

# **Balance Error Scoring System (BESS)**

*Developed by researchers and clinicians at the University of North Carolina's Sports Medicine Research Laboratory, Chapel Hill, NC 27599-8700*

The Balance Error Scoring System provides a portable, cost-effective, and objective method of assessing static postural stability. In the absence of expensive, sophisticated postural stability assessment tools, the BESS can be used to assess the effects of mild head injury on static postural stability. Information obtained from this clinical balance tool can be used to assist clinicians in making return to play decisions following mild head injury.

The BESS can be performed in nearly any environment and takes approximately 10 minutes to conduct.

## **Materials**

### 1) Testing surfaces

-two testing surfaces are needed to complete the BESS test: floor/ground and foam pad.

*1a) Floor/Ground:* Any level surface is appropriate.

*1b) Foam Pad (Power Systems Airex Balance Pad 81000)*

Address = PO Box 31709 Knoxville, TN 37930 tel = 1-800-321-6975

Web Address = [www.power-systems.com](http://www.power-systems.com)

Dimensions: Length: 10"  
Width: 10"  
Height: 2.5"

The purpose of the foam pad is to create an unstable surface and a more challenging balance task, which varies by body weight. It has been hypothesized that as body weight increases the foam will deform to a greater degree around the foot. The heavier the person the more the foam will deform. As the foam deforms around the foot, there is an increase in support on the lateral surfaces of the foot. The increased contact area between the foot and foam has also been theorized to increase the tactile sense of the foot, also helping to increase postural stability. The increase in tactile sense will cause additional sensory information to be sent to the CNS. As the brain processes this information it can make better decisions when responding to the unstable foam surface.

### 2) Stop watch

-necessary for timing the subjects during the 6, twenty second trials

### 3) An assistant to act as a spotter

-the spotter is necessary to assist the subject should they become unstable and begin to fall. The spotter's attention is especially important during the foam surface.

### 4) BESS Testing Protocol

-these instructions should be read to the subject during administration of the BESS

### 5) BESS Score Card

*(the Testing Protocol and a sample Score Card are located at the end of this document)*

**BESS Test Administration**

- 1) Before administering the BESS, the following materials should be present:
  - foam pad
  - stop watch
  - spotter
  - BESS Testing Protocol
  - BESS Score Card
- 2) Before testing, instruct the individual to remove shoes and any ankle taping if necessary. Socks may be worn if desired.
- 3) Read the instructions to the subject as they are written in the BESS Testing Protocol.
- 4) Record errors on the BESS Score Card as they are described below.

**Scoring the BESS**

Each of the twenty-second trials is scored by counting the errors, or deviations from the proper stance, accumulated by the subject. The examiner will begin counting errors only after the individual has assumed the proper testing position.

*Errors:* An error is credited to the subject when any of the following occur:

- ◆ moving the hands off of the iliac crests
- ◆ opening the eyes
- ◆ step stumble or fall
- ◆ abduction or flexion of the hip beyond 30°
- ◆ lifting the forefoot or heel off of the testing surface
- ◆ remaining out of the proper testing position for greater than 5 seconds

**-The maximum total number of errors for any single condition is 10.**

*Normal Scores for Each Possible Testing Surface*

	<b>Firm Surface</b>	<b>Foam Surface</b>	
Double Leg Stance	.009 ± .12	.33 ± .90	
Single Leg Stance	2.45 ± 2.33	5.06 ± 2.80	
Tandem Stance	.91 ± 1.36	3.26 ± 2.62	
<b>Surface Total</b>	<b>3.37 ± 3.10</b>	<b>8.65 ± 5.13</b>	
<b>BESS Total Score</b>			<b>12.03 ± 7.34</b>

*Maximum Number of Errors Possible for Each Testing Surface*

	<b>Firm Surface</b>	<b>Foam Surface</b>
Double Leg Stance	10	10
Single Leg Stance	10	10
Tandem Stance	10	10
<b>Surface Total</b>	<b>30</b>	<b>30</b>

-if a subject commits multiple errors simultaneously, only one error is recorded. For example, if an individual steps or stumbles, opens their eyes, and removes their hands from their hips simultaneously, then they are credited with only **one error**.

-subjects that are unable to maintain the testing procedure for a minimum of **five seconds** are assigned the highest possible score, ten, for that testing condition.

## FIRM / GROUND TESTING POSITIONS



*Double leg stance:* Standing on a firm surface with feet side by side (touching), hands on the hips and eyes closed



*Single leg stance:* Standing on a firm surface on the non-dominant foot (defined below), the hip is flexed to approximately  $30^\circ$  and knee flexed to approximately  $45^\circ$ . Hands are on the hips and eyes closed.

*Non-Dominant Leg:* The non-dominant leg is defined as the opposite leg of the preferred kicking leg



*Tandem Stance:* Standing heel to toe on a firm surface with the non-dominant foot (defined above) in the back. Heel of the dominant foot should be touching the toe of the non-dominant foot. Hands are on the hips and their eyes are closed.

## FOAM TESTING POSITIONS



*Double leg stance:* Standing on a foam surface with feet side by side (touching), with hands on the hips and eyes closed



*Single leg stance:* Standing on a foam surface on the non-dominant foot (defined below), with hip flexed to approximately  $30^\circ$  and knee flexed to approximately  $45^\circ$ . Hands are on the hips and eyes closed.

*Non-Dominant Leg:* The non-dominant leg is defined as the leg opposite of the preferred kicking leg



*Tandem Stance:* Standing heel to toe on a foam surface with the non-dominant foot (defined above) in the back. Heel of the dominant foot should be touching the toe of the non-dominant foot. Hands are on the hips and their eyes are closed.

**WARNING:** Trained personnel should always be present when administering the BESS protocol. Improper use of the foam could result in injury to the test subject.

## Script for the BESS Testing Protocol

**Direction to the subject:** *I am now going to test your balance.*

*Please take your shoes off, roll up your pant legs above ankle (if applicable), and remove any ankle taping (if applicable).*

*This test will consist of 6 - twenty second tests with three different stances on two different surfaces. I will describe the stances as we go along.*

### **DOUBLE LEG STANCE:**

**Direction to the subject:** *The first stance is standing with your feet together like this [administrator demonstrates two-legged stance]*

*You will be standing with your hands on your hips with your eyes closed. You should try to maintain stability in that position for entire 20 seconds. I will be counting the number of times you move out of this position. For example: if you take your hands off your hips, open your eyes, take a step, lift your toes or your heels. If you do move out of the testing stance, simply open your eyes, regain your balance, get back into the testing position as quickly as possible, and close your eyes again.*

*There will be a person positioned by you to help you get into the testing stance and to help if you lose your balance.*

**Direction to the spotter:** *You are to assist the subject if they fall during the test and to help them get back into the position.*

**Direction to the subject:** *Put your feet together, put your hands on your hips and when you close your eyes the testing time will begin*

[Start timer when subject closes their eyes]

### **SINGLE LEG STANCE:**

**Direction to subject:** *If you were to kick a ball, which foot would you use? [This will be the **dominant** foot]*

*Now stand on your **non-dominant** foot.*

[Before continuing the test assess the position of the dominant leg as such: the dominant leg should be held in approximately 30 degrees of hip flexion and 45 degrees of knee flexion]

*Again, you should try to maintain stability for 20 seconds with your eyes closed. I will be counting the number of times you move out of this position.*

*Place your hands on your hips. When you close your eyes the testing time will begin.*

[Start timer when subject closes their eyes]

**Direction to the spotter:** *You are to assist the subject if they fall during the test and to help them get back into the position.*

### **TANDEM STANCE:**

**Directions to the subject:** *Now stand heel-to-toe with your non-dominant foot in back. Your weight should be evenly distributed across both feet.*

*Again, you should try to maintain stability for 20 seconds with your eyes closed. I will be counting the number of times you move out of this position.*

*Place your hands on your hips. When you close your eyes the testing time will begin.*

[Start timer when subject closes their eyes]

**Direction to the spotter:** *You are to assist the subject if they fall during the test and to help them get back into the position.*

**\*\*\* Repeat each set of instructions for the foam pad**

## Score Card

### Balance Error Scoring System (BESS)

(Guskiewicz)

#### Balance Error Scoring System – Types of Errors

1. Hands lifted off iliac crest
2. Opening eyes
3. Step, stumble, or fall
4. Moving hip into > 30 degrees abduction
5. Lifting forefoot or heel
6. Remaining out of test position >5 sec

**The BESS is calculated by adding one error point for each error during the 6 20-second tests.**

<b>SCORE CARD:</b> (# errors)	FIRM Surface	FOAM Surface
Double Leg Stance (feet together)		
Single Leg Stance (non-dominant foot)		
Tandem Stance (non-dom foot in back)		
<b>Total Scores:</b>		

**BESS TOTAL:**

Which **foot** was tested:  Left  Right  
(i.e. which is the **non-dominant** foot)