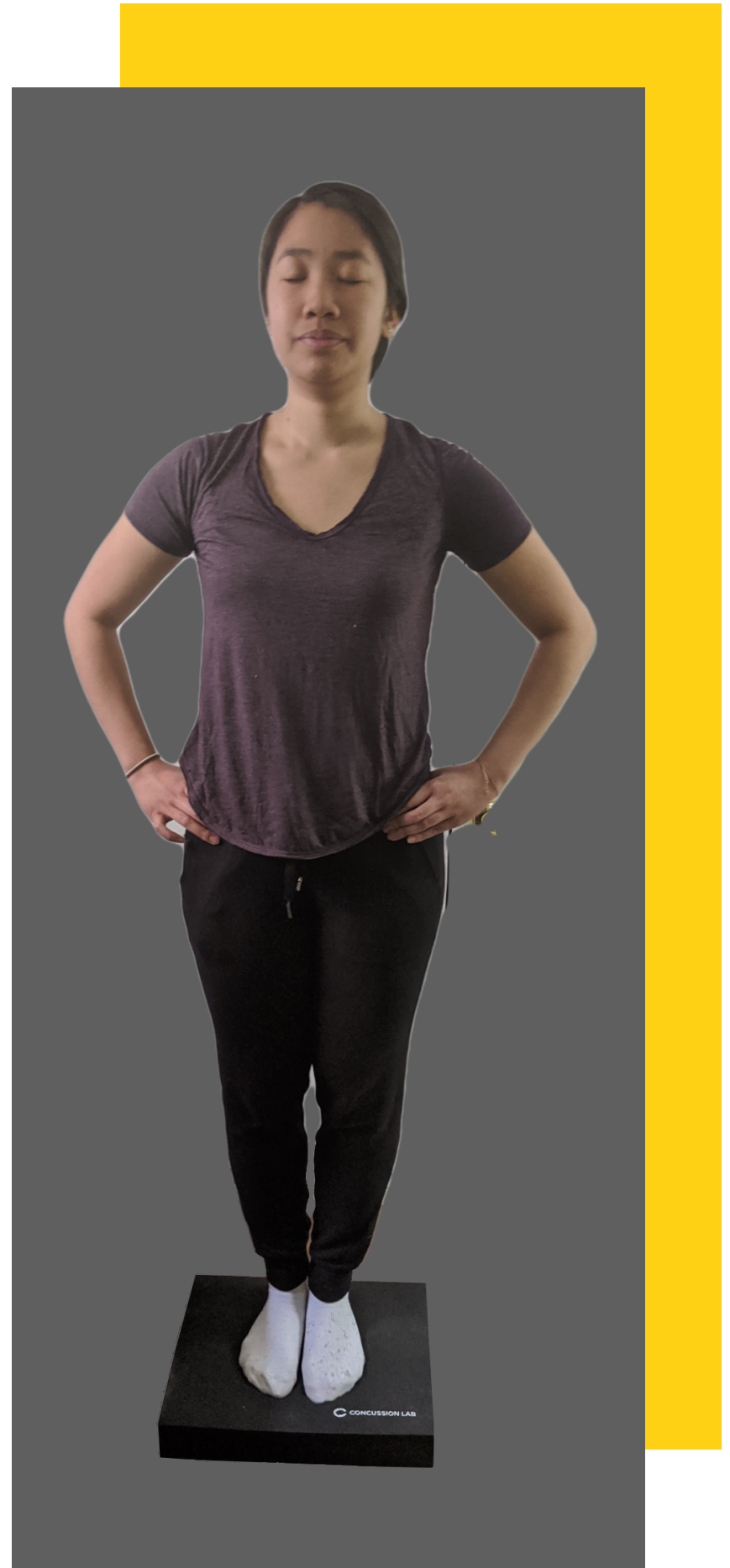


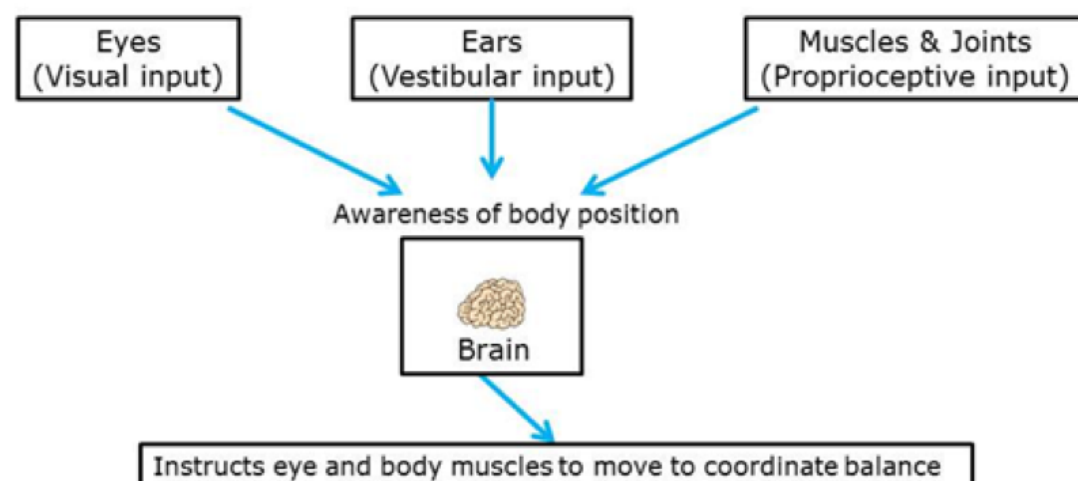
VESTIBULAR ASSESSMENT & INTERVENTION POST- CONCUSSION

Static Balance
Measures Using
the BESS Test



Vestibular System and Static Balance

- To maintain balance, the vestibular system must work in synergy with other systems like the visual and proprioceptive systems in order to collect information about the orientation and position of the body in space¹
 - The feedback obtained from these systems regulate the appropriate muscle contractions needed to maintain balance¹
 - Static balance integrates the visual, vestibular, and somatosensory systems to achieve steadiness → **SENSORIMOTOR INTEGRATION**
- The **vestibulospinal tract** of the vestibular system is designed to maintain adequate postural tone in the muscles of the trunk and extremities to provide overall balance during posture and locomotion²
 - Static equilibrium is the state in which all the forces acting on the body tend to keep the body in a desired position and orientation²
- The peripheral vestibular system provides feedback from the inner ear in order to maintain balance and is especially important when there is a mismatch or disruption of feedback from the visual and proprioceptive systems¹
- In the current literature, it has been established that a concussion can produce high rates of postural and balance deficits in the first 24-72 hours after the injury³
 - However, these balance deficits **dissipate within 3-5 days** after a concussion injury⁴
 - As a result, static balance should be assessed shortly after a suspected concussion to establish any static vestibular deficits that may impact concussion diagnosis and management.



Balance Error Scoring System (BESS) Test

- Portable, cost-effective and objective method of assessing static postural stability
- Takes only 10 minutes to conduct
- SCAT5 uses a Modified BESS (mBESS) test → removes testing portion on foam surface

BALANCE EXAMINATION

Modified Balance Error Scoring System (mBESS) testing⁵

Which foot was tested
(i.e. which is the non-dominant foot)

☐ Left
☐ Right

Testing surface (hard floor, field, etc.) _____

Footwear (shoes, barefoot, braces, tape, etc.) _____

Condition	Errors
Double leg stance	of 10
Single leg stance (non-dominant foot)	of 10
Tandem stance (non-dominant foot at the back)	of 10
Total Errors	of 30

Test Objective

- Assesses the patient's static balance
- This test systematically disrupts the sensory selection process by altering available somatosensory and/or visual information while measuring the ability to minimize postural sway¹

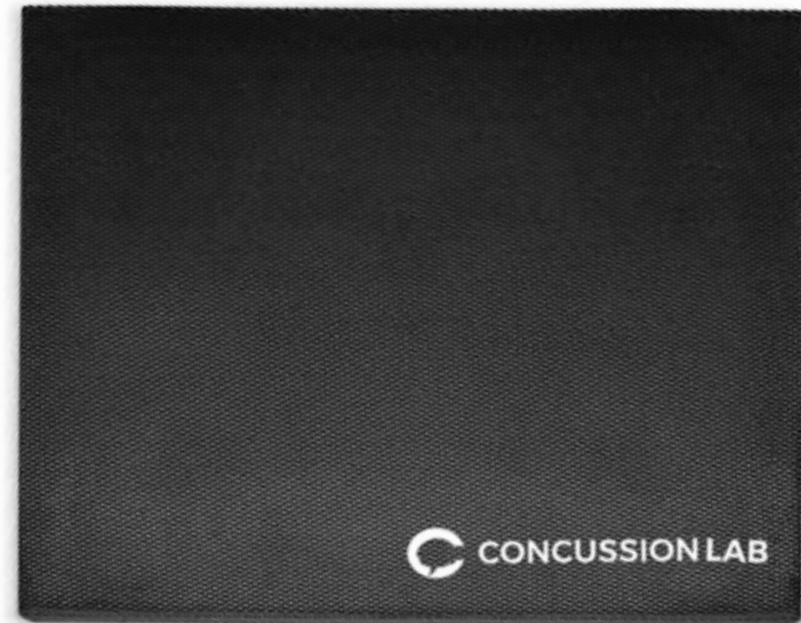
Balance Error Scoring System (BESS) Test

Clinical Utility

- Moderate to high reliability and moderate to high criterion-related validity
- High content validity in identifying balance deficits in concussed and fatigued populations¹
- When using the BESS amongst the concussion population, the current literature has highlighted that these individual had more errors day 1 post injury but returned to baseline within 3-5 days post injury²⁻⁴
- Important to administer test at first assessment post-concussion

Equipment⁵

- Foam pad
- Stopwatch
- BESS testing protocol
- BESS score card



Balance Error Scoring System (BESS) Test

Instructions¹

- Before conducting the test:
 - Ensure all materials are ready for use
 - The patient must remove their shoes, and any ankle taping (if applicable) as well as roll up their pant leg above the ankle (if applicable) in order to perform this test
 - Read the instructions to the patient as they are written in the BESS Testing Protocol
- The patient must perform 3 different stances on 2 different surfaces → floor, foam pad
 1. Double leg
 2. Single leg
 3. Tandem stance
- The patient must perform these stances for 20s with their eyes 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.

Balance Error Scoring System (BESS) Test

Instructions¹

- The HCP must record the amount of errors or deviations from the proper stance during each 20s stance once the patient has achieved the proper testing position

- Moving the hands off of the iliac crests
- Lifting the forefoot or heel off of the testing surface
- Step, stumble, or fall
- Abduction or flexion of the hip beyond 30°
- Opening the eyes
- Remaining out of the proper testing position for greater than 5 seconds

- ****A maximum total number of errors for any single condition is 10**
- **If the patient commits multiple errors simultaneously, only one error is recorded**
- **A trial is considered incomplete if the patient is unable to sustain the stance position for longer than 5s**
 - **This patient will be credited with the highest possible score of 10 for that testing position**

BESS Testing Positions

Firm/ Ground Testing Positions¹



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° and knee flexed to approximately 45°. 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 eyes are closed.

Foam Testing Positions¹



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, with hip flexed to approximately 30° and knee flexed to approximately 45°. Hands are on the hips and eyes closed.



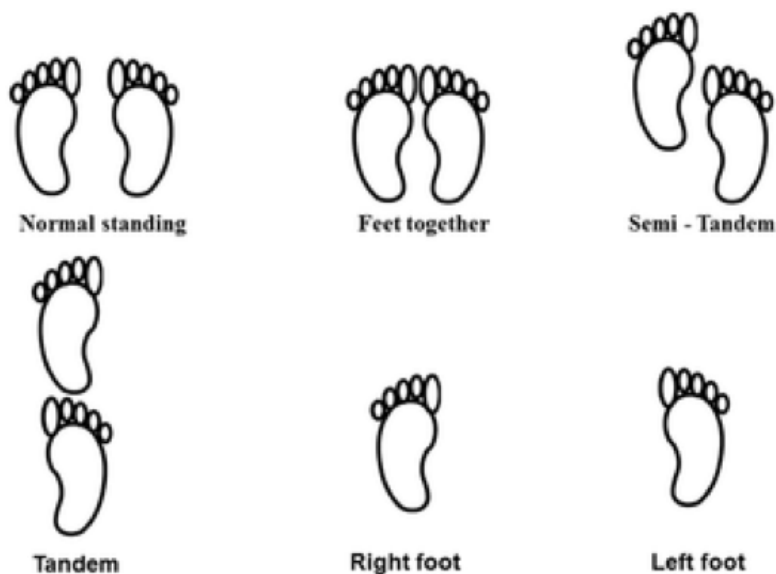
Tandem Stance: Standing heel to toe on a foam surface with the nondominant foot in the back. Heel of the dominant foot should be touching the toe of the non-dominant foot. Hands are on the hips and eyes are closed.

Interventions/Exercises¹

- First begin by attempting to sustain standing balance for up to 30s
 - If patient experiences difficulty with standing balance or an exacerbation of symptoms occurs, try seated balance on a stability ball



Progressions



- Altering stance position → to narrow base of support
 - Double-leg with feet close together
 - Single-leg
 - Semi-tandem
 - Tandem

Interventions/Exercises¹

Progressions

- Closing the eyes → to remove visual input (further challenges the vestibular and proprioceptive systems)
- Altering the support surface → soft mat, foam pad, wobble board, bosu ball
- Can also combine variety of progressions
- Functional and more dynamic tasks can be added to this exercise to increase the level of difficulty for the patient
 - Adding *head turns* to the left and right/up and down while performing balance exercises
 - Can combine with *gaze stability* exercises
 - Adding *oculomotor* or *cervical position sense* exercises while balance training
 - Adding *upper extremity movements* while balance such as throwing/catching a ball or juggling
 - Can also simply use *BESS* test protocol in treatment plan for convenience

