Gait and Balance Protocols

1. TIMED UP AND GO TEST

Timed "Up & Go" Test consists of timing an individual as he or she stands, walks 3 m, turns 180 degrees, and returns to the chair and sits down. The score on the test is the time it takes (in seconds) to complete the task (ref 1).

The timed "Up & Go" test measures, in seconds, the time taken by an individual to stand up from a standard arm chair (approximate seat height of 46 cm, arm height 65 cm), walk a distance of 3 meters (approximately 10 feet), turn, walk back to the chair, and sit down again.

The subject wears his/her regular footwear. If participant's usually use assistive devices such as canes or walkers, they should use them during the test, but this should be indicated on the data collection form. No physical assistance is given.

Instructions for the investigators:

"Setting Up the test area:

- Determine a path free from obstruction
- Place a chair with arms at one end of the path.
- Mark off a 3 m (10 ft.) distance using tape or a cone or other clear marking.

Start the test

- Speak clearly and slowly.
- Inform participant of sequence and outcome
- "When I say go, you will stand up from the chair, walk to the mark (cone) on the floor, turn around, walk back to the chair and sit down. Walk at your regular pace." "I will be timing you using the stopwatch."
- Ask participants to repeat the instructions to make sure they understand."

Participant starts with their back against the chair, their arms resting on the arm rests, and their walking aid at hand. Using a cue like "Ready, set, go" might be useful. Start timing on the word "GO" and stop timing when the subject is seated again correctly in the chair with their back resting on the back of the chair. Either a wrist-watch with a second hand or a stop-watch can be used to time the performance.

2. TESTS OF STANDING BALANCE (TSB)

For **tests of standing balance (TSB)**, the subjects will be asked to attempt to maintain their feet in the side-by-side, semi-tandem (heel of one foot beside the big toe of the other foot), and tandem (heel of one foot directly in front of the other foot) positions for 10 seconds each.

Instructions: "This is a series of quick tests to see how well you can maintain your balance under various conditions. Each test simply involves having to stand still for a short length of time on a stationary surface.

Instructions:

"I am not going to do anything "tricky" or purposely try to make you lose your balance. You will just be standing still."

"Stand in this position -with your feet side by side/ semi-tandem/tandem and your arms and hands at your waist like this. Keep your eyes open and look at the target. Remain in this position for as long as you can or until I ask you to stop. I will let you know when we are ready to begin; and then please do not talk until we are finished with this part of the test. Do you have any questions?"

The subjects will be given a score of 1 if they can hold a side-by-side standing position for 10 seconds but unable to hold a semi-tandem position for 10 seconds, a score of 2 if they can hold a semi tandem position for

10 seconds but unable to hold a full tandem position for more than 2 seconds, a score of 3 if they can stand in the full tandem position for 3 to 9 seconds, and a score of 4 if they can stand in the full tandem position for 10 seconds (ref 2).

3. DUAL TASK METHOD

The dual-task method, which requires participants to perform multiple tasks simultaneously, has been used to investigate the effect of cognitive tasks on postural control and vice versa. Attention and executive functions appear to be the most important cognitive functions in the regulation of gait and balance control in older people. It has been shown that the ability to maintain postural stability is reduced when performing 2 or more tasks concurrently (ref 3) and these deficits are increased in elderly people with balance impairment. Older adults who perform poorly under dual-task conditions are at increased risk for falls (ref 4). Additional research has shown that, with a simultaneous walking and talking task, participants were found to either stop walking or take a longer time to complete their gait task. These findings confirm the notion that balance performance is influenced by simultaneously performing a cognitive task.

Performance under **dual task conditions** will involve testing walking similar to baseline while the subject is concomitantly performing serial 3's subtractions (starting at a random number between 90-200). In addition, for the TUG, testing of **walking over obstacles** (one obstacle placed mid distance) will be performed in conjunction to TUG without and with the dual task modifier. For the obstacle crossing tasks, the patients will be instructed to walk and step over an obstacle (a shoe box: 10 cm highx19 cm widex33 cm long) placed at the 2-m mark. Time to complete the test and if the subject hit the obstacle will be recorded.

For the counting backward by threes, the patients will be asked to walk counting backward by threes from any starting number from 90 to 200 simultaneously with either narrow walking or obstacle crossing. The total number of subtractions completed during the counting backward task will be recorded. The subject will be instructed to pay attention to counting.

SUMMARY OF GAIT AND BALANCE TESTING PER EACH SUBJECT

Test	Baseline TUG	Dual Task TUG	Obstacle TUG	Dual task + obstacle TUG	TSB
Time (min)	3	3	3	4	2

References

1. Podsiadlo D, Richardson S, The timed "Up & Go": a test of basic functional mobility for frail elderly persons. J Am Geriatr Soc, 1991. 39(2): p. 142-8.

2. Guralnik JM, Ferrucci L, Simonsick EM, Salive ME, Wallace RB, Lower-extremity function in persons over the age of 70 years as a predictor of subsequent disability. N Engl J Med, 1995. 332(9): p. 556-61.

3. van Iersel MB, Ribbers H, Munneke M, Borm GF, Rikkert MG, The effect of cognitive dual tasks on balance during walking in physically fit elderly people. Arch Phys Med Rehabil, 2007. 88(2): p. 187-91.

4. Silsupadol P, Siu KC, Shumway-Cook A, Woollacott MH, Training of balance under single- and dual-task conditions in older adults with balance impairment. Phys Ther, 2006. 86(2): p. 269-81.