

APPENDIX

Specifications for Tasks included in the mobility battery:

Quantitative measurement methods for components of these tasks were taken from the extensive biomechanical literature, supplementary references follow the task descriptions.

Quiet Standing: The clinical Romberg test compares quiet standing with eyes open to eyes closed with feet in comfortable stance, the ‘sharpened’ Romberg uses feet together in tandem stance¹⁷. Force plate data were collected for 1 minute with the first and last 15s discarded. Sway path and area were evaluated over the middle 30s period and 3 ratios were calculated⁴⁰ (eyes closed/eyes open, feet together-eyes open/eyes open and feet together-eyes closed/ feet together-eyes open).

Leaning: The base of support is the furthest position an individual allows their center of gravity to reach without moving their feet or falling. Subjects were asked to lean maximally forward, right, left and backward without bending their hips or knees or losing their balance¹⁸. This movement was practiced at least once on the force-plate prior to recording three trials. Center of pressure excursions as measured by the force plate were calculated in each direction³³.

Sit-to-stand: Subjects began in a sitting position (back touching backrest) on a chair set⁴² at 41.4 cm, with arms crossed below the sternum and feet on the force-plate. On “go” the subject was asked to stand; if they could not arise without using their arms after two attempts, they were permitted to use one or both arms. It has been demonstrated that performance phases for sit-to-

stand were identical with or without hands³⁴. Rise-time was measured from onset of anterior-posterior force until vertical force reached body weight. Phase I began at onset with movement in the anterior direction, while Phase II began with vertical force causing liftoff from the seat and ended when these forces reached body weight⁴³. Standing was defined as the time vertical force reached body weight. The times, medial-lateral and anterior-posterior excursions, as well as force impulse values, were determined for each phase.

Gait: Two 8.1 m out and back walks were performed at self-selected and as-fast-as-possible pace⁴⁴. Gait velocity and center of pressure excursions during initiation of gait were calculated. Anterior-posterior moment generated at gait initiation⁴⁵ was obtained from the force plate and normalized by foot length.

Turns: Subjects started two strides (1.8-2.8 m) from the chair used in sit-to-stand. The time from the first step until the subject began to sit and the number of steps taken were measured³⁸. The turning moment about the vertical axis was obtained from the force plate⁴⁶.

Reaching in a cabinet: A small (16 oz.), empty glass bottle was placed on a shelf 15.3-30.5 cm below the waist. The Subject stood on a chalk mark placed at a horizontal distance equal to their measured arm length plus 15 cm from the shelf and was asked to reach for the bottle and after retrieving it, stand still, holding it in their hand. Maximum excursion forward from the initial center of pressure position, sway area during the forward reach and velocity of the movement were calculated⁴⁷.

Pulling open a door: The subject was asked to briskly open the door with the left hand using a left-facing shallow handle commonly used as a shopping center entry door. The subject stood on a chalk mark placed at a horizontal distance equal to their measured arm length plus 15 cm from the door handle. Maximum excursion backward of initial center of pressure position, sway area during the pull, and movement velocity were calculated⁴⁸.

Stepping into a bathtub: Subjects were asked to step sideways into the tub (33 cm side), keeping the hips perpendicular during the weight transfer⁴⁹. They were allowed to practice and select the lead leg and could use a vertical grab bar if necessary. Three phases were measured, anticipatory weight adjustment, transfer of body weight to the standing leg, and position maintenance. The anticipatory phase began with COP movement away from the tub and ended when the furthest point was reached, beginning the weight transfer. Transfer ended when vertical force falls below body weight⁵⁰. The times, medial-lateral and anterior-posterior excursions³³, sway path, peak acceleration and force impulses were determined for each phase.

Walk down stairs: The subject was asked to descend three 17.8 cm steps using the handrail³⁵, if desired. The time from the initial unweighting of the lead leg⁵⁰ until completion of the stair descent and amount of pause in contact with the force plate at the bottom before walking forward were measured. Center of pressure excursions and anterior-posterior moment (normalized by foot length) during gait initiation were obtained from the force plate.

Other Physical Performance Measures

Tinetti Performance Oriented Mobility Assessment⁵ (POMA)- Total score: Balance (9 components, sitting balance, arises, attempts to arise, immediate standing balance, standing balance, nudged, eyes closed, turning 360 degrees, and sitting down; maximum 16 points) and Gait (7 components, initiation of gait, step length, step height, step symmetry, step continuity, path, trunk and walking stance, maximum 12 points) subscales were measured as abnormal =0 or normal =1; though in some cases adaptive=1 and normal =2. Subscale scores are combined to calculate the Total score, which has a maximum of 28 points²².

EquiTest Sensory Organization Test⁸ (SOT): Six ‘sensory conditions’ (normal vision/ fixed support, absent vision/ fixed support, sway-referenced vision/ fixed support, normal vision/ sway-referenced support, absent vision/ sway-referenced support and sway-referenced vision/ sway-referenced support) are each measured three times. Sway-referencing describes a servo-motor controlled movement of the force plate or visual surround “to directly follow anterior-posterior body sway”. Sway-referencing the support surface and/or visual surround provides inaccurate somatosensory and visual information. A Composite score is calculated across all 6 conditions²³.

SUPPLEMENTARY REFERENCES

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