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Efficacy of Speed dependent treadmill training against conventional Physical therapy on Gait and mobility in stroke patients

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ABSTRACT

Background & Purpose: A stroke is a condition where a blood clot or ruptured artery or blood vessel interrupts blood flow to an area of the brain. A lack of oxygen and glucose (sugar) flowing to the brain leads to the death of brain cells and brain damage, often resulting in an impairment in speech, movement, and memory. Age has been shown to have a strong association with the incidence of stroke Main disability in stroke is gait.

METHODS: In this study, Stroke subjects from various Neuro medical centres, Bangalore were selected according to inclusion criteria in randomized controlled trial. 40 subjects were included for the study, i.e 20 subjects each group. Group 1 patients were treated with speed dependent treadmill training with conventional Physical therapy whereas Group 2 patients were treated with only conventional Physical therapy. Status were assessed before start treatment session and after the end of 1 month with outcome measures by Walking speed, Cadence, Timed Up and Go (TUG) test. Pre and post-test values of 2 groups were statistically compared.

RESULTS : It shows that significant increase in gait and mobility in speed dependent treadmill training with conventional Physical therapy group than only conventional Physical therapy group.

CONCLUSION: The result of the study indicates that adding speed dependent treadmill training with conventional physical therapy is more effective for improvement of mobility than only conventional Physical therapy.

KEY WORDS

Treadmill training, Gait, Timed Up and Go test, cadence, walking speed, stroke

INTRODUCTION

Stroke defined as the rapid development of clinical signs and symptoms of a focal neurological disturbance lasting more than 24 hours or leading to death with no apparent cause other than vascular origin. (WHO 2005)[1] Gait impairment and loss of normal walking pattern is one of the most disturbing outcomes of post-stroke hemiplegic patients. In 50% of stroke survivors, walking impairments are observed 3 months after the insult, while 25% of stroke patients are never able to walk independently.[2] Treatments given for improvement of gait are aerobic exercises like treadmill training, cycling or swimming. Other treatments are balance training, floor walking gait pattern study, physiotherapy given by muscle strengthening, stretching of lower limb muscles. In patients with hemiparesis and impaired gait, the use of treadmill training has been a promising in rehabilitation of these patients .[3,4] Treadmill training, along with conventional therapies, can significantly improve gait function.[5]. Although physical therapy has shown a great effect in people with mobility problem more than one year after stroke, after cessation of treatment the improvement gained are not maintained [6,7].

Need of the study: A novel approach introduced for early gait training of stroke survivors involves the use of body weight support during gait training on a motorized treadmill. The rationale for this approach is that while partial weight support removes some of the biomechanical and equilibrium constraints of full weight bearing, walking movements may be facilitated on the treadmill by the activation of spinal locomotion centres. Paraplegic patients treated with this method have exhibited improvement in walking capacity. Similarly, positive outcomes have been reported for people who have had a stroke. This study aimed to address the gait dysfunction with the treatment approach that is speed dependant treadmill training in subacute stroke population.

OBJECTIVE OF THE STUDY

1. To find the effect of speed dependent treadmill training on gait and mobility in stroke patients
2. To compare the effect of speed dependent treadmill training with conventional physical therapy on gait and mobility in stroke patients

REVIEW OF LITERATURE

Pohl M, Mehrholz J, 2002 [8]concluded the effect of speed dependent treadmill training is more effective compared with steady treadmill training. In this study Gait speed, stride length, cadence, and Berg's balance score (BBS) were recorded and analyzed before and after the 10 training sessions.

Shamay S. Ng et al., 2005 [9] test-retest reliability of the Timed Up & Go (TUG) test, its ability to differentiate subjects with chronic stroke from healthy elderly and found that TUG scores were reliable

Mehrholz J, Wagner K 2007 [10] determine the reliability, concurrent and predictive validity, and responsiveness of the Functional Ambulation Category (FAC) in hemiparetic patients after stroke. The FAC has excellent reliability, good concurrent and predictive validity, and good responsiveness in patients with hemiparesis after stroke.

Macko RF, Smith GV 2001[11] found the effectiveness of Treadmill training on chronic stroke patients. Clinical outcome measures on over ground walking speed, cadence, stride length, and the Functional Ambulation Category (FAC) were compared at the end of a 4-week training period.

Methodology

Stroke subjects from various Neuro medical centres, Bangalore were selected according to inclusion criteria in randomized controlled trial. 40 subjects were included for the study, i.e 20 subjects each group. All subjects of this study given their informed consent before participation of the study. Outcome measure were used 1) walking speed, 2) cadence, and 3) Timed Up and Go (TUG) test

INCLUSION CRITERIA

- Age range from 40 to 60 yr.
- First episode of stroke, more than 4 weeks and less than 8 weeks.
- Able to walk a minimum distance of 12 meters with either intermittent help or stand by while walking.
- FAC level 3 and above
- Able to understand the purpose and content of the study.

FAC [12] (functional ambulatory category)

FAC Level	Ambulation Description	Definition
1	Nonfunctional	Unable to ambulate Ambulates only in parallel bars Requires supervision or physical assistance from > 1 person
2	Dependent, Level II	Requires manual contact of one person during ambulation on level surfaces Manual contact is continuous and necessary to support body weight and/or to maintain balance or assist coordination
3	Dependent, Level I	Requires manual contact of one person during ambulation on level surfaces Manual contact is continuous or intermittent light touch to assist balance or coordination
4	Dependent, Supervision	Ambulation occurs on level surfaces without manual contact of another person Requires stand-by guarding of one person because of poor judgment, questionable cardiac status, or the need for verbal cuing to complete the task
5	Independent, Level Surfaces Only	Ambulate is independent on level surfaces Requires supervision/physical assistance to negotiate stairs, inclines, or unlevel surfaces.
6	Independent, Level and Non-Level Surfaces	Ambulation is independent on unlevel and level surfaces, stairs, and inclines.

Procedure:

Group 1 patients were treated with speed dependent treadmill training with conventional Physical therapy whereas Group 2 patients were treated with only conventional Physical therapy. Status were assessed before start treatment session and after the end of 1 month with outcome measures by Walking speed, Cadence, Timed Up and Go (TUG) test.

Walking speed [13] is measured by time taken for walk 12 m distance. We used stop watch for measurement of time.

Cadence[14] is measured by number of steps in 60 seconds.

The mobility was assessed using ***Timed "Up and Go test" (TUG).*** It measures the time taken by the individual to stand up from a standard arm chair, walk a distance of three meters, then turn, walk back to the chair and sit down again. It is measured in "seconds".

The test area should be free from obstructions. place a chair with arm rest at one end of the path, mark off a three meter distance using tape or other clean marking.

While testing*:*

- Speak clearly and loudly
- The subject starts with sitting on the chair with back supported, arms resting on the arm rest.
- Use a cue like "ready, set, go" might be helpful.
- A stop watch will be used to time the performance.

Group 1 is treated by speed dependent treadmill training and conventional Physical therapy

TREADMILL training provided initial speed of the treadmill is as low as 0.2–0.4 km/hr. After walking for 30 seconds the subject had a 2 min rest. If they completed the first walking trail safely and without stumbling the belt speed was increased by 10% on the next trial. However if a subject failed to complete the first trial, the belt speed was decreased by 10% on next trial. Subjects completed 7 to 8 walking trials in approximately 4 min. The belt speed was increased by a maximum of 5 increments within one training timing.

Five sessions per week, 15 sessions were completed in 3 weeks period. Actual walking during training sessions (excluding rest periods) was 4 minutes per day during the first week, 6 minutes per day during the second week, and 8 minutes per day during the third week. Total intervention periods (including rest periods) generally ranged between 8-20 minutes. For each patient starting treadmill speed remains same it is not changed patient to patient.

GROUP 2 :- This control group individuals are treated by only conventional physiotherapy which includes following exercises.

- Stretching exercises for hamstring and calf muscle.
- Strengthening exercises done by weight cuff.
- Balance board exercises.
- Tandem walking to improve balance.
- Floor walking gait training.
- Parallel bar walking.
- Side walking and one lag standing.
- Mat exercises.

RESULTS & DATA ANALYSIS

The data analyses were conducted with SPSS 11.5 for Windows. Descriptive statistics were calculated for each group. The paired t test was used to test the significance within the group for gait & mobility. Independent t test was used to test the gait & mobility significance between the two groups.

Table 1:- COMPARISION OF DEMOGRAFHIC DATA OF AGE, GENDER, HEIGHT AND WEIGHT, SIDE INVOLVED AND DURATION BETWEEN THE 2 GROUPS.

	GROUP 1	GROUP 2
AGE	51.50±6.06	51.30±6.48
GENDER (F:M)	5:5	6:4
HEIGHT	173.40±8.85	169.70±7.62
WEIGHT	64.10±10.07	63.80±5.96
SIDE INVOLVED (L:R)	5:5	4:6

Table 2:-WALKING SPEED ANALYSIS

WALKING SPEED (SEC)	PRE TEST MEAN±SD	POST TEST MEAN±SD	P VALUE
GROUP 1	29.70±2.36	17.50±2.37	<0.001**
GROUP 2	28.40±1.58	23.80±1.62	<0.001**

According to above comparison it shows that Group 1 pre-test mean score was 29.70±2.36 and post test score was 17.50±2.37. Group 2 mean score was 28.40±1.58 and post test score was 23.80±1.62. There p value was <0.001**. It shows that significant increase in mobility in group 1 than group 2(conventional therapy).

Table 3: CADENCE ANALYSIS

CADANCE (Number of Steps)	PRE TEST MEAN±SD	POST TEST MEAN±SD	P VALUE
GROUP 1	24.90±3.63	34.30±4.06	<0.001**
GROUP 2	25.80±2.44	29.20±1.81	<0.001**

According to above comparison it shows that group 1 pre-test mean score was 24.90±3.63 and post test score was 34.30±4.06. Group 2 mean score was 25.80±2.44 and post test score was 29.20±1.81. There p value was <0.001**. It shows that significant increase in mobility in group 1 than group 2(conventional therapy).

Table 4: TUG ANALYSIS

Timed Up and Go (TUG)	PRE TEST MEAN±SD	POST TEST MEAN±SD	P VALUE
GROUP 1	27.40±2.88	15.10±3.07	<0.001**
GROUP 2	27.50±2.27	23.60±2.59	<0.001**

According to above comparison it shows that group 1 pre-test mean score was 27.40±2.88 and post test score was 15.10±3.07. Group 2 mean score was 27.50±2.27 and post test score was 23.60±2.59. There p value was <0.001**. It shows that significant increase in mobility in group 1 than group 2 (conventional therapy).

CONCLUSION

The result of the study indicates that speed dependent treadmill training is more effective for improvement of mobility than steady treadmill training and conventional therapy.

The study supports the mobility as a key aspect of stroke rehabilitation and the important factor for functional independence after stroke. These results point out for the need for early physiotherapy intervention focused on mobility management in order to enhance independence.

This study also directs to a fact that Therapists working with stroke patients should be encouraged to monitor the level of impairment, and use multidirectional approach rather than focusing on conventional therapy only.

Recommendations: Further studies can be done to find out the effectiveness of Treadmill training, using body weight support combined with Functional Electrical Stimulation.

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