Scoring Sway Balance™
Scoring System and BESS Comparison
October 2\textsuperscript{nd}, 2013
WHAT IS A SWAY SCORE?

Sway Balance™ is a mobile software system that uses the built-in motion detection of a mobile device to measure postural sway. Postural sway is an important indicator of possible balance deficits. Dysfunctional balance is one of the least effectively evaluated symptoms of neurological conditions, concussion and orthopedic injury.

To administer a test, an athlete or patient is instructed to press the mobile device against their chest with both hands, while performing a five-test protocol that includes a combination of bipedal stance, tandem stance and single leg stance positions. Sway measures thoracic postural sway using the built-in motion sensors of any iOS device to estimate balance. Upon completion of the test, a Sway score is displayed on the athlete’s profile based on a 100-point scale. A perfect Sway score is 100, indicating little to no movement occurred during the test trial.

ESTABLISHING A BASELINE

The establishment of an individualized baseline is important to provide the most accurate benchmark for each athlete. With the Sway Balance system, setting up a balance baseline has never been easier. Recommendations from the 3rd International Consensus Statement on Concussion and the National Athletic Trainer’s Association (NATA), suggest the establishment of a neuropsychological and balance baseline for every player. Establishing an individualized baseline for each player, with the one-minute Sway test, provides an objective assessment for balance on the sideline and in recovery. The use of Sway makes return to play decisions much less about judgment and more about quantitative measures. To establish an effective baseline, athletes should be tested at least three times, with Sway scores falling within an acceptable range of variation.
SWAY VARIATION GUIDELINES

The Sway Balance system analyzes an athlete’s score distribution, over multiple tests, and assigns a “normal range” established using a confidence interval ($\alpha = 0.05$). The confidence interval provides an individualized range, with 95% confidence that any new score will fall into the range, if the test is performed without a change in independent variables. Sway uses a color-coded system to determine whether an athlete has established a consistent score with a large enough effect size. Green indicates low variation over at least three tests. Yellow shows moderate variability with at least 3 baseline tests. Red indicates either a high variability in test score or not enough tests have been completed. If an athlete shows a red confidence band, this athlete should be retested.

![Color-coded system](image)

**Athlete has performed a minimum of 3 baseline tests with a confidence interval of +/- 2.5 points.**

**Athlete has performed a minimum of 3 baseline tests with a confidence interval of +/- 5.0 points.**

**Athlete has not performed 3 baseline tests OR the confidence interval is greater than +/- 5.0 points.**

WHAT DOES MY SWAY SCORE MEAN?

The Sway score is intended to provide an individualized baseline of each athlete or patient’s own ability to maintain postural control during the testing conditions. Balance scores vary for each individual and should be compared to each individual’s “normal” baseline. Variation also exists between the different tests. Average score and standard deviation in active young adults for feet together, tandem and single foot tests are listed below:

<table>
<thead>
<tr>
<th>Feet Together</th>
<th>Tandem Stance</th>
<th>Single Foot Stance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Right</td>
<td>Left</td>
</tr>
<tr>
<td>Feet Together</td>
<td>99.69</td>
<td>92.28</td>
</tr>
<tr>
<td>± 0.69</td>
<td>± 9.30</td>
<td>± 9.54</td>
</tr>
</tbody>
</table>
BALANCE ERROR SCORING SYSTEM COMPARISON

Percentile ranks provide an estimate that can be compared to the Balance Error Scoring System (BESS), the current standard of care for sideline balance assessment. Wichita State University studies have shown a strong relationship between Sway tests and the BESS through studies performed at Wichita State University ($r = 0.77$)\(^2\) and Kansas University Medical Center ($r = 0.87$, $r = 0.95$)\(^3\).
Sway Medical estimates the average overall score is between 80 and 85 based on over 5,000 tests performed. Wichita State University found mean Sway scores to be 79.62 (+/- 18.28) with a strong correlation to BESS scores (PCC = -0.767)\(^2\) in active young adults. The Wichita State University study found the comparative average BESS score was 10.4 (+/-5.98), which is consistent with previous research\(^4\) and indicates the study provided a comparable group of balancers.

High correlative values found between BESS and Sway shows that the Sway Balance mobile software application provides accurate assessments of balance with less subjectivity. The subjective nature of the BESS has been shown to produce low inter-rater reliability\(^5\) in some studies, providing a less useful and comparable value that is highly dependent upon test administrator skill level.

The BESS has been shown to be a valid acute concussion assessment tool when used by the same test administrator\(^6\), however Sway Balance provides objective measures less dependent upon the clinical experience of the test administrator with comparable reliability to force platform technology\(^7\).

**WHAT IF I HAVEN’T ESTABLISHED A BASELINE?**

Every athlete should establish a neurocognitive and balance baseline on ImPACT and Sway, however this does not always occur. In athletes that have not established a proper baseline, the test administrator should use caution in relying on any single test. If a concussion is suspected, the athlete should be immediately removed from participation.
A Sway test should be performed on the sideline if the athlete appears to show no obvious signs of concussion, and does not report symptoms. If the athlete does exhibit signs of concussion or performs poorly on the Sway Balance test (< 80 overall score), the athlete should be removed from participation until they are released to return to play by a qualified medical professional. The recommendation on what constitutes poor performance is not suitable for every athlete and athletes who are well balanced, may still score higher than 80 on the Sway Balance test even if they are impaired.

THE SWAY BALANCE SOFTWARE SHOULD NOT BE THE SOLE INDICATOR FOR MAKING A RETURN TO PLAY DECISION. A COMPREHENSIVE CONCUSSION MANAGEMENT PROTOCOL INTEGRATES A MULTIFACETED APPROACH TO THE EVALUATION OF AN ATHLETE WITH A SUSPECTED CONCUSSION.

Sway can also be used to track a player in recovery from a concussion when a baseline is not available. Medical professionals should consider administering a Sway test daily to see if balance scores continue to improve or if they have plateaued. If the athlete is scoring consistently, it can be an indication that balance has stabilized or returned to normal. With any test, there is a brief period of familiarization, so it is important to take multiple tests before using the Sway Balance system to assist in any clinical judgment.
REFERENCES


