OPEN ACCESS

Research Article

Comparative Efficacy of 'Functional Reach Test' and 'Single Leg Stance Test' As a Clinical Screening Tool for Balance Measurement in Hemiparetic Patients with Stroke

Dr. Vivek H. Ramanandi (PT)[1], Dr. Payal Patel (PT)[2], Dr. Rajbaa Jaadav (PT)[3]

[1]MPT (Neuro), Ph.D. Scholar, Senior Lecturer, Satish Goswami College of Physiotherapy, Ahmedabad, Gujarat, India
[2]MPT (Ortho), Lecturer, Satish Goswami College of Physiotherapy, Ahmedabad, Gujarat, India
[3]BPT, Jr. Lecturer, Satish Goswami College of Physiotherapy, Ahmedabad, Gujarat, India

*Corresponding Author
Dr. Vivek H. Ramanandi

Abstract: Background & Objectives: The assessment of balance is important to direct appropriate interventions to improve balance performance and to monitor changes in balance overtime. Performance based balance tests & measures can be used to determine balance function following stroke. Though BBS is most reliable, it consumes around 15-20 minutes which is not practically applicable in a clinical set-up. The purpose of study was to compare the efficacy and usefulness of FRT and SLST as a clinical balance screening tool in hemi paretic stroke patients. Methods: This observational cross-sectional was done at various physiotherapy, rehabilitation and neurology clinics in Ahmedabad & Vadodara. Data were collected from 48 subjects on basic demographics, descriptive stroke characteristics, the berg balance scale scores, functional reach test scores and single leg stance test scores. Results & Interpretation: The results of between group analyses for the present study showed strong correlation between FRT & BBS compared to SLST & BBS suggesting that the efficacy of FRT is more compared to SLST in examining balance. Conclusion: FRT can be used as a quick clinical balance screening tool in hemi paretic stroke by the clinicians.
Keywords: Stroke, Balance, Functional Reach Test, Berg Balance Scale, Single Leg Stance Test.

INTRODUCTION

Stroke is the sudden loss of neurological function caused by an interruption of blood flow to the brain (Susan, B. *et al.,* 2007). Numbers of well defined population based studies on incidence of stroke in India are limited. One study conducted at Vellore, south India, showed an annual incidence rate of 13/100,000 population (15.2/100,000 in males and 10.8/100,000 in females) (Bharucha, N. E., & Kuruvilla,T. 1998). Hemi paretic stroke patients frequently present balance abnormalities along with changes in the level of consciousness and impairments of sensory, motor, cognition, perceptual and language functions (Clarissa Barros de Oliveira 2008).

The performance of all activities of daily living requires good balance control while at rest or when moving from one position to another (Berg, K., *et al.,* 1989; Huxham, F. E., *et al.,*2001). Assessment of balance is important to direct appropriate interventions to improve balance performance and to monitor changes in balance overtime. Standard outcome measures can be used to help make this decisions (Stevenson, T.J., 2001). Various tests used for balance assessment following stroke are berg balance scale (BBS), Fugl Meyer test (FM-B), postural assessment scales for stroke patients (PASS), functional reach test (FRT), performance oriented mobility assessment (POMA) and timed up & go test. Best tools for balance evaluation in patient stroke are still under debate (Susan, B. *et al.,* 2007). An advantage of functional balance tests is their practicality for assessment in a variety of settings because of their low cost, lack of complex equipment and time efficiency (Berg, K. *et al.,* 1992; Farrell, M. 2004). Performance based balance tests & measures can be used to determine balance function following stroke (Susan, B. *et al.,* 2007).

Many studies are done that proved BBS, SLST and FRT to be reliable for balance assessment

(Bharucha, N. E., & Kuruvilla,T. 1998; Duncan, P.W. *et al.,* 1990; Barbara, A.C. 2004). Though BBS is most reliable, it consumes around 15-20 minutes which is not practically applicable in a clinical set-up (Chou, C.Y. *et al.,*2006 February) There are very less studies conducted to find a quick balance screening tool which is of short duration and requires minimal instrument & training in stroke patients. FRT and SLST are 2 simple and quick balance screening tools and can be used easily by clinician with minimal instrument and training. Both tests have high functional applicability, are less time consuming and can be easily used by the clinician with minimal instrument and training.

This study can be useful for clinicians to save their precious time in clinical settings and to provide a reliable, readily available and easy to perform bed-side examination tool for balance testing.

Aim of this study was to compare the efficacy of FRT and SLST as a clinical balance screening tool in hemi paretic stroke patients.

METHODS
The study was an observational cross-sectional study conducted at various physiotherapy, rehabilitation and neurology clinics in Ahmedabad and Vadodara regions of Gujarat during the period of June-2018 to December- 2018. 48 (27 Male ; 21 female) hemiparetic, ambulatory stroke patients who didn't have other pathology affecting their balance or upper or lower limb orthopedic condition which may affect their test performance and were ready to give written consent for participation were selected from various settings. Patients with flaccid paralysis; vestibular, proprioceptive & cranial nerve impairments; other neurological impairments; inability to understand command and co-operate were excluded.

All data were collected by physiotherapist. Study participants completed a series of physical assessments during a 1- time visit. Data were collected on basic demographics (age, sex) and stroke characteristics. Descriptive stroke characteristics included: time since stroke, side of hemi paresis, type of stroke and stroke

related disability. Participants were screened by the physiotherapist for any other neurological disorder, ear or vestibular problems, musculoskeletal injury to spine, upper or lower limbs or other problems which may affect ability to maintain balance.
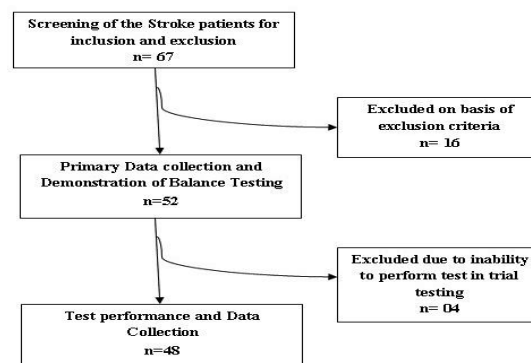

Fig-1: Flow of the patients during the study

The berg balance scale (BBS), functional reach test (FRT) and single leg stance test (SLST) was used to assess balance as per the standard guidelines (Berg, K. *et al.,*1989; 5. Huxham, F. E. *et al.,* 2001; Duncan, P.W. *et al.,* 1990; Barbara, A.C.2004).The unaffected sides of the subjects were taken into consideration. All the 3 tests were performed on unaffected side and data was collected. The procedure of SLST and FRT was repeated 3 times and each reading was recorded on the data collection sheet. The average and peak of the 3 trials was recorded and compared for efficacy. Both the sides were tested.

RESULTS
All the tests and calculations were performed using Microsoft Excel 2010 and IBM SPSS statistics version 20.0. The data were analyzed for descriptive statistics and correlation by Pearson's correlation co-efficient.

The table-I shows the distribution and characteristics of all 48 subjects according to age group, gender, side of hemiparesis, duration since stroke and type of stroke.

Table-I Characteristics of Sample Participants

Age Group (Years)			31-40	41-50	51-60	61-70	71-80	81-90
Characteristic	Classification	No. of subjects						
Gender	M	n=27	3	5	8	7	3	1
	F	n=21	2	6	7	4	1	1
Side of Hemiparesis	Right	n=23	2	4	9	6	2	0
	Left	n=25	3	7	6	5	2	2
Duration since stroke	< 6 yrs	n= 22	2	5	11	4	3	1
	6-12 yrs	n= 19	2	4	3	5	1	0
	>12 yrs	n=7	1	2	1	2	0	1
Type of Stroke	Ischemic	n=19	2	4	7	3	1	2
	Hemorrhagic	n=29	3	7	8	8	3	0

Table: II Correlation between different Balance Evaluation tests

TESTS	r-value	p-value	Correlation
BBS and FRT	0.8057	<0.0001	Strong
BBS and SLST	0.7564	<0.0001	Strong
FRT and SLST	0.7553	<0.0001	Strong

The table-II shows strength of correlation based upon the Pearson Correlation Coefficient (r) calculated to find the correlation at <0.0001 p-values. Results of between the group analysis showed that the correlation of FRT with BBS (r = 0.8057; p= < 0.0001) is stronger than correlation of SLST with r BBS (r= 0.7564; p= < 0.0001). The correlation between FRT and SLST (r= 0.7553; p= < 0.0001) was also strong. Thus, the results of this study shows stronger correlation of FRT with BBS than correlation of SLST with BBS.

DISCUSSION

The results of this study are suggestive of stronger correlation of FRT with BBS when compared to SLST. The results are suggestive that the efficacy of FRT as a screening test may be more as compared to SLST.

Our study supports the views expressed in the previous studies by Flansbjer & Brogardh(2012) and Col Barbara a. Springer(2004) Single Leg Stance is strongly related to the BBS & can be used as an independent test to measure upright postural control after stroke. The SLST is a reliable, readily available & easy to perform bed-side examination tool for balance testing (Barbara, A.C. 2004; Flansbjer , U-B. *et al.,*2012).

Duncan *et al.,* (1990) and Smith, D.S., Hembree, J.A., Thompson (2004) reported that the functional reach test have high reliability & validity as balance test and was closely associated with performance on the BBS (Duncan, P.W. *et al.,*1990; Smith, D.S. *et al.,*2004). Therefore, the clinician may elect it to use the shorter functional reach as a measure of balance where efficient use of time is the primary goal. This is further evident as seen in the findings of our study.

The results of present study examined the correlation of both SLST and FRT with BBS and found that the correlation of FRT is stronger with BBS than that of SLST. This may be because more similarity in the reach activity being tested, which is common in day to day life activities. Whereas, single leg standing is a far less common activity as a part of daily life. Thus, FRT can be used as a quick balance screening tool in hemiparetic stroke patients.

But, as is true in all research, several limitations to this study exist. The sample of current study was selected on convenience basis and was small as compared to the population being tested. In this study, hemiparetic stroke patients were tested for their balance. Three tests – FRT, SLST and BBS were performed and BBS was considered gold standard. The unaffected sides of the subjects were taken into consideration. All the 3 tests were performed on unaffected side and data was collected. Unaffected side was chosen as patients with ACA Infarct may face difficulty in standing on one leg on affected side. Also, those with MCA Infarct may have difficulty in reaching the maximum forward distance. These may have affected the result values. Further, the duration of stroke might affect the performance and level of recovery in balance measurements which can be possibly affecting our results, as our sample was a mix of variety of durations after stroke.

This study can be useful for clinicians to save their precious time in clinical settings and to provide a reliable, readily available and easy to perform bed-side examination tool for balance testing. The clinicians may elect to use the shorter functional reach as a measure of balance where efficient use of time is the primary goal.

REFERENCES

1. Susan, B., Sullivan, O., Schmitzj, J.T. (2007). *Physical Rehabilitation, (5), 257-705.*
2. Bharucha, N. E., & Kuruvilla,T. (1998).Epidemiology of stroke in India. *Neuro J Southeast Asia,(3), 5-8.*
3. Clarissa Barros de Oliveira (2008). Italo Roberto Torres de Medeiros; Norberto Anizio Ferreira Frota; Mario Edvin Greters; Adriana B. Conforto. Balance control in hemi paretic stroke patients: Main tools for evaluation. *Journal of Rehabilitation research & development, (12),15-26.*
4. Berg, K., Wood- Dauphinee , S., Williams, J.I., & Gayton, D. (1989). Measuring balance in the elderly: Preliminary development of an instrument. *Physiotherapy Canada,41(6): 304-11.*
5. Huxham, F. E., Goldie, P. A., & Patla, A. E. (2001). Theoretical considerations in balance assessment. *Australian Journal of Physiotherapy*, *47*(2), 89-100.

6. Stevenson, T.J., (2001) Detecting change in patients with stroke using the Berg Balance Scale. *Australian Journal of Physiotherapy (*47), 29-38.

7. Berg, K., Maki, B.E,, Williams, J.I., Holliday, P.J. (1992). Wood- Dauphinee SL. Clinical and Laboratory measures of postural control in an elderly population. *Archives of Physical Medicine & Rehabilitation,(73),1073-80.*

8. Farrell, M. (2004). Using functional assessment & screening tool with frail older adults. *Topics in Geriatric Rehabilitation,20(1),14-20.*

9. Duncan, P.W., Weiner, D.K., Chandler, J., & Studenski, S. (1990). Functional reach: A new clinical measure of balance. *J Gerontology,45(6),192-7.*

10. Barbara, A.C.(2004). Springer; COL Raul Marin; Tamara Cyhan, RN, Normanw. Gill. Normative values for the unipedal stance test with eyes closed and open.

11. Chou, C.Y., Chien, C.W., Hsueh, I.P., (2006 February). Developing a short form of the BBS for people with stroke. *Physical therapy,86 (2), 195-204.*

12. Flansbjer , U-B., BLOM, J., & Brogardh, C. (2012). The reproducibility of BBS & the SLS in chronic stroke & the relationship between the two tests. *Physical medicine & Rehabilitation, 4(3), 165-170.*

13. Smith, D.S., Hembree, J.A., &Thompson, M.E. (2004). BBS & functional reach: Determing the best clinical tool for individual's post acute stroke. *Clin. Rehabil, (18),811-818.*