

## Four Square Step Test (FSST): Reference Guide

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### Introduction

One of the main goals of orthotic and prosthetic interventions is to improve function through mobility. The four square step test (FSST) is an outcome measure that is designed to assess a subject’s dynamic stability and ability to step over small objects forward, laterally, and backward.<sup>1</sup>

**Establishing Author:** Dite W, Temple VA. (2002)

**Data Type:** ratio

**Measurement Type:** performance-based outcome measure

**Assessment Type:** observer

### Psychometric Properties

Outcome measures can improve the quality of clinical evaluations and notes as well as offer a reference for patient progress. The four square step test has been shown to have strong psychometric properties in a variety of populations, including transtibial amputees, geriatrics, individuals with Parkinson’s disease, and acute stroke.<sup>1,2,3,4</sup>

**Reliability.** Excellent test-retest reliability was found for post-stroke subjects in two week testing intervals, from initial admission to four weeks, with great statistical significance ( $p < 0.01$ ).<sup>4</sup> Excellent reliability was also noted in the geriatric population and in patients with Parkinson’s disease, both on and off medication.<sup>1,3</sup> Inter-rater reliability was excellent in geriatric and Parkinson’s disease populations.<sup>1,3</sup>

**Validity.** Concurrent validity was determined to be excellent in the geriatric population between the four square step test and both the step test and timed up and go (TUG, with  $r = -0.83$  and  $r = 0.88$ , respectively). Fair concurrent validity was found between FSST and the functional reach test in the geriatric population, with  $r = -0.47$ .<sup>1</sup> Fair concurrent validity between the FSST and both the 6-minute walk test (6MWT) and 5 times sit to stand was determined when testing subjects with Parkinson’s disease. The Spearman’s correlations were found to be  $r = -0.52$  and  $r = 0.58$ , respectively, in those tests.<sup>3</sup> A floor effect for the FSST was discovered when testing the acute stroke population, where 40-62% of participants had at least one unsuccessful trial in testing at initial admission, 2 weeks, or 4 weeks from an accident.<sup>4</sup>

**Responsiveness.** Among unilateral transtibial amputees, a predictive threshold time of 24 seconds for the FSST was established as the time that distinguished multiple fallers from non-multiple fallers, with a sensitivity of 92% and specificity of 93%. A longer time was found to identify multiple fallers 86% of the time in that population. A time equal to or faster than the threshold was found to identify the amputees as non-multiple fallers 96% of the time.<sup>2</sup> Threshold times for additional populations are shown in table 2.

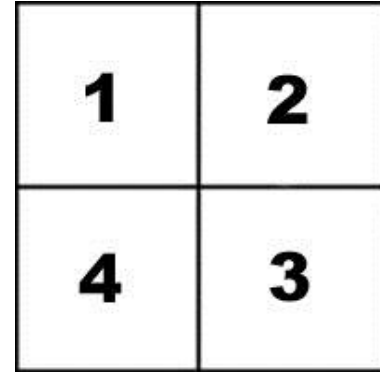
**Table 1.** A comparison of psychometric properties tested in common outcome measures

Outcome measure	Reliability			Validity	Responsiveness		Normative Data
	Test-Retest	Inter-rater	Intra-rater		MDC	Floor/Ceiling Effect	
<b>FSST</b>	yes	no	yes	yes	no	floor	yes
<b>Single Limb Stance</b>	yes	no	no	yes	no	ceiling	yes
<b>Timed Up &amp; Go</b>	yes	yes	yes	yes	yes	ceiling	yes
<b>L-Test</b>	no	yes	yes	yes	yes	none	yes

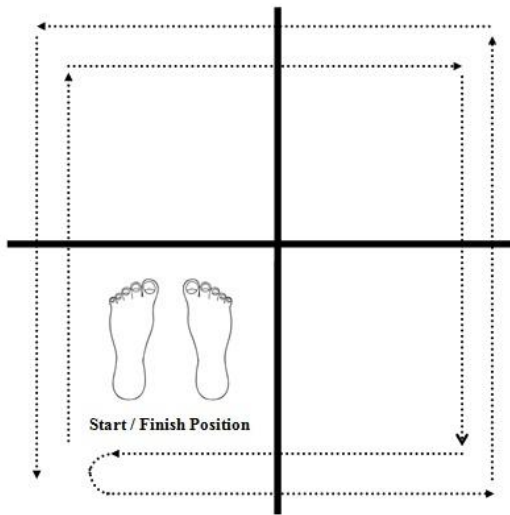


### Required Resources

- Total Time:** <3 minutes
- Personnel:** 1-2 persons
- Equipment:** a stopwatch and 4 canes or similar barriers
- Space:** approximately 4 square meters
- Cost:** free



**Figure 1.** Testing configuration. The subject begins standing in square 4.



1. Set up the canes or similar barriers to form a cross on the ground.
2. The subject begins in the lower left quadrant, square 4 as seen in figure 1.
3. Instruct the subject to step each foot in each square progressing clockwise and then counterclockwise to complete a trial. The subject should try to face forward the entire time.
4. Time the subject from initial contact in square 1 to the return of both feet in square 4 at the end of the sequence.

### Test Administration

The subject receives one demonstration and one practice trial. The subject then completes two trials, with the better time being recorded.

### Interpretation

A shorter time to finish the test represents better dynamic stability and ability to step over small objects forward, laterally, and backward. Several threshold values of increased fall risk have been established in various populations using the four square step test<sup>1,2,3,4</sup>. These times, as well as other normative data, are shown below<sup>1,4</sup>. By comparing a patient’s test results with these values, clinicians can justify the prescription of orthotic or prosthetic interventions. Efficacy of treatment can be shown by:

- Surpassing a threshold of reduced fall risk.
- Returning a patient to a score that is average among a patient’s

**Figure 2.** Testing sequence. The subject must make contact in all 4 squares clockwise and counterclockwise

Threshold Times Indicating Fall Risk by Population	
Population	Threshold
Lower Extremity Amputees	>24 sec. <sup>2</sup>
Geriatric Population	>15 sec. <sup>1</sup>
Acute Stroke	>15 sec. <sup>4</sup>
Parkinson’s Disease	>9.68 sec. <sup>3</sup>

Balance and Mobility Times for Older Adults <sup>1</sup>	
Multiple Fallers	Non-multiple Fallers
32.6 sec +/- 10.1	17.6 sec +/- 8.3

normal peers.

## Limitations

This test is not intended for individuals who may fall during the implementation of this outcome measure due to extreme instability or balance impairments. In addition, a floor effect exists in that the test is able to be failed. It was found in the post-stroke population that 40-62% of participants had at least one unsuccessful trial in testing at initial admission, 2 weeks, or 4 weeks from an accident<sup>4</sup>. The test fails to assess ability to transfer, endurance, and characteristics of simple gait, such as walking speed. This measure should be used in conjunction with other measures such as the 10-meter walk test, 2-minute walk test, and the timed up and go to provide a more comprehensive assessment of a patient.

Mean +/- SD	20.8 sec +/- 15.0
Range	6.1-60.1 sec
Subjects w/ failed trials	62%

## Documentation in Clinical Notes

When assessed with the four square step test (FSST), the patient scored 20.5 s today. This shows an decrease/increase in time since last assessed on 99/99/9999 and represents an improvement/regression in the patient's dynamic stability and ability to step over small objects forward, laterally, and backward.

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**Disclaimer:** The Authors, the Outcomes Research Committee, and the American Academy of Orthotists and Prosthetists does not endorse the use of any single outcome measure over any other single outcome measure and declares no conflict of interest in the presentation of this measure. There may be multiple versions of the instructions published in research literature. This reference guide has attempted to remain consistent with the instructions from the original developers of the outcome measure wherever possible, however in some instances one version of the instructions was chosen for ease of use in the clinic.

## References

1. Dite W, Temple VA. A clinical test of stepping and change of direction to identify multiple falling older adults. *Arch Phys Med Rehab.* 2002; 83(11): 1566-1571.
2. Dite W, Connor HJ, Curtis HC. Clinical identification of multiple fall risk early after unilateral transtibial amputation. *Arch Phys Med Rehab.* 2007; 88(1): 109-114.
3. Duncan RP, Earhart GM. Four square step test performance in people with Parkinson disease. *J Neuro Phys Ther.* 2013; 37(1): 2-8.
4. Blennerhassett JM, Jayalath VM. The four square step test is a feasible and valid clinical test of dynamic standing balance for use in ambulant people post-stroke. *Arch Phys Med Rehab.* 2008; 89(11): 2156-2161.

5. Rehab Measures: Four Step Square Test. <http://www.rehabmeasures.org/Lists/RehabMeasures/DispForm.aspx?ID=900>. Center for Rehabilitation Outcomes Research Website. Published October 30, 2010. Updated November 19, 2014. Accessed January 6, 2015.
- Figure 2. <http://ci-journal.net/index.php/ciej/article/viewFile/767/901/4934>