

Perception of Weight Bearing Distribution during Standing and Its Association with Proprioception in Post Stroke Patients- A Cross Sectional Study

G. Malarvizhi¹, R. Balakrishnan², A. U. Deepika³, R. Krishna Preetha⁴,
S. Monica³, S. Supriya³

¹Assistant Professor, Department of Basic Medical Sciences, P.S.G. College of Physiotherapy and Hospitals, Coimbatore.

²HOD of Neurology Department, Department of Neurology, P.S.G Hospitals, Coimbatore, India.

³Interns

Corresponding Author: G. Malarvizhi

ABSTRACT

The aim of the present study was to find out the relation between the perception and proprioception of weight bearing distribution during standing in post stroke patients and to compare the perception of weight bearing distribution normal and post stroke patients. A 47 post stroke patients, 30 normal individuals were included according to the inclusion criteria and were inquired about the perception of weight bearing in both the lower limbs and cross checked with the help of balance master. Errors of perception between perception and balance master values were recorded. Proprioception were checked with the help of re-positioning test using goniometer and recorded. Perception between post stroke and normal individuals were assessed by Balance master. Repositioning test was assessed by Goniometer. The perception was analyzed using Independent 't' test between post stroke patients and normal individuals. The correlation between proprioception and perception were analyzed by using Pearson correlation. Independent 't' test mean difference values for perception between stroke and normal individuals were used to find out whether there is any significant difference between the two groups. Independent t test of perception between post stroke and normal individuals obtained mean 12.89, standard deviation 10.256, t value = 4.678 at p value = 0.000. Thus null hypothesis was rejected and alternate hypothesis was proved. Therefore there was a significant difference between post stroke and normal individuals in perception of weight bearing distribution. Pearson Correlation between perception and proprioception of weight bearing distribution during standing in post stroke patients obtained $r = 0.835$ at p value = 0.000, null hypothesis is rejected and alternate hypothesis was proved, indicating that there is significant relation between perception and proprioception of post stroke individuals. Thus this study proved the alternate hypothesis by showing there will be difference in perception of weight bearing distribution between hemiplegic and normal individuals. Proprioception impairment is associated with perception in hemiplegic patients.

Key words: Perception, Proprioception, Weight bearing, Standing, Post stroke individuals, Normal individuals.

INTRODUCTION

Stroke is a global health problem. It is a second commonest cause of death and fourth leading cause of disability worldwide.¹ Stroke is the third leading cause of death in the United States and a major cause of disability in the elderly.

Although the incidence of the stroke is decreasing but the prevalence in the population is increasing because of enhanced survival and growing elderly population.² The latest available estimates from Indian Council of Medical Research (ICMR) indicate that in 2004 there were

930,985 cases of stroke in India with 639,455 deaths and 6.4 million disability adjusted life years lost³. In Indian population stroke is relatively common in young population [Indian population 60years \geq 7.5% compared to the west (e.g., British population \geq 65years)].⁴ The estimated adjusted prevalence rate of stroke range, 84 - 262/100000 in rural and 334 - 424/100000 in urban areas. The incidence rate is 119-145/100000 based on the recent population studies in 2013.⁵ Stroke was defined more than 40 years as “rapid developing clinical signs of focal (or global) disturbances of cerebral function, lasting more than 24 hours or leading to death, with no apparent cause or than that of vascular origin. World Health Organisation (WHO) IN 2013.⁶

Cerebral infarction accounts for 80% primary intracerebellar hemorrhage for 10% and subarachnoid hemorrhage for 5% of all the first stroke¹⁰. The most common insult to the brain results in middle cerebral artery lesion. More than two-third of all first strokes are within the distribution of middle cerebral artery. Studies have indicated that occlusion of right cerebral hemisphere causes confusion and stroke victim exhibits imbalance. Approximately 50% of people who survive stroke have chronic motor deficits, the most common form is hemiparesis. Individuals with hemiparesis following a stroke have difficulty bearing weight on or “loading” the paretic lower extremity and transferring weight from one leg to other. As a result, these individuals commonly exhibit asymmetry during sitting and standing activities and during walking, with the greater proportion of body weight distributed on the non-paretic lower extremity than on the paretic extremity.

Few studies have focused on the perception of Weight Bearing (WB) distribution during functional tasks. For sit to stand task, when healthy subjects (mean age: 65 years) were asked to bear 25%, 50%, and 75% of their weight on 1 of their lower limbs, the mean absolute errors of WB perception (absolute difference between

actual WB distribution and perception) were 7.3% (4.7%), 3.3% (3.7%), and 7.7% (4.8%), respectively. Using the same protocol with poststroke individuals revealed greater errors (WB target 25%: 9.6% [7.0%]; WB target 50%: 5.2% [4.0%]; WB target 75%: 9.8% [4.0%]) of WB perception in patients than in healthy subjects.

Postural disorders represent a primary impairment after stroke, and many patients do not recover the ability to maintain undisturbed upright stance.⁷ Three main patterns characterize the standing posture of hemiparetic patients : i) an increase in centre of gravity displacement, which reflects postural instability and results from orthopedic, sensorimotor, and cognitive impairments; ii) the presence of a small area of stability beyond which the centre of gravity cannot move without exposing the patient to a loss of balance (this results either from an inability to control a stressed equilibrium system or from impaired co-ordination between posture and movement); and iii) weight bearing asymmetry, with more weight on the non-paretic leg.⁹

Since some patients align their erect posture to a biological vertical contralesionally tilted, it has also been suggested that the shift in the center of gravity towards the ipsilesional leg might be a compensatory strategy to prevent contralesional falling.⁹

Proprioception provides basic information for balance, and is spread throughout the skin, ligaments, tendons, and muscles; information such as postural recognition, body location, joint speed, angle, and its ratio of movement that control each movement of each bodily activity is transmitted to the central nervous system, which allows for the production of normal movement, maintains dynamic safety for the joints, and protects the joints from external damage. Such damage to proprioception can exhibit great difficulties in maintaining postural control for patients with stroke; in particular, damaged lower limb

proprioception can affect postural body sway.⁸

BALANCE MASTER

The Balance System (SD) allows testing and training in both static and dynamic formats. Extremely versatile, it is the only system that provides fast, accurate. Fall Risk Assessment and Conditioning for older adults plus closed-chain, weight-bearing assessment and training for lower extremity patients. Using this unique device, clinicians can assess neuromuscular control by quantifying the ability to maintain dynamic bilateral and unilateral postural stability on a static or unstable surface. Use any of four test protocols including fall risk, athletic single leg stability, limits of stability and postural stability. The Balance System SD also serves as a valuable training device to enhance kinesthetic abilities that may provide some degree of compensation for impaired proprioceptive reflex mechanisms following injury. An easy to follow touch-screen format makes the system simple to learn and operate, leading the user step-by-step through testing protocols and training modes.

After a stroke, hemiparetic individuals stand by placing more weight on their non-paretic foot, although they have the capacity to perform more symmetrically on demand, with visual feedback, or by altering the foot positions. The asymmetrical performance has been associated with motor weakness and loss of postural control. It is not well known whether hemiparetic subjects are aware of this asymmetry of weight -bearing and if they perceive it adequately.

METHODOLOGY

A 47 post stroke patients, 30 normal individuals participated in the study and divided into two groups, Convenience sampling used, Participants were recruited from the Stroke Rehabilitation Centre, Department of Physical medicine and Rehabilitation and Department of Neurology in PSG IMS&R Hospitals,

Coimbatore. Stroke Patients were included if they met the following criteria: (1) Age(40-60years) (2) Able to stand without support (3) Ischemic type of stroke (4) Stroke- impairment in lower limb(<6 out of 7 on the Chedoke McMaster stroke assessment) and Normal individuals were included: (5) Age (40-60years) (6) No relevant stroke history and Participants were excluded if they have: (1) Non-stroke related disabilities (2) Severe Cardio pulmonary disease (3) Hemi-anopsia (4) Uneducated (5) Comprehensive aphasia(< 25 out of 30 in The Folstein mini-mental examination) (6) Hemi-neglect(Bell's test) and Normal individuals were excluded if they have: (7) Diabetes (2) Sensory impairments (3) Uneducated. The study was approved by the Institutional Human Ethics Committee, PSG Institute of Medical Sciences and Research. All the participants signed written informed consent prior to participation. The participants were inquired about the perception of weight bearing in both the lower limbs and cross checked with the help of balance master. Errors of perception between perception and balance master values were recorded. Proprioception were checked with the help of re-positioning test using goniometer and recorded.

OUTCOME MEASURES: This is a Cross- sectional study design and based on the literature review, the post-stroke hemiparetic individuals will have weight bearing asymmetry and errors of weight bearing perception. So the observation on weight bearing distribution, perception and proprioception will be helpful for future studies regarding the management of stroke.

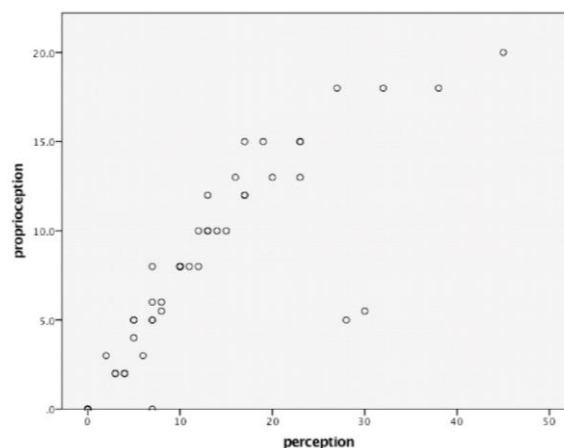
STATISTICAL ANALYSIS: Data collected from individuals were analyzed using Independent t Test to measure perception between post stroke and normal individuals. Pearson Correlation was used to analyze relation between proprioception and perception of weight bearing distribution during standing in post stroke patients.

RESULTS

A total of 47 post stroke patients between 40 and 60 years were recruited for this study. The analysis was done between the perception and proprioception values of post stroke patients and normal individuals.

Independent t Test of perception between post stroke and normal individuals obtained t value = 4.678 at P value=0.000. Therefore there is significant difference between post stroke and normal individuals in perception of weight bearing distribution.

Pearson Correlation between proprioception and perception of weight bearing distribution during standing in post stroke patients obtained r =0.835 at P value =0.000, indicating that there is significant relation between proprioception and perception of post stroke individuals.



Graph 1: Scatter plot between perception and proprioception

Table 1: Baseline Characteristics

VARIABLES	VALUES	
Number of patients	47	
Gender		
Male	31	
Female	16	
	MEAN	STANDARD DEVIATION
Age (years)	52.276	45.75
Perception	12.89	10.256
Proprioception	8.106	5.473

INDEPENDENT ‘t’ TEST mean difference values for perception between stroke and normal individuals were used to find out whether there is any significant difference between the two groups as per SPSS software.

Table 2: Comparison of perception between Hemiparetic and Normal Individuals.

OUTCOME	GROUP		t value	p value
	Hemiparetic	Normal individual		
Perception Mean (SD)	12.89(10.256)	5.63 (4.047)	4.351	0.000

PEARSON CORRELATION: To find the association between perception and proprioception.

Table 3: Correlation between perception and proprioception for post stroke patients (n=47)

OUTCOMES	r value	p value
Perception Proprioception	0.835	0.000

DISCUSSION

The main aim of this study is to find out the Perception of weight bearing distribution during standing and its association with proprioception in post stroke patients- A cross sectional study.

A 47 post stroke patients and 30 Normal individuals were included in the study as per the inclusion criteria. The inclusion criteria was framed in accordance with the study on inclusion criteria done by Anabele briere et.al., Hence the post stroke patients were included by using Chedoke Mc Master stroke assessment.

Perception and proprioception were chosen as outcome measures for this study. None of the subjects experienced any discomfort during the assessment and observation.

The perception was analyzed using Independent t test between post stroke patients and normal individuals. The correlation between perception and proprioception were analyzed by using Pearson correlation.

There was a significant difference in perception and proprioception and the study showed that there is an association between perception and proprioception of weight bearing distribution during standing in post stroke patients and there is also difference in perception of asymmetry between hemiplegic and normal individuals.

The results of this study correlates with the study done by Anabele Briere et.al. on The perception of weight bearing

distribution during sit to stand task in hemiparetic and healthy individuals. They found that the results were the greater weight bearing asymmetry and errors of weight bearing perception in hemiparetic participants during sit to stand task.

This study can be further carried out in patients with generalized age category and also by suggesting the treatment to correct them.

Thus this study proved the alternate hypothesis by showing there will be difference in perception of weight bearing distribution between hemiplegic and normal individuals. Proprioception impairment is associated with perception in hemiplegic patients.

CONCLUSION

This study concludes that, there is an association between proprioception and perception of weight bearing distribution during standing in post stroke patients and there is also difference in perception of asymmetry between hemiplegic and normal individuals.

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