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### Original Research

## Generalizability Theory Analysis of Balance Error Scoring System Reliability in Healthy Young Adults

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### Abstract

**Context:** An assessment of postural control is commonly included in the clinical concussion evaluation. Previous investigators have demonstrated learning effects that may mask concussion-induced balance decrements.

**Objective:** To establish the test-retest reliability of the Balance Error Scoring System (BESS) and to provide recommendations that account for known learning effects.

**Design:** Test-retest generalizability study.

**Setting:** Balance research laboratory.

**Patients or Other Participants:** Young adults (n = 48) free from injuries and illnesses known to affect balance.

**Intervention(s):** Each participant completed 5 BESS trials on each of the assessment dates, which were separated by 50 days.

**Main Outcome Measure(s):** Total score of the BESS was used in a generalizability theory analysis to estimate the overall reliability of the BESS and that of each facet. A decision study was completed to estimate the number of days and trials needed to establish clinical reliability.

**Results:** The overall reliability of the BESS was  $G = 0.64$ . The test-retest reliability was improved when male (0.92) and female (0.91) participants were examined independently. Clinically acceptable reliability (greater than 0.80) was established when 3 BESS trials were administered in a single day or 2 trials were administered at different time points.

**Conclusions:** Learning effects have been noted in individuals with no previous exposure to the BESS. Our findings indicate that clinicians should consider interpreting the mean score from 3 BESS administrations on a given occasion for

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both normative data comparison and pretest and posttest design. The multiple assessment technique yields clinically reliable scores and provides the sports medicine practitioner with accurate data for clinical decision making.

**Keywords:** [learning effects](#), [concussions](#), [postural control](#)

Steven P. Broglio, PhD, ATC, contributed to conception and design; acquisition and analysis and interpretation of the data; and drafting, critical revision, and final approval of the article. Weimo Zhu, PhD, contributed to conception and design, analysis and interpretation of the data, and drafting, critical revision, and final approval of the article. Kay Sopiartz contributed to acquisition of the data and drafting, critical revision, and final approval of the article. Youngsik Park, MS, contributed to analysis and interpretation of the data and drafting and final approval of the article.

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