

# Additional Effects of Obstacle Training on Gait Speed and Balance in Chronic Stroke Patients

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## ABSTRACT

**Background:** Stroke survivors have an increased risk of falls and subsequent injuries due to their locomotor disabilities including impaired balance, decreased stride length, walking speed & endurance, compromised ability to step over objects which leads to difficulty in community ambulation. Community ambulation requires the ability to integrate walking with a variety of tasks in a complex and changing environment and the ability to successfully navigate in the community. Obstacle training represents the objects of environment such as toys on the floor, wires, potholes etc. Hence it is crucial to study the effect of obstacle training on functional ambulation.

**Method-**Twenty-three patients were recruited according to eligibility criteria out of which 21 patients completed the intervention. After recruitment, baseline 1 measurement was done using the outcome measures. For two weeks the patients continued only with conventional physiotherapy. After two weeks baseline 2 measurement was done. Then obstacle training along with conventional training which consisted of 6 supervised session over the period of 2 weeks and the patient had to step over 10 equidistant blocks and they had to do 12 rounds of the same. After intervention period post assessment was done.

**Results-**There are significant changes seen in the gait speed and balance post intervention. The mean change in the outcomes ( $p=0.00$ ) were more in the intervention phase plus conventional phase rather than conventional phase alone.

**Conclusion-**This study concludes obstacle training can be used as an adjunct to conventional training for improving gait speed and balance.

**Keywords-** Chronic stroke; obstacle training; rehabilitation; gait speed; balance.

## INTRODUCTION

Stroke is defined by the World Health Organization as 'A clinical syndrome consisting of rapidly developing clinical signs of focal (or global in case of coma) disturbance of cerebral function lasting more than 24 hours or leading to death with no apparent cause other than a vascular origin'. Stroke is third leading cause of hospital admissions in industrial population. <sup>(1)</sup> Stroke shows symptoms of weakness of muscles i.e. hemiparesis, spasticity, visual,

balance and cognitive impairments, hemisensory loss, attention deficits.

The risk of falls in individuals post stroke is very high and it is a huge concern for their entire life. Falls can cause physical and psychological impact on the person. <sup>(2)</sup> The risk factors include hemisensory loss, weakness of muscles, visual hemianopia, diabetes, cardiac involvement, etc. <sup>(3,4)</sup> Also risk of falls can be because of balance impairments, attention deficits can be factor for fall. <sup>(5,6)</sup> Environment plays a huge role

for prevalence of falls mainly uneven surfaces cause falls. <sup>(7)</sup>

Gait velocity is reduced in people suffering from stroke. One of the main gait determinants is hip knee flexion; this is mainly impaired in stroke patients, which causes reduction gait velocity. Decreased gait velocity has strong correlation with impaired mobility. Gait speed is also influenced by paretic hip extensor coupling of knee extension and hip flexion. <sup>(8)</sup> This mainly causes reduction in community ambulation and reduces social participation. <sup>(9)</sup> Community ambulation requires to walk with a variety of tasks in a complex and changing environment and the ability to successfully navigate in the community. <sup>(10)</sup> Patients are mainly worried because it is difficult to do obstacle crossing, walking on uneven surface and also crossing roads. Therefore, it is necessary to train the patients to do such complex task. This study therefore aims at studying the effect of obstacle training on gait speed and balance of the patients.

Obstacle training represents the objects of indoor environment i.e. wires, stools, toys on the floor etc. In community environment obstacles are in the form of curbs on the roads, potholes etc. which causes falls and also causes difficulty in doing community ambulation as there is weakness and balance is lost in crossing these obstacles. <sup>(7)</sup> All this obstacle causes difficulty in doing Activities of daily living and also hampers social and community participation. Training for obstacle training is trying to tackle this problem and train the patients in a safe environment. This can help patients to improve their community ambulation and assist them in their day to day activities. Hence the aim of the study is to study the additional effect of obstacle training along with conventional therapy on gait speed and balance in chronic stroke patients. The objectives of the study are to assess the additional benefits of gait speed and balance in chronic stroke patients with a) conventional training and b) obstacle training.

## MATERIALS AND METHODS

The study was done on 23 patients. All the patients were given consent forms which contained the details of the project. The mean age of the patients was  $51.08 \pm 13.27$ . There were 20 males (dropped out =2) and 3 females in the study. The patients who had a cerebrovascular accident 6 months ago and who have reduced step length were included in the study. Also, patients who could walk 10meters independently with or without an assistive device were included. Patients having unstable hypertension, seizures, angina visual affection, difficulty in understanding commands were excluded from the trial. Also, patients having any other neurological diseases like multiple sclerosis, Parkinson's disease, traumatic brain injury were excluded. Any recent joint replacement surgery patients were also excluded. Two patients dropped out of the trial after one week of conventional treatment.

The patients were assessed using six-minute walk test, 10-meter walk time test, Tinetti performance oriented mobility assessment and baseline 1 measurements were taken. The patients continued to do their conventional therapy for 2 weeks. Conventional therapy consisted of weight bearing activities for upper limb and lower limb, task-oriented reaching and manipulation activity for upper limb, transfers like sit to stand, walking in parallel bars, balance training in standing, truncal rotation activities in sitting. After two weeks the patients baseline 2 assessments were taken. Post baseline 2 assessment, conventional therapy along obstacle training was started. Obstacle training consisted of 6 supervised sessions over a period of 2 weeks i.e. three sessions per week was done. The intervention consisted of patients stepping over 10 foam blocks of 3 inch height placed at equidistant points. The patients had to take 12 rounds of this setting and this consisted of 1 session. They were timed for each session. The obstacle training sessions were generally taken post conventional treatment to maintain

similarity in the study. After 6 sessions of obstacle training, post interventional assessment was taken

### Statistical analysis-

Statistical analysis was done using SPSS 16 software. Repeated measures Anova was done for six-minute walk test and Timed 10-meter walk test. POMA was analyzed using Friedman's two-way Anova by ranks. Level of confidence was set at  $p \leq 0.05$  and also Bonferroni method was used for analyses. For results of six-minute walk test and timed 10-meter walk test Mauchly's test of sphericity was observed and then Greenhouse-Geisser test for within subject effect was seen.

## RESULTS

### 1) Six-minute walk test (p=0.000)

Six-minute walk test	Mean ± Standard deviation
Baseline 1	141.5±71.13
Baseline 2	164±74.82
Post training	189±78.42

### 2) Ten-meter walk time test (p=0.000)

10-meter walk time test	Mean± Standard deviation
Baseline 1	15.86±7.2
Baseline 2	14.47±7.1
Post training	13.00±6.91

### 3) Performance oriented mobility assessment (p=0.000)

Poma	Mean± Standard deviation
Baseline 1	18.17±3.05
Baseline 2	19.71±3.34
Post training	21.33±2.93

## DISCUSSION

The current study has shown a significant change in walking speed, walking endurance and balance with conventional therapy and obstacle training rather than conventional training alone.

In a recent study by Mentiplay, it has been found that hip flexors and ankle plantar flexor strength have a large contribution to gait velocity. <sup>(9)</sup> Obstacle training mainly works on activating hip flexors and using knee strategy. <sup>(11)</sup> Also, it has been found that gait velocity is good indicator of function and a good measure for community ambulation. <sup>(12,13)</sup> Gait velocity also depends on the cardio vascular

endurance of the patients. <sup>(14)</sup> Improvement in six-minute walk test results thereby show improvement in cardio vascular endurance thus improving gait velocity.

Risk of falls is high in patients post stroke causing fear of fall. One of the important reasons for fall is balance impairment. The fear of fall and balance impairments mainly causes limited community ambulation. In a previous study it is mentioned that the main reason of balance impairment is weakness of muscles, proprioception loss and also sensory loss. <sup>(14)</sup> This study tries to focus improving muscle strength and proprioception by repetition of movement, but it is observed in the study that changes in standing are more than dynamic gait balance. The changes can be attributed to conventional therapy which helps in improving standing balance.

Furthermore, it has been observed in this study that the patients had started to gain confidence to cross obstacles post training. The time to do the intervention is reduced every session for all patients. The fatigue is delayed after every session for each patient from their previous session showing improvement in their cardio-vascular endurance. This helped patients self-evaluate their progress after every session. The patients had a positive approach to the therapy and also the patient had a break from the monotonicity from the conventional treatment.

The limitation of my study is that there is no washout period and the conventional therapy has a carry-over effect. Also, the effect of the training was not measured after two weeks of intervention to see the effect of training in patients. The study can be done on a larger population and the effect on the patient can be observed.

## CONCLUSION

This study concludes that obstacle training can be used as an adjunct to conventional training for improving gait speed and balance. This gives a different approach to the treatment with involvement

of the patient in the treatment making it more functional and specific. Clinical implication of the study is, obstacle training can be included with the regular conventional treatment of the patient making the rehabilitation process quicker and faster, thus making the patient functionally independent and increase the social participation.

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