Muscle girth

CO-ORDINATION

BALANCE

GAIT

- Quantitative analysis
- Qualitative analysis

BLADDER AND BOWEL EXAMINATION

INVESTIGATION

DIAGNOSIS

SPECIAL TEST

TREATMENT

- Medical management
- Physiotherapy management

APPENDIX-II

FUGEL-MEYER MOTOR ASSESSMENT SCALE FOR LOWER-EXTREMITY

Area	Test	Scoring criteria	Maximum possible score	Attained score
LOWER EXTREMITY (supine)	• Reflex activity-tested in supine position. Achilles Patellar	0- no reflex activity 2- reflex activity	4	
	a) Flexor synergy Hip flexion Knee flexion Ankle dorsiflexion b) Extension synergy-(motion is resisted) Hip extension Adduction Knee extension Ankle plantarflexion	a) 0-cannot be performed 1-partial motion 2-full motion b) 0-no motion 1-weak motion 2-almost full strength compared to normal	6	
Sitting(knees free of chair)	• movement combining synergies a) knee flexion beyond 90° b) ankle dorsiflexion	a) 0-no active motion 1-from slightly extended position knee can be flexed but not beyond 90° b) 0-no active flexion 1-incomplete active flexion 2-normal dorsiflexion	4	

Area	Test	Scoring criteria	Maximum possible score	Attained score
Standing	• movement out of synergy hip at 0° a) knee flexion b) ankle dorsiflexion	a) 0- knee cannot flex without hip flexion 1- knee begins flexion without hip flexion, but doesn't get to 90°, or hip flexes during motion 2-full motion as described b) 0-no active motion 1-partial motion 2-full motion	4	
Sitting	• normal reflexes a) knee flexors b) patellar c) Achilles	0- two of the 3 are markedly hyperactive 1- one reflex is hyperactive or two reflexes are lively 2- no more than 1 reflex is lively	2	

Area	Test	Scoring criteria	Maximum possible score	Attained score
Supine	• coordination/speed heel to opposite knee (5 repetitions in rapid succession) a) tremor b) dysmetria c) speed	a)1-marked tremor 2- slight tremor 3-no tremor b) 0-pronounced or unsystematic 1-slight or systematic 2-no dysmetria c)0-six seconds slower than unaffected side 1-two or 5 seconds slower 2-less than 2 seconds difference		

TOTAL MAXIMUM LOWER-EXTREMITY SCORE = 34

APPENDIX III

FIVE REPETITIONS SIT-TO-STAND TEST

5X Sit-to-Stand Test (5XSST)

Description: Assesses functional lower extremity strength, transitional movements, balance, and fall risk.

Equipment: Stopwatch; standard height chair with straight back (16 inches high);

Therapist Instructions: Have the patient sit with their back against the back of the chair. Count each stand aloud so that the patient remains oriented. Stop the test when the patient achieves the standing position on the 5th repetition.

Patient Instructions: “Please stand up straight as quickly as you can 5 times, without stopping in between. Keep your arms folded across your chest. I’ll be timing you with a stopwatch. Ready, begin.”

Interpretation:

- Lower times = better scores
- MDC: 3.6-4.2 sec
- MCID: 2.3 sec

Age Bracket	Time (sec)
60-69 years	11.4
70-79 years	12.6
80-89 years	14.8

MDC:- Minimal Detectable change

MCID :- Minimum Clinically important difference

Mong,2010 cut off score 12 seconds is discriminatory between healthy, elderly and subjects with chronic stroke

APPENDIX-IV

TIME 'UP AND GO' TEST

Have the patient sit in a straight-backed high-seat chair

Instructions for patient:

- Get up (without use of armrests, if possible)
- Stand still momentarily
- Walk forward 10 ft (3 m)
- Turn around and walk back to chair
- Turn and be seated

Factors to note:

- Sitting balance
- Transfers from sitting to standing
- Pace and stability of walking
- Ability to turn without staggering

Modified qualitative scoring

1) No fall risk Well-coordinated movements, without walking aid

2) Low fall risk Controlled but adjusted movements

3) Some fall risk Uncoordinated movements

4) High fall risk Supervision necessary

5) Very high fall risk Physical support of stand by physical support necessary

APPENDIX V

MINI-MENTAL STATE EXAMINATION (MMSE)

PATIENT'S NAME:_____ **DATE:**

Maximum score	Patient's score	Questions
5		"What is the year? Season? Date? Day? Month?"
5		"Where are we now? State? County? Town/city? Hospital? Floor?"
3		The examiner names three unrelated objects clearly and slowly, then the instructor asks the patient to name all three of them. The patient's response is used for scoring. The examiner repeats them until patient learns all of them, if possible.
5		"I would like you to count backward from 100 by sevens." (93, 86, 79,72, 65, …)Alternative: "Spell WORLD backwards." (D-L-R-O-W)
3		"Earlier I told you the names of three things. Can you tell me what those were?"
2		Show the patient two simple objects, such as a wristwatch and a pencil and ask the patient to name them.
1		"Repeat the phrase: 'No ifs, ands, or buts.'"
3		"Take the paper in your right hand, fold it in half, and put it on the floor."(The examiner gives the patient a piece of blank paper.)
1		"Please read this and do what it says." (Written instruction is "Close your eyes.")
1		"Make up and write a sentence about anything." (This sentence must contain a noun and a verb.)
1		"Please copy this picture." (The examiner gives the patient a blank piece of paper and asks him/her to draw the symbol below. All 10angles must be present and two must intersect.)
30 TOTAL		

INTERPRETATION OF MMSE

Method	Score	Interpretation
Single cut off	<24	Abnormal
Range	<21 >25	Increased odds of dementia Decreased odds of dementia
Education	21 <23 <24	Abnormal for 8th grade education Abnormal for high school education Abnormal for college education
Severity	24-30 18-23 0-17	No cognitive impairment Mild cognitive impairment Severe cognitive impairment

INTERPRETATION OF MMSE SCORES

Score	Degree of Impairment	Formal psychometric assessment	Day-to-Day functioning
25-30	Questionably significant	If clinical signs of cognitive impairment are present, formal assessment of cognition may be valuable.	May have clinically significant but mild deficits. Likely to affect only most demanding activities of daily living.
20-25	Mild	Formal assessment may be helpful to better determine pattern and extent of deficits	Significant effect. May require some supervision, support and assistance
Ten to Twenty	Moderate	Formal assessment may be helpful if there are specific clinical indications. Clear impairment.	May require 24-hour supervision.
0-10	Severe	Patient not likely to be testable. Marked impairment.	Likely to require 24-hour supervision and assistance with ADL.

APPENDIX -VII

INFORMED CONSENT FORM

I _____ agree to take part in the project study, conducted by _____, post graduate student (MPT), Sri Ramakrishna Institute of Paramedical Sciences, College of Physiotherapy, MGR university.

I acknowledge that the research study has been explained to me and I understand that agreeing to participate in the research means that I am willing to,

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

I have been informed about the purpose, procedures and measurements involved in the research and my queries towards the research have been clarified.

I understand that my participation is voluntary and can withdraw at any stage of the research.

Signature of the patient /care giver:

Contact address:

Signature of the investigator:

Date:

APPENDIX -VII

MASTER CHART

FUGL-MEYER MOTOR ASSESSMENT SCALE

S.No	Group A		Group B	
	Pre-test	**Post-test**	**Pre-test**	**Post-test**
1.	10	20	13	27
2	15	19	10	25
3	13	22	9	26
4	7	19	8	29
5	9	18	11	30
6	10	24	12	28
7	10	20	10	25
8	9	23	15	31
9	11	19	10	30
10	12	22	11	26
11	8	21	9	27
12	10	18	8	25
13	11	17	6	30
14	13	20	5	25
15	14	18	11	32

5- REPETITIONS SIT-TO-STAND

S.No	Group A		Group B	
	Pre-test	Post-test	Pre-test	Post-test
1.	15	13	15	10
2	13	11	14	9
3	14	12	13	9
4	13	11	14	10
5	15	13	15	8
6	14	12	14	10
7	15	13	13	9
8	13	11	10	10
9	15	13	10	10
10	14	11	9	9
11	15	12	10	10
12	13	10	9	9
13	13	11	10	10
14	14	12	9	9
15	15	13	10	10

MODIFIED TIME UP AND GO TEST

S.no	Group A		Group B	
	Pre-test	**Post-test**	**Pre-test**	**Post-test**
1.	20	16	13	13
2	21	15	10	10
3	23	16	12	12
4	25	20	15	15
5	22	17	12	12
6	20	16	14	14
7	22	18	12	12
8	20	15	13	13
9	23	17	15	15
10	20	15	12	12
11	24	20	11	11
12	20	15	13	13
13	21	16	12	12
14	25	19	11	11
15	22	20	10	10