Measurement Characteristics and Clinical Utility of the Clinical Test of Sensory Interaction on Balance (CTSIB) and Modified CTSIB in Individuals With Vestibular Dysfunction

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Vestibular dysfunction resulting from peripheral vestibular disorders, head trauma, and other central nervous system disorders can lead to imbalance and falls.1-3 Balance impairment can have a significant impact on an individual’s ability to perform activities of daily living or participate in work and leisure activities. A thorough assessment of balance includes examination of the sensory systems that contribute to postural control. The Clinical Test of Sensory Interaction on Balance (CTSIB) was developed to assess the contribution of the visual, somatosensory, and vestibular systems to postural control.4 The original test evaluates static postural stability in 6 distinct standing conditions with eyes open, with eyes closed, and with the use of a dome to alter visual input on both firm and foam surfaces. This test has been modified to include eyes open and eyes closed on both firm and foam surfaces, given the finding that altered visual inputs from the dome were not different from those in the eyes closed condition.5 This test can be administered in less than 15 minutes with minimal equipment (stopwatch and foam pad). The CTSIB and modified CTSIB have excellent reliability and validity in adults with vestibular disorders and can be easily administered in all clinical settings.

This Rehabilitation Measures Database summary provides a review of the psychometric properties of the CTSIB and modified CTSIB in adults with vestibular dysfunction. A full review of the CTSIB and modified CTSIB as well as reviews of more than 100 other instruments can be found at www.rehabmeasures.org.

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BIBLIOGRAPHY

Measure Name: (Modified) Clinical Test of Sensory Interaction on Balance

Acronym: CTSIB/mCTSIB

Summary Author:
Horn L, Rice T, Stoskus J, Lambert K, Dannenbaum L, Scherer M

Population Reviewed: Vestibular Dysfunction

Admin Time: 30 seconds/trial

Items:
CTSIB: 6 mCTSIB: 4

Purpose and Administration Instructions:
- Assess the contribution of the visual, somatosensory, and vestibular systems to postural control in standing
- All conditions tested without upper extremity support

Validity:
- Criterion Validity: Adequate to excellent for the CTSIB depending on time period tested during rehabilitation
- Construct Validity: Scores on the CTSIB were significantly lower in individuals with vestibular disorders compared to healthy adults

Required Equipment:
- Stop watch; foam pad (medium density viscoelastic foam); visual conflict dome for CTSIB (modified Japanese lantern not required for mCTSIB)

Reliability:
- Not established in individuals with vestibular dysfunction

Scoring Instructions:
- Each condition tested up to 30 seconds, 3 trials of each condition
- Average score is calculated for each condition or add average for all conditions (maximum score=180 seconds)

Scoring Interpretation:
Average of 3 trials

<table>
<thead>
<tr>
<th>Foam, Eyes Open (sec)</th>
<th>Foam, Eyes Closed (sec)</th>
<th>Foam, Visual Conflict Dome (sec)</th>
</tr>
</thead>
<tbody>
<tr>
<td>25-44 y/o</td>
<td>30.00 (0)</td>
<td>30.00 (0)</td>
</tr>
<tr>
<td>45-64 y/o</td>
<td>30.00 (0)</td>
<td>30.00 (0)</td>
</tr>
<tr>
<td>65-84 y/o</td>
<td>29.5-30.00 (0-2.1)</td>
<td>12.5-18.5 (11.7-13.1)</td>
</tr>
</tbody>
</table>

Range of 3 trials in normal adults, standard deviation in parentheses

Total of average of all conditions

<table>
<thead>
<tr>
<th></th>
<th>20-49 y/o</th>
<th>50-59 y/o</th>
<th>60-69 y/o</th>
<th>70-79 y/o</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>179.7</td>
<td>180</td>
<td>179.9</td>
<td>177.4</td>
</tr>
<tr>
<td>SD</td>
<td>1.6</td>
<td>0</td>
<td>0.5</td>
<td>8.7</td>
</tr>
<tr>
<td>5 percentile</td>
<td>176.5</td>
<td>180</td>
<td>178</td>
<td>151.3</td>
</tr>
</tbody>
</table>

5th percentile used to define the lower limit of normal function

A composite score < 260 seconds (summing all 3, 30sec trials for each of 6 conditions) has specificity of 90% and sensitivity of 44% for identifying fallers.

If average score below 81 seconds in compliant surface conditions, relative risk of falling is 8.67 (age adjusted odds ratio)

Considerations:
- CTSIB: The original test was performed with shoes off, but there is no significant difference when the test is performed with shoes on
- MCTSIB: The original test was performed with feet together, but there is no significant difference when performed with feet apart

Abbreviations:

Cut-off Criteria:

<table>
<thead>
<tr>
<th></th>
<th>r</th>
<th>ICC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excellent</td>
<td>≥ 0.6</td>
<td>≥ 0.75</td>
</tr>
<tr>
<td>Adequate</td>
<td>0.31-0.59</td>
<td>0.40-0.74</td>
</tr>
<tr>
<td>Poor</td>
<td>≤ 0.3</td>
<td>&lt; 0.4</td>
</tr>
</tbody>
</table>