

## Effect of Modified Shoe with Motor Relearning Programme on Timed Up and Go Test Values and Gait Parameters in Chronic Stroke Patients: Comparative Study

R. Muthupandi kumar<sup>1</sup>, R. Shyam Sundar<sup>2</sup>,  
M. Premkumar<sup>3</sup>, Mohammed Ameer Hussain<sup>4</sup>

<sup>1,2</sup>PhD Research Scholar, <sup>3</sup>Professor cum PhD Research Scholar, Institute of Physiotherapy, Srinivas University, City Campus, Pandeshwar, Mangaluru, Karnataka - 575001, <sup>4</sup>PhD Research Scholar, Institute of Physiotherapy, Srinivas University, Mangaluru, India..

**How to cite this article:** R. Muthupandi kumar, R. Shyam Sundar, M. Premkumar et. al. Effect of Modified Shoe with Motor Relearning Programme on Timed Up and Go Test Values and Gait Parameters in Chronic Stroke Patients: Comparative Study. Indian Journal of Physiotherapy and Occupational Therapy.

### Abstract

**Background:** Hemiplegia secondary to stroke contributes to problems associated with standing and walking. Hemiplegic patients suffer from poor balance, slow walking, and weak muscles. Shoe modification and foot orthoses can play an important role in the nonsurgical management of foot and ankle pathology. Therapeutic footwear may be used to treat patients with diabetes, arthritis, neurologic conditions, traumatic injuries, congenital deformities, and sports-related injuries. These modalities may improve patient gait and increase the level of ambulation.

**Aims and objectives of the study:** To analyse the effect of modified shoe with motor relearning programme on Timed Up and Go test values and gait parameters of chronic stroke patients.

**Data Analysis and Results:** Pre intervention values of Timed Up and Go test (TUG) and gait parameters were homogenous between control and experimental groups with  $p \geq 0.05$  and post intervention values of TUG and gait parameters were statistically significant improvement in experimental group where shoe modification with motor relearning program with  $p \leq 0.05$

**Conclusion:** It was concluded that Modified Shoe with Motor Relearning Programme had statistically significant improvement in the Timed Up and Go test values and gait parameters of chronic stroke patients when compared to motor relearning program alone.

**Keywords:** Chronic Stroke, Motor Relearning Program, Timed Up and Go Test, Gait Parameters.

### Introduction

Stroke is the second most frequent cause of death after coronary artery disease. In India, stroke is an

important cause of premature death and disability.<sup>1,2</sup> Hemiplegia secondary to stroke contributes to problems associated with standing and walking. Hemiplegic patients suffer from poor balance, slow

**Corresponding Author:** M. Prem Kumar, Professor cum PhD Research Scholar (Corresponding Author), Institute of Physiotherapy, Srinivas University, City Campus, Pandeshwar, Mangaluru, Karnataka - 575001.

**ORCID ID:** 0000-0003-0958-6143

walking, and weak muscles.<sup>3,4</sup> Spasticity usually develops slowly with anti gravity muscles of the upper extremity and usually affects the depressors of the shoulder girdle and arm; the fixators and retractors of the scapula, the side flexors of the trunk, the adductors and internal rotators of the arm, the flexors and pronators of the elbow and wrist, the flexors and adductors of the fingers.<sup>5</sup>

Physiotherapy interventions for stroke subjects are represented by various approaches, for example proprioceptive neuromuscular facilitation, Brunnstrom, Bobath and motor relearning program. There is a general opinion that physiotherapy improves the function of the stroke subjects. But the benefit seems to be statistically small and limited. In few controlled studies on these subjects there was no proper documentation showing the effect of above mentioned physiotherapy approaches gives better result than the other approaches.<sup>6</sup>

Motor relearning program (MRP) was developed by Carr and Shepherd for stroke that incorporates many aspects of motor learning theory and provides practical guidelines for retraining functional skills.<sup>7</sup>

Ambulation is an important movement pattern by which one can move in community.<sup>8,9</sup> Walking is an essential movement which enables us to be active and productive. Normal walking speed for elderly people is 1.3 m/s and walking capacity measured by the distance covered in 6 minutes is 576 meters for men and 494 meters for women. After stroke, many patients have lingering walking disabilities.

Shoe modification and foot orthoses can play an important role in the nonsurgical management of foot and ankle pathology. Therapeutic footwear may be used to treat patients with diabetes, arthritis, neurologic conditions, traumatic injuries, congenital deformities, and sports-related injuries. These modalities may improve patient gait and increase the level of ambulation.<sup>10,11</sup>

Therapists use a wide-range of strategies and interventions to assist those with a neurological disorder to be able to complete everyday tasks and participate in activities. Therapists may use a remedial approach, such as repetitive task performance

or spaced retrieval, or a compensatory approach such as using cues, or modification of the task, or environment. Evidence suggests that repetitive task training is an effective approach for regaining motor function after stroke.<sup>12</sup>

Due to characteristic hemiplegic gait there is learned disuse of affected limb. In such population weight bearing asymmetry, equinovarus positioning of foot complex, reduced hip extension, hyperextension of knee and pelvic retraction are observed in affected lower extremity while walking. So they are not able to do the necessary hip-knee ankle flexion of the affected lower extremity during the swing phase of gait. As a consequence, the affected leg relatively lengthens causing the patient to walk with a hiking or a circumduction gait. Increasing the height of the unaffected side can help to relatively shorten the affected lower extremity, shifting weight on affected side in stance helping symmetrical weight bearing, foot clearance in swing and reduce the effort of walking. Few studies showed significant immediate improvement in weight bearing with temporary use of shoe lift on unaffected lower extremity in stroke patients.<sup>13-16</sup>

The main aim of this study was to compare the effect of Modified shoe with Motor Relearning Programme versus Motor Relearning Program alone on Gait of Chronic stroke patients. With this study results for Chronic Stroke patients, the physiotherapy treatment may include Modified Shoe with Motor Relearning Programme to treat effectively chronic stroke patients.

## Materials and Methods

**Study Design:** Comparative study.

**Study Setting:** Aayush Physiotherapy Clinic, Bypass Road, Madurai.

**Study Duration:** 24 months.

**Study Sampling:** Convenient Sampling.

**Study Population:** In Around Madurai District.

**Study Sample:** 10 subjects in each group.

### Criteria of Selection:

#### Inclusion Criteria:

- Age: 55 to 75 years
- Sex: Both Sex
- Both side affected hemiplegic patients
- Hemiplegic for the past 6 months
- Hemiplegic can walk with assistance

#### Exclusion Criteria:

- Severe musculoskeletal disorder.
- Serious neurological and cardiorespiratory disorders
- Disoriented and non cooperative patients.
- Non cooperative patients

#### Variables:

- Time Up and Go Test values in seconds
- Step Length and Cadence

#### Intervention:

- Shoe Modification
- Motor Relearning Program

#### Procedure:

20 subjects full fill the criteria of selection were selected and recruited for this study through convenient sampling method. Their demographic data including vitals were collected and documented. Pre intervention Timed Up and Go test values in seconds were measured and recorded. Subjects were divided into control and experimental group of 10 each through lottery method. Motor relearning program was given to control group by adapting functional ambulatory patterns whereas experimental group were given motor relearning program with modified shoe in ambulation training. Interventions were given on functional ambulation, 45 minutes a session, 4 sessions a week for 20 weeks were given. Post intervention Timed Up and Go test values were taken and documented. Suitable statistical methods in the form of paired student t test with descriptive

analysis was done with the assistance of spss 16.0 software version for windows.

#### Motor Relearning Programme:

Motor Relearning Programme (MRP) studies show considerable improvement in functional recovery, walking, motor function, balance and quality of life in acute and sub-acute stroke patients, to improve ambulation of post-stroke patients. Active participation and self reliance would help in subjects to learn effectively motor learning of the pattern of movement, in a given context and task.

#### Shoe Modification:

The use of a 1 cm shoe rise on the unaffected side was used to effect the affected gait cycle of stroke patients. Hence, finding out the effect of shoe raise on the uninjured leg along with motor relearning program on spatio-temporal parameters and gait deviations of the affected gait cycle, is of absolute importance.

### Data Analysis and Results

Shapiro Wilk test was used for checking normality distribution of data and independent student t test was used for analysis between variables in between groups.

This study results were showing that the pre and post intervention values of variables of timed up and go test values and gait parameters of cadence and step length in chronic patients of both control and experimental group in this study. In that pre intervention mean values of TUG and gait parameters were statistically homogenous with  $p \geq 0.05$ . Post intervention values of TUG and gait parameters were significantly better in experimental group where the patients were received motor relearning program with modified shoe when compared to control group where patients were received motor relearning program alone with  $p \leq 0.05$ . Results of significance p value were with  $p \leq 0.05$  in experimental group was the main outcome of this study which supports the evidence of effectiveness of shoe modification. Independent student t test was used for data analysis with spss software version 16.0 for windows.

**Table 1: Comparison of pre intervention values of mean, SD and p value between control and experimental group with student t test (Source: Author)**

No of Subjects	Variables	Control Group (Spencer Technique) Mean ± SD	Experimental Group (Myofascial Release) Mean ± SD	P value
20	Timed Up and Go Test values	22.0 ± 6.89	22.5 ± 2.5	0.6121
	Step length	24.54 ± 13.37	25.24 ± 12.74	0.5782
	Cadence	35.65 ± 23.12	36.40 ± 16.48	0.6342

**Table 2: Comparison of post intervention values of mean, SD and p value between control and experimental group with student t test (Source: Author)**

No of Subjects	Variables	Control Group (Spencer Technique) Mean ± SD	Experimental Group (Myofascial Release) Mean ± SD	P value
20	Timed Up and Go Test values	18.7 ± 5.34	16.4 ± 0.93	0.0095
	Step length	30.0 ± 26.47	35.0 ± 18.82	0.0043
	Cadence	40.2 ± 22.86	48.0 ± 22.47	0.0032



**Fig 1: Shoe modification (Source: Author)**



**Fig 2: Patient ambulation with shoe modification (Source: Author)**

**Discussion**

There was statistically significant improvement of timed up and go test values and gait parameters of step length and cadence in experimental group subjects where motor relearning program with modified shoe were given. That might be happened because of even 1 cm rise of sole and shoe modification would alter the biomechanics of loading and propulsion. This was echoing the view of a study results in 2014 which stated that combination of 1 cm of insole on unaffected leg with conventional physiotherapy, promoted symmetrical weight distribution during standing and walking, improved gait performance and balance in people with stroke.<sup>17</sup> and study results strengthened the conclusion of study by **Dr.Gajanan Bhalerao** et. al. in 2016 stated that addition of shoe-raise on unaffected side helps to improve step length, stride length cadence & gait velocity as compared to MRP alone. However, there was no additional change seen in Rivermead Visual Gait Assessment Score with the use of shoe raise.<sup>19</sup>

Number of subjects was less and treatment intervention was limited in this study. That can be progressed and explored by increasing the sample size and advanced research study design as randomized control trail with proper sampling and allocations in future research.

## Conclusion

It was concluded that Modified Shoe with Motor Relearning Programme had statistically significant improvement in the Timed Up and Go test values and gait parameters of chronic stroke patients when compared to motor relearning program alone.

**Ethical Clearance:** Taken from Institutional Ethical Review Board, Santosh College of Physiotherapy, Madurai.

**Conflict of Interest:** Nil

**Source of Funding:** Self

## References

1. Aboyans V, Causes of Death Collaborators. Global, regional, and national age-sex specific all-cause and cause-specific mortality for 240 causes of death, 1990-2013: a systematic analysis for the Global Burden of Disease Study 2013. *The Lancet (British edition)*. 2015 Jan 10;385(9963):117-71.
2. Pandian JD, Sudhan P. Stroke epidemiology and stroke care services in India. *Journal of stroke*. 2013 Sep;15(3):128.
3. Thijssen DH, Paulus R, van Uden CJ, Kooloos JG, Hopman MT. Decreased energy cost and improved gait pattern using a new orthosis in persons with long-term stroke. *Archives of physical medicine and rehabilitation*. 2007 Feb 1;88(2):181-6.
4. Wang RY, Lin PY, Lee CC, Yang YR. Gait and balance performance improvements attributable to ankle-foot orthosis in subjects with hemiparesis. *American journal of physical medicine & rehabilitation*. 2007 Jul 1;86(7):556-62.
5. Farmani F, Mohseni Bandpei MA, Bahramizadeh M, Aminian G, Nikoo MR, Sadeghi-Goghari M. The effect of different shoes on functional mobility and energy expenditure in post-stroke hemiplegic patients using ankle-foot orthosis. *Prosthetics and Orthotics International*. 2016 Oct;40(5):591-7.
6. Laskowitz DT, Kasner SE, Saver J, Rummel KS, Jauch EC, BRAIN Study Group. Clinical usefulness of a biomarker-based diagnostic test for acute stroke: the Biomarker Rapid Assessment in Ischemic Injury (BRAIN) study. *Stroke*. 2009 Jan 1;40(1):77-85.
7. Ward NS, Cohen LG. Mechanisms underlying recovery of motor function after stroke. *Archives of neurology*. 2004 Dec 1;61(12):1844-8.
8. Yekutiel M, Guttman E. A controlled trial of the retraining of the sensory function of the hand in stroke patients. *Journal of Neurology, Neurosurgery & Psychiatry*. 1993 Mar 1;56(3):241-4.
9. Krutulyte G, Kimtys A, Krisciūnas A. The effectiveness of physical therapy methods (Bobath and motor relearning program) in rehabilitation of stroke patients. *Medicina (Kaunas, Lithuania)*. 2003 Jan 1;39(9):889-95.
10. Solomon NA, Glick HA, Russo CJ, Lee J, Schulman KA. Patient preferences for stroke outcomes. *Stroke*. 1994 Sep;25(9):1721-5.
11. Mohapatra S, Eviota AC, Ringquist KL, Muthukrishnan SR, Aruin AS. Compelled body weight shift technique to facilitate rehabilitation of individuals with acute stroke. *International Scholarly Research Notices*. 2012;2012.
12. Chaudhuri S, Aruin AS. The effect of shoe lifts on static and dynamic postural control in individuals with hemiparesis. *Archives of Physical Medicine and Rehabilitation*. 2000 Nov 1;81(11):1498-503.
13. Tyson SF, Sadeghi-Demneh E, Nester CJ. A systematic review and meta-analysis of the effect of an ankle-foot orthosis on gait biomechanics after stroke. *Clinical rehabilitation*. 2013 Oct;27(10):879-91.
14. Erel S, Uygur F, Engin Şimşek İ, Yakut Y. The effects of dynamic ankle-foot orthoses in chronic stroke patients at three-month follow-up: a randomized controlled trial. *Clinical rehabilitation*. 2011 Jun;25(6):515-23.
15. Chaudhuri S, Aruin AS. The effect of shoe lifts on static and dynamic postural control in individuals with hemiparesis. *Archives of Physical Medicine and Rehabilitation*. 2000 Nov 1;81(11):1498-503.
16. Rodriguez GM, Aruin AS. The effect of shoe wedges and lifts on symmetry of stance and weight bearing in hemiparetic individuals. *Archives of physical medicine and rehabilitation*. 2002 Apr 1;83(4):478-82.
17. Chitra J, Mishra S. Effect of compelled body weight shift therapy on weight bearing symmetry and balance in post stroke patients: an experimental pre-post study. *Int J Physiother Res*. 2014;2(6):781-6.
18. Dr.Gajanan Bhalerao, Dr.Dhanashree Parab. Effect of shoe raise along with motor relearning programme (MRP) on ambulation in chronic stroke. *Int J Physiother*. 2016; 3(3); 297-303.