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Original Research Article

Correlation of 'the Five Times Sit To Stand Test' With Balance and Gait in Stroke Patients

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ABSTRACT

Introduction: The Five times sit to stand test is a simple, valid and reliable test to assess ability to complete sit to stand five times in a row. It requires lower extremity strength and considerable skill to generate sufficient speed of movement as it's a timed test. Objective of the study was to find the correlation between The Five times sit to stand test with balance and gait.
Methodology: 36 stroke patients were assessed using Activities specific balance confidence scale and modified version of Emory functional ambulation profile
Results: There was a weak negative correlation (-0.33, $p<0.05$) between 5TSST and ABC Score using Pearson correlation test. A high positive correlation (0.9, $p<0.05$) was achieved between the first three components of mEFAP with 5TSST time using Pearson correlation. While the obstacle course time and stair time with 5TSST time showed a moderate positive correlation (0.6,$p<0.05$).
Conclusion: 5TSST correlated with balance and gait in stroke patients.

Key words- 5TSTT, modified Emory functional ambulation profile, mEFAP, Activities specific balance confidence scale

INTRODUCTION

Stroke results in movement problems like spasticity, atypical pattern of movement, compensatory strategies which lead to functional limitations and disability. Hemiplegia or hemiparesis i.e. paralysis/weakness of one side of the body is the most common presentation of stroke. Gait dysfunction is one of the most serious consequences of stroke. [1] The limited walking ability that follows a stroke restricts the person's functional independent mobility. [2] Gait training is a major part of the rehabilitation to make the patients as independent as possible thereby achieving the best possible long term outcome. Safe, independent and functional walking requires motor control and strength in the leg to support body weight, to move the multiple joints of the lower extremities in complex pattern and to control speed, momentum and balance. Independent ambulation needs to be achieved not only at home but also in the community. Fear of falls, fall or risks of falls post stroke are also frequent in community dwellers as a cause of balance impairments. Falls after stroke can have detrimental effects on physical function resulting in increased immobility leading to greater disability.

The common problems of the hemiplegic patients gait are loss of controlled movement of lower extremities at various phases of a gait cycle. [3] During gait, the sequential flow of motor activity is disrupted. [4] Similar to gait, sit to stand transition usually gets affected in the individuals with Stroke. [5] The ability to

stand up from sitting position is a prerequisite for most of our daily activities. It involves gradual change from broader base of support to smaller base of support and lower position of center of gravity to higher position. The Five times sit to stand test (5TSST) is a quick and an easy to administer test. [6] It assesses an individual's ability to complete sit to stand five times in a row. It is not only dependent on the lower limb strength, but completion of five times sit to stand test also requires considerable skill to generate sufficient speed of movement as it's a timed test. It also needs coordination of multiple segments. It assesses the lower extremity strength, coordination, transitional movement. Evidence in older adults suggests that it predicts fall risk. [7] 5TSST also identifies people with balance dysfunction. [8] It is a simple and reliable tool for functional performance in stroke patients and it correlates with knee flexor muscle strength but not with balance abilities post stroke. [9]

The purpose of our study was to find the relation between 'The five times sit to stand test' with balance and gait. Activities specific balance confidence scale (ABC) is a 16 item self-report measure in which patients rate their balance confidence for performing various activities and is an excellent predictor of fall. [10] Gait speed has been found to be an important factor for independence in ambulation. [11] The functional ambulation profile assesses the ability of a patient diagnosed with stroke to walk with maximal independence and in the least time under various environmental circumstances. The modified version of Emory functional ambulation profile also incorporates the important component of manual assistance, is readily available, easy to administer and interpret, low cost and has a basic inclusion of variety of environmental components necessary for functional mobility. [12-14] The study was undertaken to find the correlation between 'The five times sit to stand test (5TSST)', Activities specific balance confidence scale (ABC) and the modified version of Emory functional ambulation profile (mEFAP)

MATERIALS AND METHODS

36 patients with stroke who were able to perform sit to stand independently and walk with or without assistance participated in the study after giving informed consent from Physiotherapy OPD, D.Y.Patil University, Nerul. Sub acute and chronic stroke patients with Mini Mental Score more than 24 were included. Patients with presence of contracture or deformity pertaining to lower extremities and back or lower extremity pain more than 4 on Visual Analogue Scale were excluded. Firstly, for the Five times sit to stand test, the patients were instructed either to sit with arms folded across chest with their back against the chair or to have the impaired arm at the side or in a sling. A standardized chair with arms was used. The therapist first demonstrated the test. The patients were instructed to stand up and sit down 5 times as quickly as possible with command "GO". The patient had to stand fully between repetitions of the test and not touch the back of the chair during each repetition. Timing began at "GO" and ended when buttocks touch the chair after the fifth repetition. Inability to complete 5 repetitions without assistance or use of upper extremity support indicated failure of test. Then 16 item self-reported measure in which patients rated their balance confidence for performing activities. Item were rated on a scale that ranged from 0-100%. Score of zero represents no confidence and 100 represents complete confidence. Overall scores were calculated by adding item scores and then dividing by the total number of items. Then a timed measure of walking under 5 environmental domains using the modified Emory functional ambulation profile (mEFAP) was used. Each subtask time was multiplied by the appropriate factor to the level of assistive device used during each task and the subtasks were later summed up. The environmental domains were walking on the floor (5mt), carpet (5mt), up and go

(3mt), traversing obstacles and ascending and descending 5 stairs.

Statistical analysis-The time in seconds taken during the five times sit to stand test was correlated with ABC score and mEFAP (total time) using Pearson correlation coefficient. 5TSTT time was also correlated with time taken for each component of mEFAPi.e. Floor gait, carpet gait, timed up and go, obstacle gait and stair climbing. SPSS version 21 was used for statistical analysis.

RESULT

Table 1.Demographic characteristics

Age (mean)	58.76 $^{+}$_3.4 years
Gender	27males 9 females
Affected side (hemiparesis)	21 left 15 right
Stage	19 chronic 17 sub acute
Independence in ambulation	31 independent,5used cane

Table 2.Correlation between 5 X SST and ABC Score

		ABC Score
5TSST	Pearson Correlation	-0.33
	Sig. (2-tailed)	.04
	N	36

Significance level p< 0.05

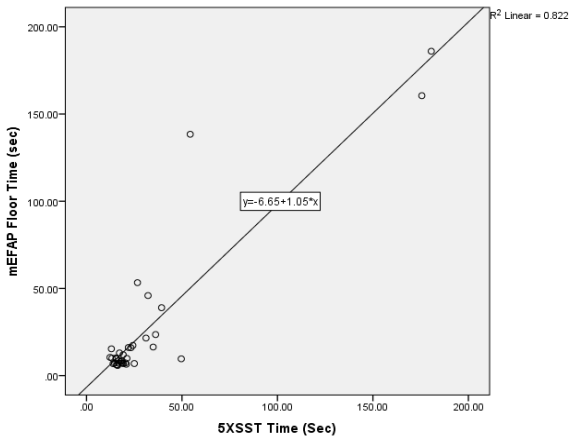
There was a weak negative correlation between 5 X SST and ABC Score using Pearson correlation test.

Table 3. Correlation between 5 X SST and mEFAP

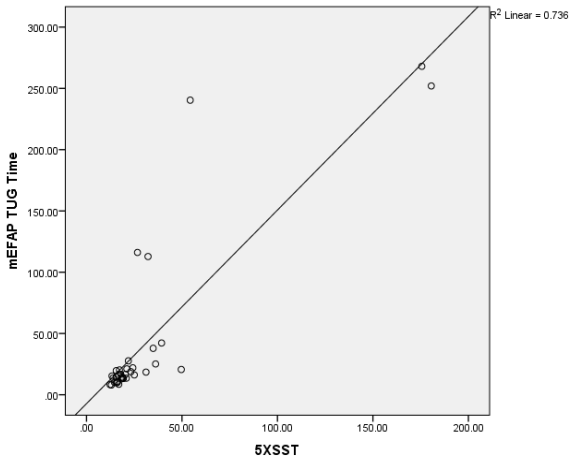
Components of mEFAP(sec)	Correlation	5TSST Time (Sec)
mEFAP Floor Gait	Pearson Correlation	0.907**
	Sig. (2-tailed)	.000
	N	36
mEFAP Carpet Gait	Pearson Correlation	0.874**
	Sig. (2-tailed)	.000
	N	36
mEFAP TUG	Pearson Correlation	0.858**
	Sig. (2-tailed)	.000
	N	36
mEFAP Obstacle Gait	Pearson Correlation	0.610**
	Sig. (2-tailed)	.000
	N	36
mEFAP Stairs	Pearson Correlation	0.689**
	Sig. (2-tailed)	.000
	N	36
mEFAP Total	Pearson Correlation	0.854**
	Sig. (2-tailed)	.000
	N	36

** Significance level p< 0.05

A high positive correlation was achieved between the first three components of mEFAP with 5XSST time using Pearson correlation. While the obstacle course time and stair time with 5XSST time showed a moderate positive correlation.



Graph 1 Correlation between time taken to complete gait on floor and 5TSTT



Graph 2 Correlation between time taken to complete Timed up & go and 5TSTT

DISCUSSION

The demographic characteristics of 36 participants are described in Table 1.When5TSST was correlated with ABC scale, it showed a weak negative correlation(r= - 0.33, p=0.04) between the two measures. As the time taken to complete 5TSST was more, the confidence on ABC was low. A previous study also showed weak association between 5TSST and fall risk. [15]

According to the second objective of our study, components of functional ambulation (mEFAP) were correlated with 5TSST.Each component of mEFAP assessed time taken to complete 5mt floor walk, 5mt carpet walk, up & go task (3mt),

obstacle course and 5 ascending and descending stairs. A Significant positive correlation was found between the time required to complete all the components of mEFAP and time taken to complete 'the five times sit to stand test' in our participants. When individual components were correlated, the first two components of walking viz. gait on floor, carpet showed high correlation with 5TSTT.

Previous studies indicate that impairment in lower extremity strength and coordination of movement of lower extremities affect function in stroke patients. Loss of muscle strength has been found as the significant contributing factor of physical disability in stroke patients. [16] Muscle weakness is characterized by inability to generate appropriate timed and sufficient muscle force to accomplish the task. Knee muscle weakness affects walking ability post stroke hemiparesis. Knee muscle strength is a moderate to strong predictor of walking ability in individuals with chronic mild to moderate poststroke hemiparesis. [17] The main determinant of gait speed was found to be isokinetic muscle strength of both lower extremities. [18] Sit to stand and stand to sit task also require control of lower limb extensors. 5TSST which involves activation of multiple groups of lower extremity muscles most notably the knee extensors. The increase of time to perform the 5XSST could also be due to insufficient lower limb extensor forces to stand among stroke patients. Evidence also suggests that the Extensor muscle overactivity is one of the components of gait disorders in stroke patients. [19] Motor coordination of lower limbs is essential for the activities of daily living like sit to stand and walking. A motor task needs to be performed in an accurate, rapid as well as controlled manner in order to achieve a given environmental demand. [20,21] hence there was a relation between time taken to complete 5TSST and functional ambulation profile.

Strong correlation was also found between 5TSST and timed up and go. Stroke leads to sensory, motor, perceptual deficits and altered spatial cognition leading to balance, posture and movement control problems, they tend to bear more weight on the unaffected side. [22] In addition hemiparesis can lead to reduced limits of stability. Altered postural reactions and anticipated postural adjustments as well as abnormal synergistic muscular activation play an important part in postural control. [23] In our study, moderate correlation was found between 5TSST and obstacle gait as well as stairs component of mEFAP. Individuals living in the community post stroke have impaired ability to accomplish these demanding tasks.

CONCLUSION

5 times sit to Stand Test correlated with balance and gait in stroke patients.

A weak correlation of 5TSST with balance confidence on activities but high correlation with timed up and go was found .5TSST and modified functional ambulation profile showed a high positive correlation.

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