Timed Single Limb Stance (SLS) Test: Reference Guide

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Introduction

Balance is an important domain of neuromuscular rehabilitation, as it affects an individual's static and dynamic stability. The timed single limb stance (SLS) test is an outcome measure designed to assess static balance and the ability of the subject to stand on a pathological or sound limb.[1]

Many variations of the SLS exist due to the amount of time it has been in use and the many different populations it has been used to test. Arm placement is a point of emphasis that is often not mentioned in journal articles that use the. When arm placement is mentioned in the literature, the participant is instructed to stand with hands at the hips or with arms crossed.[4,7,8] Placing the hands on the hips may make the test safer for the participant. Another point of emphasis is whether to keep the eyes open or closed during the test. The times and thresholds described in this article refer to SLS with eyes open as it has been shown to relate to overall function, postural stability, fall status, and health-related fitness.[8] Closing the eyes during a balance test has been shown to be reliable to test vestibular function and proprioception, but not neuromuscular performance.[9] Eyes closed trials may be added to the end of the testing protocol to be recorded separately; however, the testing with eyes closed can increase the subject's risk of falling and presents additional liability to the testing facility.

Establishing Author: Sheldon JH. (1963)

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 single limb stance test was developed for the Parkinson's disease population, but it has translational potential in many other populations, including lower extremity amputees, geriatrics, and those with osteoarthritis.[1,2,3] The SLS has strong psychometric qualities, and a base of normative data is also available.[4]

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	
FSST	yes	no	yes	yes	no	floor	yes
Single Limb Stance	Yes	no	no	yes	no	ceiling	yes
Timed Up & Go	yes	yes	yes	yes	yes	ceiling	yes
L-Test	no	yes	yes	yes	yes	none	yes

Reliability. A "strong" test-retest reliability for the SLS was found in a study of patients with Parkinson's disease found. Results from tests on both legs were analyzed, and the intra-class correlations were nearly identical, at r=0.82 for the right leg and r=0.83 for the left.[3]

Validity. Excellent concurrent validity was shown between the single limb stance test and the posture and gait component of the unified Parkinson's disease rating scale (UPDRS) in a population with Parkinson's disease, with Pearson's correlation r=0.71.[5] The SLS also had good concurrent validity, r=0.55, with the activities-specific balance confidence (ABC) scale in a separate study of that population.[6] A ceiling effect exists in the SLS, as the test terminates at 30 seconds; however, its effect has not been analyzed.[7]

Responsiveness. A threshold value of 10 seconds for the SLS has been determined to indicate fall risk in subjects with Parkinson's disease. The cut-off time was found to have 75% specificity for fallers and 74% sensitivity for non-fallers, with the latter group exhibiting an average SLS time of 15 seconds.[6]

Required Resources

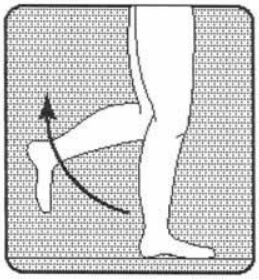
Time: < 5 minutes

Personnel: 1-2 persons

Equipment: stopwatch

Space: approximately 1 square meter

Cost: free



Test Administration

1. The subject begins in quiet standing with hands on the hips.
2. The subject lifts one leg off the ground and stands unassisted.
3. Time starts when the foot is lifted off the ground
4. Time stops when the lifted foot either makes contact with the ground, makes contact with the stance limb, when the stance foot moves laterally on the floor, or when the hands leave the hips.

The subject completes three (3) trials on the leg being tested. The best time and the average of the three times is recorded. The leg being tested is the leg that remains in contact with the ground. The stance foot must remain flat on the floor at all times.

Interpretation

Longer SLS times indicate increased levels of postural stability and balance. Elderly subjects who could not maintain a single limb stance time of at least 5 seconds were found to carry twice the risk of sustaining an injury due to a fall when compared to their age-matched peers who could.[1] This finding corroborates the claim that the first 5 seconds of the SLS is a measure of dynamic stability, in contrast to static stability as in the remainder of the test, as the subject is regaining a standing balance from a bipedal stance.[3] This 5 second marker is indicated on a timeline in figure 1, along with the aforementioned 10 second fall risk threshold and other notable SLS times. Normative data is presented in table 2.[4] Comparison of a patient's results with these times can help clinicians justify orthotic or prosthetic prescriptions. 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 normal peers.

Table 2. timeline of notable SLS times and thresholds (in seconds)

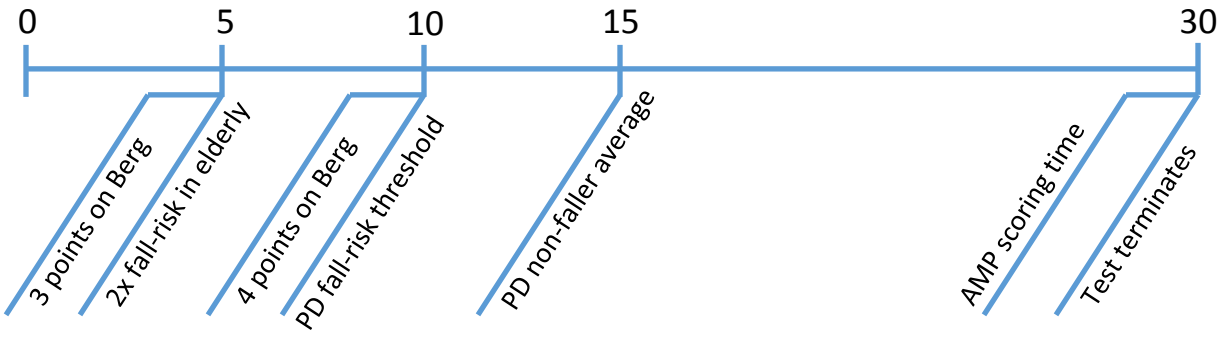


Table 2. normative data for the SLS with eyes open and eyes closed

Unipedal Stance Test Time by Age Group and Gender for Eyes Open and Closed[4]						
Age & Gender Groups	Ages 18-39	Ages 40-49	Ages 50-59	Ages 60-69	Ages 70-79	Ages 80-99
Eyes Open Male	43.2 +/- 6.0	40.1 +/- 11.5	38.1 +/- 12.4	28.7 +/- 16.7	18.3 +/- 15.3	5.6 +/- 8.4
Eyes Open Female	43.5 +/- 3.8	40.4 +/- 10.1	36.0 +/- 12.8	25.1 +/- 16.5	11.3 +/- 11.2	7.4 +/- 10.7
Eyes Closed Male	10.2 +/- 9.6	7.3 +/- 7.4	4.5 +/- 3.8	3.1 +/- 2.7	1.9 +/- 0.9	1.3 +/- 0.6
Eyes Closed Female	8.5 +/- 9.1	7.4 +/- 6.7	5.0 +/- 5.6	2.5 +/- 1.5	2.2 +/- 2.1	1.4 +/- 0.6

Limitations

This test is not intended for individuals who may be unable to stand safely on one foot due to extreme weakness, instability, or vestibular conditions. A ceiling effect exists in that the test protocol terminates at 30 seconds, although its effect has not yet been analyzed. The SLS fails to assess the 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 analysis.

Documentation in Clinical Notes

Example: When assessed with the single limb stance test, the patient scored 0-30 seconds today. This shows an decrease/increase in time since last assessed on 99/99/9999 and represents an improvement/regression in the patients static stability and ability to stand on a pathological/sound limb.

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Disclaimer: The authors, Outcomes Research Committee, and the American Academy of Orthotists and Prosthetists do not endorse the use of any single outcome measure over any other single outcome measure and declare 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

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