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Research Article

Correlation of Four-Square Step Test with Timed Up and Go Test in Chronic Stroke Patients

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Abstract:
Background & Purpose: To find whether four square step test has a statistically significant correlation with timed up and go test or not in case of ambulant chronic stroke patients.
Subjects: Twenty-seven chronic stroke patients with mean age 58.70 ± 6.75 years participated in the study. The mean time from stroke was 26.48 ± 12.73 months, and all subjects were community ambulators.
Methods: The study used a Co relational study design. Subjects performed both four square step test with timed up and go test at different timing of day.
Result: The result of our study showed highly significant correlation between four square step test and timed up & go test ($r = .983, p<0.05$) in chronic stroke patient.
Discussion & Conclusion: The FSST is easy to perform and provide a quantitative measure of the ability to quickly change direction while lifting the feet off the ground. The FSST assess the ability to change direction quickly and it takes minimum space and time to administer the test. Hence, the Four Square Step Test is better test to measure dynamic balance in ambulatory chronic stroke patients.

Keywords: Chronic Stroke, Dynamic balance, FSST and TUG

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INTRODUCTION

To be classified as stroke, focal neurological deficits must persist for at least 24 hours. Motor deficits in Stroke are characterized by paralysis (hemiplegic) or weakness (hemi paresis), typically on the side of the body opposite the site of lesion. The term hemiplegic is often used generically to refer to the wide variety of problems those results from stroke. [21]

Functional mobility skills are typically impaired following stroke. During acute stroke phase (within 1st 3week), 70to80%of patients demonstrate mobility problems in ambulation while 6 month to 1 year later the figures are recurred, with 70-80% of patient able to walk independently with or without assistive devices[7,17].

The four square step test (FSST) is a clinical test of dynamic standing balance that may be suitable for this purpose. The FSST was designed to examine ability to step over small objects and change direction within a clinical setting and requires minimal space, equipment, and time . The FSST was found to be reliable and capable discriminating between non faller and faller in older adult, and people with vestibular dysfunction. The FSST also seems advantageous to use with people with stroke because performance during the test require use of visual perception and cognitive skill in addition to physical abilities that are relevant to walking indoors and outdoors[2, 23].

The timed up and go (TUG) test is a simple and quick functional mobility test that requires a subject to stand up from a chair with arm rest , walk three meters, turn , walk back and sit down. The time taken to complete this task is measured in seconds with a stop watch.[2,23]

These scores were capable of detecting differences in functional mobility between healthy elderly subjects and subjects with stroke. The Timed Up and Go (TUG) test measures, in seconds, the time taken by an individual to stand up from a standard arm chair (approximate seat height of 46 cm [18in], arm height 65 cm [25.6 in]), walk a distance of 3 meters (118 inches, approximately 10 feet), turn, walk back to the chair, and sit down. The subject wears his/her regular footwear and uses his/her customary walking aid cane. No physical assistance is given. The subject starts with his/her back against the chair, his/her arms resting on the armrests, and walking aid at hand. The subject is instructed that, on the word "go" he/she has to get up and walk at a comfortable and safe pace to a line on the floor 3 meters away, turn, return to the chair and sit down again. The subject walks through the test once before being timed in order to become familiar with the test. Use either a stopwatch or wristwatch with a second hand to time the test. If using a stopwatch, start the time once the subject is standing and stop the time once the subject is seated.[22, 23, 24]

This study will be focused on finding a better assessment tool for assessing dynamic balance in chronic stroke patients, which also takes less time and tests more components like dynamic balance, cognition etc.

METHODOLOGY

Sample

Total 27 subjects (both male and female) who were previously diagnosed by a neurologist as suffering with chronic stroke were included as per inclusion and exclusion criteria and an informed consent was obtained from all the subjects after the procedure was explained to them. All the subjects were assigned to one group only. Subjects were recruited from different hospitals, physiotherapy centres and communities in and around Prayagraj and Ghaziabad.

Study design

Correlation study

Inclusion criteria

- Ambulatory chronic stroke patients (≥6 month after stroke)One time stroke as confirmed by physician
- Can ambulate 10meter with or without assistive device (cane)
- Both genders
- Age between 45-65 years
- Mini mental examination score (≥ 24)

Exclusion criteria

- Acute stroke cases
- More than one time stroke
- Any unstable cardio-respiratory condition as diagnosed by physician
- Any fainting spells in past of unknown cause
- History of any musculoskeletal disorder of lower limb affecting the study
- Fracture of lower limb in past 6 months
- Unhealed fracture of lower limb
- History of postural hypotension
- Any neurological condition other than stroke
- Past history of vestibular or auditory deficit as confirmed by physician
- History of any visual disorder which can not be corrected by optical glass
- History of vertigo
- Any serious medical complication

Instrumentation and outcome measures

- Stopwatch
- Chair with arm rest
- Measuring tape
- Marker
- 4 canes

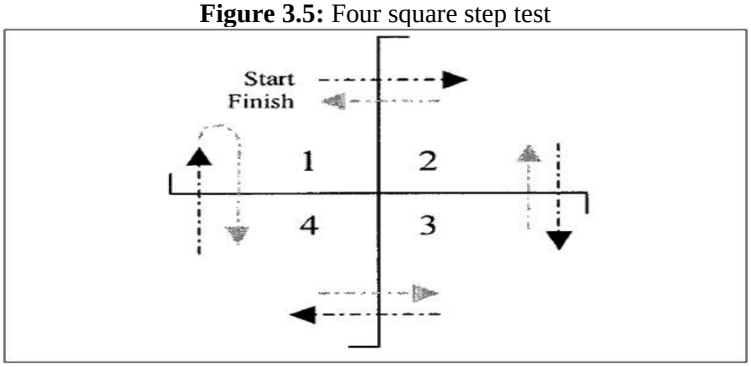
PROCEDURE:

A total of 36 subjects with chronic stroke were screened for the study but 9 subjects could not meet inclusion criteria.

Hence, 27 subjects were finally selected from various physiotherapy clinics, hospital and rehabilitation centers through convenient sampling. Subjects were screened on Mini Mental Status Examination (MMSE). Subject/attendant were informed about the purpose and procedure of the study and were asked to sign an informed consent statement for participation in the study.

After this, the subject started performing the four square step test according as the procedure given below.

Figure 3.5: Four square step test



Four square step test

Subject stood in square number one facing square number two the aim was to step as fast as possible in to each square in the following square.

Square number 2, 3, 4, 1, 4, 3, 2 and 1. This sequence required the subject to step forward, backward, and sideway to the right and left. The score was recorded as the time taken to complete the sequence. The stopwatch was started when the first foot came in contact with the floor in square 2 and was stopped when the last foot came back to touch the floor in square 1. The following instructions was given to the subject, "Try to complete the sequence as fast as possible without touching the sticks. Both feet must make contact with the floor in each square. If possible, face forward during the entire sequence." Then the sequence was shown to the subject. One practice trial was done to ensure that subject knows the sequence. After that the actual test was performed and time was noted. A trial was repeated if the subject failed to complete the sequence successfully, lost balance, or made contact with a cane during the sequence. All subjects weared theirusual indoor footwear and choose whether to use their walking cane when performing the FSST. A person remained close to the subject for the safety purpose. The entire test included giving instructions, a practice trial and final performance. It took less than 5minutes to complete.[2,4,6,9]

Timed "up and go"test

In this test the subject had to stand up from a chair with armrests, walk 3 meters, turn, walk back to the chair, and sit down. Participants had to circle a small object placed at the 3-m mark. Participants were instructed as "go as fast as you safely can." The stopwatch timing was started when the participant's bottom lift the chair and was ended when the bottom made contact with the chair after the walk.

TUG was performed twice in each session, that is, onefor practice and one for actual test performance. Participants weared theirusual indoor footwear and chose whether to use their walkingcane when performing the TUG. No personal physical assistancewas allowed. The physical therapist stood nextto the chair and was accompanied the participant when walking forreasons of safety.A additionalverbal cue was given by physical therapist, such as "turn around" or "sit down." The TUG was timed with astopwatch. [2,4,6,9]

It was of at most importance that each test was performed at different timing of the day in order to prevent any carry over effect.

Also for both tests, the subjects were allowed to start their test with their preferred foot for their convenience.

Both FSST add TUG was completed in approximately same time for each candidate.

Later, the data was sent for statistical analysis and result was found.

DATA ANALYSIS

SPSS version 13 was used for data analysis. The statistical significant was set at 0.05 at 95 % confidence interval.

Karl Pearson correlation was used to correlate between FSST and TUG.

RESULTS

The data was analyzed for 27 participants and the mean age was 58.70 ± 6.75 yrs and mean of duration of stroke was 26.48 ± 12.73 months.

Table 5.1: Mean & SD of Age & Duration of Stroke subjects

SUBJECTS	AGE		DURATION OF STROKE	
N=27	MEAN	SD	MEAN	SD
	58.70	6.75	26.48	12.73

Table 5.2: Mean and SD of FSST & TUG for the Subjects included in the study

Variables	FOUR SQUARE STEP TEST (FSST)		TIMED UP & GO (TUG) TEST	
	Mean	SD	Mean	SD
N = 27	27.44	24.22	26.67	19.32

The result of our study showed highly significant correlation between four square step test and timed up & go test ($r = .983, p<0.05$) in chronic stroke patient.

Table 5.3: Correlation of FSST and TUG

Variables	Correlation	
	r value	P value
FSST Vs TUG	.983	P < 0.05

DISCUSSION

People with stroke often have difficulties changing direction and stepping to negotiate obstacles when walking.[1,2]This can compromise safe walking within the hospital, home, and community,[3]and can increase the likelihood of falls.[4]The incidence of falls among stroke survivors is estimatedto be high with 73% of stroke survivors having a fall within 6 months postonset, and 60% reporting a fall shortly after discharge from hospital.3-5 In addition to the risk of injury, a fall can lead to fear of falling and reduced confidence with mobility.[4]This could lead to a vicious cycle where the person becomes less active, and at risk of decline in physical capacity and further falls.[4]After stroke, impaired dynamic standing balance can limit the ability to walk safely and increase the risk of having a fall.[1,3,6]

The present study was carried out to find out whether exists any correlation between FSST & TUG in case of chronic stroke patients who are ambulatory.

Our result found a highly significant correlation between FSST & TUG test. Similar result was previously seen in a study conducted on older adults, vestibular disorder & kinaesthetic ability trainer (Wayne Dite et al. 2002, Susan L. Whitney, et al. 2007, G. Zafer2010). Both the tests FSS & TUG could be used for dynamic balance and the TUG & FSST had aspects of balance that involved stepping unlike other balance test which do not involved stepping.

Since the result shows that FSST was significantly correlated to TUG, there are certain points which emphasise the advantage of FSST over TUG.

The first advantage is that FSST was divided to incorporate a greater complicity of stepping then TUG.

Secondly, FSST is more cognitively demanding ie remembering the sequence.

Thirdly, FSST involves multiple and complete transfer of weight between feet while changing direction.

Fourthly, FSST required less space than TUG which required a minimum of five meter space, while FSST 180m^2 of space. Thus, FSST can be used in bed side or clinical set ups more easily.

CONCLUSION AND CLINICAL SIGNIFICANCE

Conclusion

The FSST is easy to perform and provide a quantitative measure of the ability to quickly change direction while lifting the feet off the ground.

The FSST assess the ability to change direction quickly and it takes minimum space and time to administer the test.

Hence, the Four Square Step Test is better test to measure dynamic balance in ambulatory chronic stroke patients.

Clinical Significance

Four square step (FSST) test has shown highly significant correlation with timed up and go (TUG) test in case of ambulatory chronic strok patients. Thus, use of FSST scale as an outcome,measure or as an assessment tool for balance in chronic stroke patients will be more beneficial because FSST evaluate cognitive label as well as the dynamic balance of person in a much better way than TUG because in FSST the person has to cross hurdles while performing the test. This activity requires much better testing dynamic balance as well as his cognition label also, the whole procedure of FSST scale is not usually performed by the person in daily life while the TUG has component like simple getting up from chair walking in space which a person usually use in his daily activity. So, here the person is well in advance used to the components of scale while in FSST he/she is not. Therefore, FSST is better test for checking balance.

FSST is more suitable test for balance for small clinical setups and bed side test as it requires very less space it approximately 180m^2 while TUG require a minimum of 5 meter space for walking.

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