##### Four Square Step Test (FSST)

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Title: A clinical test of stepping and change of direction to identify multiple falling older adults.

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Abstract

OBJECTIVES: To establish the reliability and validity of a new clinical test of dynamic standing balance, the Four Square Step Test (FSST), to evaluate its sensitivity, specificity, and predictive value in identifying subjects who fall, and to compare it with 3 established balance and mobility tests. DESIGN: A 3-group comparison performed by using 3 validated tests and 1 new test. SETTING: A rehabilitation center and university medical school in Australia. PARTICIPANTS: Eighty-one community-dwelling adults over the age of 65 years. Subjects were age- and gender-matched to form 3 groups: multiple fallers, nonmultiple fallers, and healthy comparisons. INTERVENTIONS: Not applicable. MAIN OUTCOME MEASURES: Time to complete the FSST and Timed Up and Go test and the number of steps to complete the Step Test and Functional Reach Test distance. RESULTS: High reliability was found for interrater (n=30, intraclass correlation coefficient [ICC]=.99) and retest reliability (n=20, ICC=.98). Evidence for validity was found through correlation with other existing balance tests. Validity was supported, with the FSST showing significantly better performance scores (P<.01) for each of the healthier and less impaired groups. **The FSST also revealed a sensitivity of 85%, a specificity of 88% to 100%, and a positive predictive value of 86%.** CONCLUSION: As a clinical test, the FSST is reliable, valid, easy to score, quick to administer, requires little space, and needs no special equipment. It is unique in that it involves stepping over low objects (2.5cm) and movement in 4 directions. The FSST had higher combined sensitivity and specificity for identifying differences between groups in the selected sample population of older adults than the 3 tests with which it was compared.

**Equipment:**

* Stop watch
* 4 canes (laid in a cross pattern)
* Gait belt

|  |  |
| --- | --- |
| 2 | 3 |
| 1 | 4 |

**Sequence:**

* Start by standing in square 1, facing square 2 *(imagine that direction is facing “north”)*
* Begin in a clockwise direction, i.e. 2-3-4-1; then immediately move counterclockwise, i.e. to squares 4-3-2-1.

**Instructions:** “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 *(“north”)* during the entire sequence”.

* Demonstrate.
* Allow a practice trial
* Two trials 🡪 the best time (in seconds) is taken as the score.
* Repeat a trial if the subject:
  + fails to complete the sequence successfully
  + loses balance
  + makes contact with the cane

Subjects who were unable to face forward during the entire sequence and needed to turn before stepping into the next square were still given a score.

Scoring: time in seconds. \*Note: the stopwatch starts when the first foot contacts the floor in square 2.

“**Cutoff score of 15 seconds** was identified. Subjects with scores of greater than 15 seconds were considered as multiple fallers and those with scores < 15 as nonmultiple fallers. At 15 seconds, the FSST has a positive predictive value of 86% and a negative predictive value of 94% for the sample tested.” (Dite, 2002)

**Addendum: Special Populations**

(Whitney, 2007) Population: “for people with balance deficits secondary to vestibular disorders, a cutoff score of greater than 12 seconds on the FSST was associated with a sensitivity of 80% and specificity of 92% for the identification of subjects with 1 or more risk factors for falls.”

Whitney SL, Marchetti GF, Morris LO, Sparto PJ. (2007). The reliability and validity of the Four Square Step Test for people with balance deficits secondary to a vestibular disorder. *Arch Phys Med Rehabil*. 88(1):99-104.

(Blennerhassett, 2008) Population: post stroke: “the FSST is a feasible and valid test of dynamic standing balance that is sensitive to change during stroke rehabilitation.”

Blennerhassett JM, Jayalath VM. (2008). The Four Square Step Test is a feasible and valid clinical test of dynamic standing balance for use in ambulant people poststroke. *Arch Phys Med Rehabil*. 89(11):2156-61.

(Dite, 2007) Population: s/p transtibial amputation: 40 subjects given FSST at 6mo. s/p transtibial amputation. Scores of 24 seconds or more (sensitivity, 92%; specificity, 93%) were associated with increased risk of having multiple falls.

Dite W, Connor HJ, Curtis HC. (2007). Clinical identification of multiple fall risk early after unilateral transtibial amputation. Arch Phys Med Rehabil. 88(1):109-114.