THE EFFECTIVENESS OF REPEATED BILATERAL LEG TRAINING TO IMPROVE LOWER EXTREMITY MOTOR PERFORMANCE IN MCA STROKE PATIENTS

Dissertation

Submitted To

The Tamilnadu Dr.MGR Medical University

In partial fulfillment for the degree of

MASTER OF PHYSIOTHERAPY

271520165

CHERRAAN'S COLLEGE OF PHYSIOTHERAY

CHERAN INSTITUTE OF HEALTH SCIENCES

Coimbatore ,Tamilnadu ,India

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CERTIFICATE

The work embodied in the thesis entitled "**THE EFFECTIVENESS OF REPEATED BILATERAL LEG TRAINING TO IMPROVE LOWER EXTREMITY MOTOR PERFORMANCE IN MCA STROKE PATIENTS**" submitted to the **Tamilnadu Dr.MGR Medical University, Chennai** in the partial fulfilment of the degree of Bachelor of physiotherapy, was carried out by candidate bearing register number of 271520165 at Cherraan's Collage of physiotherapy, Coimbatore under my supervision. This is original work done by her and has not been submitted in part or full for any degree/diploma at this or any or any other university/institute. The thesis is fit to be considered for evaluation for award of the degree of Bachelor of physiotherapy.

……. …..……

Signature of Guide **Signature of Principal**

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

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

Date :…… Date:…….

Internal Examiner…… External Examiner…….

Project work evaluated on ……

DECLARATION BY THE STUDENT

I hereby declare and present my project work entitled "**THE EFFECTIVENESS OF REPEATED BILATERAL LEG TRAINING TO IMPROVE LOWER EXTREMITY MOTOR PERFORMANCE IN MCA STROKE PATIENTS**".

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

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

…… ……

signature of the supervisor **signature of the student**

Date:

Place:

ACKNOWLEDGEMENT

I take this opportunity to express my heartfelt gratitude to all those who made this project possible.

My most sincere appreciation to those who the most to me. I am indebted to my parents and family members for their great support, inspiration, love and encouragement throughout this study.

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I extend my special thanks to the participants who participated in the study that gave me an opportunity to complete this study.

Last but not the least the thesis become possible with the support love and tolerance of my classmates who provided me with timely support guidance and motivation throughout my research.

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ABSTRACT

Objective: To find out the effectiveness of repetitive bilateral leg training along with conventional therapy in improving lower extremity motor function in MCA stroke patients.

Method: The study conducted was an experimental comparative approach. Sample of 30 subjects satisfying the criteria were divided into two groups, control (group A) and experimental (group B). Control group received range of motion exercises, functional mobility exercises, strengthening exercises, balance training, gait training. For experimental group, in addition to conventional physiotherapy repetitive bilateral leg training was given. Treatment was given for 3 weeks.

Outcome Measures: The outcome measures taken were Fugl Meyer lower extremity score and step test.

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

Conclusion: The repetitive bilateral leg training seemed to be beneficial in improving lower limb motor performance in MCA stroke patients.

INTRODUCTION

I - INTRODUCTION

Stroke is defined as the rapidly developing clinical signs of focal or gobal disturbance of cerebral blood function with symptoms lasting for 24 hours or longer or leading to death, with no apparent cause other than vascular origin.

Stroke is one of the most common causes of death and disability worldwide. It affects approximately 600000 individuals each year in United States, with an estimated number of 400000 stroke survivors. It leaves the stroke survivors with significant physical and mental disability, thus creating a major social and economical burden.

The incidence of stroke increases dramatically with age, doubling every decade after 55. For the American white men aged 65-74, the incidence is about 14.84, above75 it is 24.6 and for 85 and older it is 27%. In 2002 the greatest number of people above 65 lived in China followed by US and India. By 2025 the world population is expected to include over 830 million people above 65 will live in developing countries like India and China.

The middle cerebral artery is the single most common site of stroke. MCA stroke is characterized by common features such as contralateral spastic hemiparesis or hemiplegia and sensory deficit of face, arm and leg with the face and arm more involved than the leg. Homonymous hemianopsia (visual field defect) and loss of conjugate gaze to the opposite side also result. Lesions of the parieto-occipital cortex of the dominant hemisphere can produce aphasia. Lesions of the parietial lobe of the non dominant hemisphere can produce perceptual dysfunctions.

Stroke can be of either ischemic or hemorrhagic variety. Clinically a variety of deficits can occur as a result of stroke including changes in the level of consciousness, impairment of sensory, motor, cognitive, perceptual and language functions. Motor deficits are characterized by paralysis (hemiplegia) or weakness (hemiparesis) typically on the side of the body opposite to site of lesion. The term cerebrovascular accident (CVA) is used interchangbily with stroke very often.

In this study the investigator checks the effectiveness of repetitive bilateral leg training to improve lower extremity motor performance in post stroke patients.

1.1 NEED FOR STUDY:

Stroke is the major cause of disability in elderly patients. Traditional methods of compensatory treatments are shown to improve motor function.

Stroke is the largest consumer of rehabilitation services. Physiotherapist have major role in hospital based rehabilitation setting and in the community based rehabilitation setting. Re-education of motor and functional abilities are the main targets of treatment of physiotherapist.

Recently bilateral training has emerged from the motor control literature as a promising training strategy for stroke patients. Studies conducted in the upper limb indicated it as favorable method. The very limited number of preliminary studies conducted in lower limb points towards the need of a detailed study. So there is a great need to find the effectiveness simple home or clinic based bilateral training program on improving lower limb function.

1.2 AIMS:

- To find the effectiveness of repetitive bilateral leg training in improving lower extremity motor function of stroke patients.

1.3 OBJECTIVES OF STUDY:

- To find the effectiveness of conventional exercises in improving the lower extremity motor function of stroke patients.
- To find the effectiveness of repetitive bilateral leg along with conventional exercises in improving the lower extremity motor function of stroke patients.
- To compare the mean differences in the lower extremity motor function scores of Experimental group and control group .

1.4 HYPOTHESES:

Hypotheses to test objective 1

- There is a statistically significant improvement in lower extremity motor function in stroke patients following the use of Conventional Physiotherapy.
- There is no statistically significant improvement in lower extremity motor function in stroke patients following the use of Conventional Physiotherapy.

Hypotheses to test objective 2

- There is a statistically significant improvement in lower extremity motor function in stroke patients following the use of repetitive bilateral leg training exercises along with Conventional Physiotherapy.
- There is no statistically significant improvement in lower extremity motor function in stroke patients following the use of repetitive bilateral leg training exercises along with Conventional Physiotherapy.

Hypotheses to test objective 3

- There is a statistically significant difference in the mean improvement in lower extremity motor function of Experimental group and control group.
- There is no statistically significant difference in the mean improvement in lower extremity motor function of Experimental group and control group.

REVIEW OF LITERATURES

II REVIEW OF LITERATURES

Stroke:

World Health Organization, 1988

Stroke is defined as rapidly developing clinical signs of focal or global disturbances of cerebral blood function with symptoms lasting for 24 hours or longer or leading to death, with no apparent cause other than vascular origin.

Rown Harward, 2004

Stroke is a clinical syndrome a focal or global neurological impairment of sudden onset lasting longer than 24 hours or leading to death.

Adams et al, 2003

A sudden non conclusive loss of neurologic function due to an ischemic or hemorrhagic intracranical vascular event.

E.S.Sapna et al 2009

They suggested that apart from acute stage mortality of >20%, stroke survivors frequently exhibit persistent functional impairments that limit quality of life.

Sarah F Tyson et al 2006

They conducted the study to assess the distribution of weakness in upper and lower limbs post-stroke and the factors associated with weakness. The design was a prospective cross-sectional survey. A consecutive sample of 75 patients 37 (49%) men, mean age 71.5 (SD 12.2)year,46 (61%) left hemiplegic with a first-time anterior circulation stroke, tested 2-4 weeks post stroke, were recuited from NHS trusts. The main outcome measure was weakness (Motricity Index, MI). Mean MI score was 58.5 (SD 39.6) and 69.1(SD 33.6) for the upper and lower limb ($p<0.001$), but examination of individual data indicated 36(48%) had no negligible difference, the lower limb was more frequently the stronger. There was no significant difference between the proximal and distal joint in either limb. Severity of weakness was not associated with the

subject's demographics or stroke pathology, but was associated with neglect and sensation. Although group analysis showed that most participants had a similar degree of weakness in both limbs. When there was a difference, the lower limb was more frequently the stronger. Proximal joints were not more severely affected than distal joints. Patient demographics and stroke pathology factors were not associated with weakness, but stroke related impairments were.

CONVENTIONAL PHYSIOTHERAPY:

Alex Pollock et al, 2008

They found out that mixed physiotherapy approach is significantly favorable to no treatment or placebo intervention in the recovery of functional independence after stroke. This significant effect arguable demonstrates that any physiotherapy is better than none.

Yannan Fang et al, 2003

This study is to investigate additional early physiotherapy after stroke improved functional recovery in stroke patients. A prospective, randomized, controlled study design was used. The study was conducted in one stroke ward and an acute stroke unit in a large teaching hospital, southern China. Subjects were patients with .rst-onset stroke consecutively admitted to the stroke center. One group (*n=78)* received additional early physiotherapy (AEP) for 45 minutes, .ve days a week for four weeks starting within the first week since stroke onset ; the routine therapy (RT) group (*n=78)* received no professional rehabilitation therapy. Main outcome measures were Glasgow Coma Scale, Mini-Mental State Examination, Fugl – Meyer Assessment of Motor Recovery, Clinical Neurological Deficit Scale and Modified Barthel Index (MBI).Results shows that the patients from the AEP group had a high drop-out rate (*n=28)*, but those remaining made relatively better functional recovery at 30days than those from the RT group if measured by MBI. Multiple linear regression analyses revealed that cognitive disturbance, aphasia, double incontinence, site of lesion and sensory impairment might affect functional recovery after stroke. Conclusion: Additional early physiotherapy might improve independence of patients after stroke but failed to show benefit in other aspects in our study. Cognitive disturbance, aphasia, double incontinence, site of lesion as well as sensory impairment might affect functional out come after stroke.

Ernest E, 1990

He concluded that the majority of the hard evidence implies that stroke patients benefit from rehabilitation with physiotherapy. This benefit may be statistically small, but for a given individual, it could mean the difference between living at home or in an institution.

FUGL MEYER SCALE:

Susan B O Sullivan 2001

Fugl Meyer assessment of physical performance scale has good validity and higher reliability for assessing motor function.

Duncan P et al 1983

This study establishes intratester reliability for all components of physical performance and intertester reliability for the total scores of upper and lower extremity motor performance. In a cumulative numerical scoring system devised by Fugl Meyer et al. Intertester reliability was found to be high for the total scores of upper and lower extremity motor performance. All intratester and intertester reliability coefficient were high and statistically significant. Establishing the reliability of the Fugl-Meyer method of assessing recovery of function following cerebrovascular accident has increased the usefulness of this method for clinical assessment and as a tool for the comparative analysis of the effectiveness of various therapeutic interventions.

Julie Sanford, July 1993

The purpose of this study was to establish the interrater reliability of assessments made with the Fugl Meyer evaluation of physical performance in a rehabilitation setting. Twelve patients (7 male, 5 female), aged 49 to 86 years (66), who had sustained a cerebrovascular accident participated in the study.

All patients were admitted consecutively to a rehabilitation center and were between 6 days and 6 months post stroke. Three physical therapists, each with more than 10 years of

experience, assessed the patients in a randomized and balanced order using this assessment. The therapist standardized the assessment approach prior to the study but did not discuss the procedure once the study began. The overall reliability was high (overall intraclass correlation coefficient=.96), and the intraclass correlation coefficients for the subsections of the assessment varied from .61 for pain to .97 for the upper extremity. The relative merits of using the Fugl Meyer assessment as a research tool versus a clinical assessment for stroke are discussed.

David J. Gladstone, September 2002

The measurement of recovery after stroke is becoming increasingly important with the advent of new treatment options under investigation in stroke rehabilitation research. The fugl-Meyer scale was developed as the first quantitative evaluative instrument for measuring sensorimotor stroke recovery, based on Twitchell and Brunnstrom's concept of sequential stages of motor return in the hemiplegic stroke patient. The Fugl-Meyer is a well designed, feasible and efficient clinical examination method that has been tested widely in the stroke population. Its primary value is the 100- point motor domain, which has received the most extensive evaluation.

Excellent interater and intrarater reliability and construct validity have been demonstrated, and preliminary evidence suggests that the Fugl-Meyer assessment is responsive to change. Limitations of the motor domain include a ceiling effects, omission of some potentially relevant items, and weighting of the arm more than the leg, further study should test performance of this scale in specific subgroups of stroke patients and better define its criterion validity , sensitivity to change, and minimal clinically important difference.

Based on the available evidence, the Fugl-Meyer motor scale is recommended highly as a clinical and research tool for evaluating changes in motor impairment following stroke.

STEP TEST:

Vicki Stemmons Mercer, October 2009

The Step Test (ST) is a measure of dynamic standing balance and paretic-lower-extremity motor control in patients with stroke. The purpose of this study was to determine relationships between ST scores and measures of activity and participation during the first 6 months after stroke. This was a prospective cohort study. Thirty- three individuals (18 men, 15 women) with a diagnosis of a single, unilateral stroke participated in the study. Participants were tested one time per month from 1 to 6 months post stroke. The ST was considered an impairment-level measure. Self- selected gait sped and the Medical Outcomes Study 36-Item Short-Form Health Survey (SF-36) Physical Function Index (PFI) were used to assess physical function. Three domains (mobility, basic and instrumental activities of daily living, participation) of the Stroke Impact Scale were used to assess self-reported disability. Regression analyses were conducted to examine the bivariate association between ST scores and each physical function and disability measure at each time point (1-6months).The ST scores were positively associated with both physical function measures. The associations were stronger for self-selected gait speeds(R=.60-.79) than for the PFI scores (R^2=.32-.60). During the first 6 months after stroke, each additional step with the paretic lower extremity on the ST corresponded to a 0.07-m/s to 0.09-m/s increase in gait speed, and each additional step with the nonparetic lower extremity was associated with a 0.07-m/s to 0.08-m/s gait speed increase The impairment – disability associations were weaker than the impairment –physical function associations.

Keith D. Hill Juile, October 1996

A new clinical test of dynamic standing balance, called the step Test, has been developed to evaluate dynamic single limb stance. This aspect of balance is not adequately assessed in other reported balance tests and may be important in identifying balance problems during common potentially destabilizing activities, such as locomotion, for stroke patients. The step test involves stepping one foot on, then off, a block as quickly as possible in asset time period. Forty-one healthy elderly subjects (mean age 72.5,44% males), and 41 stroke patients undergoing in-patient

rehabilitation (mean age 72.5,54% males) were assessed, on average 54 days post-stroke. Retest reliability was high in a sub group of 14 healthy subjects(Intraclass Correlation Coefficents, ICC> 0.88).performance on the step test by the stroke group was significantly lower than that of the healthy elderly group ($p<0.001$), with only 4.8% scoring within one standard deviation of the healthy elderly mean score. Performance on the Step Test correlated significantly with functional reach and gait velocity and stride length ($p<0.001$). Based on the result of the study, it is recommended that the Step Test form part of abalance test battery for stroke patients.

REPETITIVE BILATERAL LEG TRAINING:

Johannsen L et al

The author sought to test whether the BATRAC strategy would transfer to the legs by improving LE motor function following ten 30 minutes sessions of bilateral leg training with rhythmic auditory cueing (BLETRAC). Twenty-four chronic stroke participants, recruited from the community, were randomized to either the BLETRAC or the BATRAC intervention. Assessments were performed before (week 0) and after (week 6) training as well as 3 months later (week 18). Change in the Fugl Meyer LE and UE subscales served as primary outcomes. Timed 10-m walk, movement parameters during treadmill walking, and a repetitive aiming task for both feet and hands were the secondary outcomes. Following an intention to treat approach, data from 21 subjects were analyzed. After training, improvements in the Fugl-Meyer LE and UE subscales tended to be better for the corresponding intervention group. The BLETRAC group also showed increases in step length during treadmill walking and performance in the repetitive foot and hand aiming tasks. No differences between the intervention groups were found at follow-up.

This exploratory trial demonstrates that transfer of the BATRAC approach to the legs is feasible. Transient improvements of limb motor function in chronic stroke participants were induced by targeted exercise (BLETRAC for the LE). It may be that further periods of training would increase and maintain effects.

Stephen J Page et al, 2005

Bilateral training aids rehabilitation progression. Bilateral training has been shown to produce increased strength, range of motion and performance of discrete unilateral and bilateral movement in the affected limb of stroke patients. This study is to determine efficacy of a bilateral reciprocal training regimen on affected leg impairment and dynamic balance. The authors used randomized, controlled, single-blinded crossover study in an outpatient rehabilitation hospital. Seven patients who experienced stroke>1 year prior to study entry exhibiting affected leg weakness were selected. Subjects were randomly assigned to receive both of the following in a randomized, sequential order: (a) a resistance-based, reciprocal, affected leg locomotor training protocol using the Nustep apparatus (n=4) and (b) a home exercise programme (HEP) consisting of self-supervised practice with fractionated joint movements of the lower limb. Each phase of the intervention was performed for 30 minutes each session, three days a week, and conducted over an eight-week period. Outcomes were evaluated by a blinded rater using the lower extremity scale of the Fugl-Meyer and the Berg Balance Scale.

After NuStep participation, patients in both treatment groups showed impairment reductions as shown by the Fugl-Meyer (+4.0; +2.2), and increased balance as shown by the Berg Balance Scale (+4.0; +4.0). These trends were exhibited regardless of group assignment. Impairment reductions and balance gains may be achieved using a resistance-based, reciprocal upper and lower limb locomotor training protocol.

METHODOLOGY

III METHODOLOGY

3.1 STUDY DESIGN:

- Experimental study

3.2STUDY SETTING:

- This study was conducted in ALMAS Hospital kottakkal, Malappuram.

3.3 STUDY DURATION:

- Total duration of study was 4 months

3.4SAMPLE DESIGN:

- Non probability purposive sampling.

3.5 SAMPLE SIZE:

30 patients satisfying the criteria were selected. They were divided into 2 groups

3.6 SELECTION CRITERIA:

3.6.1 Inclusion criteria

- Sub acute stroke patients
- Unilateral stroke
- MCA stroke
- Ischaemic stroke
- First time stroke
- Both males and females
- Patients with stable cardiovascular parameter

3.6.2 Exclusion criteria

- Chronic stroke
- ACA and PCA territory stroke
- Bilateral lesion
- Visually impaired patients
- Recurrent stroke
- Severe joint deformities
- Rheumatoid arthritis
- Recent fractures
- Active cancer
- Neurological problems such as myopathy, leprosy, demyelinating diseases of central nervous system, degenerative disease of central nervous system like Parkinsonism and other movement disorders.
- Cognitive and mental impairment
- Non co-operative patients
- Hemorrhagic stroke

3.7 STUDY METHOD:

Thirty patients who came under the inclusion criteria were selected and were divided into two groups by non probability sampling method.

Control group- Fifteen patients received conventional physiotherapy alone.

Experimental group- Fifteen patients received repeated bilateral leg training along with conventional physiotherapy.

3.8 PARAMETERS:

- Fugl Meyer motor assessment scale for lower limb
- Step test

3.9 VARIABLES:

Independent variables

- Conventional physiotherapy, Repeated bilateral leg training.

Dependent variables

- Lower limb motor function.

STATISTICAL TOOLS:

- Paired t test and unpaired t test
- Paired t test to assess changes within the group
- Unpaired t test to assess changes between the groups

3.10 STUDY PROCEDURE:

A total of 30 stroke patients were selected who met the inclusion criteria, and were divided into two groups, Group A (Control group) and Group B (Experimental group) using randomized method. 15 patients were taken in each group. Conventional physiotherapy was given to Group A patients. Group B patients received repetitive bilateral leg training along with conventional physiotherapy 6 days per week for 3 weeks. Assessment was taken on the first day and on completion of the treatment after 3 weeks. The outcomes measures used were FMA and Step test.

The values were tabulated in the tabular column. Analysis of results were done with paired ‘t’ test assess changes within the group and independent ‘t’ test assess the changes between the group to find out the significance at 5%.

Methodology:

Pretest

Prior to treatment the individuals were assessed using Fugl Meyer scale and step test.

Group A (Control group)

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

group a received the following set of treatment

- **Active assisted range of motion exercise of both upper and lower extremity.**

  Upper limb:

  Shoulder girdle -Elevation-Depression, Protraction-retraction 5 repetitions each

  Glenohumeral joint -Abduction- Adduction, Flexion- Extension 5 repetitions each

  Elbow joint -Flexion- extension 5 repetitions each

  Radio Ulnar joint - Supination- Pronation 5 repetitions each

  Wrist joint - Flexion- Extension 5 repetitions each

Metacarpo phalangeal Joint - Flexion- extension 5 repetitions each

Interphalangeal joints - Flexion- extension 5 repetitions each

Lower limb:

Hip joint -Flexion- Extension in side lying 5 repetitions each

-Abduction exercises 5 repetitions

- Internal- external rotation 5 repetitions each

Knee joint -Flexion- extension 5 repetitions each

Ankle joint -Dorsiflexion- plantarflexion 5 repetitions each

Subtalar joint -Inversion-eversion exercises 5 repetitions each

- **Functional mobility exercises:**
  - Bed mobility exercises

    Rolling to affected side -5 Repetitions

    Rolling to unaffected side -5 Repetitions

    Bridging of pelvis -5 Repetitions

    Prone on elbow -5 Repetitions

    Prone on hands -5 Repetitions

    Supine lying to sitting -5 Repetitions

  - Sitting to standing without assistance -5 Repetitions

- Walking in parallel bar -5 Repetitions
- Walking without supportive devices -5 Repetitions
- Stair climbing exercises -5 repetitions

- **Balance training**

Wobble board with support - 10 Repetitions

Forward and backward stepping - 10 Repetitions

Manual perturbations

Side ways - 10 Repetitions

Forward and backward - 10 Repetitions

Each subject in the control group was given the above treatment once daily 6 days a week and each session lasted for 1 hour and total treatment duration was 3 weeks.

GROUP B (EXPERIMENTAL GROUP):

In addition to the treatment given to control group, the experimental group received repeated bilateral leg training for 40 minutes. Prior to the treatment individuals were assessed using Fugl Meyer scale lower extremity score and step test.

REPETITIVE BILATERAL LEG TRAINING:

The training procedure starts with active assisted movements in supine lying and sitting positions and a static cycling session. On course of the training program active assisted movements progressed to active movements and resisted movements depending on the improvement shown by the patients. Patients performed the bilateral training program both in supine lying and sitting positions. Each treatment session lasted for 30-40 minutes and rest period was provided after completion of a single joint movements.

RANGE OF MOTION EXERCISE:

- **In supine lying position:**

JOINT	MOVEMENT	REPETITIONS
Hip	Flexion- extension	20 Repetitions
	Abduction-adduction	20 Repetitions
	Medial- lateral rotation	20 Repetitions

- **Sitting position:**

JOINT	MOVEMENTS	REPETITIONS
Knee	Flexion-extension	20 Repetitions
Ankle	Plantar-dorsiflexion	20 Repetitions
	Inversion – Eversion	20 Repetitions

Cycling:

Experimental group receives bilateral training using a static cycle for a period of 15- 20 minutes.

Post test:

After giving the treatment the individuals were assessed using Fugl-Meyer scale and Step test.

DATA PRESENTATION AND ANALYSIS

IV DATA PRESENTATION AND ANALYSIS

CONTROL GROUP:

TABLE 1:STATISTICAL ANALYSIS OF FUGL MEYER SCALE USING PAIRED T TEST

FUGL MEYER SCALE	MEAN	STANDARD DEVIATION	STANDARD ERROR MEAN	T	SIGNIFICANCE
Pre test	16.4	1.54919	0.40000	18.06	0.05
Post test	19.8667	1.55226	0.40079		

FIGURE 1: STATISTICAL ANALYSIS OF FUGL MEYER SCALE USING PAIRED T TEST:

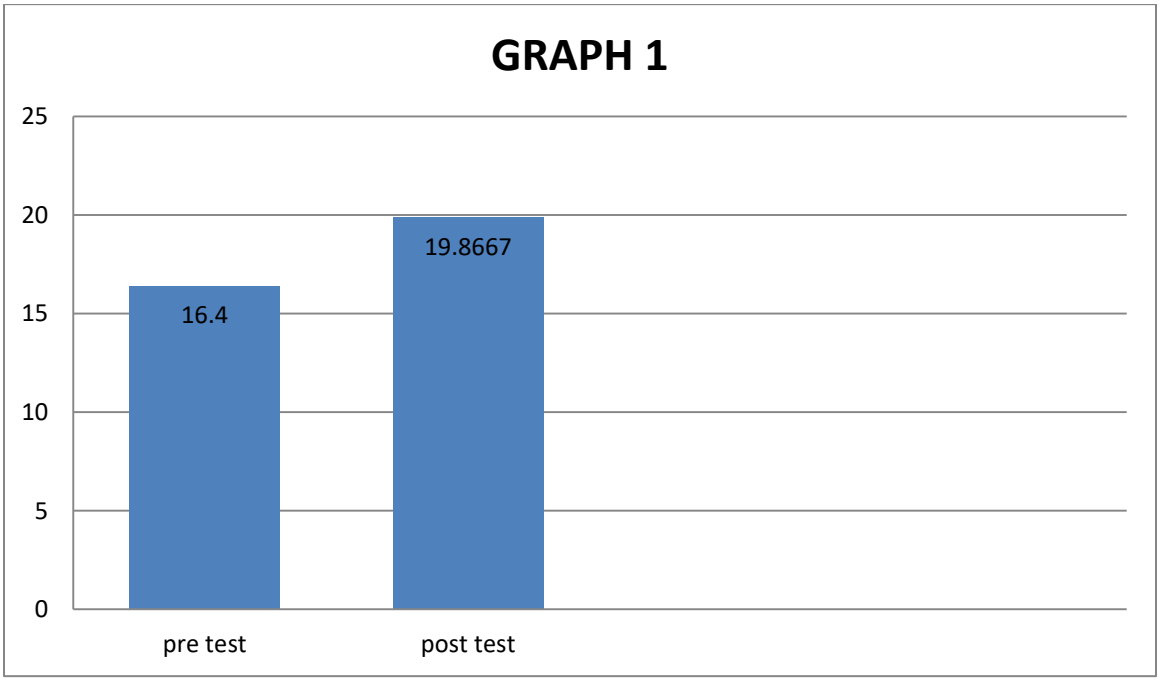
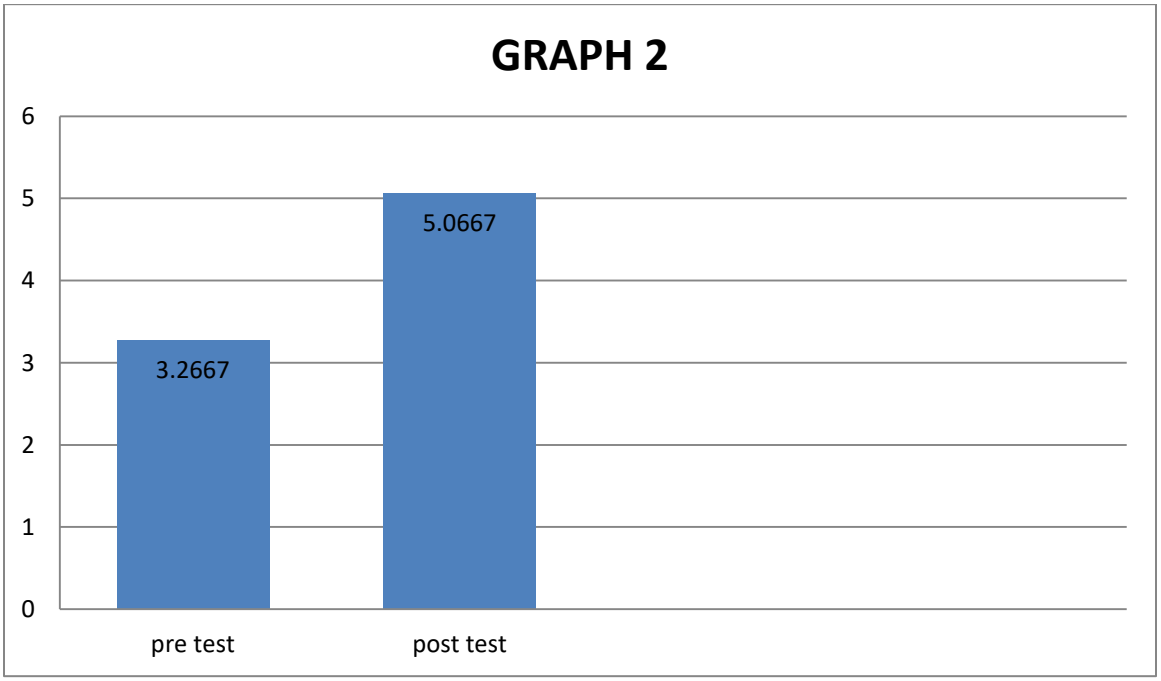


TABLE 2:STATISTICAL ANALYSIS OF STEP TEST USING PAIRED T TEST

STEP TEST	MEAN	STANDARD DEVIATION	STANDARD ERROR MEAN	T	SIGNIFICANCE
Pre test	3.2667	0.79880	0.20624	12.43	0.05
Post test	5.0667	0.88371	0.22817		

FIGURE 2: STATISTICAL ANALYSIS OF STEP TEST USING PAIRED T TEST:



EXPERIMENTAL GROUP:

TABLE 3:STATISTICAL ANALYSIS OF FUGL MEYER SCALE USING PAIRED T TEST:

FUGL MEYER SCALE	MEAN	STANDARD DEVIATION	STANDARD ERROR MEAN	T	SIGNIFICANCE
Pre test	16.8667	1.45733	0.37628	56.50	0.05
Post test	27.1333	1.76743	0.45634		

FIGURE 3: STATISTICAL ANALYSIS OF FUGL MEYER SCALE USING PAIRED T TEST:

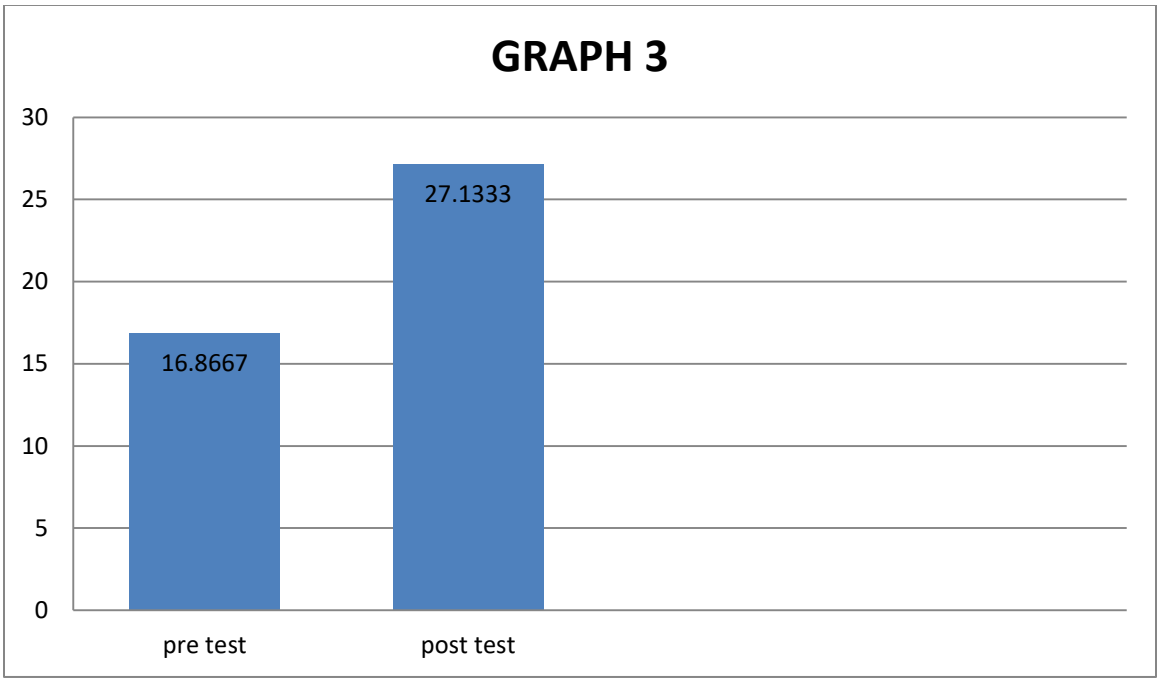
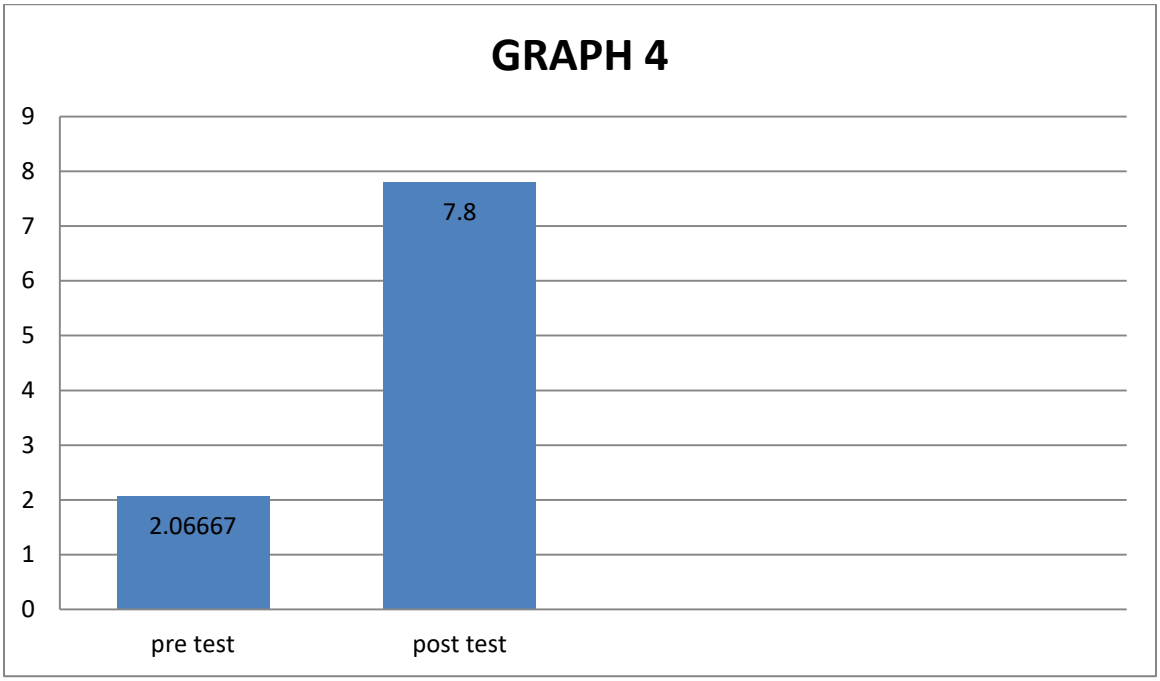


TABLE 4:STATISTICAL ANALYSIS OF AND STEP TEST USING PAIRED T TEST:

STEP TEST	MEAN	STANDARD DEVIATION	STANDARD ERROR MEAN	T	SIGNIFICANCE
Pre test	2.06667	0.70372	0.18169	20.19	0.05
Post test	7.8	1.08233	0.27944		

FIGURE 4: STATISTICAL ANALYSIS OF STEP TEST USING PAIRED T TEST:



USING INDEPENDENT T TEST:

TABLE 5:STATISTICAL ANALYSIS OF FUGL MEYER SCALE MEAN DIFFERENCE:

GROUP	MEAN	STANDARD DEVIATION	STANDARD ERROR MEAN	MEAN DIFFERENCE	T	SIGNIFICANCE
EXPERIMENTAL GROUP	10.2667	0.703729	0.18170	6.8	25.73	0.05
CONTROL GROUP	3.4666	0.74322	0.19189			

FIGURE 5: STATISTICAL ANALYSIS OF FUGL MEYER SCALE MEAN DIFFERENCE:

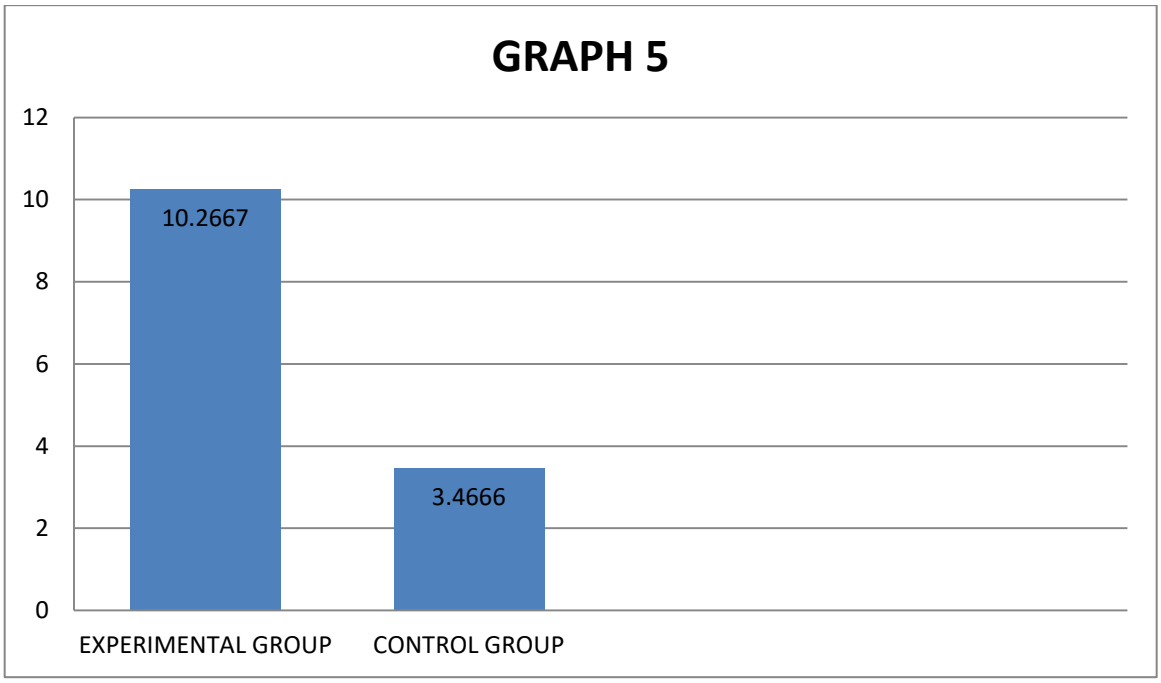
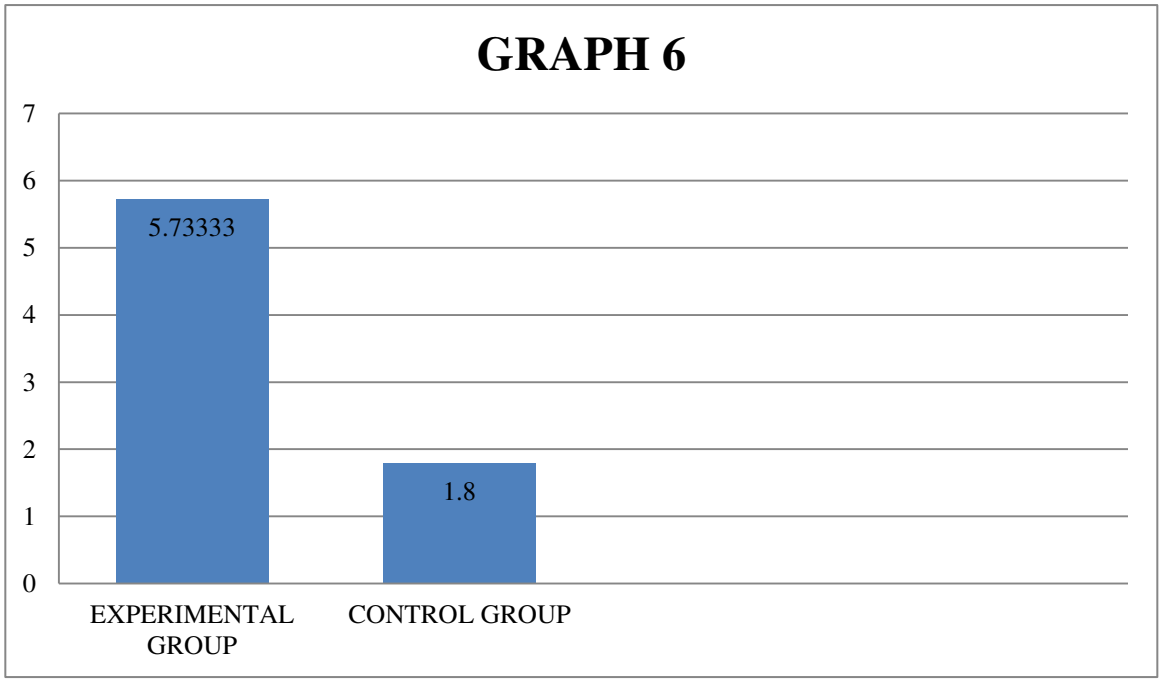


TABLE6: STATISTICAL ANALYSIS STEP TEST MEAN DIFFERENCE:

GROUP	MEAN	STANDARD DEVIATION	STANDARD ERROR MEAN	MEAN DIFFERENCE	T	SIGNIFICANCE
EXPERIMENTAL GROUP	5.73333	1.09978	0.2839	3.9333	12.34	0.05
CONTROL GROUP	1.8	0.56061	00.14474			

FIGURE 6: STATISTICAL ANALYSIS STEP TEST MEAN DIFFERENCE:



RESULTS AND DISCUSSION

RESULTS

Fugl Meyer Assessment:

- Effectiveness of conventional physiotherapy (control group)

While comparing the pre-test and post test values of control group using paired‘t’ test, the calculated t value is 18.06. When comparing the mean values of both, the post-test mean value is 19.8667 which is greater than the pre-test mean 16.4. Hence it confirms that there is a significant difference in post-test control group than pre-test control group.

- Effectiveness of Bilateral leg training and conventional physiotherapy (experimental group)

While comparing the pre-test and post-test values of experimental group using paired ‘t’ test, the value is 56.50. When comparing the mean values of both, the post-test mean value 27.1333 which is greater than the pre-test mean 16.8667. Hence it confirms that there is a significant difference in post0test experimental group than pre-test experimental group.

STEP TEST:

- Effectiveness of conventional physiotherapy (control group)

  While comparing the pre-test and post-test values of control group using paired ‘t’ test, the calculated t value is 12.43.When comparing the mean values of both, the post test mean value is 5.0667 which is greater than the pre-test mean 3.2667. Hence it confirms that there is a significant difference between the pre test and post test values in control group.

- Effectiveness of Bilateral leg training and conventional physiotherapy (experimental group)

  While comparing the pre-test and post-test values of experimental group using paired ‘t’ test, the calculated t value is 20.19. There is significant difference between the pre-test and post-test values of experimental group. When comparing the mean values of both, the post-test mean value 7.8 is greater than the pre-test mean value 2.06667. Hence

  it confirms that there is a significant improvement in post-test experimental group than pre-test experimental group.

DISCUSSION

This study was an experimental approach to find the effectiveness of repeated bilateral leg training to improve the lower extremity performance in MCA stroke patients.

The age of the subject were almost identical in both experimental and control group. The duration of the condition was three to six month after onset. Eight males and seven females were in control in experimental group.

Both groups were assessed on the first day and last day of the treatment. The tool taken to measure the outcome was Fugl Meyer lower extremity motor performance scale and the total score is thirty four. It assesses the impairment in motor performance. It has been shown to be valid and reliable tool for assessing motor function (Duncan P et al 1983). Another outcome measure used is Step test. It also has been shown to be valid and reliable (Vicki Stemmons Mercer 2009).

The control group was given conventional physiotherapy which includes range of motion exercises, functional mobility exercises, strengthening exercises, balance training and gait training. Repeated bilateral leg training was additionally given to experimental group while rests of the treatments were same.

A three week treatment program administered to the experimental group in adjunct to conventional physical therapy to improve the motor function. This support the hypothesis that repeated training program bilaterally improves the lower extremity motor function of post stroke. While comparing the gain obtained by both groups it evident that experimental group performed better than the control group.

On statistical analysis of Fugl Meyer lower extremity score, paired t test showed significant difference in pre test and post test scores of both control group and experimental group.

On statistical analysis of Fugl Meyer lower extremity examination, independent t test showed significant difference in experimental group over control group.

On statistical analysis of Step test, paired t test showed significant difference in pre test and post test scores of both control group and experimental group.

On statistical analysis of Step test score, independent t test showed significant difference in experimental group over control group.

Recently bilateral training has emerged from the motor control literature as promising strategies for stroke patients (S J Page et al). Studies conducted in upper limb indicate it as a favorable method (Jill Whittal et al).

Practicing bilateral movements in synchrony and in alteration may result in facilitation effects from the non paretic limb to the paretic limb. When bimanual movements are initiated simultaneously, the limb act as a unit that supersedes individual limb action, indicating that both limb are strongly linked as co-ordinated unit in the brain (Kelso Jas et al 1983).

Bilateral training induces functionally relevant recruitment of contralesional motor cortex in chronic stroke survives (A R Luft et al 2003).

Another proposed mechanism is plasticity. Researches demonstrated that even a simple novel thumb movement sequence repeated over a time induces cortical representation changes and these representations enlarge as learning occurs. These cortical changes following motor task learning have traditionally been called plasticity (Classen et al).

Cycling leg exercise while sitting incorporates bilateral assisted active training, the paretic limb cycles with the help of non paretic limb. Thus while strengthening the lower limb muscle; cycling exercises also encourage muscle control of lower limb which may enable patient to take more weight through affected leg while standing (Kautz S A, Brown D A 1998).

After bilateral arm training with auditory cueing, MRI showed novel or enlarged activation on the primary cortex of non injured contra-lesional hemisphere (J Whitall et al 2004).

The role of contralesional hemisphere is said to be critical in motor recovery of unilateral stroke patients. Functional magnetic resonances imaging study shows that the damaged hemisphere has increased blood flow when bilateral movements are made. These data are consistent with the idea that activity of undamaged hemisphere (Staines W R, Mcllroy et al 2001). Bilateral arm movement training appears helpful in post stroke rehabilitation; this might be due to facilitation of contralesional hemisphere.

Another proposed mechanism is that bilateral training is optimal for stroke patients because they receives proprioceptive and visual feedback from the unaffected limb that they do not receive during unilateral practice in which only the affected limb is used. Indeed when practicing bilateral a patient can use the unaffected extremity's neurologically intact afferent and efferent signals, and look and feel the movement within that limb, to promote similar movement in affected limb. The visual input of seeing the unaffected limb performing an action may also provide a model with which the patient can better move the affected limb and become more successful (Stephen J Page et al 2005).

This study suggests that a bilateral training program for the lower extremites of post strokre hemiplegia patients leads to significant functional gains. The method appears simple and so it will be a very useful training method for stroke patients. All the recent datas suggests that the impropvement by bilateral training results from the mechanism of neuroplasticity. We can conclude that a bilateral training procedure for the lower extremity in hemiplegic patients is better compared to the unilateral training procedure.

SUMMARY AND CONCLUSION

SUMMARY AND CONCLUSION

Summary:

The purpose of the study determines effectiveness of repeated bilateral leg training to improve lower extremity motor performance in subacute stroke patients. For the study an experimental approach to pre-test post test control group design was used. Population included unilateral MCA stroke patients. Sample size was 30 and by random sampling method, they were divided into two groups, a control group (Group A) and an experimental group (Group B) of 15 subject each. The tools selected for measuring outcome was Fugl Meyer lower extremity motor performance score to obtain lower extremity motor performance (with a maximum score of 34) and step test.

The data was collected before and after administration of treatment program. Duration of the treatment program was three weeks. Control group was given conventional physiotherapy and experimental group was given 40 minutes of repetitive bilateral leg training in addition to conventional physiotherapy. The data obtained were analysed using‘t’ test.

The result of statistical analyses showed significant improvement in the experimental group over the control group. Thus it can be concluded that repetitive bilateral leg training can be used to improve the lower extremity motor performance in post stroke hemiplegic patients.

Conclusion

Repetitive bilateral leg training is an effective method for improving; lower extremity motor function in hemiplegic middle cerebral artery stroke patients.

It has been shown to improve lower extremity motor functions and the patients find the method relatively easy to perform. So bilateral training can be considered as an effective method for home or clinical based rehabilitation of stroke patients.

LIMITATIONS AND SUGGESTIONS

LIMITATIONS:

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

SUGGESTIONS:

- To establish efficacy of the treatment a large sample size study is required.
- To make the results more valid a long term study may be carried out.
- Conduct the study outcome measures such as gait analyses, walking speed etc.

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APPENDICES

APPENDIX I

CONSENT FORM

I……..aged…….yrs, voluntarily consent to participate

the research named **"THE EFFECTIVENESS OF REPEATED BILATERAL LEG TRAINING TO IMPROVE LOWER EXTREMITY MOTOR PERFORMANCE IN MCA STROKE PATIENTS".** The researcher has explained me the treatment approach in brief, risk of participation and has answered all the questions pertaining to the study to my satisfaction.

Signature of Subject **Signature of Researcher**

APPENDIX II

EVALUTION FORM

Subjective Assessment

Name :

Age :

Sex :

Occupation :

Address :

Chief Complaint :

History of present illness :

Past medical history :

Drug history :

Family history :

Social history :

Personal history :

General Examination :

Vital signs

Temperature

Pulse rate

Respiratory rate

Blood pressure

Cardiovascular system

Respiratory system

Objective Assessment

Neurological examination

- Higher functions:
    - Level of consciousness

Glasgow coma scale (E4 M6 V5)

- Eye opening

Spontaneous - 4

To speech - 3

To pain - 2

No response - 1

- Best motor response

Follows motor commands - 6

Localizes pain - 5

Withdrawal - 4

Abnormal flexion - 3

Abnormal extension - 2

No response - 1

- Verbal response

  Oriented - 5

  Confused conversation - 4

  Inappropriate words - 3

  Incomprehensible sounds - 2

  No response - 1

- Orientation

  Time

  Place

  Person

- Attention
- Cognition
  - Fund of knowledge
  - Calculation ability
  - Proverb Interpretation

  Mini mental state examination test is used to assess cognition

- Co-operation

- Memory

  Declarative

  Non declarative

  Long term

  Short term

- Cranial nerve examination

Nerves	Right	Left
Olfactory		
Optic		
Oculomotor		
Trochlear		
Trigeminal		
Abducent		
Facial		
Vestibulocochlear		
Glossopharyngeal		
Vagus		
Spinal accessory		
Hypoglossal		

- Sensory Examination

  Sensory assessment scale

Intact : normal, accurate

Decreased : Delayed response

Exaggerated : Increased sensitivity

Inaccurate : Inappropriate perception of a given stimulus

Absent : no response

Inconsistent : unable to assess

ASIA Sensory Scoring

- - absent
- - impaired
- - normal

NT - Not testable

Sensation includes:

Superficial (pain, touch, temperature, pressure)

Deep (movement sense, position sense, vibration sense)

Combined cortical (two point discrimination, graphasthesia, stereognosis, tactile localisation, double simultaneous stimulation, barognosis, recognition of texture)

- Motor examination
  - Muscle power

- - No palpable or observable muscle contraction
- – palpable muscle contraction, no observable motion
- – full available ROM against gravity minimizes plane, no resistance
- – full available ROM against gravity, no resistane
- – Full available ROM against gravity nearly moderate manual resistance
- - Full available ROM against gravity, strong manual resistance

b) Tone

Assess hypertonicity and hypotonicity

- Girth measurement
- Deep tendon reflexes
  - - no response

    1+ - present but depressed

    2+ - average, normal

    3+ - increased, brisker than average

    4+ -very brisk hyperactive with clonus

Deep tendon reflexes are (biceps, bracheoradialis, triceps,fingerflexors, hamstring, quadriceps,tendo Achilles, jaw jerk

- Superficial reflex (plantar reflex, abdominal, corneal, cremestric)
- Primitive reflexes (ATNR, STNR, tonic neck reflex, tonic labrynthine reflex, flexor withdrawal, grasp reflex, moro, startle,sucking, rooting)
- Range of Motion

- Co-ordination (non-equilibrium, equilibrium test)
- Balance assessment scales (berg balance scale)
- Gait assessment (observational gait analysis, step length, stride length, cadence)
- Functional assessment (Barthel index)
- Investigation

  MRI and CT scan report

  Other interventions (blood, EEG, ECG)

M) Problem list

Primary

Secondary

N) Aims

O) Recommendation

P) Follow up.

FUGL-MEYER ASSESSMENT FOR LOWER EXTREMITY

- **Reflex activity**
    - Subject is supine or sitting.
    - Attempt to elicit the Achilles and patellar reflexes.
    - Assess the unaffected side first.
    - Test affected side.
    - Scoring (maximum possible score= 4)
        - 0- No reflex activity can be elicited.
        - 2- Reflex activity can be elicited. Items to be scored are Achilles and patellar reflexes.

- **Flexor synergy**
    - Subject is supine.
    - Have patient perform movement with unaffected side first.
    - On the affected side, check subject's available PROM at each joint to be tested.
    - Start with leg fully extended at hip, knee, and ankle. Instruct the subject to "bring your knee to your chest" (therapist is observing for evidence of hip, knee, ankle flexion in order to assess the presence of all components of flexor synergy). Therapist can cue the patient to move any missing component.
    - Test 3x on the affected sided and score best movement at each joint.
    - Scoring (maximum possible score= 6)
        - 0- cannot performed at all
        - 1- partial motion

- 2- full motion

  Items to be scored are: hip flexion, knee flexion, and ankle dorsiflexion.

- **Extensor synergy**
  - Subject is sidelying.
  - Have patient perform movement with unaffected side first.
  - On the affected side, check subject's available PROM at each joint to be tested.
  - Start in 90 degrees knee flexion and ankle dorsiflexion.
  - Instruct the subject to "push your foot down and kick down and back".(ankle plantarflexion, knee extension, hip adduction and hip extension.)
  - Slight resistance should be applied in adduction which is gravity-assissted in the position to ensure subject is actively doing it.
  - Test 3x on the affected side and score best movement at each joint.
  - Scoring (maximum possible score=8)
    - 0- No motion
    - 1- partial motion
    - 2- full motion

      Items to be scored are: hip extension, hip adduction, knee extension, ankle plantarflexion.

- **Movement combining synergies (in sitting)**
  - Knee flexion beyond 90 degree
  - Subject is sitting, feet on floor, with knees free of chair. Knee to be tested is slightly extended beyond 90 degree knee flexion. Calf muscles should not be

stretch. To drecrease friction, subject's shoes can be removed, but socks should remain on.

- Have patient perform movement with unaffected side first.
- Subject is instructed to "pull your heel back and under the chair."
- Test 3x on the affected side and score best movement.
- Scoring (maximum possible score=2):
    - 0- No active motion
    - 1- From slightly extended position, knee can be flexed but not beyond 90 degree.
    - 2- Knee flexion beyond 90 degree.

- **Ankle dorsiflexion**
    - Subject is sitting, feet on floor, with knees free of chair. Calf muscles should not be on stretch.
    - Have patient perform movement with unaffected side first.
    - On the affected side, check subject's available PROM at the ankle join.
    - Subject is instructed to "keeping your heel on the floor, lift your foot."
    - Test 3x on the affected side and score best movement.
    - Scoring (maximum possible score= 2):
        - 0- No active motion
        - 1- Incomplete active flexion
        - 2- Normal dorsiflexion

- **Movement out of synergy(standing, hip at 0 degrees)**
    - Knee flexion
        - Subject is standing, hip at 0 degrees (or full available ROM up to 0 degrees). On leg that is being tested, hip is at 0 degree (or full available ROM up to 0 degrees), but the knee is flexed, and the subject's toes are touching the floor slightly behind. Evalutor can provide assistance to maintain balance and subject can rest hands on table.
        - Have patient perform movement with unaffected side first.
        - Subject is instructed to "keeping your hip back, kick your bottom with your heel"
        - Test 3x on the affected sided and score best movement.
        - Scoring (maximum possible score=2):
            - 0- Knee cannot flex without hip flexion
            - 1- knee flexion begins without hip flexion but does not reach to 90 degree or hip begins to flex in later phase of motion

              2- knee flexion beyond 90 degree (knee flexion beyond 90 degree with hip maintained in extension)

    - Ankle dorsiflexion
        - Subject is standing hip at 0 degrees. If subject's calf muscle length is limiting active dorsiflexion in this starting position, then leg that is being tested can be positioned forward, so the hip is at approximately 5 degree of flexion, and calf muscles are in lengthened position. Knee must stay fully extended. Evaluator

can provide assistance to maintain balance and subject can rest hands on a table.

- Have patient perform movement with unaffected side first.
- On the affected side, check subject's available dorsiflexion PROM.
- Subject is instructed to "keeping your knee extended and your heel on the floor, lift your foot".
- Test 3x on the affected side and score best movement.
- Scoring (maximum possible score=2):
    - 0- No active motion
    - 1- Partial motion (less than full available range with knee extended; heel must remain on floor with medial and lateral borders of the forefoot clearing the floor during dorsiflexion.
    - 2- Full motion (within available dorsiflexion range with knee extended and heel on the floor)

- **Normal Reflexes (sitting)**
    - Only done if the subject attains a score of 4 on section v(ie, if the subject does not score a 2 on each of the pervioys items, then score this item 0)
    - The examiner shall elicit patellar and Achilles phasic reflexes with a reflex hammer and knee flexors with quick stretch of the affected leg and note if the reflexes are hyperactive or not.
    - Scoring (maximum possible score= 2):
        - 0- At least 2 of the 3 phasic reflexes are markedly hyperactive.
        - 1- One reflex is markedly hyperactive or at least 2 reflexes are lively
        - 2- No more than one reflex is lively and none are hyperactive.

- **Coordination/speed- sitting: heel to opposite knee repetitions in rapid succession**
    - Subject positioned in sitting with eyes open.
    - Have patient perform movement with unaffected side first.
    - Subject is instructed to "Bring your heel from your opposite ankle to your opposite knee, keeping your heel on your shin bone, move as fast as possible".
    - Use a stopwatch to time how long it takes the subject to do 5 full (ankle to knee to ankle) repetitions.
    - Use the full achieved active ROM in the unaffected limb as the comparison for the affected limb. If active ROM of affected limb is significantly less than that of affected limb, patient should be scored "0" for speed.
    - Repeat the same movement with the affected leg. Record the time for both the unaffected and affected sides. Observe for evidence of tremor or dysmetria during movement.
    - Scoring tremor (maximum possible score= 2)
        - 0- marked tremor , 1- Slight tremor, 2- No tremor
    - Scoring Dysmetria (maximum possible score=2)
        - 0- pronounced or unsystematic dysmetria
        - 1- Slight or systematic dysmetria
        - 2- No dysmetria
    - Scoring speed (maximum possible score=2):
        - 0- Activity is more than 6 seconds longer than unaffected leg
        - 1- 2-5.9 seconds longer than unaffected leg
        - 2- Less than 2 seconds difference.

STEP TEST

- The step test assesses an individual's ability to place one foot onto a 7.5cm high step and then back down to the floor repeatedly as fast as possible for 15 seconds.
- The score is the number of steps completed in the 15 second period for each lower extremity.
- Participants were permitted to were any customary orthoses but, in accordance with published procedures for standardized administration, were not permitted to use an assistive device during testing.
- Both sides were tested, with participants completing the test first with the nonparetic foot and then with the paretic foot. Scores for lower extremity were recorded separately, as well as the sum of these 2 scores.
- Participants who were unable to stand unsupported were given a score of 0 for both lower extremities. Test-retest reliability of the ST is high, with intraclass correlation coefficients (ICCs) greater than .88 in people undergoing inpatient rehabilitation after stroke.
- The ST has evidence of validity, in that scores correlate with other clinical tests of balance and mobility, and scores for ST performance with the nonparetic limb as the stepping limb as the stepping limb correlate with force platform measures of paretic lower extremity loading.

APPENDIX III

DATA ANALYSIS

FORMULAS USED FOR CALCULATIONS

1. MEAN $$\mathbf{d = \frac{\Sigma d}{n}}$$

2. STANDARD DEVIATION $$\mathbf{S.D = \sqrt{\frac{\Sigma(d-\bar{d})^2}{n-1}}}$$

3. STANDARED MEAN ERROR $$\mathbf{SME = \frac{S.D}{\sqrt{n}}}$$

4. PAIRED 't' TEST $$\mathbf{t = \frac{d\sqrt{n}}{S.D}}$$

where,

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

n = Sample size

S.D = Standard deviation

d = Difference between pre and post test

5. UNPAIRED 't' TEST

$$\mathbf{s} = \sqrt{\frac{(n_1-1)s_1^2+(n_2-1)s_2^2}{n_1+n_2-2}}$$

$$\mathbf{t} = \frac{\overline{x_1}-\overline{x_2}}{s\sqrt{\frac{1}{n_1}+\frac{1}{n_2}}}$$

where,

n_1 = Total number of subject in Group A

n_2 = Total number of subject in Group B

x_1 = Difference between pre test & post test values of Group A

x_2 = Difference between pre test & post test values of Group B

x_1 = Mean difference between pre test & post test values of Group A

x_2 = Mean difference between pre test & post test values of Group B

APPENDIX IV

MASTER CHART

Fugl meyer assessment

Pre test and post test values of control and experimental groups

NO	CONTROL GROUP		EXPERIMENTAL GROUP	
	PRE TEST	POST TEST	PRE TEST	POST TEST
1	14	18	18	29
2	17	19	17	28
3	15	19	15	26
4	18	22	17	27
5	15	18	19	29
6	17	19	17	26
7	16	20	16	25
8	18	22	17	27
9	17	20	18	29
10	16	20	18	28
11	17	20	16	26
12	19	23	15	25
13	18	21	17	28
14	15	19	19	30
15	14	18	14	24

STEP TEST

Pre test and post test values of control and experimental groups

NO	CONTROL GROUP		EXPERIMENTAL GROUP	
	PRE TEST	POST TEST	PRE TEST	POST TEST
1	3	5	1	6
2	3	5	2	7
3	3	4	3	8
4	4	6	3	8
5	5	6	2	7
6	3	5	2	6
7	4	6	1	8
8	4	5	2	9
9	3	6	2	9
10	2	4	3	10
11	2	3	2	8
12	3	5	3	7
13	4	6	2	8
14	3	5	1	8
15	3	5	2	8