Correlation Between Two Clinical Balance Measures in Older Adults: Functional Mobility and Sensory Organization Test

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Background. Functional mobility of older adults has been shown to correlate with stance stability to various extents. This variability could be due to the difference in the way sensory information is processed in these two types of balance tests. Correlations between functional mobility and stance stability under altered sensory conditions, such as those in the Sensory Organization Test (SOT), are needed to test this possibility. The present study investigated the correlation between the performance of older adults on a newly developed Sensory-Oriented Mobility Assessment Instrument (SOMAI) and on the various sensory conditions of the SOT.

Methods. Twenty-seven community-dwelling older adults (76 ± 7 years) underwent tests of the six SOT conditions and 10 SOMAI mobility maneuvers performed under normal- and focal-vision (peripheral vision eliminated) conditions. Behavioral performance in the two SOMAI conditions and the amounts of postural sway in the six SOT conditions were ranked among the subjects. Correlations of performance rankings on these two tests were analyzed.

Results. Performance on the two SOMAI conditions significantly correlated with that on the SOT conditions in which accurate visual, vestibular, and somatosensory inputs were all present (p < .05). Performance on the focal-vision SOMAI condition was also significantly correlated with that on the SOT condition in which somatosensory input was unreliable for orientation while visual and vestibular inputs were reliable (p < .05). There were no correlations between the SOMAI performance and performance on the no-vision or unreliable-vision SOT conditions.

Conclusions. The ability to use all visual, somatosensory, and vestibular inputs for balance was correlated with functional mobility. The moderate correlations between the performance on the normal-sensory SOT condition and the SOMAI conditions suggest that body systems other than balance senses also contribute to mobility performance.

MOBILITY assessment instruments evaluate a person's balance and mobility function while performing dynamic maneuvers that resemble daily activities. Several such instruments have shown satisfactory reliability and validity in identifying older people with balance problems, discriminating older adults by their needs for different assistive devices to maintain balance, or predicting their likelihood of falls (1–4).

The Sensory Organization Test (SOT) is another established clinical instrument for evaluating balance problems (5,6). In particular, the SOT assesses a person's ability to maintain balance under altered sensory conditions by relying upon available accurate sensory input(s) and suppressing misleading one(s). When given misleading sensory input(s), older adults with fall histories showed greater difficulty in maintaining standing balance than those without fall histories (7,8).

Although mobility instruments and the SOT test are both valuable clinical tools for balance function evaluation, studies correlating performance on the first two SOT conditions (eye-open and eyes-closed quiet stance with accurate somatosensory and vestibular inputs) and that on mobility instruments showed only low to moderate or even negative relationships (9–12). This lack of high correlations could be due to the differences in the nature of the tests (static versus dynamic) and the way sensory information is utilized in the two types of balance tests. To further understand how sensory inputs are utilized in mobility performance, correlations between the mobility performance and performance on each SOT condition may be important.

To examine this relationship, we designed a sensory-oriented mobility assessment instrument (SOMAI) and compared performance of older adults on the SOMAI with performance on a standard SOT. The SOMAI included modifications of existing mobility instruments (4,13) to place greater demand on using balance senses in a mobility test. These modifications included: (a) performing the maneuvers in a continuous fashion that required rapid adaptation to changing environmental and task conditions; (b) walking across uneven and unstable floor surfaces; and (c) mobility performance under not only normal-vision, but also focal-vision conditions. Because the SOMAI placed greater challenges on the use of sensory inputs, it was possible that older adults who could better integrate all three balance sensory inputs, as indexed by better performance on the first SOT condition, would also perform better in the SOMAI tests.

METHODS

Subjects.—Twenty-seven older volunteers (23 females and 4 males, mean age = 76.2 ± 7.4 yr) participated in the study. The inclusion criteria were: of 65 years of age or
older, free of severe musculoskeletal problems and neurological diseases such as stroke and Parkinson’s disease, being physically active and able to walk independently at least one block, living independently or semi-independently in the community, and having experienced balance difficulties in activities of daily living. Further, their balance difficulties were to some extent related to impaired sensory function as indicated by showing a minimum of two losses of balance (LOBs) on a standard SOT on a movable platform. Each participant signed a consent form approved by the University of Oregon.

**Physical examinations.**—The examinations showed that only one subject had ankle muscle (dorsi- and plantarflexors) weakness on the left leg. A high percentage of subjects demonstrated decreased ranges of motion in ankle dorsiflexion and cervical lateral flexion (Table 1).

**Neurological examination.**—None of the subjects were diagnosed as having “hard” signs of neurological pathology by their primary care physicians. To uncover any undiagnosed neurological dysfunction or soft signs that often accompany the normal aging process, a neurologist conducted a neurological examination. We considered that these soft signs may account for balance difficulties in some subjects. All but three subjects (S8, S13, and S40) who were not available during the examination, were tested.

The examination included assessment of the mental status, general balance function, and function of the following nervous subsystems: vestibular, somatosensory, visual, pyramidal tract, cerebellum, and basal ganglia. Rating of the performance on this examination was done by considering the performance of a healthy 30-year-old young adult as normal so that soft neurological signs could be identified. The number of LOBs on the SOT for the three subjects who did not receive the neurological examination was 4, 2, and 4, respectively, indicating that these subjects did not have the worst or the best balance abilities among all of the subjects recruited.

Table 2 summarizes the results of this examination. Eleven subjects showed difficulty with tandem gait and four subjects had difficulty making a 360° turn, indicating a decline in their general balance ability. Some subjects showed a decline in joint position sense (N = 5), vibration sensation (N = 9), or conjugate eye movement (N = 10). Very few had problems in tactile sensation, visual field, saccade, or pursuit eye movement (N ≤ 1). Five subjects had soft signs of the cerebellum; three subjects had soft signs of basal ganglia.

**Experimental protocol.**—Each subject first experienced the SOT. The SOT consisted of seventeen 20-s trials of 6 sensory conditions tested in the standard order (5,6): normal vision and support surface (condition 1), eyes closed and normal support surface (condition 2), sway-referenced vision and normal support surface (condition 3), normal vision and sway-referenced support surface (condition 4), eyes closed and sway-referenced support surface (condition 5), and sway-referenced vision and support surface (condition 6).

### Table 1. Number of Subjects Who Showed Impairment in the Physical Examination and the Means and Standard Deviations (SDs) of Joint Range of Motion (N = 27)

<table>
<thead>
<tr>
<th>Items</th>
<th>Number of Subjects</th>
<th>Mean (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strength</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Left ankle dorsiflexor</td>
<td>1 (grade=poor)</td>
<td></td>
</tr>
<tr>
<td>Right ankle dorsiflexor</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Left ankle plantarflexor</td>
<td>1 (grade=fair minus)</td>
<td></td>
</tr>
<tr>
<td>Right ankle plantarflexor</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Range of Motion</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Left ankle dorsiflexion</td>
<td>18</td>
<td>3.2 (7.1)</td>
</tr>
<tr>
<td>Right ankle dorsiflexion</td>
<td>20</td>
<td>3.0 (5.6)</td>
</tr>
<tr>
<td>Left ankle plantarflexion</td>
<td>11</td>
<td>54.0 (10.4)</td>
</tr>
<tr>
<td>Right ankle plantarflexion</td>
<td>6</td>
<td>60.0 (10.3)</td>
</tr>
<tr>
<td>Cervical rotation to left</td>
<td>9</td>
<td>59.1 (11.6)</td>
</tr>
<tr>
<td>Cervical rotation to right</td>
<td>5</td>
<td>58.8 (10.3)</td>
</tr>
<tr>
<td>Cervical lateral flexion to left</td>
<td>27</td>
<td>21.4 (9.0)</td>
</tr>
<tr>
<td>Cervical lateral flexion to right</td>
<td>27</td>
<td>19.4 (9.2)</td>
</tr>
<tr>
<td>Cervical flexion</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Cervical extension</td>
<td>5</td>
<td>51.9 (14.1)</td>
</tr>
</tbody>
</table>

**Notes:** All measures were referenced to the norm of healthy 30-year-old adults. All but cervical flexion range of motion were measured in degrees. Cervical flexion to the chest was considered normal.
6). In the sway-referenced condition, visual or somatosensory input from the ankle provided information incongruent with body sway and thus became unreliable. Subjects had to suppress the unreliable sensory input(s) and switch to rely upon accurate sensory information for orientation. There were two trials for the first condition, and three trials for each of the remaining conditions.

Subjects wore a harness and stood with the feet shoulder-width apart on a marked position and arms folded in front of the chest on each trial. Subjects were encouraged to stay on their feet during the test. An attendant stood behind the subject to prevent an actual fall.

Immediately following the SOT, subjects then underwent the SOMAI, which consisted of 10 maneuvers. Some maneuvers were newly designed whereas others were modifications to existing maneuvers (4,13). The maneuvers were carried out in the following sequence: (a) subject rose from a chair without armrests; (b) walked down an 8.25-m-long, flat concrete-surface walkway with a comfortable pace; (c) reached up at arm length to remove a piece of tape from the wall; (d) bent down to attach the tape back onto the wall at knee height; (e) turned 180° to face an 8.25-m-long carpeted walkway; (f) walked across the carpeted walkway and approached the first raised area where a foam cushion (.41 m long × .46 m wide × .06 m high) was placed underneath the carpet; (g) walked across the first raised area and negotiated the cushion; (h) walked toward the second raised area where another foam cushion of the same dimension was placed underneath; (i) walked across the second raised area and negotiated the second cushion; and (j) sat back down onto the same chair (Figure 1).

The maneuvers were performed first in the normal-vision condition and then repeated under the focal-vision condition in the same sequence. In the normal-vision condition, subjects wore correcting glasses as needed. In the focal-vision condition, subjects wore goggles that eliminated peripheral vision of the surrounding area and the subject’s feet. The performance was recorded onto a videotape for behavioral analysis.

Data processing.—Both the number of losses of balance (LOBs) and the amounts of sway in the SOT conditions were calculated. An LOB was defined as subjects having moved either one of the feet, reaching for support with hand(s), or continuing to sway in one direction without any return so that assistance by the attendant was necessary to prevent a fall.

The platform for the SOT was equipped with four strain gauges which recorded the vertical ground reaction forces (GRFs). The difference between the summed GRF from the front and the rear pairs of the strain gauges indicated the center-of-force (COF) of the platform that was equivalent to the COF output from the commercial posturography system, the EquiTest (16). The COF signal was sampled at 100 Hz and the root-mean-square (RMS) of the COF, representing the amount of postural sway, was calculated. For the non-LOB trials, the RMS was calculated based on the whole 20-s time window. For the LOB trials, the RMS was calculated from time zero to the onset of an LOB. The subject’s sway during each SOT trial was normalized to his/her maximum RMS value, with 100% assigned to this maximum RMS value. This maximum value always occurred in LOB trials for all subjects except for subject S13. Data from subject S13 were excluded from further analysis.

Performance on each maneuver of the SOMAI in both vision conditions was rated based on a 4-point scale (Table 3). A score of “0” indicated normal ability, “1” indicated adaptive or cautious behavior, “2” indicated impaired ability but the subject could still manage the task, and a score of “3” indicated that the subject needed assistance from a second person to prevent a loss of balance. The possible total mobility scores for each vision condition ranged between 0 and 30.

To evaluate the reliability of the rating used in the designed SOMAI, the performance of four subjects who had different levels of functional mobility was rated by two investigators (P.F.T. & S.M.) twice with a minimum of 6 intervening days. Both inter- and intrarater agreements on all maneuvers were calculated using Cohen’s index “kappa” (17). The criterion of agreement was preset at .8. The intrarater test-retest agreement was .89 and .81, respectively, for the two investigators. The interrater agreement was .81. All of the maneuvers were then rated by the same investigator (P.F.T.) who established a test-retest intrarater agreement of .89 and was blind to the subject’s performance on the SOT.

Statistical analyses.—A nonparametric statistical analysis was conducted to investigate the association of the score ranking between the SOT and the SOMAI (18–19). The normalized RMS scores in each SOT condition and the
FUNCTIONAL MOBILITY AND SENSORY ORGANIZATION TEST

Table 3. Rating Scales for the Ten Maneuvers in the Sensory-Oriented Mobility Assessment Instrument

<table>
<thead>
<tr>
<th>Maneuvers</th>
<th>0 = Normal</th>
<th>1 = Adaptive, May Use Caution</th>
<th>2 = Impaired, But Can Manage by Self</th>
<th>3 = Need Assistance of Second Person to Prevent Loss of Balance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stand up</td>
<td>Stand up easily, no use of arm</td>
<td>Use arms minimally to assist in rising to stand, or rise slowly</td>
<td>Any sign of unsteadiness, may use arms to push or significantly balance self</td>
<td>Require multiple attempts, or unable to stand without assistance of a second person</td>
</tr>
<tr>
<td>Gait weaving</td>
<td>No or minor weave in footpath</td>
<td>Obviously weave in footpath or stagger once</td>
<td>Not steady, weave or stagger to the side more than once</td>
<td>Require assistance at least once to prevent lateral loss of balance</td>
</tr>
<tr>
<td>Reach up</td>
<td>Reach up and regain standing position easily</td>
<td>Reach up slowly or pause as a precaution to maintain balance, or use hand(s) for minimal support</td>
<td>Obviously support self, may place hand(s) on wall or may take an extra step to catch self, or appear unsteady</td>
<td>Appear in danger of losing balance, or require assistance of a second person</td>
</tr>
<tr>
<td>Bend down</td>
<td>Bend down easily</td>
<td>Bend down slowly or pause as a precaution for balance, or use hand(s) for minimal support</td>
<td>Obviously support self, or take an extra step to maintain balance</td>
<td>Appear in danger of losing balance, or require assistance of a second person</td>
</tr>
<tr>
<td>Turn 180°</td>
<td>Turn (essentially pivot) in a continuous and flowing movement</td>
<td>Use four steps to complete turn, no obvious unsteadiness</td>
<td>Use more than four steps or appear unsteady</td>
<td>Require assistance to prevent loss of balance</td>
</tr>
<tr>
<td>Approach to first cushion</td>
<td>No slowing down</td>
<td>Approach slowly as a precaution</td>
<td>Stop to negotiate as a separate task</td>
<td>Require more than one attempt or assistance to step onto cushion</td>
</tr>
<tr>
<td>Reaction to first cushion</td>
<td>Complete step across cushion without obvious slowing</td>
<td>Make step by slowing or speeding up or by minor use of arms to stabilize self; may stagger slightly but easily recover</td>
<td>Show signs of unsteadiness, react by gross use of arms or a stagger step; or require more than one step to recover</td>
<td>Require assistance to prevent loss of balance</td>
</tr>
<tr>
<td>Approach to second cushion</td>
<td>No slowing down</td>
<td>Approach slowly as a precaution</td>
<td>Stop to negotiate as a separate task</td>
<td>Require more than one attempt or assistance to step onto cushion</td>
</tr>
<tr>
<td>Reaction to second cushion</td>
<td>Complete step across cushion without obvious slowing</td>
<td>Make step by slowing or speeding up or by minor use of arms to stabilize self; may stagger slightly but easily recover</td>
<td>Show signs of unsteadiness, react by gross use of arms or a stagger step; or require more than one step to recover</td>
<td>Require assistance to prevent loss of balance</td>
</tr>
<tr>
<td>Sit down</td>
<td>Sit down smoothly, no use of arms</td>
<td>May use arm(s) lightly to assist lowering or to assure self of location of chair, or sit down slowly</td>
<td>Use arm(s) to lower self or as an obvious assist for balance, or to correct off center</td>
<td>Require assistance to prevent loss of balance, or fall into or off center of chair</td>
</tr>
</tbody>
</table>

scores in the two SOMAI conditions were ranked among subjects. Each set of the SOT rankings was paired with the normal-vision and focal-vision mobility rankings. The Spearman's rank correlation coefficients ($r_s$) were calculated for 12 pairs of comparisons (6 SOT conditions × 2 SOMAI conditions) and tested for the significance level using a two-tailed test. A $p$ value of .05 was considered significant, which in turn determined the critical value of $r_s$ to be .39 ($N = 26$).

RESULTS

Correlations between performance on the SOT and on the SOMAI.—Table 4 presents the 12 Spearman’s rank correlation coefficients between the rankings of the amounts of postural sway in the six SOT conditions and rankings of scores on the two mobility conditions. Results showed that performance rankings in both mobility conditions had significant correlations with the sway ranking in condition 1 of the SOT ($p < .05$) (Table 4, Figure 2). Thus older adults who had greater sway during quiet stance under a normal sensory condition showed higher mobility scores (poorer performance) in both SOMAI conditions.

Performance on the focal-vision SOMAI condition also had a significant correlation with that in condition 4 of the SOT ($p < .05$). This finding suggested that those who had difficulty with standing balance when somatosensory input alone was inaccurate had more mobility problems when peripheral vision was eliminated in the SOMAI.
Table 4. Spearman’s Rank Correlation Coefficient (r_s) Between the Rankings on the Six SOT Conditions and Those on the Two Mobility Assessment Conditions (N = 26)

<table>
<thead>
<tr>
<th>SOT Conditions</th>
<th>Normal-Vision</th>
<th>Focal-Vision</th>
</tr>
</thead>
<tbody>
<tr>
<td>VnSn (V,S, Ve)</td>
<td>0.53*</td>
<td>0.43*</td>
</tr>
<tr>
<td>VcSn (S, Ve)</td>
<td>0.24</td>
<td>0.29</td>
</tr>
<tr>
<td>VsSn (S, Ve)</td>
<td>0.32</td>
<td>0.35</td>
</tr>
<tr>
<td>VnSs (V, Ve)</td>
<td>0.37</td>
<td>0.59*</td>
</tr>
<tr>
<td>VcSs (V, Ve)</td>
<td>0.21</td>
<td>0.20</td>
</tr>
<tr>
<td>VsSs (S, Ve)</td>
<td>0.31</td>
<td>0.26</td>
</tr>
</tbody>
</table>

Notes: The six SOT conditions are represented using the following letters: V, visual enclosure condition; S, support surface condition; n, normal; s, sway-referenced. The accurate sensory information that was available in each SOT condition is in parenthesis: V, vision; S, somatosensory; Ve, vestibular input.

No other significant correlations were found between the remaining SOT conditions and the SOMAI conditions. Visual information was either eliminated (conditions 2 and 5) or unreliable to convey accurate sway information (conditions 3 and 6) in these remaining SOT conditions.

Performance on the SOT.—A total of 124 LOBs were found among all subjects. These LOBs mainly occurred in conditions 4, 5, and 6. Fifteen of these LOBs (12.1%) occurred in condition 4 among four subjects, 61 (49.2%) occurred in condition 5 of all subjects, and 48 (38.7%) occurred in condition 6 among 23 subjects. Specifically, all of the subjects had at least one LOB in condition 5. No LOB occurred in conditions 1, 2, or 3.

The amount of sway was the greatest in condition 5, followed by that in condition 6 and condition 4. The amounts of sway in the normal support surface conditions (condi-

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**A. Normal-Vision Condition for Mobility Test**

$r_s = .53, p < .05$

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**B. Focal-Vision Condition for Mobility Test**

$r_s = .43, p < .05$

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$r_s = .59, p < .05$

Figure 2. Scatterplots of the total score in the SOMAI versus normalized sway in the SOT conditions. Only those that showed significant Spearman’s rank correlation coefficient ($r_s$) are plotted.
tions 1, 2, and 3) were much smaller than those found in the sway-referenced support surface conditions (conditions 4, 5, and 6) (Figure 3). The relative amounts of sway in the six SOT conditions were compatible with findings reported in previous studies (20,21).

**Mobility scores.**—The total scores for the performance in all of the maneuvers in the normal- and focal-vision condition were 5.4 (± 3.9) and 11.3 (± 5.4), respectively. The mean of each maneuver was greater in the focal-vision condition than in the normal-vision condition, suggesting that subjects had greater mobility difficulty when peripheral vision was eliminated.

**DISCUSSION**

The present study examined whether older adults' performance on a mobility instrument which requires significant use of three balance senses would be correlated with standing performance when all three balance senses provide accurate information. Paired comparison between the performance on this mobility instrument (SOMAI) and the SOT revealed significant correlations between the SOMAI performance and the performance on the condition 1 of the SOT. There were no significant correlations between the SOMAI performance and the SOT conditions in which visual and/or somatosensory inputs were absent or inaccurate. These results suggested that the performance on the SOMAI is significantly correlated with that during quiet standing when all three sensory inputs are available and accurate, but not when some sensory information is reduced or inaccurate.

Performance on SOMAI appeared to require all three balance senses, especially visual and vestibular inputs. This was evident by: (a) the significant correlations between the two SOMAI conditions and the SOT condition 1; (b) non-significant correlations between the two SOMAI conditions and the SOT conditions 2, 3, 5, and 6; and (c) the significant correlation between the focal-vision SOMAI performance and the SOT condition 4 performance. The high demands on sensory information could be primarily due to the dynamic nature of the SOMAI maneuvers. The fact that the maneuvers were performed in a continuous manner required the subjects to constantly adjust and re-weight sensory input during the entire course of the SOMAI. Thus, the presence of accurate information from all three balance senses should be beneficial to performing the SOMAI maneuvers.

It is noteworthy that the focal-vision SOMAI performance was significantly correlated with the performance on condition 4 of the SOT. This result suggests that the SOMAI is also sensitive to the ability to use visual and vestibular information when somatosensory input was unreliable. The greater emphasis on the use of visual and vestibular inputs in performing the SOMAI maneuvers, even when only focal-vision was allowed, could be attributed to the inclusion of unstable and cushioned surfaces in the walking course of the SOMAI. The inaccurate somatosensation from the ankle joint may have forced subjects to rely more on visual and vestibular inputs when stepping over the cushion. The fact that the correlation between the full-vision SOMAI performance and the performance on the condition 4 of SOT also approached the significance level ($p = .07$) may support this argument.

Furthermore, it is also noted that performance on the SOMAI did not correlate with SOT conditions 2, 3, 5, and 6, in which visual input was eliminated or misleading with or without inaccurate somatosensory information. This finding suggests that an older person’s ability to maintain standing balance while visual information is not available does not predict his or her ability to perform mobility tasks. In other words, performance on the SOMAI requires significant visual input, be it focal vision or full vision. The fact that the SOMAI included many target objects (e.g., chair and tape) and obstacles in the walking course could potentially increase the demand of using visual input in performing the test.

The nonsignificant correlations between the sway in the SOT conditions 5 and 6 and the performance on either mobility condition could be also due to the high incidence of LOBs in these two SOMAI conditions. This high incidence of LOBs resulted in a smaller between-subject variability in these SOT conditions. Nevertheless, the results suggest that given the dynamic nature of the SOMAI maneuvers, a person’s ability to use vestibular input alone to maintain balance cannot predict his or her performance on the SOMAI test.

Finally, both the SOT conditions and the two SOMAI conditions were given in an order of increasing difficulty. Although this order could potentially introduce some learning effect, it effectively reduced fear of falling of the subjects during the tests. To examine this trial order effect, we calculated the correlations between the SOMAI performance and the balance performance in the first trial of each SOT condition. The results yielded were similar to those based on the averaged amount of sway in each SOT condition.

**CLINICAL IMPLICATIONS AND FUTURE DIRECTIONS**

Functional mobility assessment is a valuable and inexpensive clinical instrument to evaluate the ability of older adults to integrate dynamic balance control into performance of daily activities. Many researchers have suggested...
functional mobility assessment to be incorporated into routine clinical examinations of older persons (22,23). The underlying mechanisms that contribute to poor functional mobility, however, remain unanswered. The understanding of these mechanisms will provide clinicians with important guidelines to design case-specific intervention.

The SOMAI was a modification to existing mobility assessment instruments with additional challenges to the balance sensory function. Performance on the SOMAI appeared to require all three balance senses, particularly the visual and vestibular inputs. Clinicians using functional mobility assessment instruments need to take into consideration the balance sensory function of patients.

However, the moderate correlations between the SOMAI performance and the SOT performance also suggest that balance sensory function is not the only factor that influences mobility performance. Factors such as muscle weakness and limited joint range of motion are likely to play a role in mobility function (24,25). In the current study, however, the inter-subject variability was low in these factors. Only one subject showed ankle muscle weakness and a high percentage of subjects demonstrated decreased range of motion in the ankle and cervical regions. Therefore, the contribution of these other factors to mobility performance on the SOMAI was difficult to determine. To further analyze the relationship between these factors and the SOMAI performance, future studies using SOMAI on older populations with different levels of musculoskeletal and motor problems will be necessary.

One limitation of the current SOMAI is that it does not differentiate between different types of sensory impairment (vision versus somatosensory, for example). To resolve this issue, future research needs to test SOMAI on patients with different sensory disorders. Specificity and sensitivity of each of SOMAI maneuvers to different sensory disorders are worth being investigated.

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