P-ISSN: 2394-1685
E-ISSN: 2394-1693
Impact Factor (ISRA): 5.38
IJPESH 2021; 8(2): 103-108

www.kheljournal.com
Received: 19-01-2021
Accepted: 21-02-2021

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Effectiveness of task oriented walking intervention on improving balance in MCA stroke patients

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Abstract
Background: Stroke is the leading cause of adult disability. Balance dysfunction is common in stroke victims which indeed affect functional performance in life. Task oriented walking intervention is a simple intervention by which we can attain balance as early as possible.
Objective: To find out the effect of task oriented walking for improving balance in stroke patients.
Method: The study was an experimental design and the study setting was at physical medicine and rehabilitation department Matha Hospital, Tellakam. 30 patients with left MCA stroke between the age group of 55-65, were assigned in to two treatment groups. Group A (Control Group) and Group B (Experimental Group). The group A (n=15) treated with conventional method. The group B (n=15) were treated with Task Oriented Walking along with conventional treatment. Duration of the treatment was 6 weeks with 5 days in a week. Outcome was measured using Berg Balance Scale, Timed Get Up and Go Test and ABC Scale prior to and at the end of the treatment program.
Results: Both group showed significant improvement in balance after the rehabilitation program. The experimental group showed a statistically significant improvement in balance when compared to the control group at 1% level of significant.
Conclusion: Stroke patients who received Task Oriented Walking along with conventional physical therapy showed a statistically significant improvement in balance than control group. It can be in corporate in the management of stroke patients for improving balance. A well designed trial is needed to study the effectiveness of Task Oriented Walking in improving balance in large group and to know its long term effect.

Keywords: physical fitness, pulse rate, non-sportsmen, Sirsa

Introduction

Stoke is defined as a condition characterized by rapidly developing symptoms and signs of a focal brain lesion with symptoms lasting for more than 24 hours or leading to death with no apparent cause other than vascular origin. (WHO, 1989) [8].

Stroke is also known as cerebrovascular accident, is a rapid loss of brain function due to disturbance in the blood supply to the brain. This can be due to ischemia caused by blockage or a haemorrhage (Wikipedia). Brain cell function requires a constant delivery of oxygen and glucose from the blood stream. A stroke occurs when blood supply to part of part of the brain is disrupted, causing brain cell to die. (Medicine.net)

Stroke is the major cause of morbidity and mortality. India annual incidence of stroke was 130/100000 population. The incidence of stroke rises rapidly with increasing age, two third of all people other than 55. (Umpherd DA, 2001) [3]. It is the third leading cause of death and the most common causes of disability. The incidence of stroke about 1.25 times greater for males than females. About 22% of women with an initial stroke will die within 1 year. (Susan O Sullivan)

The middle cerebral artery (MCA) is one of the three paired arteries that supply blood to the cerebrum. The MCA arises from the internal carotid and continue into the lateral sulcus where it then branches and projects to many parts of the lateral cerebral cortex. It also supplies blood to the anterior temporal lobe and insular corties. The left and right MCA rises from trifurcation of the internal carotid artery, and thus are connect to the anterior cerebral arteries and posterior communicating arties, which connect to the cerebral arteries. (Wikipedia)

After coronary heart disease and cancer of all type, stroke is the third commonest causes of death worldwide. (Banerjee T.K. 2006) [5]

Balance is the ability to of maintain the centre of gravity over the BOS, usually while in an upright position. Balance is a dynamic phenomenon that involves a combination of stability and mobility. Balance is necessary to hold a position in space in a controlled and co-ordinated manner. (Carolyn Kisner)

Balance control is a complex sensory and motor skill. It requires spatial and temporal integration of sensory input enabling the planning and execution of movement pattern that are necessary for central body mass with in the BOS. (Horak FB *et al.*, 1997) [38]

Balance problem in hemi paretic patients after stroke can be caused by different impairment in the physiological system involved in postural control, including sensory afferent, movement strategies, biochemical constraints, cognitive processing and perception of verticality. (JRRD, Oliverira, 2008)

Re-establishment of balance function after stroke is an important construct is physiotherapy practice. Balance retraining programme is any intervention design to help an individual to attain body maintenance in both static and dynamic equilibrium. (Juneja *et al.*, 1998) [19].

Balance problem in stroke are divided into

1) Static Balance –It is the ability to maintain posture in a resting position

2) Dynamic balance –It is the ability to maintain posture control during the performance of functional task. (African journal of neurological Science, 2002)

Balance is thought to be of great significance as it is an integral part of all movement. It can be defined as the ability to maintain or recover the body's BOS, to prevent falling and complete required movement. (Physical Education and Sports, 2011)

The efficacy of a Task oriented walking intervention is improving balance self-efficacy in person with stroke. The most commonly occurring deficit, is to the lower limb, resulting in an immediate impairment, to balance and walking ability. Self-efficacy is defined as a judgement of one's ability to organize and execute given types of performance. (The American Geriatrics Society, 2005)

Data on balance self-efficacy, operational level of confidence a person has in performing activities without losing balance or becoming unsteady, were available from a randomized controlled trail that was designed to evaluate the efficacy of a task oriented intervention in enhancing walking ability in community dwelling person with stroke. (Salbach NM, 2004)

Material Used

- Brunnstrom recovery stage of hemiplegia
- Chair with back rest
- Soccer ball
- Obstacle
- Balance beam
- Stop watch
- Assessment chart
- Data collection sheet

Procedure for the study

30 subjects who are fulfilled inclusion criteria recruited using non-probability convenient sampling and allocated into the group. Namely control group (Group A) and experimental group (Group B). Each group contain 15 patient each. Group B (Experimental Group) received conventional Physiotherapy Task oriented Walking Intervention.

Treatment Protocol

Group A (Control Group)

1. Active assisted ROM Exercise

A. Upper Limb

- Shoulder girdle-Protraction, retraction, elevation and depression
- Gleno humeral joint –Flexion, Extension, adduction, abduction, internal rotation, external rotation.
- Elbow joint-flexion, extension
- Forearm –Supination, pronation
- Wrist –flexion, extension, radial deviation, ulnar deviation
- Metacarpophalageal joint –Flexion, Extension
- Inter-phalangeal joint-Flexion, Extension.

B. Lower Limb

- Hip Joint- Flexion, Extension, abduction, adduction, internal rotation, external rotation
- Knee Joint – Flexion, Extension
- Ankle Joint – Dorsiflexion, plantar flexion, eversion, inversion

2. Functional Mobility Exercise

A. Activities in sitting

- **Upper Limb Activities**
- With arms extended had flat on the table behind him and move side to side
- With both arm flexed across chest, uses sound hand to draw to the affected scapula forward into protraction
- Hands clasped with elbow extended supported on a table, move weight from side to side.
- Hands rest on chin

- ***Lower Limb Activities***
- Isolated flexion and extension of the pelvis
- Placing hemiplegia leg and facilitating crossing it over the other leg
- Sampling the heel on the floor
- Weight bearing with selective extension

B. Activities in Standing

- **Upper Limb Activities**
- Hitting a balloon with hands clasped together and progress to hemiplegia hand alone
- Modified plantigrade.

- **Lower limb activities**
- Extension of hip with external rotation
- Standing with a rolled bandage under the toes.
- Coming off a high plinth on the hemiplegic limb
- Releasing the hip and knee.

3. Balance Training

Activities in sitting

- Turning both flexed knees to the side
- Reaching forward to touch the floor
- Reaching forward with clasped hands.

Activities in standing

- Standing wide to narrow tandem standing
- Standing on one leg

- Weight transference sideways with knee sideway
- Wobble board exercise

Gait training

- Walking in parallel bar with support
- Walking sideways in parallel bar
- Stair climbing

Group B (Experimental Group)

Received conventional physiotherapy with "Task Oriented Walking Intervention".

Task oriented walking intervention

All patients in experimental group will received Task Oriented Walking along with conventional physiotherapy all days in a week for 6 weeks. Total of 30 days. Patients train on average 1 hour/day.

Task oriented walking consist of 8 training session given a week for 6 weeks. The training intervention was a progressive program of 8 tasks. And the Tasks are

- Standing up
- Walk and sitting down on a chair
- Kicking a soccer ball against the wall
- Walking along the balance beam
- Performing step-up
- Walking on obstacle course
- Walking while carrying an weight
- Walking up and down stairs.

Statistical Analysis

1.1 Comparison of the ages of the control and experimental group

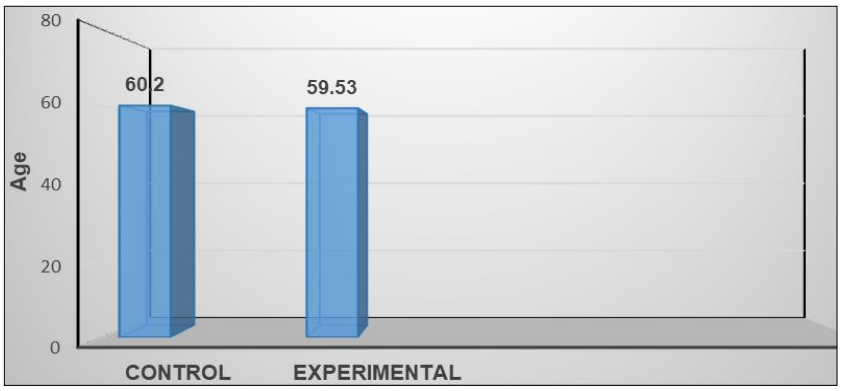

Fig 1: Comparison of the ages of the Control and Experimental Groups

1.2 Gender wise distribution of control and experimental group

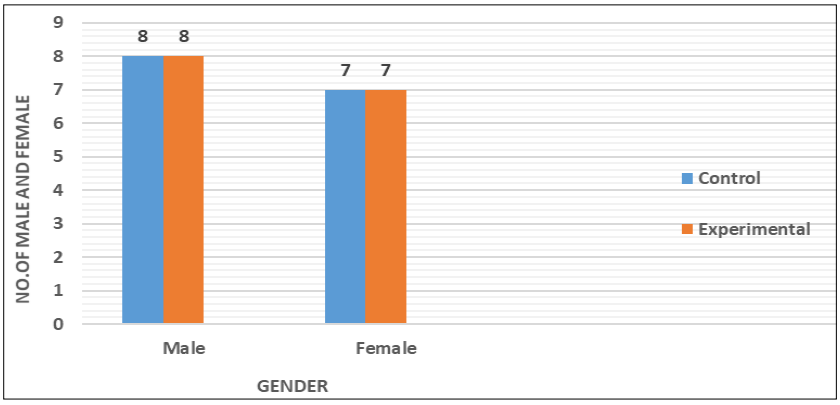

Fig 2: Gender Wise Distribution

1.3 comparison of the BERG values of control and experimental groups

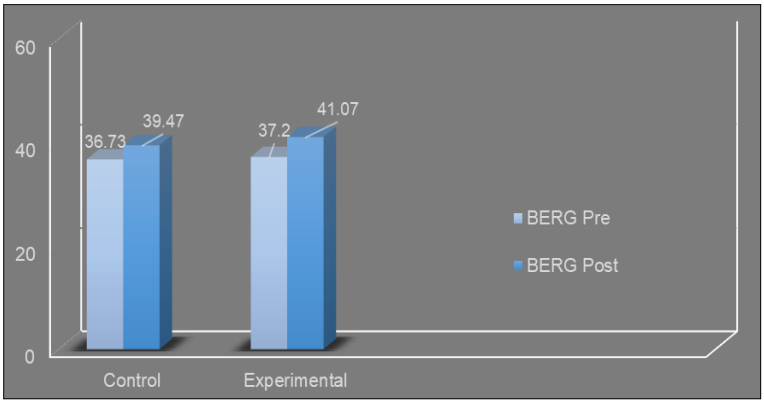

Fig 3: Comparison of the BERG values of control and experimental groups

1.4 Comparison of TUG values of control and Experimental groups

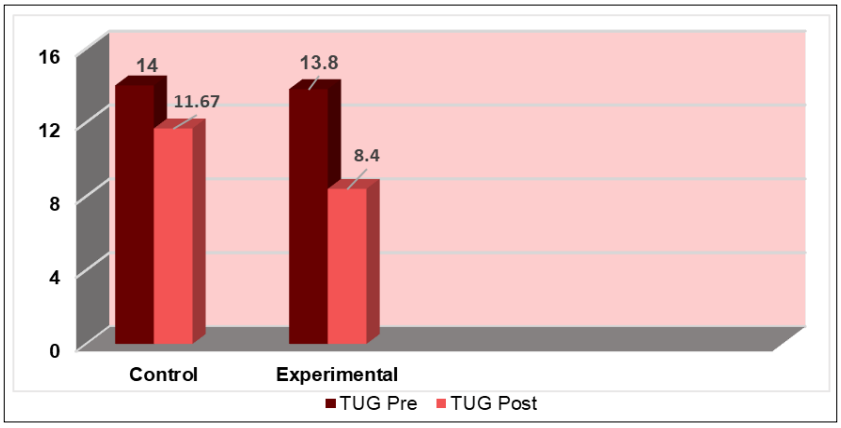

Fig 4: Comparison of the TUG values of Control and Experimental groups

1.5 Comparison of the ABC values of control and Experimental groups

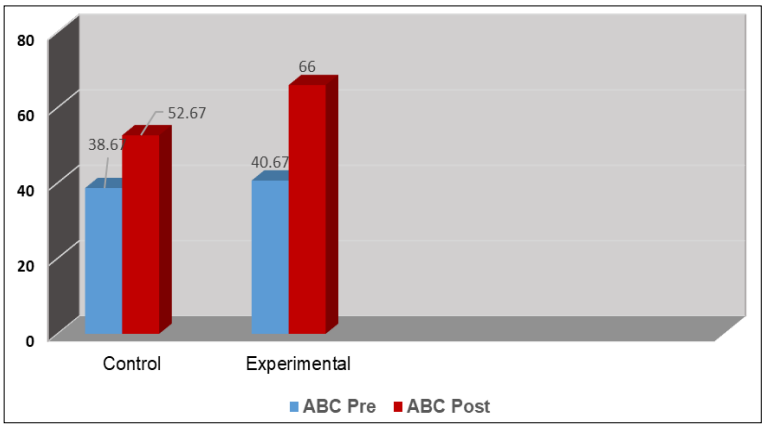

Fig 5: Comparison of the ABC values of Control and Experimental groups

Effectiveness of new method in experimental group

Analysis of Pre and Post berg Score of control group using Paired 't' Test

Group	N	Mean		S_d		t	Significance Level
		Pre	Post	Pre	Post		
Experimental group	15	37.20	41.07	2.042	2.120	-17.960	.000

Mean pre-test of Berg score for the experimental group was 37.20 and mean post test score was 41.07.Sd of pre value is 2.042 and post value is 2.120 and 't' value obtained is -17.960,which is statistically significant at 1% level. Hence there is significant difference between the pre and post berg value at 1% level of significance. The post berg values are significantly greater than the pre berg values in the case of experimental group. Data analysis shows significant improvement in berg score of experimental group. This might be due to the cumulative effect of Task Oriented Walking along with conventional physiotherapy

Result

Stroke patients who received Task oriented walking intervention along with conventional physical therapy showed a statistically significant improvement in balance than who received conventional Physical therapy alone. Task oriented walking intervention can be used in the management of stroke patients to improve balance and thereby increase functional mobility

Discussion

The research was an experimental approach to find out the efficacy of Task Oriented Walking Intervention in improving balance in stroke patient. The sample for study included 30 stroke patients in the Brunstrom lower extremity recovery stage IV and assigned in to control an experimental group 15 each. The age of the subject were almost similar in both groups. The age group between 55 to65 years. The subject were randomly divided in to two groups. Group A (control Group) and Group B (Experimental Group) each consisting of 15 subjects each. Both control group and experimental group consisted of 8 males and 7 females. The outcome measurement was Berg-Balance scale, Timed up and go test and ABC scale. Treatment duration for the control group in each daily session was 30 minutes. Treatment duration for the experimental group in each daily session was one hour. The treatment was given all days in a week for 6 weeks, Total of 30 days. Experimental group consist of 8 training session given in a week for 6 weeks. The training intervention was a progressive program of 8 tasks. Both groups were assessed on the first and last day of treatment. Both control and experimental group received conventional Physical therapy which consisted of active assisted ROH exercises for upper limb and lower limb, Activities in standing for upper limb and lower limb, Balance training for sitting and standing and gait training exercises. Along with conventional Physical therapy, Task oriented walking was given to the experimental group. The mean pre-test score of control group using Berg balance scale was 36.73, TUG was 14.00 and ABC was 38.67 and that

for experimental group was 37.26, 13.80 and 40.67 respectively. After one month treatment program mean of post test score of control group using Berg balance scale was 39.47, TUG was 11.67 and ABC was 52.66 and that for experimental group was 41.07, 8.40 and 66.00 respectively.

Statistical Analysis was done using two sample t test and paired t test. On analysis Pre-Berg scores of control and experimental group show no significance at 5% level and Post-Berg scores of control and experimental group shows significant difference at 5% level. Pre- TUG scores of control and experimental group showed no significance at 5% level and Post-TUG scores of control and experimental group showed significant difference at 1% level. Pre-ABC scores of control and experimental group showed no significance at 5% level and Post- ABC scores of control and experimental group showed significant difference at 1% level. Pre and Post-test values of Berg, TUG and ABC scores of control group showed significant difference at 5%, 5% and 5% level respectively. And also for Pre and Post-test values of Berg, TUG and ABC scores of experimental group is also significant at 5%, 1% and 1% level respectively. So there is statistically significant improvement in balance in stroke patients who received conventional Physiotherapy. So the Null hypothesis is rejected.

Following stroke, Patients loss functions of the motor, Sensory and higher brain cognitive facilities to various degree which leads to diminished to balance. Patient who has suffered a stroke present with abnormal and delayed response in the extremity muscles during standing displacement and dis-oriented proprioception. They also demonstrate postural control problem such as loss of anticipatory activation during voluntary movement, increased sway during quiet standing and decreased area of stability during weight shifting while standing. Also these could result in loss of static and dynamic stability and reduced functional activities. (Nitm S *et al.*, 1999) [20]. Postural stability is the ability to maintain the bodies center of gravity with in its base of support, this is commonly referred to as balance. The ability to balance depends in large part on sensory, muscular and motor system. The three most influential sensory system are the visual, vestibular and somatosensory system. The somatosensory system provide information about the bodies position and contact from the skin through pressure, vibration and tactile sensation as well as joint and muscle to co-operate unconscious reflex in order to maintain balance. (Susan B O'sullivan)

Balance problem are primary disability after stroke, they lead to loss of autonomy and expose patients to high risk of falling. MCA stoke may disrupt corticibullbar projections are collateral of the corticospinal tracts or lie close to the tract and terminate in the pons or medulla. (National stroke association-2002). Balance is an important pre-requisite and prognostic factor for recovery of functional activities including walking and motor functions. Re-establishment of balance function after a stroke is therefore an important. Balance re-training intervention designed to help an individual attain body maintenance in both static and dynamic equilibrium. (Hamzat *et al.*, 2007) [12] Recovery of function after stroke is depends mainly on neuroplasticity. It is defined as the ability of the brain to change and repair itself. Plastic changes after stroke can result from passive adaption of the brain to the lesion, spontaneous recovery of damaged brain tissue, behavioral consequence of the lesion or therapeutic intervention. (James HC, 2005) [32] Bilateral proprioceptive stimulation may facilitate cortical neuroplasticity, by there mechanism (a) Motor cortex disinhibition that allows increased use of spared pathway of the damaged hemisphere. (b) Increased recruitment of the ipsilateral pathway from the contra lesional/contralateral hemisphere to supplement the damaged crossed corticospinal pathway and (c) Up regulation of descending premotor neuron command on the propriospinal neuron. (James H Careugh *et al.*, 2005) [32].

The primary motor cortex is involved in the planning and execution of movement. It works in association with other cortical regions(such as the pre-motor areas, supplementary motor areas and the posterior parietal cortex) in addition to sub-cortical regions (like the thalamus and the basil ganglia) and of course the cerebellum(which is particularly important for co-ordination and fine tuning complicated movement).The cortex receives, and projects a vast amount of information (about the muscle movement, and external environment, balance, sensory, proprioception etc), and it process all of this in a very- very short space of time. It then sends signals to the appropriate body parts and produce voluntary movement. But it doesn't stop here, for there is a constant stream of feedback flowing back in to the cortex. Brain is an extremely dynamic thing and it constantly re-adjusting the connection within itself to cope with the demands of normal function. Information governing involuntary movement (like reflex) never make it to the brain. Instead this is dealt with in the spinal cord (at the reflex arc). (Uk journal, 2010)

Task oriented is able to preferentially activate the self-efficiency. Self-efficiency involves a generative capacity in which component cognitive, social and behavioral skills must be organized into integrated course of action to serve innumerable purpose. Self-efficiency is concerned with judgment of how well one can execute course of action required to deal with prospective situation. (Albert Bandure, 2001) Task oriented training with extensive practice is essential to reacquiring skill and enhancing recovery (Susan B O'sullivan). Bilateral proprioceptive stimulation may induce spiral and cortical reorganization both through the affected and non-affected side (Kimberly. J.J *et al.*, 2004). Hence the discussion can summarized as Task oriented training along with conventional therapy is effective in stroke patients and improving balance.

Limitations

1. Short duration study.
2. Study consist of only small sample size of 30 patients.
3. Right hemiplegic patients of left middle cerebral artery were only consider.
4. The study assessed only the short term progress of the patients
5. Analyses were based on data from a completed trial and were not powered to detect treatment effects in subgroup.

Conclusion

The study proves that The Task Oriented Walking along with conventional physical therapy is more effective than conventional physiotherapy alone in improving balance of post stroke patients. So Task Oriented Walking can be used as an effective treatment program in improving balance in stroke patients along with conventional physical therapy, there by rehabilitating the patients easier than the patient receiving conventional physical therapy alone. This helps the patients to improve quality of life. This can be used as a simple intervention in adjacent to conventional physical therapy in the treatment of stroke rehabilitation.

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