

Effect of Single Task Training Verses Motor Dual Task Training on Functional Balance in Post Stroke Patients

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ABSTRACT

BACKGROUND: The purpose of the study was to find the effect of single task training verses motor dual task training on functional balance in post stroke patients. **METHODS:** Thirty first onset of unilateral ischemic Middle Cerebral Artery (MCA) territory stroke patients were randomly allocated into two groups the single task training group (n=15) received single task strengthening and balance exercises and the motor dual task training group (n=11) received strengthening and balance exercise along with a secondary motor task. Intervention was given 45 minutes per session, once in a day, five days per week for two weeks. The balance was analyzed using Berg Balance Scale (BBS). **RESULT:** In both the groups, balance significantly improved in Berg balance scale. Compared with the single task training group; the motor dual task training group attained very statistically significant improvement. **CONCLUSION:** Motor dual task training exercises effectively promotes balance early in stroke patients.

Key words: Unilateral, MCA Territory, Ischemic Stroke, Berg Balance Scale, Secondary task.

INTRODUCTION

Stroke was defined by the World Health Organization (WHO) more than 40 years ago as “rapidly developing clinical signs of focal (or global) disturbance of cerebral function, lasting more than 24 hours or leading to death, with no apparent cause other than that of vascular origin”.^[1] Balance is the ability to maintain the center of gravity over the base of support, involves the coordination and stability of the body in

the surroundings. It affects most day-to-day activities, such as moving around and reaching for objects, it is often severely affected following a stroke. Of the many systems and organs that provide sensory input to the central nervous system, the somato-sensory, visual, and vestibular systems are the ones most directly involved with balance. The loss or disruption of sensory input in the visual, vestibular, or somato-sensory systems can affect balance in a number of ways. How balance is affected depends on several factors, including the extent of the nervous system damage, the number and extent of sensory losses, and the availability of the other senses for compensation. In many instances, more than one sensory system is impaired. The restoration of balance and gait is one of the main concerns of stroke rehabilitation to increase the independence of patients in many daily living activities and to increase their participation in society.^[2,3] The stroke patients may have difficulty performing 1 activity or at least 2 activities at the same time.^[4] In other words, they may have difficulty focusing their attention on different tasks at the same time^[5] due to misallocation of their attentional resources.^[6] Thus, patients with stroke may need special attention while walking and performing another activity. For instance, Yang et al.^[6] reported that elderly with chronic stroke had disturbed balance and slowed walking speed while performing a motor task, such as carrying a tray with glasses. They may also have an increased risk of falling if they focus their attention on

another activity, such as traffic lights while crossing a road.^[7] Thus, the interest of the researchers in the motor dual-task training approach as a neurophysiologic procedure, and as an additional procedure to the conventional rehabilitation of stroke to restore patients balance is increasing extensively.^[4] Thus, in general, the literature focuses on the assessment of motor dual-task performance of patients with stroke. Therefore, the purpose of this study was to find the effect of single task training verses motor dual task training on functional balance in post stroke patients.

MATERIAL AND METHODOLOGY

Participants: This study is a randomized control study, which includes pre-interventional evaluation, intervention, and post-interventional evaluation. Thirty stroke participants who participated in the intervention were recruited from the department of Physical Medicine and Rehabilitation and department of Neurology, PSG Institute of Medical Sciences and Research hospital, Coimbatore, Tamilnadu, India. Study received and ethical clearance from the Institutional Human Ethics Committee. The participants were screened to ensure that they followed the following inclusion criteria. Ischemic stroke involving Middle Cerebral Artery (MCA) territory on Magnetic Resonance Imaging findings are Computerized Tomography scan, the age group between 40 to 65 years, the first ever unilateral ischemic stroke, the stroke duration less than three months, Mini Mental Score Examination score 23 or above, medically stable, able to follow the commands during the therapy. The exclusion criteria were other neurological conditions, cardio respiratory and musculoskeletal condition, non correctable visual deficit, sensory deficit, severe auditory impairment and perceptual disorder. The informed consent was obtained from the participants before they were enrolled into the intervention. The thirty participants included in the study were

then randomly allocated either to single task training group or to motor dual task training group using the computer generated random number table, with fifteen participants in each group. **Interventions:** The participants of the single task training group received exercises 45 minutes, once in a day, five days per week for two weeks. The exercises were performed in supine, side lying, sitting and standing position. The exercises in supine were static exercises to the quadriceps, hamstring and gluteus muscles, dragging the heel, straight leg raising, pelvic bridging, crossing and uncrossing of the affected limb. The exercises in side lying were bending of knee and hip(flexion and extension), lifting the leg up and holding and the exercises in sitting was weight shifting towards the affected side, raising the leg off the ground and ankle dorsi-flexor training. The exercises in standing were weight shifting in the affected limb. The participants in the dual task training group receive all the strengthening exercise along with standing quietly with usual or reduced base of support, standing with eyes closed and tandem standing, recovery of standing following manual perturbations.^[8] The secondary task involved a manual task (e.g. holding a ball, squeezing the exercise ball, holding a cup, transferring cup from one hand to the other hand and during sitting and standing they performed simultaneous motor tasks such as holding a ball, squeezing the exercise ball, holding a cup, holding a cup of water without spilling, transferring cup from one hand to the other hand, receiving and returning a cup of water, picking and transferring cup of water from and to the table, emptying and filling the cup with water, carrying a tray with glasses, coin transfer, but-toning, bouncing a ball, catching or throwing a ball while sitting and standing). The participants of the dual task training group received exercises 45 minutes, once in a day, five days per week for two weeks. Exercise therapies usually take place one to five times a week for two to six weeks.^[8] An exercise session normally takes 20 to 45 minutes.^[7,9] Along

with the whole exercises; both the group received regular physiotherapy treatment.

Ethical Clearance:

The study followed the ethical standards of institutional human ethics committee, PSG IMS&R. [Ref. project No: 16/360].

Outcome Measure:

Berg balance scale^[10] (BBS) was used to assess the balance, it has 14 items, each item is scored between 0 to 4, with the maximum score of 56. The higher the score indicates the better balance. It was measured before the intervention and after 2 weeks of intervention.

Statistical Analysis:

Data were analyzed using Graph Pad In-Stat software – Trial version 3.10. The data were entered into an excel spreadsheet, tabulated and subjected to statistical analysis. Various statistical measures were used for this study which includes mean,

standard deviation (SD) and test of significance such as paired ‘t’ & unpaired ‘t’ test. Pre and post interventional outcome within the group were analyzed using paired ‘t’ test. Unpaired ‘t’ test was used to compare the difference in scores between the two groups (i.e.) single task training group and , motor dual task training group.

RESULTS

A total of thirty participants participated in this study. Balance was measured with the help of Berg Balance Scale. The difference in pre and post test interventional score for single task training group was 1.40±0.986 this difference is considered to be statistically significant. The difference in the pre and post interventional score for the motor dual task training group was 2.733±1.534 this difference is considered to be very statistically significant. (Table.1)

Table 1: Berg Balance Scale

Berg Balance Scale	Pre- test mean	Post- test mean	Mean difference	Standard deviation	‘t’ value	‘p’ value
Single task training group	29.27	30.67	1.40	0.986	5.503	<0.0001
Motor dual task training group	30.27	33.00	2.733	1.534	6.902	<0.0001

The difference in the post intervention for single task training group and motor dual task training group was 2.33+2.90. (Table.2)

Table 2:

Berg Balance Scale	Post- test Mean	Mean difference	Standard deviation	‘t’ value	‘p’ value
Single task training group	30.67	2.333	2.899	2.204	0.0359
Motor dual task training group	33.00				

DISCUSSION

A first simple definition of balance or postural control refers to the ability to control one’s own position of the centre of mass and the area of the base of support. Pollock and colleagues defined postural control as “the act of maintaining, achieving or restoring a state of balance during any posture or activity”.^[11] The improvement of balance and walking ability is an essential aim in the therapy of stroke to preserve Activities of Daily Living. Simultaneous training of motor dual tasks during conventional therapy has already been considered as beneficial for different groups of people.^[12,13,14,15]

Everyday life involves many dual task situations, in which a person needs to do two or more things simultaneously: An attention-demanding walking task e.g., walking while carrying a cup, walking while talking to someone, walking through the supermarket and looking for a certain product, carrying a tray with food while walking. Without the ability to carry out these types of simultaneous movements the ability to cope with everyday life is severely impaired. Additionally, it is assumed that the lack of ability to carry out dual tasks is one reason why people stumble and fall. Dual task training aims to improve the ability to do two or more things

simultaneously and thus reduce the risk of falling. Dual task training consists of a primary task and an additional secondary task. The two tasks could be performed independently as a single task and have distinct and separate goals. In a dual task intervention, people practice both tasks simultaneously. The primary task of interest is an exercise intervention that aims to improve balance.^[16] In more recent research, the inability to perform two or more tasks simultaneously (multi- or dual tasking) is regarded as an indicator for a higher fall risk.^[17,18,19,20]

There are three hypotheses of how dual task training might work. First, people learn to integrate two tasks more efficiently.^[21] Second, dual task training can improve the automatization^[22] of the primary task^[21,23] that is, the primary task will need less motor capacity. Finally, dual task training results in faster information processing.^[22] In recent years, dual task training has developed into an emerging approach for gait and balance training in people experiencing neurological conditions such as stroke.^[24,25,26] The balance training with a dual task has been hypothesized to be beneficial for improving balance and walking impairments in people with stroke.^[13]

CONCLUSION

This two weeks study results showed improvement in motor dual task training group in comparison with single task training group. We found that balance was improved after the training sessions in the stroke in both groups. However, the group which had motor dual-task training while sitting and standing showed a significantly better performance in balance than the group which only had single motor task training. However, Choi et al.^[27] found that dual-task training was as effective as conventional balance training in improving balance in post stroke patients in a sub-acute phase. Hence, dual task training could enhance ambulation, a precondition of many ADLs, and reduce risks such as falling.

Based on the outcomes of this study, the following changes are suggested: The study can be extended to a large sample size and the duration of the study can be increased with a follow up.

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