

Treadmill Training Verses Circuit Training to Improve Gait in Chronic Stroke Patients - A Comparative Study

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Abstract: *Stroke or Cerebro vascular accident is a sudden loss of neurological functions. Gait and Balance impairments occur in patients with stroke. These are often associated with poorer recovery of functions after the stroke. Gait is often altered. Most Early physiotherapy for gait training after stroke has shown general effectiveness in ambulation. It might be challenging for the stroke survivors to participate in their roles in work, home and community. The person becomes sedentary and physically inactive. The purpose of the study was to determine the effectiveness of Treadmill training and Circuit training to improve Gait in 30 chronic stroke patients who are assigned into 2 groups by random allocation Group - A (Treadmill Training) consisting of 15 patients. Group - B (Circuit Training) consists of 15 patients. Prior to the starting of the intervention program pre assessment was done by using outcome measures BBS, 6 MWT, TUG and 10 MWT for both the groups. For both the groups interventions were given for 4 days for 4 weeks with Treadmill & Circuit training treatment for 60 minutes to the respective group patients. To compare within the group between pre and post intervention, paired t - tests were performed. And an independent t - test was used for comparing differences between the groups. Statistical analysis of the data showed both Groups A and B showed significant difference from pre to post intervention. Therefore, this study provides that Circuit Training is more effective in improving gait for chronic stroke patients.*

Keywords: Chronic Stroke, GAIT, Circuit Training, Treadmill Training, Berg Balance scale, 6 - minute walk test, 10 - Meter walk test, Time Up & Go.

1. Introduction

Stroke or Cerebro vascular accident is a sudden loss of neurological functions. Disability is the main problem after a stroke. There are 3 types of Stroke, those are Ischemic Stroke, Hemorrhagic Stroke and Transient Ischemic Stroke (TIA).^{1,2} More than 85% of the stroke are ischemic stroke, 6 10% stroke are inter cerebral stroke, 5% are sub arachnoid stroke.⁴

In stroke there are Focal deficits means change in level of consciousness, impairments of sensory, motor, cognitive, perceptual and language functions. Neurological Deficits can last longer than 24 hours. Motor deficits are characterized by paralysis or weakness.¹

More than 80% of stroke patients have walking impairments, impaired balance which leads to frequent falls and this leads to fear of participation in activities of daily living.⁵

A world - wide review –developed countries have decreased report in stroke incidence from 163/100, 000 to 93/100, 000 individuals. In developing countries stroke incidence has increased to 56/100, 000 to 117/100, 000 persons on report in

2000 - 2008. Cumulative incidence of stroke is higher in women than men.

Mortality rate for women is lower than men aged 25 - 44 and 45 - 64 in hemorrhagic stroke. Ischemic stroke higher in older women >65yrs.⁶

The Risk factors for stroke are Modifiable, Non - modifiable and recently described risk factors. Modifiable risk factors are hypertension, dyslipidemia, diabetes mellitus, smoking, obesity alcohol consumption, physical inactivity, hereditary factors also contribute to stroke. Non - modifiable risk factors are age, sex, race. Most recently described risk factors are infection, pollution, inflammatory disorders, cardiac arterial disorders.^{1, 8, 9} Gait is often altered and the impairments still persist even after 3 months after the stroke. Most of the patients do not return to functional activities after stroke. Early physiotherapy for gait training after stroke has shown general effectiveness in ambulation¹⁰.

Fall incidence rates between 23% and 50% have been noted for people chronic stroke (>6 months). But lower rate for sub - acute stroke with 25% rate. Injury is a frequent complication of falls and falls occur during walking activities in patients with functional impairments and

impaired balance.¹¹

Rehabilitation of the patient with stroke disability is based on training the patient to make him perform well and making it easier to complete the functional activity. Only with rehabilitation and training motor control can be improved by giving task specific activities by making the patient use all the body segments while performing the task. The time spent on practicing tasks will account for the gain of residual movement ability.¹²

There are many interventions such as fitness training, high intensity therapy and repetitive task training are used which has better effective outcomes.

This study is a comparative study which focuses mainly on treadmill training to that of circuit training in improving gait. Circuit training satisfies 3 roles for an effective and efficient training. Role 1. By using different workstations, circuit training helps patients to practice intensively and progressively for goals specific needs. Role 2. Circuit class training helps to optimize therapist's time and can engage the patient in accomplishing task. Role 3. Encompasses group dynamics that include peers support and social interaction.¹³ Circuit training focused on improving the performance and endurance of functional tasks involving the lower extremities. It may comprise a series of workstations arranged in a circuit or series of individualized activities in a group setting.

Treadmill training promotes functional locomotor recovery after stroke. Treadmill training for gait is effective in improving walking distance and balance.

Walking speed or velocity is measured by using 10 MWT. Walking distance or endurance is measured using 6 MWT. Balance is measured by using BBS. The final lower limb functional test was TUG¹³.

Methodology & Materials Required for Study Design

Comparative in nature, Randomized sampling.

Study Population

Subjects with gait impairment due to stroke.

Study Setting

Subjects were recruited from outpatient department of Sanjeevani College of Physiotherapy, Sangareddy.

Ethical Clearance

The ethical clearance was taken from the ethical committee of MNR Sanjeevani College of Physiotherapy at Sangareddy.

Study Duration

June 2022 to September 2022

Intervention Duration

4 days for 4 weeks

Treatment Duration

60 minutes

Sampling Design

Randomized Sampling

Study Sample

A total number of 30 patients both male and female suffering with gait impairment due to chronic stroke and who are willing to participate. As per the study 30 patients are allocated into 2 groups 15 in each by block randomization after obtaining the consent form.

2 groups

Group A: Treadmill Training Program

Group B: Circuit Training Program

Outcome Measures

Time Up and Go, 6 - minute walk test, 10 - meter walk test, Berg balance scale.

Inclusion criteria

- Patients should have normal communication skills.
- Patients walk independently or with minimal human assistance.
- Patients should stand erect with or without support.
- Patients should be able to walk 10 meters with or without an assistive device.
- Patients should have well cognitive condition to understand the instructions given by the physiotherapist.
- Patients should hold the trunk in erect posture.

Exclusion criteria

Patients with -

- Pulmonary embolism,
- Postural hypotension,
- Uncontrollable hypertension.

Materials used

- 1) Treadmill
- 2) Chair
- 3) Ropes
- 4) Mini stairs
- 5) Wobble board
- 6) Obstacles like cones, bricks
- 7) Stopwatch

Procedure

A total of 30 subjects were taken for the study purpose who met the inclusion criteria and they were assigned into 2 groups by block randomization. 15 subjects into group - A and other 15 into group - b An informed consent form was received from each subject.

Treadmill Training Program _Group - A

- Treadmill training for improving gait in chronic stroke patients.
- 15 patients were randomly chosen for treadmill training.
- Patients were trained for 20 - 30 =minutes for 4 weeks.
- In this study speed, cadence, distance was recorded for treating patients with chronic stroke.

Circuit Training Program _Group - B

15 patients were randomly chosen for circuit training. There are 10 stations designed for this circuit treatment. They are:

- Sitting and reaching for the objects beyond the length from the arm.
- Sit to stand.
- Stepping forward and backward.
- Calf raises.
- Balance standing, tandem standing.
- Reciprocal leg flexion and extension to strengthen leg muscles.
- Standing up from chair, walking a short distance and returning to the chair.
- Walking on treadmill.
- Walking over various surfaces and obstacles.
- Walking over slopes and stairs.

Statistical Analysis

All statistical analysis in this study was done using SPSS ver16.0. The general characteristics of the participants were expressed in terms of mean and standard deviation by using descriptive analysis.

Between the Groups

Independent “t test” was performed to assess the Statistically significant difference in mean value between the Group - A & Group - B.

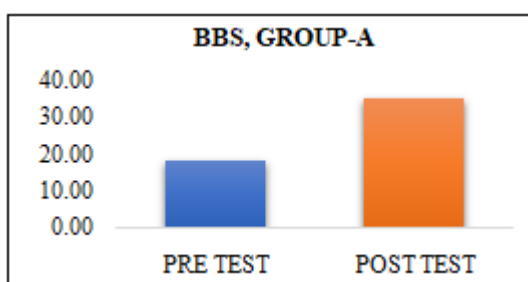
Within the Groups

A paired “t test” was performed to assess the statistical difference within the Group - A & Group - B.

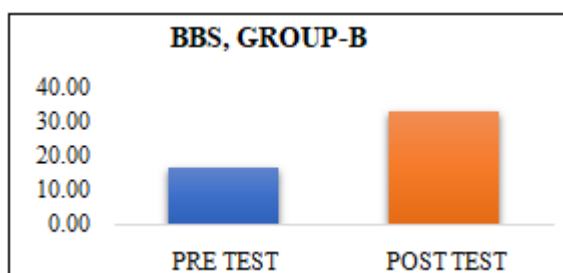
All the 30 subjects completed the entire study program as defined by 5 weeks in the outpatient basis. The outcome measure is Berg Balance scale, Time Up & Go, 6 - minute walk test and 10 - meter walk test.

Comparison of Berg Balance Scale of Group A & Group B for Pre and Post Means:

BBS	Mean	No of Patients	Std Deviation	Std Error Mean
Pre - Test	18.27	15	9.161	2.365
Post Test	34.93	15	12.981	3.352

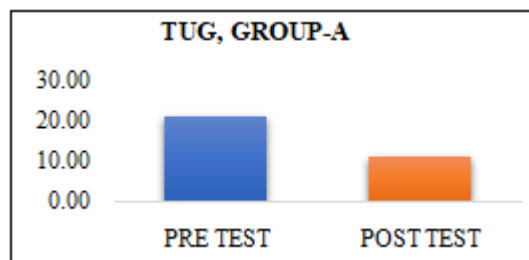


BBS	Mean	No of Patients	Std Deviation	Std Error Mean
Pre - Test	16.80	15	6.805	1.757
Post Test	33.27	15	11.925	3.079

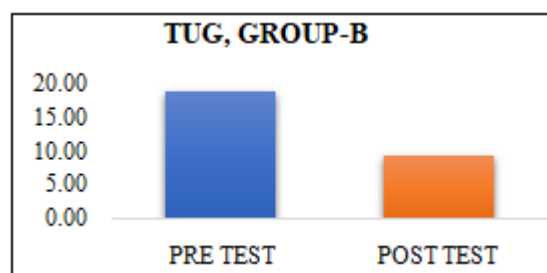


Comparison of Time Up & Go (TUG) of Group A & Group B for Pre and Post Means:

TUG	Mean	No of Patients	Std Deviation	Std Error Mean
Pre - Test	21.00	15	6.071	1.568
Post Test	10.93	15	4.527	1.169

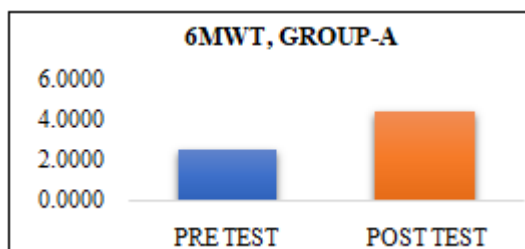


TUG	Mean	No of Patients	Std Deviation	Std Error Mean
Pre - Test	19	15	5.720	1.477
Post Test	9.40	15	2.558	0.660

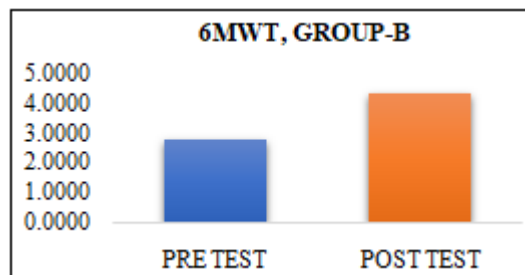


Comparison of 6 - minute walk test (6MWT) of Group A & Group B for Pre and Post Means:

6MWT	Mean	No of Patients	Std Deviation	Std Error Mean
Pre - Test	2.5780	15	1.02241	0.26399
Post Test	4.4733	15	1.06364	0.27463

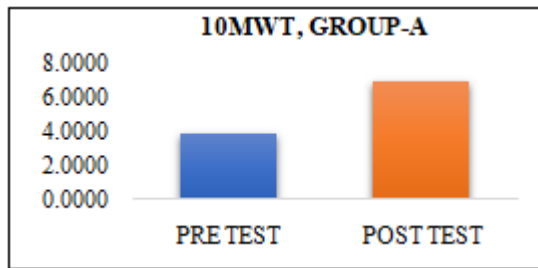


6MWT	Mean	No of Patients	Std Deviation	Std Error Mean
Pre - Test	2.7833	15	0.90960	0.23486
Post Test	4.3413	15	0.85913	0.22183

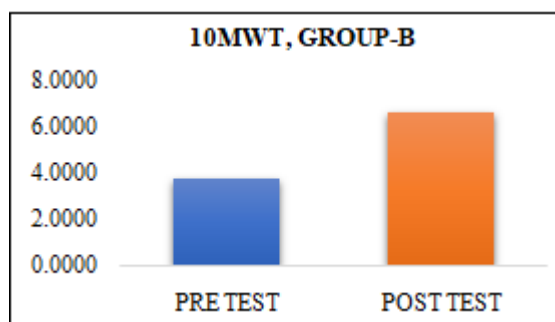


Comparison of 10 - meter walk test (10MWT) of Group A & Group B for Pre and Post Means:

10MWT	Mean	No of Patients	Std Deviation	Std Error Mean
Pre - Test	3.8647	15	1.32397	0.34185
Post Test	6.9693	15	1.43030	0.36930



10MWT	Mean	No of Patients	Std Deviation	Std Error Mean
Pre - Test	3.7500	15	1.06038	0.27379
Post Test	6.6067	15	1.27903	0.33024

**2. Discussion**

Disability is the main complication after stroke with Rehabilitation. The Patient can perform his functional activities. Although most functional recovery happens within 3 months after stroke. But with that at least 6 months can stroke patient's functional abilities. Impaired walking & impaired balance are the main complications which make them challenging for accomplishing their tasks. This led to sedentary & physically inactive^{5,6}.

In both treadmill training and circuit training walking distance has increased when measured with 6MWT, walking speed has increased in circuit training has least effect in treadmill training when obtained results by measuring it with 10MWT, in TUG time taken to complete this task has been decreased when compared to pre and posttest and effectiveness is seen in circuit training when compared treadmill training, BBS has improved in circuit training, the patient were able to balance when compared with pre and posttest in circuit training.

There are some improvements in performance in all the subjects recruited in this training. Walking distance, velocity, TUG has improved. As there are many activities in this test which are done with both upper extremities and even upper extremities abilities also improved.

According to Catherine M. Dean, this study provides evidence for the efficacy of task related circuit class at improving locomotor function in chronic stroke. According to GudurunDiermayr, task - oriented circuit training showed

clinically important improvements in walking distance and speed.

According to Bonggilkim MS PT, in this task - oriented circuit class training gait endurance and speed gradually improved with TUG, 6MWT, BBS has significant improvement. And 6MWT is used to measure the effectiveness of gait endurance.

The result of present study showed that circuit training has more effectiveness as in literature core. But for treadmill training there is need for further study and has less effectiveness than that of circuit training.

Treadmill training for stroke survivors showed significant change in walking distance. According Asmare Yetayeh Gelaw, in this study Treadmill training following stroke has improvement in walking distance and has no significant effect in improving walking speed and balance. According to Gabriela L. Gama Msc, in this study Individuals with chronic stroke improved gait speed another gait parameters with body weight support on treadmill. Only with bodyweight gait is improved.

This study is mainly focused on Gait improvement in chronic stroke patients when compared with treadmill training to that of circuit class training.

This study's objective is to compare effectiveness of treadmill training to that of circuit training for improving gait in chronic stroke patients. In this study circuit training showed significant results when compared to treadmill training. In this 4 - week program of circuit training there is increased walking distance and walking speed.

3. Conclusion

The study concluded that treadmill training and circuit training have shown statistically significant effects on improvement of gait in chronic stroke patients. But circuit training is found to be clinically more effective with a greater percentage of improvement than treadmill training.

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