Four Square Step Test for Adults with Lower-Limb Amputations

Description: The Four Square Step Test (FSST) is a clinical test of dynamic standing balance, which may be used to assess fall risk, and predict prosthetic nonuse in patients with a lower-limb amputation who are using a prosthetic device. This test should not be performed on individuals who utilize a walker.

Equipment: 4 canes (or tape if performing modified test); 3mx3m floorspace; stopwatch

Test Set-Up: Rest the canes flat on the floor forming a square as shown in the diagram below. Patient stands in square 1 facing square 2. The sequence performed is: 1,2,3,4,1,4,3,2,1 (i.e., clockwise then counter-clockwise), which requires the patient to step forward, backward and sideways to the right and left.

Patient Instructions: “Try to complete the sequence as fast as possible without touching the canes (tape). Both feet must contact the floor in each square. If possible, face forward during the entire sequence.”

Clinician Instructions: After giving the verbal instructions, demonstrate the sequence and allow for questions. Give the participant 1 practice trial prior to timing; allow body rotation to clear canes if needed. Invalid trials are those where the sequence is incorrect, there is a loss of balance, both feet do not touch each square, or the canes (or tape) are touched. Turning does not invalidate trial but may lead to longer times. Start the stopwatch when the first foot contacts box 2 and stop when both feet return to box 1. Do not call numbers out during the test. Record the faster time of 2 trials.

Modification: Canes can be replaced with lines on the floor to increase valid trials and reduce the floor effect and may help with differentiation of functional mobility levels.

Predictive Ability when Stepping Over Canes:
- Risk of multiple falls at 6 months post-discharge in patients with a unilateral transtibial amputation who are ≥18 years:
  - ≥24 seconds: Sensitivity 92%; Specificity 93%; Positive Predictive Value: 86%; Negative Predictive Value: 96%
- Prosthetic nonusers in patients with a transtibial amputation (or more proximal amputation) or bilateral amputations 1 year follow-up post-discharge from rehabilitation: ≥36.6 seconds

Psychometric Properties
Test-Retest Reliability: ICC: 0.97 (0.94-0.98)
Interrater Reliability: ICC: 0.99 (0.99-1.00)
MDC90: 2.0 (0.8-3.5) seconds
SEM: 0.9 seconds
MCID: Unknown
Floor Effect

Reference Values: Prosthesis Users
- Bilateral transfemoral, aged 27.7 ± 8.4 yrs
  Time, sec (mean±SD): 22.0±10.2
- Full-length prostheses (n=17)
  Time, sec (mean±SD): 21.4±5.3
- Stubby-length prostheses (n=5)
  Time, sec (mean±SD): 10.4±5.3

Reference Values Modified Test: Lower-Limb Loss ≥ 1yr prior
- Transtibial
  - K3, aged 50 (95%CI: 46–55) yrs (n=28)
    Time, sec mean [95%CI]: 8.82 [8.30–9.34]
  - K4, aged 40 (95%CI: 35–46) yrs (n=22)
    Time, sec mean [95%CI]: 7.80 [7.21–8.38]
- Transfemoral
  - K3, aged 50 (95%CI: 40–61) yrs (n=10)
    Time, sec mean [95%CI]: 10.34 [9.47–11.21]
  - K4, aged 38 (95%CI: 26–49) yrs (n=7)
    Time, sec mean [95%CI]: 8.67 [7.63–9.72]

Reference Values: Able-Bodied Adults
- Adults, aged 74 ± 6 yrs (n=27)
  Time, sec (mean±SD): 8.70 (7.36, 10.01)*
- Adults, aged 84 ± 6 yrs (n=45)
  Time, sec (mean±SD): 15.8±8.3

*Data presented as median (Q1, Q3)


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