



ISSN: 0975-833X

Available online at <http://www.journalcra.com>

International Journal of Current Research  
Vol. 11, Issue, 09, pp.6805-6813, September, 2019

DOI: <https://doi.org/10.24941/ijcr.36338.09.2019>

INTERNATIONAL JOURNAL  
OF CURRENT RESEARCH

## RESEARCH ARTICLE

### A COMPARATIVE STUDY TO ANALYZE THE EFFECT OF BODY WEIGHT SUPPORT TREADMILL TRAINING VERSUS WITHOUT BODY WEIGHT SUPPORT TREADMILL TRAINING FOR IMPROVING GAIT IN POST STROKE PATIENTS

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#### ARTICLE INFO

##### Article History:

Received 12<sup>th</sup> June, 2019  
Received in revised form  
18<sup>th</sup> July, 2019  
Accepted 16<sup>th</sup> August, 2019  
Published online 30<sup>th</sup> September, 2019

##### Key Word:

There was significant  
Improvement seen in Group A.

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Citation: Dr. Preet Thakor and Dr. Manoj Kumar, 2019. "A comparative study to analyze the effect of body weight support treadmill training versus without body weight support treadmill training for improving gait in post stroke patients", *International Journal of Current Research*, 11, (08), 6805-6813.

#### ABSTRACT

**Background:** For non-ambulatory stroke patients, treadmill walking with partial weight support provides the opportunity to complete more walking practice than would be possible using assisted over ground walking. Body weight support treadmill training (BWSTT) "uses overhead suspension system and harness to support a percentage of the patient's body weight as the patient walks on a treadmill", thereby removing weight symmetrically from the lower extremities.<sup>20</sup> The performance of complete gait movements on a treadmill with partial body weight support as a task-oriented approach could restore the gait of non-ambulatory patients faster and with less effort for the therapists. **Outcome measure:** Step length, stride length, cadence, 10 meter walk test, dynamic gait index. **Method:** SUBJECTS: 30 diagnosed with stroke and divided in two groups: Group A (experimental group) (n=15), Group B (control group) (n=15). Study duration 3 times per week for 4 weeks. **Results:** Results showed that Group A showed more significant improvement than Group B.

## INTRODUCTION

Stroke is defined by WHO as rapidly developing clinical signs of focal or global disturbances of cerebral function, with symptoms lasting more than 24 hours or leading to death with no apparent non-vascular cause (Ashrafian, 2010). It is an acute onset of neurological dysfunction due to an abnormality in cerebral circulation with resultant signs and symptoms that correspond to involvement of focal areas of brain (Thompson, 1996). Clinically a variety of deficits are possible, including changes in the level of consciousness, and impairments of sensory, motor, cognitive, perceptual, and language functions. Motor deficits are characterized by paralysis (hemiplegia) or weakness (hemiparesis), typically on the side of the body opposite the side of the lesion. The term Hemiplegia is often used generically to refer to the wide variety of problems that result from stroke (Margit, 2011). Stroke is the third major leading cause of death & disability in many countries of the world<sup>4</sup>. Mortality due to stroke is 5.5 million in the world and those who survive stroke each year worldwide is estimated to be 15 million<sup>4,5</sup>. Stroke is a major health problem in India (Cardiovascular diseases, 2003). Hemiparetic gait is characterized by slow and asymmetric steps with poor selective motor control, delayed and disrupted equilibrium reactions and reduced weight bearing on the paretic limb. Smooth and symmetric forward progression of the body is impaired with a large variation in gait patterns related to the

degree of recovery. Well-controlled intra-limb and inter-limb coordination is replaced by mass limb movement patterns (synergies) on the paretic side requiring compensatory adjustments of the pelvis and non-paretic side (Melek junes yavuz, 2006). Stretch, stroking superficial and deep pressure and weight bearing with approximation can all be used during therapy to increase sensory output. motor imagery, use of a mirror, mental practice, electromyographic (EMG) biofeedback, robot-assisted therapy, functional vibratory stimulation, acupuncture and electrical stimulation techniques are used for muscle re-education and facilitation to re-establish voluntary control of body positions and movements after stroke (Melek junes yavuz, 2006). Currently there is increased emphasis on functional/task specific training using intense practice of functional tasks along with behavioural shaping and environmental enrichment locomotor training using body weight support and treadmill training [BWSTT], (Susan B., 2007). Compensatory training strategies are also used in some circumstances to promote resumption of function using the less involved extremities. These are indicated for patients who demonstrate severe motor impairment and limited recovery. Motor learning strategies provide a common base for all functional training (Susan B., 2007). Body weight support treadmill training (BWSTT) "uses overhead suspension system and harness to support a percentage of the patient's body weight as the patient walks on a treadmill", thereby removing

weight symmetrically from the lower extremities (Lisa Taipalus, 2011)

### The advantages to using BWSTT

- It is a dynamic task specific repetitive activity<sup>5,6</sup>, incorporating weight bearing, stepping and balance.
- It allows for early ambulation<sup>1</sup> and can discourage compensatory gait patterns from developing.
- Practice gait as a whole task.
- Can be used for cardiovascular training, as the harness provides a safety measure for fall risk (Lisa Taipalus, 2011)

### Study

To compare treadmill training with partial body weight support to without body weight support treadmill training for improving gait in post-stroke patients.

### Objectives of the study

1. To measure the effect of treadmill training with partial body weight support to without body weight support treadmill training on step length in post-stroke patients.
2. To measure the effect of treadmill training with partial body weight support to without body weight support treadmill training on stride length in post-stroke patients.
3. To measure the effect of treadmill training with partial body weight support to without body weight support treadmill training on cadence in post-stroke patients.
4. To measure the effect of treadmill training with partial body weight support to without body weight support treadmill training on parameters of 10meter walk test in post-stroke patients.
5. To measure the effect of treadmill training with partial body weight support to without body weight support treadmill training on parameters of dynamic gait index in post-stroke patients.

### Proposed Hypothesis

**Null hypothesis (Ho):** There will not be significant effect of treadmill training with partial body weight support to without body weight support treadmill training for improving gait in post-stroke patients.

**Alternate hypothesis (Ha):** There will be significant effect of treadmill training with partial body weight support to without body weight support treadmill training for improving gait in post-stroke patients.

### Review of Literature

**Toshifumi Takao et al. (2015)** conducted a study to improvement of gait ability with a short-term intensive gait rehabilitation program using body weight support treadmill training in community dwelling chronic post stroke survivors. Eighteen subjects participated in this study. The treatment group was composed of 10 subjects (2 women; 8 men; mean age, 59.1 ± 12.5 years; time since stroke onset, 35.3 ± 33.2 months), whereas the control group was made up of 8 subjects (3 women; 5 men; mean age, 59.8 ± 6.3 years; time since

stroke onset, 39.3 ± 27.3 months). The treatment group received BWSTT 3 times a week for 4 weeks (a total of 12 times), with each session lasting 20 minutes. These results suggested that short-term intensive gait rehabilitation using BWSTT was useful for improving gait ability among community dwelling post stroke subjects (Toshifumi Takao, 2015). Jan Mehrholz *et al.* (2014) conducted study Treadmill training and body weight support for walking after stroke. They reported that people after stroke can perform up to 1000 steps in a 20-minute treadmill training session, compared with only 50 to 100 steps during a 20-minute session of conventional physiotherapy (neurophysiological approach). The speed of the treadmill, the amount of body weight support and the amount of assistance provided by the physiotherapist can all be adjusted in order to provide a sufficient training intensity. The results of this review were conclusive in part. Overall, people after stroke who receive treadmill training with or without body weight support are not more likely to improve their ability to walk independently, but their speed of walking and their walking capacity may improve. More specifically, people after stroke who are able to walk independently (but not those who are unable to walk independently) seem to benefit from this type of intervention (Jan Mehrholz, 2014). Klaske Van Kammen *et al.* (2014) conducted study The Combined Effects of Body Weight Support and Gait Speed on Gait Related Muscle Activity: A Comparison between Walking in the Lokomat Exoskeleton and Regular Treadmill Walking. Ten healthy participants walked on a treadmill and in the Lokomat, with varying levels of BWS (0% and 50% of the participants' body weight) and gait speed (0.8, 1.8, and 2.8 km/h), while temporal step characteristics and muscle activity from Erector Spinae, Gluteus Medius, Vastus Lateralis, Biceps Femoris, Gastrocnemius Medialis, and Tibialis Anterior muscles were recorded. The temporal structure of the stepping pattern was altered when participants walked in the Lokomat or when BWS was provided (i.e. the relative duration of the double support phase was reduced, and the single support phase prolonged), but these differences normalized as gait speed increased (Klaske Van Kammen, 2014)

Diana Veneri (2012) conducted study Does Combining Body Weight Support Treadmill Training with Thera-Band Improve Hemiparetic Gait? The purpose of this case was to explore the use of Thera-Band Elastic Band in combination with body weight support treadmill training during locomotor training of a person with chronic stroke. The locomotor training protocol consisted of thirty minutes of training at ten-minute intervals with five-minute rest periods in between, three times per week for a total of ten weeks. Outcome measures included fast gait speed, spatiotemporal variables of gait, endurance and strength of ankle eversion. All 90 training trials were completed. GAITRite data demonstrated a more symmetrical gait pattern, with a more equal step length and stance time when comparing the left and right limbs, and an increased stride length bilaterally (Veneri, 2012).

Pamela W. Duncan *et al.* (2011) conducted a study body-weight-supported treadmill rehabilitation after stroke. One group received training on a treadmill with the use of body-weight support 2 months after the stroke had occurred (early locomotor training), the second group received this training 6 month after the stroke had occurred (late locomotor training), and the third group participated in an exercise program at home managed by a physical therapist 2 months after the stroke (home exercise program). Each intervention included 36

sessions of 90 minutes each for 12 to 16 weeks. Results shown that all groups had similar improvements in walking speed, motor recovery, balance, functional status, and quality of life.<sup>13</sup>

## MATERIAL AND METHODS

**Study setting-** The subjects are taken from Shree B. G. Patel college of physiotherapy, Anand.

### Method of collection data

- Sampling method Convenience sampling
- Type of the study Pre and post experimental study
- Proposed sample size 30 (15 in each group)

### Inclusion criteria

- Age between 50 and 85 years of age.
- Are diagnosed clinically with hemiparesis or hemiplegia.
- Are non-ambulatory defined as scoring 0 or 1 on the Motor Assessment Scale for stroke.
- It had been their first stroke.
- More than 6 months had passed since the stroke onset.
- They had slight-to-moderate motor deficits (stages III to V of the Brunnstrom recovery stages (i.e., BRS).
- They could walk with or without walking aids (ambulation score of functional independence measure (i.e., FIM > 4).

### Exclusion Criteria

- Walked with a normal gait pattern
- Severe cardiac problems
- Treadmill training contraindicated because of existing comorbid condition Cerebellar, bilateral, or brain stem CVA
- Unable to understand simple commands because of language, cognitive, behavioral, or psychiatric disorder
- Readmitted during study period
- Not ambulating before stroke
- Have severe cognitive and/or language deficits which preclude them from following instructions in training sessions

Have unstable cardiac status which would preclude participation in a rehabilitation program.

- Have any pre-morbid history of orthopaedic conditions of the lower limbs which would preclude them from.
- Have clinically evident brainstem signs.
- A higher brain function disorder or cognitive deficit affecting their ability to understand and describe symptoms (< 24 on Mini-Mental State Examination).
- A severe heart disorder affecting gait movement intensity, or
- A severe bone and joint disease affecting gait movement.

### Materials Used in Study

- Assessment charts
- Pencil

- Papers
- Full body weight harness
- Treadmill
- Traction
- Measure tape
- Weighing machine

### Outcome Measures

- 10-meter walk
- Dynamic gait index
- Step length
- Stride length and Cadence

### Procedure

15 subjects diagnosed with stroke on the basis of clinical examination and referred from neurophysician OPD, and 15 diagnosed with stroke was recruited for the study. Subjects were selected on the basis of inclusion and exclusion criteria. Detailed assessment of patients with diagnostic tests for stroke was taken. All subjects were provided written informed consent.

Demographic data, including age, time since onset of stroke, affected side, and paralysis grade of the lower extremity according to BRS, was collected for all subjects (Visintin, 1998). The experimental group received gait training on a treadmill while an overhead harness supported a percentage of their body weight. The control group received gait training on treadmill without overhead harness while bearing full weight on their lower extremities (Visintin, 1998). The harness vertically supports the subject over the treadmill and is attached to a suspension system with a force transducer that signals the amount of body weight support will be given by the traction (Visintin, 1998). Individuals in the BWS group were provided up to 40% BWS at the beginning of training, and the percentage of BWS was progressively decreased as the subject's gait pattern and ability to walk improved (Visintin, 1998). Individuals in the BWS group were provided percentage of BWS is dependent on the individuals' capacity it varies with the individuals (Visintin, 1998). Both groups received gait training for 4 weeks at a frequency of three times per week.

During each session the patients will allow to walk for a maximum of three trials and for a total duration not exceeding 15 minutes (Toshifumi Takao, 2015). The main outcome measures were Step length, Stride length, Cadence. The time in a 10-meter Walk on the floor at maximum effort was recorded for assessment of gait speed. And Dynamic Gait Index for the measured the function of an individuals. The outcome measures were taken before start the study and after completion of 4 weeks (Toshifumi Takao, 2015). The subject's pulse rate, blood pressure and respiratory rate was monitored before initiation of each session and again after each trial to ensure that it not surpass a baseline established by the physician (Toshifumi Takao, 2015). The main outcome measures were Step length, Stride length, Cadence. The time in a 10-meter Walk on the floor at maximum effort was recorded for assessment of gait speed. And Dynamic Gait Index for the measured the function of an individuals. The outcome measures were taken before start the study and after completion of 4 weeks (Toshifumi Takao, 2015).

**Data Analysis:** This study was aimed to compare treadmill training with partial body weight support to without body

weight support treadmill training for improving gait in post-stroke patients. Paired t-test was used to compare pre and post data of experimental group (within group). Paired t-test was used to compare pre and post data of control group (within group). Unpaired t-test was used for between group comparisons. Each calculated P value was compared with table value to test hypothesis at 0.05(5%) level of significance.

**RESULTS**

Here paired t-test was used. Mean value of pre (RT) and (LT) step length for Group A was 28.33 and 30 respectively, and post value of (RT) and (LT) step length for Group A was 40.46 and 41.46 respectively. And SD of pre value of (RT) and (LT) step length for Group A was 5.1 and 5.27, and post value of (RT) and (LT) step length for Group A was 3.98 and 3.68 respectively. And t-value for (RT) and (LT) was 8.5 and 6.31 respectively with p-value <0.0001. Which shows statistically extremely significant.

**Table 1. Shows Group A pre and post Mean and SD of step length**

Group A(Experimental group)						
Step length						
	pre (RT)	post (RT)	pre (LT)	post (LT)	t- value	p-value
MEAN	28.33	40.46	30	41.46	rt=8.5	< 0.0001
SD	5.1	3.98	5.27	3.68	lt=6.31	

**Table 2. Shows Group B pre and post Mean and SD of step length**

Group B(Control group)						
Step length						
	pre (RT)	post (RT)	pre (LT)	post (LT)	t- value	p-value
MEAN	25.93	28.93	26.06	28.4	rt=9.26	< 0.0001
SD	4.43	4.44	3.85	3.75	lt=11	

Here paired t-test was used. Mean value of pre (RT) and (LT) step length for Group B was 25.93 and 26.06 respectively, and post value of (RT) and (LT) step length for Group B was 28.93 and 28.4 respectively. And SD of pre value of (RT) and (LT) step length for Group B was 4.43 and 3.85, and post value of (RT) and (LT) step length for Group B was 4.44 and 3.75 respectively. And t-value for (RT) and (LT) was 9.26 and 11 respectively with p-value <0.0001. Which shows statistically significant.

**Table 3. Shows Group A pre and post Mean and SD of stride length**

Group A(Experimental group)						
Stride length						
	pre (RT)	post (RT)	pre (LT)	post (LT)	t-value	p-value
MEAN	40.66	64.8	44.46	66.46	rt=20	< 0.0001
SD	3.82	4.79	4.75	4.42	lt=14.61	

Here paired t-test was used. Mean value of pre (RT) and (LT) stride length for Group A was 40.66 and 44.46 respectively, and post value of (RT) and (LT) stride length for Group A was 64.8 and 66.46 respectively. And SD of pre value of (RT) and (LT) stride length for Group A was 3.82 and 4.75, and post value of (RT) and (LT) stride length for Group A was 4.79 and 4.42 respectively. And t-value for (RT) and (LT) was 20 and 14.61 respectively with p-value <0.0001. Which shows statistically extremely significant.

**Table 4. Shows Group B pre and post Mean and SD of stride length**

Group B(Control group)						
Stride length						
	pre (RT)	post (RT)	pre (LT)	post (LT)	t-value	p-value
MEAN	38.6	43.13	38.86	42.6	rt=13.48	< 0.0001
SD	4.52	3.96	3.86	3.72	lt=16.36	

Here paired t-test was used. Mean value of pre (RT) and (LT) stride length for Group B was 38.6 and 38.86 respectively, and post value of (RT) and (LT) stride length for Group B was 43.13 and 42.6 respectively. And SD of pre value of (RT) and (LT) stride length for Group B was 4.52 and 3.86, and post value of (RT) and (LT) stride length for Group B was 3.96 and 3.72 respectively. And t-value for (RT) and (LT) was 13.48 and 16.36 respectively with p-value <0.0001. Which shows statistically significant.

**Table 5. Shows Group A pre and post Mean and SD of Cadence**

Group A(Experimental group)				
Cadence				
	pre	post	t-value	p-value
MEAN	40.26	63.6	13.68	< 0.0001
SD	7.8	9		

Here paired t-test was used. Mean value of pre cadence for Group A was 40.26, and post value of cadence for Group A was 63.6. And SD of pre value for Group A cadence was 7.8, and post value for Group A cadence was 9. And t-value was 13.68 with p-value <0.0001. Which shows statistically extremely significant.

**Table 6. Shows Group B pre and post Mean and SD of Cadence**

Group B(Control group)				
Cadence				
	pre	post	t-value	p-value
MEAN	35.86	41.46	12.02	< 0.0001
SD	6.42	6.34		

Here paired t-test was used. Mean value of pre cadence for Group B was 35.86, and post value of cadence for Group B was 41.46. And SD of pre value for Group B cadence was 6.42, and post value for Group B cadence was 6.34. And t-value was 12.02 with p-value <0.0001. Which shows statistically significant.

**Table 7. Shows Group A pre and post Mean and SD of 10 Meter Walk Test**

Group A(Experimental group)				
10 Meter Walk Test				
	pre	post	t-value	p-value
MEAN	1.21	0.68	0.78	< 0.0001
SD	1.4	2.0		

Here paired t-test was used. Mean value of pre Time of 10 Meter Walk Test for Group A was 1.21, and post Time of 10 Meter Walk Test for Group A was 0.68. And SD of pre Time of 10 Meter Walk Test for Group A was 1.4, and post Time of 10 Meter Walk Test for Group A was 2.0. And t-value was 0.78 with p-value <0.0001. Which shows statistically extremely significant. Here paired t-test was used. Mean value of pre Time of 10 Meter Walk Test for Group B was 1.23, and post Time of 10 Meter Walk Test for Group B was 1.1. And SD of

pre Time of 10 Meter Walk Test for Group B was 1.4, and post Time of 10 Meter Walk Test for Group B was 1.8. And t-value was 12.47 with p-value <0.0001. Which shows statistically significant.

**Table 8. Shows Group B pre and post Mean and SD of 10 Meter Walk Test**

Group B(Control group)				
10 Meter Walk Test				
	pre	post	t-value	p-value
MEAN	1.23	1.1	12.47	< 0.0001
SD	1.4	1.8		

**Table 9. Shows Group A pre and post Mean and SD of Dynamic gait index**

Group A(Experimental group)				
Dynamic Gait Index				
	pre	post	t-value	p-value
MEAN	4.33	5.46	3.5	0.0035
SD	0.69	0.49		

Here paired t-test was used. Mean value of pre score of Dynamic Gait Index for Group A was 4.33, and post score of Dynamic Gait Index for Group A was 5.46. And SD of pre score Dynamic Gait Index for Group A was 0.69, and post score Dynamic Gait Index for Group A was 0.49. And t-value was 3.5 with p-value 0.0035. Which shows statistically extremely significant.

**Table 10. Shows Group B pre and post Mean and SD of Dynamic gait index**

Group B(Control group)				
Dynamic Gait Index				
	pre	post	t-value	p-value
MEAN	4	4.46	6.84	< 0.0001
SD	0.73	0.71		

Here paired t-test was used. Mean value of pre score of Dynamic Gait Index for Group B was 4, and post score of Dynamic Gait Index for Group B was 4.46. And SD of pre score Dynamic Gait Index for Group B was 0.73, and post score Dynamic Gait Index for Group B was 0.71. And t-value was 6.84 with p-value <0.0001. Which shows statistically significant.

**Table 11. Shows Group A and Group B pre and post Mean and SD of step length**

Step length						
	Group A (RT)	Group B (RT)	Group A (LT)	Group B (LT)	t-value	p-value
MEAN	40.46	28.93	41.46	28.4	rt=7.28	< 0.0001
SD	3.98	4.44	3.68	3.75	lt=9.29	

Here unpaired t-test was used. Mean value of post (RT) and (LT) step length for Group A was 40.46 and 41.46 respectively, and post value of (RT) and (LT) step length for Group B was 28.93 and 28.4 respectively. And SD of post value of (RT) and (LT) step length for Group A was 3.98 and 3.68, and post value of (RT) and (LT) step length for Group B was 4.44 and 3.75 respectively. And t-value for (RT) and (LT) was 7.28 and 9.29 respectively with p-value <0.0001. Which shows statistically extremely significant.

**Table 12. Shows Group A and Group B pre and post Mean and SD of stride length**

Stride length						
	Group A (RT)	Group B (RT)	Group A (LT)	Group B (LT)	t-value	p-value
MEAN	64.8	43.13	66.4	42.6	rt=13.04	< 0.0001
SD	4.79	3.96	4.42	3.72	lt=15.45	

Here unpaired t-test was used. Mean value of post (RT) and (LT) stride length for Group A was 64.8 and 66.4 respectively, and post value of (RT) and (LT) stride length for Group B was 43.13 and 42.6 respectively. And SD of post value of (RT) and (LT) stride length for Group A was 4.79 and 4.42, and post value of (RT) and (LT) stride length for Group B was 3.96 and 3.72 respectively. And t-value for (RT) and (LT) was 13.04 and 15.45 respectively with p-value <0.0001. Which shows statistically extremely significant.

**Table 13. Shows Group A and Group B pre and post Mean and SD of cadence**

Cadence				
	Group A	Group B	t-value	p-value
MEAN	63.6	41.46	7.51	< 0.0001
SD	9	6.34		

Here unpaired t-test was used. Mean value of post cadence for Group A was 63.6, and post value of cadence for Group B was 41.46. And SD of post value of cadence for Group A was 9, and post value of cadence for Group B was 6.34. And t-value was 7.51 with p-value <0.0001. Which shows statistically extremely significant.

**Table 14. Shows Group A and Group B pre and post Mean and SD of 10 Meter Walk Test**

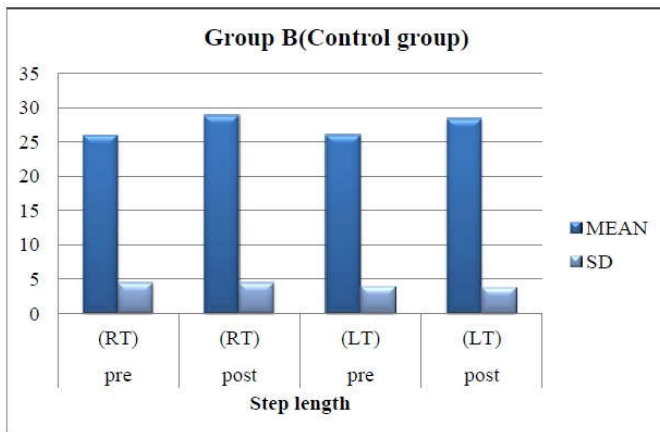
10 Meter Walk Test				
	Group A	Group B	t-value	p-value
MEAN	0.68	1.1	3.16	0.0037
SD	2.0	1.8		

Here unpaired t-test was used. Mean value of post Time of 10 Meter Walk Test for Group A was 0.68, and post Time of 10 Meter Walk Test for Group B was 1.1. And SD of post Time of 10 Meter Walk Test for Group A was 2.0, and post Time of 10 Meter Walk Test for Group B was 1.8. And t-value was 3.16 with p-value 0.0037. Which shows statistically extremely significant.

**Table 15. Shows Group A and Group B pre and post Mean and SD of Dynamic gait index**

Dynamic Gait Index				
	Group A	Group B	t-value	p-value
MEAN	5.46	4.46	4.27	0.0002
SD	0.49	0.71		

Here unpaired t-test was used. Mean value of post score of Dynamic Gait Index for Group A was 5.46, and post score of Dynamic Gait Index for Group B was 4.46. And SD of post score Dynamic Gait Index for Group A was 0.49, and post score Dynamic Gait Index for Group B was 0.71. And t-value was 4.27 with p-value 0.0002. Which shows statistically extremely significant.

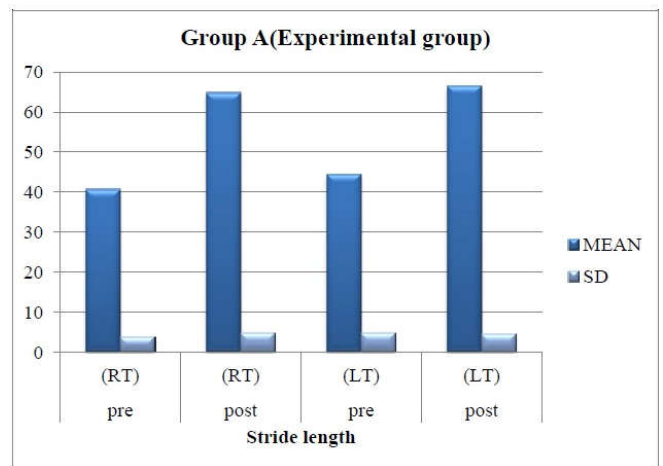


Graph 2. Bar diagram shows comparison Mean and SD of Group B step length

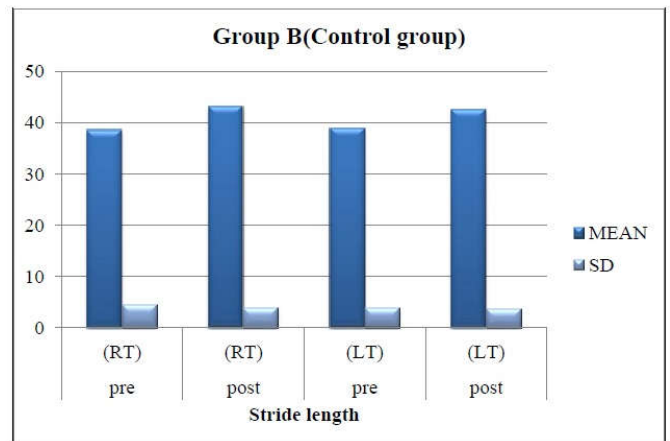
**DISCUSSION**

The results showed improvement in gait speed after 12 sessions of gait rehabilitation using BWSTT. In this study protocol was 4 weeks of BWSTT at a frequency of 3 times per week, and this was a shorter period and lower frequency than those of other studies; however, the improvement in gait speed was relatively similar (Toshifumi Takao, 2015). This was an important point of the study. In a BWSTT intervention, the proportion of body weight support and the treadmill speed are selectable during each session; however, there is no standard for selection. As the duration of the sessions ranged from 20 to

40 minutes in other studies 15 minutes was selected in the present study. The proportion of body weight support varied from 15 to 50% in previous works and Aaslund *et al.* 2013 argued that during treadmill walking, the choice of walking speed had a greater impact on kinematic walking characteristics than the proportion of body weight support.<sup>14</sup> So, the proportion of body weight support was set at individuals capacity in all sessions, and the subjects selected the treadmill speed on their own to a speed that was as fast as possible but was below their gait speed on the floor. Under the conditions, none of the subjects dropped out of the study, and they could walk safely on the treadmill (Werner, 2002).



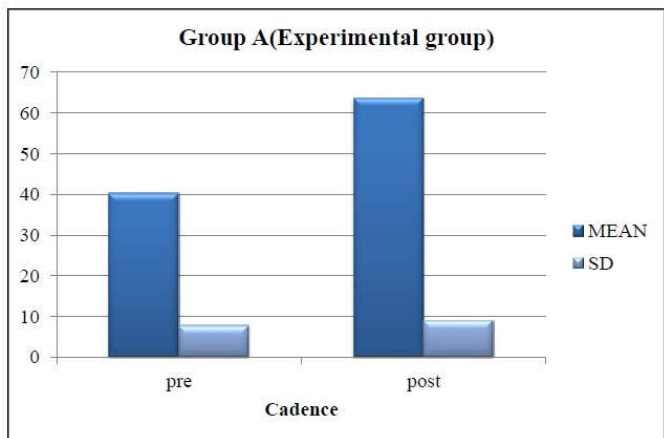
Graph 3. Bar diagram shows comparison Mean and SD of Group A stride length



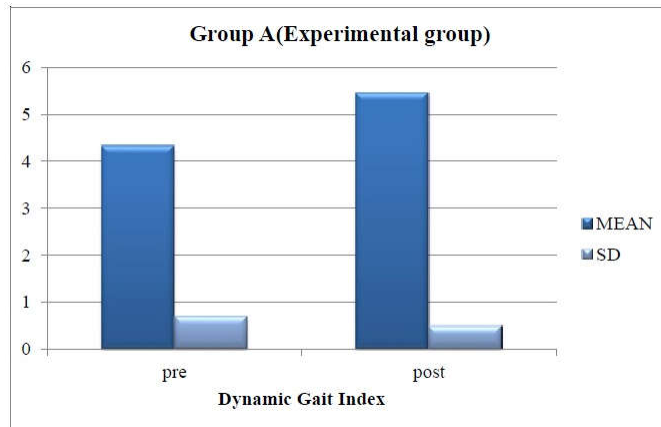
Graph 4. Bar diagram shows comparison mean and SD of Group B stride length

Thus, the protocol may be suitable for gait rehabilitation for chronic stroke survivors who can walk with or without any walking aids. Recent studies suggested that walking-related indexes were improved by intensive gait rehabilitation or several rehabilitation programs for chronic stroke survivors (Catarina, 2011). Gait speed has been recognized as an indicator of gait performance, and it is composed of step length and cadence. In this study, gait speed showed a significant increase during and after the BWSTT intervention. A recent studies suggested that BWSTT activates the central pattern generator in the human spinal cord and produces a constant rhythm of walking in poststroke survivors (Toshifumi Takao, 2015). In addition, Murray *et al.*1985 reported that subjects tended to use a faster cadence during treadmill walking than during floor walking.

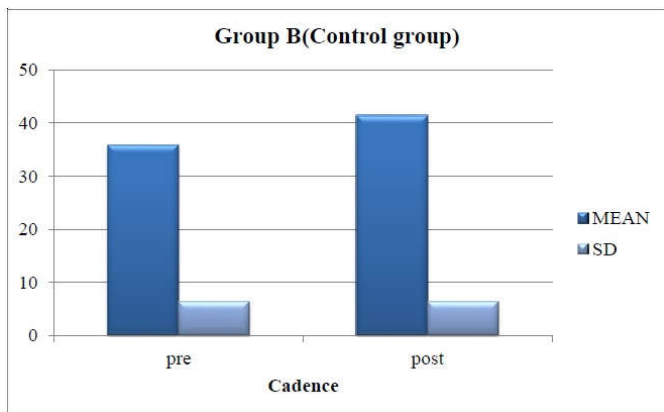




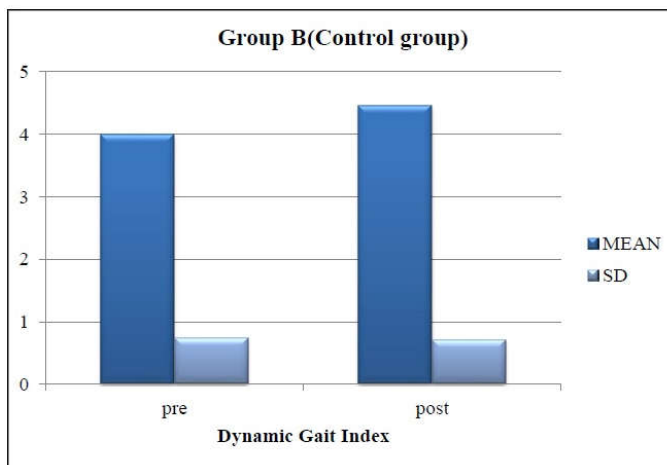
Graph 5. Bar diagram shows comparison mean and SD of Group A cadence



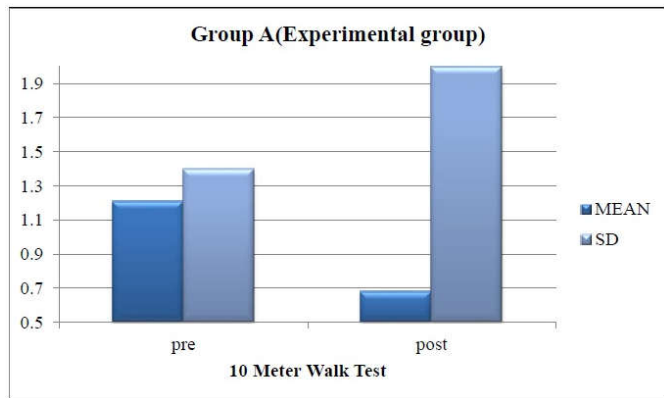
Graph 9. Bar diagram shows comparison Mean and SD of Group A Dynamic Gait Index



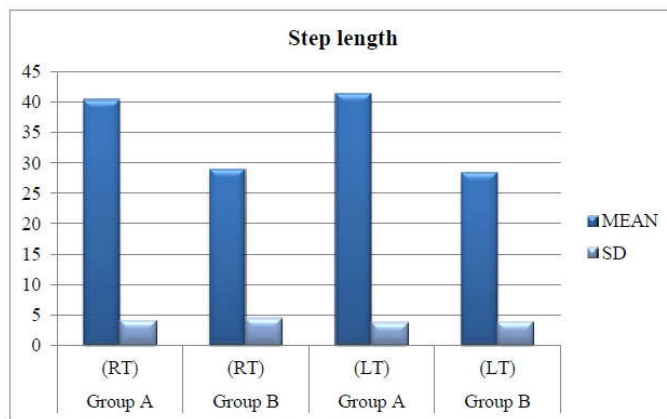
Graph 6. Bar diagram shows comparison Mean and SD of Group B cadence



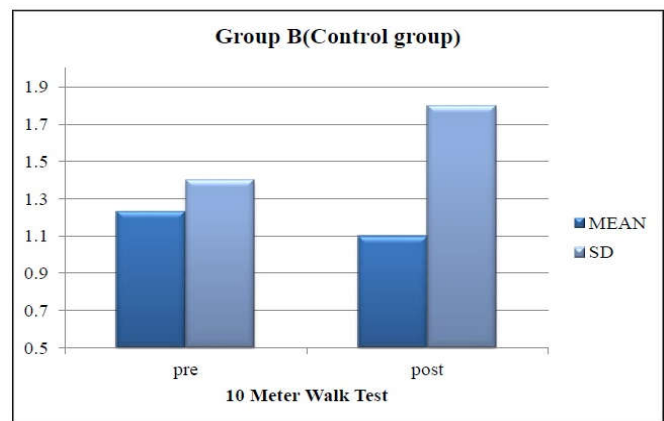
Graph 10. Bar diagram shows comparison Mean SD of Group B Dynamic Gait Index



Graph 7. Bar diagram shows comparison mean and SD of group A 10 Meter walk test

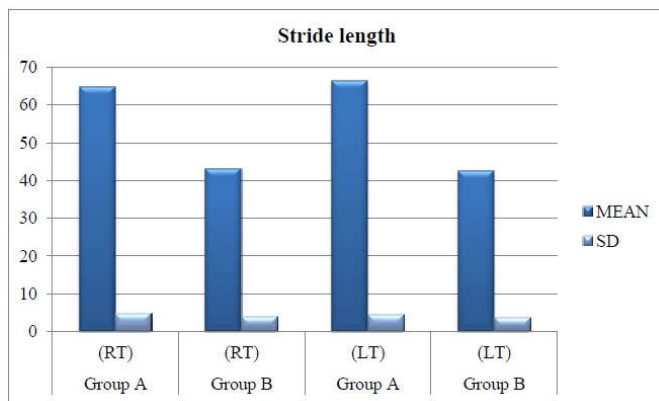


Graph 11. Bar diagram shows Comparison Mean SD of Group B step Length

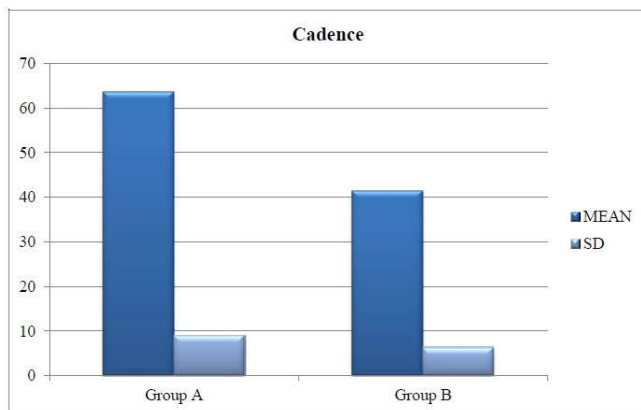


Graph 8. Bar diagram shows comparison mean and SD of Group B 10 Meter walk test

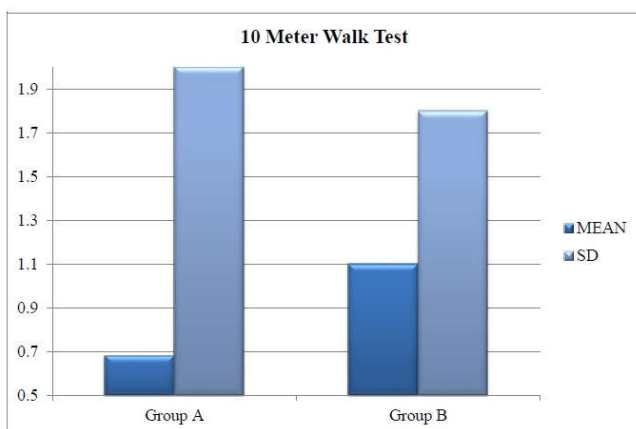
It is suggested that these two mechanisms caused the improvement in gait speed in this study (Werner, 2002). Furthermore, step length and cadence increased in the treatment group, and since both step length and cadence were associated with gait speed, their combination effects caused an increase in gait speed (Jan Mehrholz, 2014). That is to say, BWSTT could be an intervention that specifically improves gait speed. If therapists are able to secure sufficient time to perform rehabilitation for patients, they might provide chronic patients with various therapeutic treatments.



Graph 12. Bar diagram shows comparison Mean and SD of Group A and Group M stride length



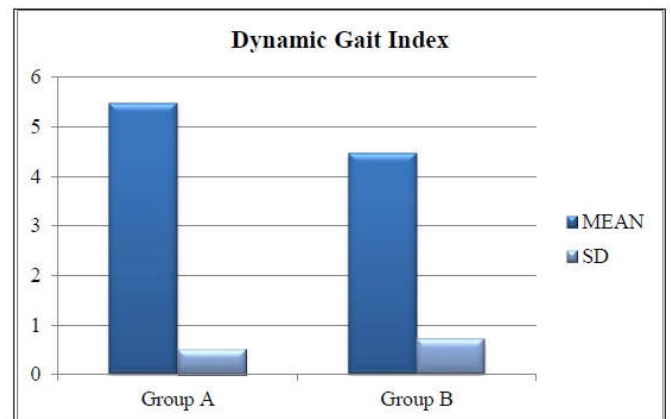
Graph 13. Bar diagram shows comparison Mean and SD of Group A and Group B cadence



Graph 14. Bar diagram shows comparison Mean and SD of Group A and Group B 10 Meter walk Test

On the other hand, it is very important to gain advantageous results under the constraints of limited time (Toshifumi Takao, 2015). Individuals with stroke present limited foot rotation and lower-limb flexion during the swing period which leads to insufficient toe-clearance. Consequently, these individuals have an increased risk for stumbling and falling (Werner, 2002). Besides increasing gait speed, gait training with partial BWS during treadmill walking promoted increased toe-clearance which is an important gait requirement for safety. Increased toe-clearance resulted from increased segmental rotation of the lower limbs (Catarina, 2011). Locomotor therapy in neurological rehabilitation is dependent on activation of spinal and supraspinal locomotor pattern

generators. Besides experiments in spinalized cats, alterations of muscle activation patterns of various lower limb muscles in paraparetic and hemiparetic subjects following locomotor therapy support the assumption of neural adaptations (Klaske Van Kammen, 2014).



Graph 15. Bar diagram shows comparison mean and SD of Group A and Group B Dynamic gait index

Also, one should keep in mind that spontaneous recovery surely contributed to the observed beneficial effects within a relatively short time. The group comparison revealed that patients in group A had reached a significantly higher gait ability level as compared with patients in group B. Setting the paretic limbs and controlling the trunk movement required a considerable physical effort from the therapists, in a nonoptimal working posture (Toshifumi Takao, 2015).

## Conclusion

This is pre and post experimental study comparing Body Weight Support System Treadmill Training versus Treadmill Training in post stroke patients on 30 subjects. This study concluded that Body Weight Support System Treadmill Training shows more improvement in gait of post stroke patients compare to Treadmill Training.

## Limitation of the Study

- The study consists of small sample size which should be received to large sample size.
- Sampling technique was not standard.

## Suggestion for Future study

- Study could be done with large sample size.
- Comparison could be done with over ground walking.

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