CERTIFICATE

This is to certify that the dissertation title " **EFFICACY OF DUAL-TASK EXERCISE ON IMPROVING WALKING ABILITY IN CHRONIC STROKE PATIENTS"** is a bonafide record of work done under the guidance and supervision in the partial fulfillment for the degree of **MASTER OF PHYSIOTHERAPY** (MPT) April 2012 by **Mr. J. BALAMURUGAN**, (Registered No- 271032) postgraduate student of **MADHA COLLEGE OF PHYSIOTHERAPY, Kundrathur, Chennai – 69.**

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EFFICACY OF DUAL-TASK EXERCISE ON IMPROVING WALKING ABILITY IN CHRONIC STROKE PATIENTS

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EFFICACY OF DUAL-TASK EXERCISE ON IMPROVING WALKING ABILITY IN CHRONIC STROKE PATIENTS

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1. INTRODUCTION

2. REVIEW OF LITERATURE

3. METHODOLOGY & MATERIALS

4. STATISTICAL ANALYSIS & INTERPRETATION

5. RESULTS

6. DISCUSSION

7.

CONCLUSION

8.

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APPENDIX

1.1 INTRODUCTION

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

The essential supply of oxygen and glucose to the central nervous tissues subsequently interrupted causing cell necrosis. Stroke is of high incidence, occurring between 250 – 350 per 100,000 / population per annum in India and as such represent a major economic burden to society as whole.

The effects of stroke are variables and may include impairment in motor and sensory systems, emotion, language, perception, and cognitive function. Impairment of motor function involves paralysis or paresis of the muscle on the side of the body contra lateral to the side of the supratentorial lesion.

Common problems after stroke are impaired motor function including Gait and Balance, Sensory deficits, Perceptional deficits, Cognitive limitation, Visual deficits, Aphasia and Depression. Balance problem occurs due to muscle weakness, abnormal muscle tone, loss of Range of Motion (ROM), distorted proprioception and impairment of vestibular mechanism

Damage to the descending neural pathways results in abnormal regulation of spinal motor neurons, causing alteration in postural and stretch reflexes and voluntary movement. Abnormality in the temporal and spatial recruitment of motor unit slow the ability of the muscle to generate tension, leading to prolonged agonist contraction.

Independent walking is possible in the majority of the patients following stroke, but the patients rarely return to the pre-stroke status. The gait of the people following stroke is characterized by problems with initiation, timing, grading of muscle activity, hyper tonicity and influenced by mechanical changes in soft tissue. Gait speed, stride length, and cadence are reduced relative to normal values. Common kinematic deviation during the stance phase of gait cycle are; decreased pelvic force angles, decreased lateral pelvic tilt displacement, changed knee extension, and decreased plantar flexion angles with the swing phase being characterized by decreased hip flexion, knee extension and dorsi flexion angles.

Various movement therapy approaches are available for retraining motor skills in adult patients with hemiplegia. Certain approaches like Proprioceptive Neuromuscular Facilitation, Rood, Brunnstrom, and Bobath relay on reflex and hierarchical theories of motor control, while others like Motor Relearning Program (MRP) and System theory approaches derive clinical implications from more recent theories of motor control and learning as well as from the principles of neural plasticity.

Conventional physiotherapy for gait training is generally recognized as beneficial in patients with stroke (Ernst E A Review of stroke rehabilitation and physiotherapy - Stroke 1990). The often study to compare efficacy of Dual Task walking Training with conventional walking training protocol for hemiplegic patients.

1.2 AIM OF THE STUDY

To find out the "**Efficacy of Dual Task Exercise Walking Training on improving walking ability in Chronic Stroke patients."**

1.3 NEED FOR THE STUDY

Recent studies reported comparisons between conventional walking training and dual task training, in hemiplegic patients. Although the results suggested that dual task walking training enhances locomotor recovery, further investigation was needed to determine whether it contributes to the improvement in walking. There are very few researches which studied the effects of dual task walking training (DTWT) with conventional walking training protocol using parallel bar. Also, as studies which compare the effects of different methods of walking training are least, further studies are needed to put forward better results to incorporate the findings in the rehabilitation of hemiplegic patients. The present study is designed to compare the effects of Dual task Walking Training (DTWT) and Conventional parallel bar walking Training (CPWT) in hemiplegic patients with higher motor functions.

1.4 HYPOTHESIS

Alternate Hypothesis

There exists significant differences between the Dual task walking training protocol and Conventional walking training protocol on improving walking ability in chronic stroke subjects

Null Hypothesis

There exists no significant differences between the Dual task walking training protocol and Conventional walking training protocol on improving walking ability in chronic stroke subjects.

1.5 OPERATIONAL DEFINITION

Stroke:

Clinical syndrome characterized by an acute loss of focal cerebral or monocular function with *symptoms* lasting less than 24 h and which is thought to be due to inadequate cerebral or ocular blood supply as a result of low blood flow, thrombosis or embolism associated with disease of the arteries, heart or blood.

Walking Speed:

Walking speed is the rate of linear forward motion of the body which can be measured in centimeters/second.

Cadence :

Number of steps per unit of time.

Stride Length:

The linear distance between two successive paints of contact of the same foot. It is measured in centimeters or meters. The average stride length for normal adult males is 1.46 meters. The average stride length for adult females is 1.28 meters.

Gait:

Human locomotion , or gait , may be described as a translatory progression of the body as a whole , produced by coordinated, rotator movements of body segments

2.0 REVIEW OF LITERATURE

1. **Lord SE, McPherson K, McNaughton HK, Rochester L, Weatherall M. (2004)** assessed how important community ambulation is to stroke survivors and to assess the relation between the level of community ambulation achieved and other aspects of mobility.
2. **Mehrholz J, Wagner K, Rutte K, Mei_ner D, Pohl M.(2007)** evaluated to determine the reliability, concurrent and predictive validity, and responsiveness of the Functional Ambulation Category (FAC) in hemiparetic patients after stroke.
3. **Dean CM, Richards CL, Malouin F.(2000)** states that Task related circuit training improves performance of locomotor tasks in chronic stroke.
4. **Ada L, Dean CM, Hall JM,Bampton J,Crompton S.(2003)** states that treadmill and over ground walking program improves walking in persons residing in the community after stroke.
5. **Salbach NM, Mayo NE, Wood-Dauphinee S, Hanley JA, Richa CL, Cote R. (2001)** identified the most responsive method of measuring gait speed, to estimate the responsiveness of other outcome measures, and to determine whether gait speed predicts discharge destinatoion .
6. Anouk Lamontagne, PhD, PT; Joyce Fung, PhD, PT The instantaneous adaptations to speed and load changes during over ground locomotion have major implications for mobility after stroke.
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12. Yang YR, Wang RY, Lin KH, Chu MY, Chan RC.(2006) showed the task-oriented progressive resistance strength training improves muscle strength and functional performance in individuals with stroke.
13. Roberts BL.(1990) Evaluated Effects of walking on reaction and movement times among elders.
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3.0 METHODOLOGY

3.1 Study Design:

Experimental study Design

3.2 Sample Size :

30 Subjects with Hemiplegia allocated into Two groups each containing 15 subjects

3.3 Study Population:

Subjects who are diagnosed as Hemiplegia referred by neurologist were taken as population Of the study.

3.4 Sampling Method:

30 Subjects who are diagnosed as Hemiplegia referred by neurologist were selected as samples for the study from the population using conventional sampling.

3.5 Study Setting:

1. Department of physiotherapy, Madha medical college and hospital, Thandalam.
2. BM physiotherapy clinic, Perungalathur.

3.6 Study Duration :

3 times a week, Total duration of study was 4 weeks.

3.7 Selection Criteria

Inclusion criteria

1. Age between 35 years – 55years.
2. Both male and female are included
3. Subjects with Hemiplegia from a single stroke occurs at least a year earlier
4. Subjects are able to walk 10 meter independently without a assistive device
5. Subjects with Functional use of involved upper extremity
6. Subjects should medically stable.

7. Subjects have an ability to understand instructions and follow commands

Exclusion Criteria

1. Subjects with Past history of seizures
2. Subjects with Severe multi infract sites
3. Subjects with Traumatic brain injuries
4. Subjects with Severe cardiovascular problems
5. Subjects with Visual – perceptual problems
6. Subjects with Demyelinating disease
7. Subjects with Degenerative changes in lower extremity joints

3.8 Variables

Independent variables

- Dual Task Walking Training
- Parallel Bar Walking Training

Dependent variables

- ✓ Walking speed
- ✓ Cadence
- ✓ Stride Length

3.9 Materials needed:

1. Stop Watch
2. Inch Tape
3. Basket ball
4. Net
5. Marker
6. Parallel Bar
7. Postural mirror

3.9 Data Collection Procedure:

30 Subjects were selected on the basics of inclusion and exclusion criteria. All the subjects were divided equally into two groups, Group A and Group B. Each group consisted of 15 subjects, the study procedures were explained to the subjects and informed consent was obtained prior to study. Before starting the training, pre-test scores were measured by using Walking speed, Cadence and Stride length.

Group A;-Subjects in Group A (n=15) received dual task walking training

Group B;- Subjects in Group B (n=15) received conventional walking training using parallel bar.

DUAL TASK WALKING TRAINING -Group A (Experimental Group):

The Subjects were informed to do the Dual Task walking program that includes walking in a closed corridor for 30 minutes. During the time of walking the subjects informed to do the ball exercises program that makes the subjects to do the Dual Task in same time.

The training program consists of seven level of basket ball exercise.

1. Walking while holding 1 or 2 balls on both hands,
2. Walking to match the rhythm of bouncing 1 ball with 1 hand or both hands,
3. Walking while holding 1 ball on 1 hand and concurrently bouncing another ball with the other hand,
4. Walking in time while kicking a basketball (the basketball was put into a net, and the net was held by the subject)
5. Walking while holding 1 ball and concurrently kicking another basketball within a net,
6. Walking while bouncing 1 ball and concurrently kicking another basketball within a net,
7. Walking while reciprocally bouncing 1 ball with both hands. Variable practice for the walking condition involved walking forward, walking backward, walking on a circular route, and walking on an S-shaped route. The subject was challenged with increasingly difficult tasks.

Once the Subjects completed First level then they were allowed to do the next level, Total Duration for complete all the tasks 30 minutes that consists of single secession this training program was performed 30 minutes of 3 times a week for 4 weeks. After completion of the training program the post score of walking speed, cadence and stride length were measured.

PARALLEL BAR WALKING TRAINING- Group B (CONTROLLED Group):

Before the parallel bar walking training, the scores of walking speed, cadence and stride length were measured and considered pre test score.

The Subjects were informed to stand in front of the mirror advised to walking in parallel bar and adjusting the posture for 30 minutes. This program repeated 3 times a week for 4 weeks.

After completed the training program post test score of walking speed, cadence and stride length were measured.

4.STATISTICAL ANALYSIS

STATISTICAL METHOD

The following statistical tools were employed to analyze the data and testing of hypothesis.

The statistical package for social sciences (SPSS) package was used to calculate and analyzed the above mentioned descriptive and interferential statistics.

1. Mean $X = \sum \bar{x}/n$

2. Standard deviation SD = $\sqrt{(X - \bar{X})2/n - 1}$

3. Paired‘t ‘test

$$t_{cal} = \frac{\bar{d}}{S_d / \sqrt{n}}$$

Where $\bar{d}$ = mean difference

S_d = standard deviation

4. Independent’t’ tests

$$t_{cal} = \frac{| sX^1 - X^2 |}{SE}$$

$$SE = S \sqrt{\frac{1}{n_1} + \frac{1}{n_2}}$$

$$\text{Where } S = \sqrt{\frac{(n_1 - 1) S_1^2 + (n_2 - 1) S_2^2}{n_1 + n_2 - 3}}$$

n_1 n_2 = size of the sample of two groups

Table 4.1 Pre Test and Post Test Analysis of walking Speed in cm/sec

	Pre Test		Post Test		T test	Significance
	Mean	**S.D**	**Mean**	**S.D**		
Group A	69.07	6.72	89.33	6.59	8.3394	0.0000*
Group B	66.73	7.26	68.67	6.70	0.7580	0.4548

**** denotes extremely significant if p Value - < 0.0001**

Table 4.1 shows Comparison between Pre Test & Post Test analysis of walking speed in both groups. This table showed that there is no statistical significance achieved with Group B (Conventional Physiotherapy), while P value of Group A was < 0.0001 and hence Dual Task Gait Training was found to be extremely statistically significant.

Graph 4.1

Graphical representation of Pre test & Post test Mean values of Walking Speed

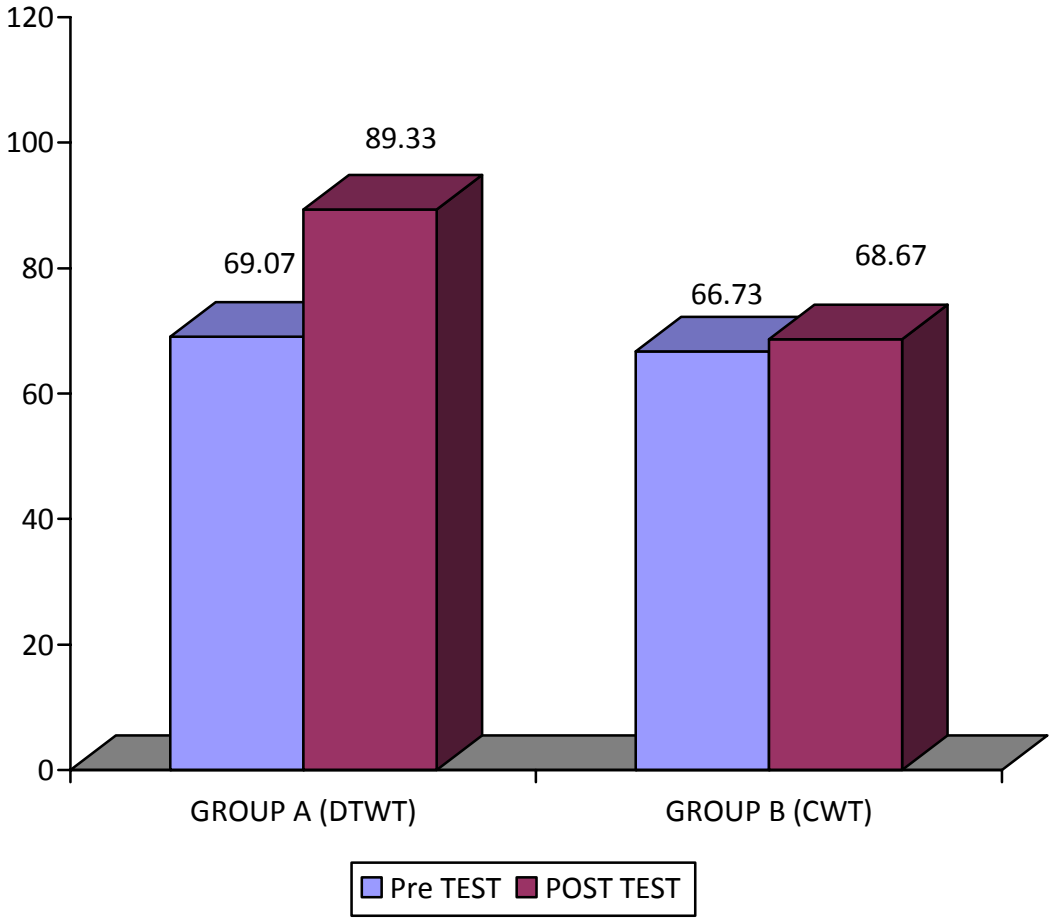


Table 4.2 Pre Test and Post Test Analysis of Cadence in min

	Pre Test		Post Test		T test	Significance
	Mean	**S.D**	**Mean**	**S.D**		
Group A	79.393	3.943	86.14	6.254	3.3543	0.0014*
Group B	79.14	6.491	81.06	6.478	0.8109	0.4242

**** denotes extremely significant if p Value - < 0.0001**

Table 4.2 shows Comparison between Pre Test & Post Test analysis of Cadence in both groups. This table showed that there is no statistical significance achieved with Group B (Conventional Physiotherapy), while P value of Group A was < 0.0001 and hence Dual Task Gait Training was found to be extremely statistically significance

Graph 4.2

Graphical representation of Pre test & Post test Mean values of cadence

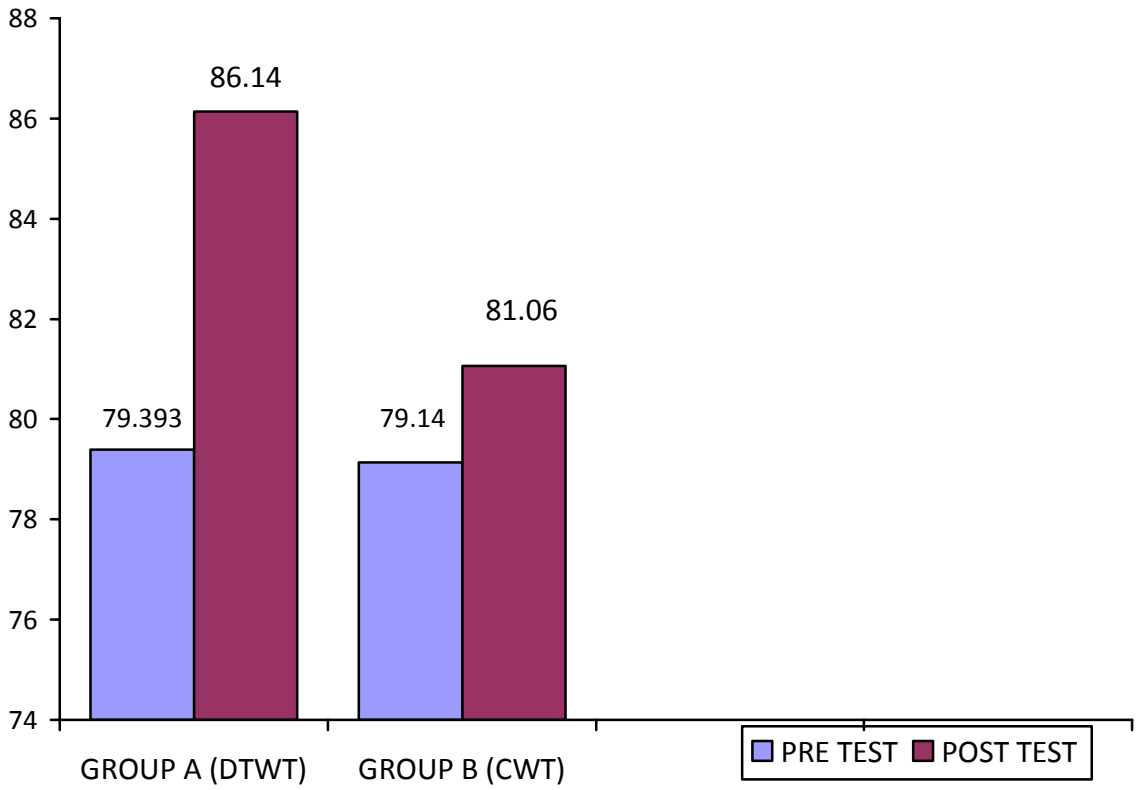


Table 4.3 Pre Test and Post Test Analysis of Stride Length in cm

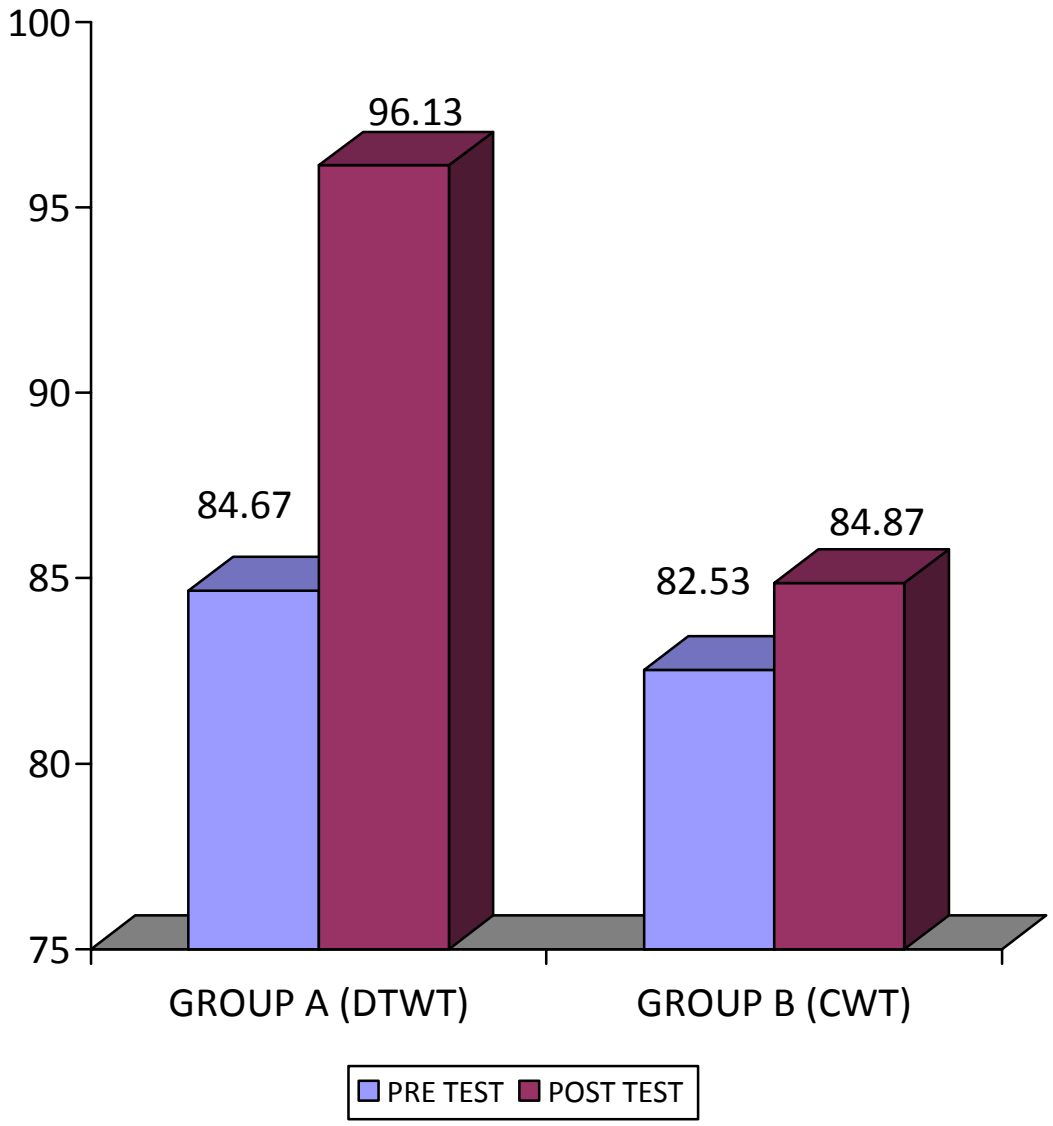
	Pre Test		Post Test		T test	Significance
	Mean	**S.D**	**Mean**	**S.D**		
Group A	84.67	3.87	96.13	4.55	7.4382	0.000*
Group B	82.53	5.91	84.87	6.44	1.0340	0.3100

**** denotes extremely significant if p Value - < 0.0001**

Table 4.3 shows Comparison between Group A & Group B in analyzing pre & post test values of Stride Length This result showed that P value of Group A (Dual Task Gait Training) was 0.0000, which is less than 0.0001 and hence there is statistical significance achieved with Group A. while P value of Group B was 0.3100 and hence Dual Task Gait Training was found to be statistically insignificant

Graph 4.3

Graphical representation of Pre test & Post test Mean values of Stride Lengh



RESULTS

From the statistical analysis it is clear that dual task gait training achieved significant results than conventional gait training done using parallel bar and mirror. Dual task gait training showed significant improvement in all the measurement parameters;-walking speed, cadence and stride length. All subjects successfully completed the study protocol. In the experimental group, the attendance rate was 100% for the 4-week training program. All participants were able to perform the exercises as planned. These results show that after the ball exercise training, significant improvement was found in all selected gait variables. On the contrary, improved gait performance was not shown in the control group.

DISCUSSION

This study results showed that a 4-week ball exercise program improved walking ability under single- and dual-task conditions with chronic stroke. After the intervention, the walking speed was increased from 69.07 to 89.33cm/s in subjects in the experimental group. It has been reported that a walking speed of 110 to 150cm/s is considered to be fast enough to function as a pedestrian in most environmental and social contexts. Furthermore, community ambulation is the ability to integrate walking with other tasks in a complex environment. Dual task walking assessment may prove helpful in identifying those who may have difficulty generalizing walking performance during testing to a complex environment. In the present study, the walking performance under the dual-task condition was also improved after intervention. Therefore, this ball exercise program may help improve community ambulation function.(**Duncan et al)** observed an average gain of 25cm/s after an 8-week, home based exercise program that was designed to improve strength, balance, and endurance in subjects at an average of 66 days post stroke. (**Dean et al**)found that a 4-week training program on the performance of locomotor-related tasks led to an average gain of 12.6cm/s in subjects at a mean of 2.3 years post stroke. (**Ada et al**)introduced a concurrent cognitive task and designed a 4-week treadmill and over ground walking program. They found that this 4-week treadmill and over ground walking program was associated with an average gain of 18 cm/s in subjects with chronic stroke. A moderate improvement in walking speed was obtained in this study when compared to previous studies. Thus, the ball exercise program may be an effective exercise program in improving walking ability. A ball exercise regimen may seem useful in terms of promoting general fitness. The results of this study showed significant improvement in walking ability after ball exercise. The reasons for the positive finding in this study remain unclear. However, the exercise we used in this study was a task-oriented program.

In addition, a hypothesis existed that coordinated muscle activity may be stimulated when working at a high level activity. Furthermore, ball exercise may provide relevant feedback. Subjects were able to achieve a new skill. The ball provides the subject with information from their surroundings, helping the subject to integrate motor tasks in a complex environment. Moreover, ball activities could be an interesting program and could promote patient participation.

CONCLUSIONS

The results of this study showed that a 4-week ball exercise program is an effective way of improving the walking ability of a selected group of limited community ambulatory and full community ambulatory subjects with chronic stroke.

RECOMMENDATION

- ⇨ Long term follow-up will be helpful to assess the effectiveness of the protocol.
- ⇨ Studies with large sample size will be beneficial.
- ⇨ Studies using subjects with poor or low motor function will throw new light in this research. In this study we used subjects with high motor function.
- ⇨ The high participation rate in the ball exercise program should be considered in developing community type exercise programs.

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CONSENT FORM

I _____ agree to take part in the research study conducted by **J. BALAMURUGAN,** Postgraduate student (M.P.T. Advanced Neurology), Madha College of Physiotherapy, entitled "**Efficacy of Dual Task Exercise Walking Training on improving walking ability in Chronic Stroke patients."**

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 purpose of the study
- Participate in evaluator program
- Make myself available for further follow up

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

I provide consent to the researcher to use the information, video or audio recordings, for research and educational purpose only.

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

I understand that no monitory benefit will be given for participation in this research study.

Signature & Name of the applicant – **Signature of the assessor:**

Date

PATIENT DATA PROFORMA

Name :

Age :

Sex :

Occupation :

Address :

Referred by :

Date of Assessment :

IP/OP NO :

Patient NO :

Group :

Diagnosis :

Review Date :

DATA

S.NO	VARIABLES	PRE TEST	POST TEST
1	Walking speed		
2	Cadence		
3	Stride length		

MASTER CHART

S.NO	WALKING SPEED (Cm/Seconds)				CADENCE(Step/min)				STRIDE LENGTH (Cm)			
	Group A (DTWT)		Group B (CWT)		Group A (DTWT)		Group B (CWT)		Group A (DTWT)		Group B (CWT)	
	Pre Test	Post Test	Pre Test	Post Test	Pre Test	Post Test	Pre Test	Post Test	Pre Test	Post Test	Pre Test	Post Test
1	65	88	77	79	80.1	98.2	88.2	90.1	88	98	87	89
2	65	78	76	76	82.1	90	86.4	88	85	104	89	90
3	66	98	67	68	78.2	88.4	80	81.4	87	91	88	91
4	60	97	67	69	76	80	75.1	76	80	90	90	92
5	61	99	55	57	74.2	76.4	74	76.4	82	96	77	78
6	59	92	69	69	78	80.2	76.2	76.8	84	95	78	79
7	71	83	71	71	80	88.2	70	71.8	82	102	75	77
8	77	91	60	60	75	81.6	89.2	90	79	98	76	78
9	78	90	73	74	74	76.7	70.4	72.6	88	89	89	90
10	69	88	78	80	77	90.2	71	73.4	89	101	91	96
11	65	77	60	65	81	84	75.8	78	85	98	80	82
12	77	95	59	61	83.3	87.7	84.6	88	87	95	81	83
13	78	90	62	65	84	88	80	84	88	90	79	80
14	75	86	60	66	80	88	84.2	86	89	97	75	77
15	70	88	67	70	88	94.5	82	83.4	77	98	83	89