

# Concussion: Sideline Assessment

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## Atlantic Sports Health



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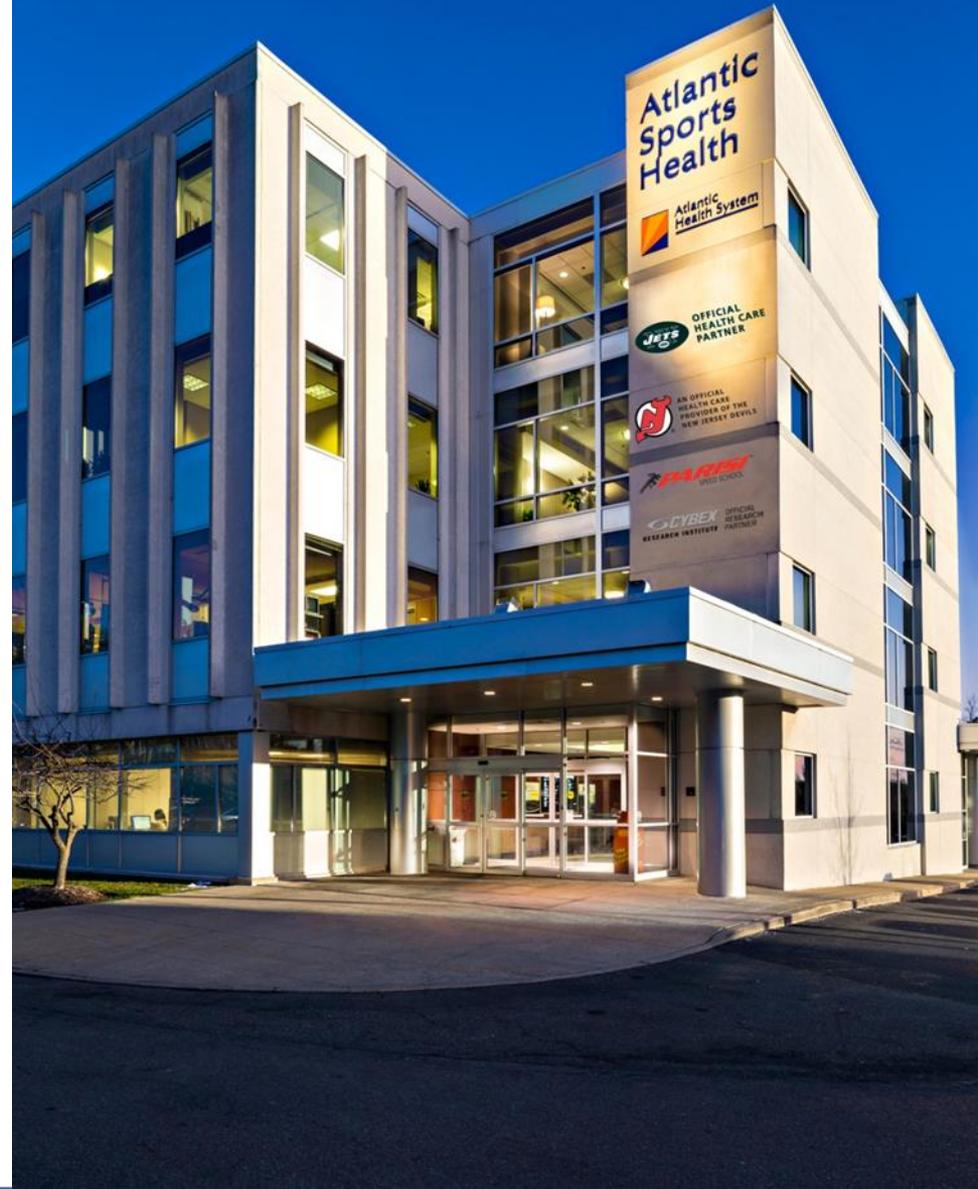


AN OFFICIAL HEALTH PROVIDER  
OF THE NEW JERSEY DEVILS



# Overview

- Signs and Symptoms
- On Field Assessment
  - PCS
  - SAC
  - SCAT III
  - King-Devick
  - Balance
- Predicting Outcome
- NFL Sideline Assessment



# mTBI Signs and Symptoms

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## Common symptoms of concussion

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Headache  
Difficulty with memory  
Dizziness/vertigo  
Generalized weakness  
Numbness/tingling  
Nausea/vomiting  
Visual changes (diplopia, blurring, etc.)  
Tinnitus  
Difficulty concentrating  
Fatigue  
Feeling foggy  
Photophobia/phonophobia  
Depressed mood  
Nervousness/anxiety  
Insomnia/hypersomnia  
Emotional lability

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## Common signs of concussion

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Appears dazed  
Vacant expression  
Confused plays  
Disoriented on questioning  
Inappropriate/uncharacteristic behavior  
Uncoordinated  
Slow response to questions  
Personality change  
Vomiting  
Loss of consciousness



# Newer Classifications: mTBI Signs and Symptoms

- Symptoms
  - Somatic (HA, nausea, dizziness, fatigue, sensitivity to light and noise)
  - Cognitive (feeling slowed down, feeling mentally “foggy”)
  - Emotional (sadness, nervousness, feeling more emotional)
- Physical Signs (vomiting, balance problems, LOC, amnesia)
- Behavioral Changes (irritability, personality changes)
- Cognitive Impairment (slowed reaction time)
- Sleep Disturbances (change in sleep patterns, trouble falling asleep)



# Symptoms

TABLE 2  
Symptoms of Concussion Recorded by HS RIO<sup>a</sup>

Symptom Recorded	No. of Concussions Resulting in Symptom	Percentage of Concussions Resulting in Symptom
Headache	508	93.4
Dizziness/unsteadiness	406	74.6
Difficulty concentrating	308	56.6
Confusion/disorientation	250	46.0
Vision changes/sensitivity to light	204	37.5
Nausea	157	28.9
Drowsiness	144	26.5
Amnesia	132	24.3
Sensitivity to noise	103	18.9
Tinnitus	58	10.7
Irritability	50	9.2
Loss of consciousness	25	4.6
Hyperexcitability	12	2.2
Other	41	7.5

<sup>a</sup>Percentages do not total 100, as athletes could report more than 1 symptom. HS RIO, High School Reporting Information Online injury surveillance system.



# Major League Soccer: ATC Survey



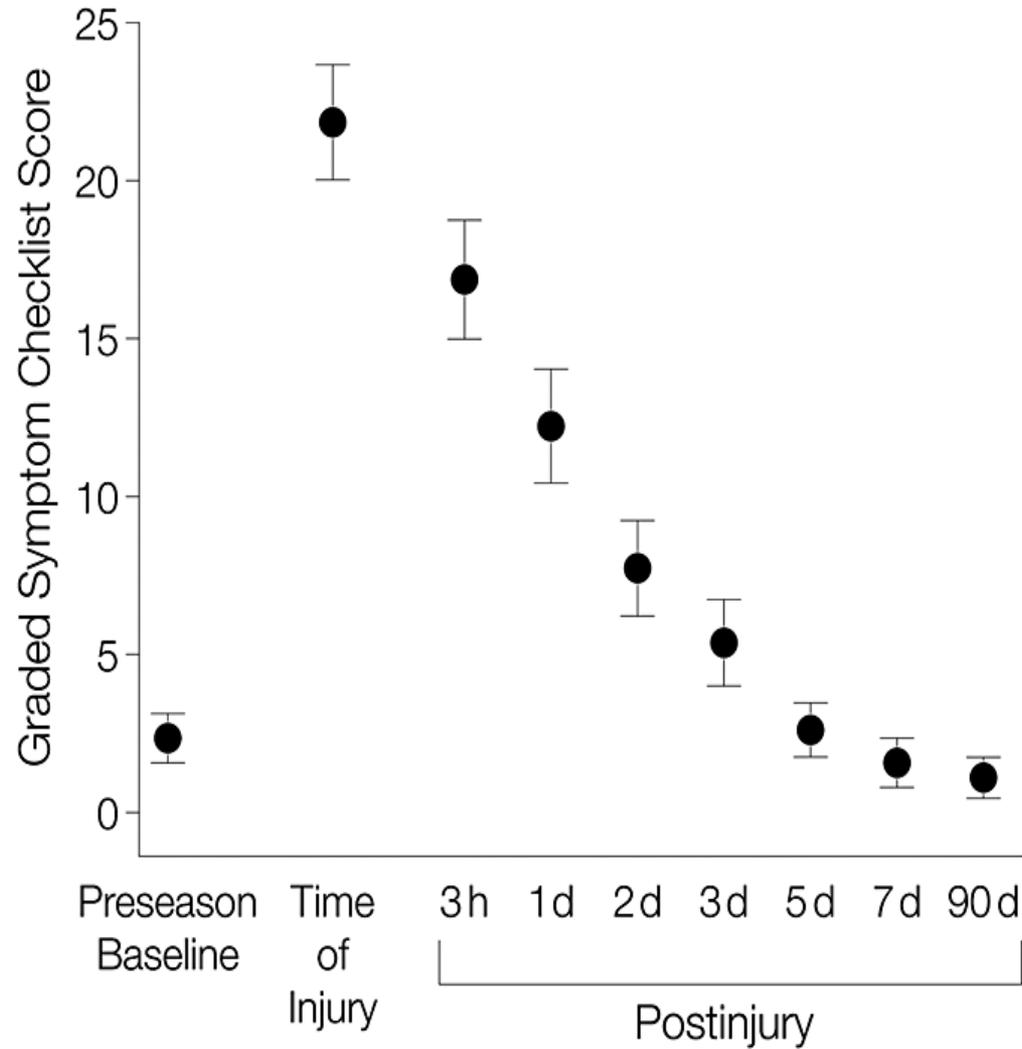
Observation	% Response
Head contact	88%
Violent blow to body	80%
Fall to ground w/o head contact	44%
Sign	
LOC/motionless	84%
Unsteady/balance	84%
Grab/clutch head	84%
Dazed & confused	80%
Slow to get up	76%
Vacant look	72%
Facial laceration w/ other sign	64%
Fall to ground	40%
Symptom	
Blurry vision/vision problems	84%
Headache	80%
Dizziness/balance problems	80%
Nausea	76%
Neck pain	64%
Light sensitivity	56%
Noise sensitivity	52%
Head contact	88%

*MLS Concussion Committee: Unpublished data 2014*



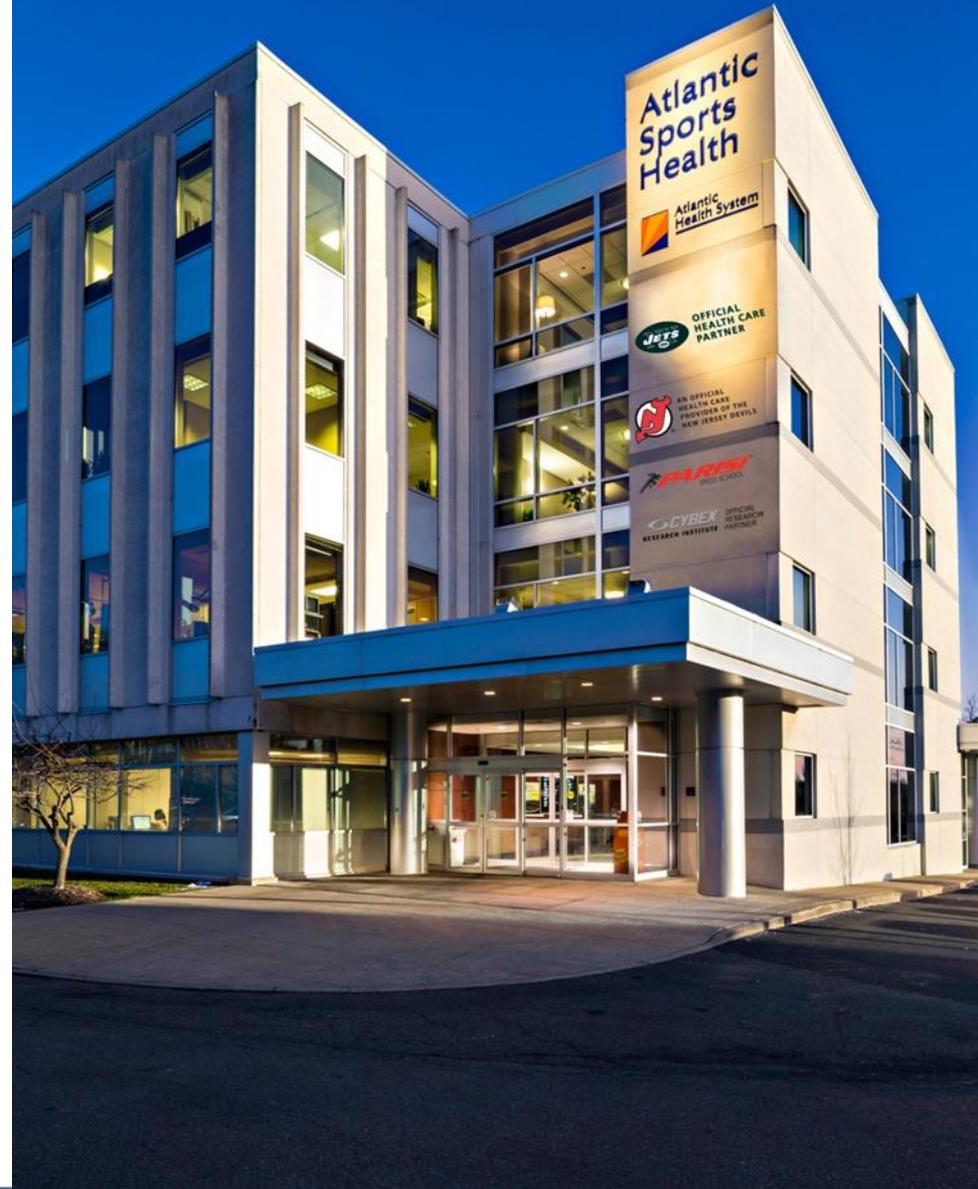
# Understanding the Natural History and Symptoms Score Resolution: The NCAA Concussion Study

*JAMA. 2003;290:2549-2555.*



# Overview

- Signs and Symptoms
- On Field Assessment
  - PCS
  - SAC
  - SCAT III
  - King-Devick
  - Balance
- Predicting Outcome
- NFL Sideline Assessment



# Diagnostic Tools: How Good Are They?

- **PCS (Multiple Class III studies)**
  - sensitivity 91-100%
  - specificity 64-89%
- **SAC score (Multiple Class III studies)**
  - sensitivity 80-94%
  - specificity 76-91%
- **Neuropsychological test (1 Class II, multiple Class III studies)**
  - sensitivity 71-88%
- **Deficits in BESS (Multiple Class III studies)**
  - sensitivity 34-64%
  - specificity 91%
- **Deficits in SOT (Multiple Class III studies)**
  - sensitivity 48-61%
  - specificity 85-90%



# Sideline Testing

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Test	Function
Post Concussive Symptom Checklist	Symptoms associated with brain injury
Hopkins Verbal Learning Test/List Learning	Verbal learning and memory
Symbol Digit Modalities Test	Short term memory, visual motor speed
Symbol Digit Modalities Memory	Incidental memory
Digit Span Test	Working memory, attention/concentration
Penn State Cancellation Test	Visual scanning, visual attention
Trail Making Test	Visual sequencing, visual motor speed
Controlled Oral Word Association Test	Verbal fluency
Stroop Test	Speed of processing, divided attention
Vigil Continuous Performance Test	Reaction time, sustained attention

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# Sideline Testing

- Which field are we at?
- Which team are we playing today?
- Who is your opponent at present?
- Which quarter is it?
- How far into the quarter is it?
- Which side scored the last goal?
- Which team did we play last week?
- Did we win last week?



# SCAT3™

## Sport Concussion Assessment Tool – 3rd Edition

For use by medical professionals only



Name: \_\_\_\_\_ Date/Time of Injury: \_\_\_\_\_ Examiner: \_\_\_\_\_  
Date of Assessment: \_\_\_\_\_

### What is the SCAT3?

The SCAT3 is a standardized tool for evaluating injured athletes for concussion and can be used in athletes aged from 13 years and older. It supersedes the original SCAT and the SCAT2 published in 2005 and 2009, respectively<sup>1</sup>. For younger persons, ages 12 and under, please use the Child SCAT3. The SCAT3 is designed for use by medical professionals. If you are not qualified, please use the Sport Concussion Recognition Tool<sup>2</sup>. Previous baseline testing with the SCAT3 can be helpful for interpreting post-injury test scores.

Specific instructions for use of the SCAT3 are provided on page 3. If you are not familiar with the SCAT3, please read through these instructions carefully. This tool may be freely copied in its current form for distribution to individuals, teams, groups and organizations. Any revision or any reproduction in a digital form requires approval by the Concussion in Sport Group.

**NOTE:** The diagnosis of a concussion is a clinical judgment, ideally made by a medical professional. The SCAT3 should not be used solely to make, or exclude, the diagnosis of concussion in the absence of clinical judgement. An athlete may have a concussion even if their SCAT3 is "normal".

### What is a concussion?

A concussion is a disturbance in brain function caused by a direct or indirect force to the head. It results in a variety of non-specific signs and/or symptoms (some examples listed below) and most often does not involve loss of consciousness. Concussion should be suspected in the presence of **any one or more** of the following:

- Symptoms (e.g., headache), or
- Physical signs (e.g., unsteadiness), or
- Impaired brain function (e.g. confusion) or
- Abnormal behaviour (e.g., change in personality).

## SIDELINE ASSESSMENT

### Indications for Emergency Management

**NOTE:** A hit to the head can sometimes be associated with a more serious brain injury. Any of the following warrants consideration of activating emergency procedures and urgent transportation to the nearest hospital:

- Glasgow Coma score less than 15
- Deteriorating mental status
- Potential spinal injury
- Progressive, worsening symptoms or new neurologic signs

### Potential signs of concussion?

If any of the following signs are observed after a direct or indirect blow to the head, the athlete should stop participation, be evaluated by a medical professional and **should not be permitted to return to sport the same day** if a concussion is suspected.

Any loss of consciousness?  Y  N  
 "If so, how long?" \_\_\_\_\_  
 Balance or motor incoordination (stumbles, slow/laboured movements, etc.)?  Y  N  
 Disorientation or confusion (inability to respond appropriately to questions)?  Y  N  
 Loss of memory:  
 "If so, how long?" \_\_\_\_\_  
 "Before or after the injury?" \_\_\_\_\_  
 Blank or vacant look:  Y  N  
 Visible facial injury in combination with any of the above:  Y  N

### 1 Glasgow coma scale (GCS)

Best eye response (E)	Score
No eye opening	1
Eye opening in response to pain	2
Eye opening to speech	3
Eyes opening spontaneously	4
Best verbal response (V)	Score
No verbal response	1
Incomprehensible sounds	2
Inappropriate words	3
Confused	4
Oriented	5
Best motor response (M)	Score
No motor response	1
Extension to pain	2
Abnormal flexion to pain	3
Flexion/Withdrawal to pain	4
Localizes to pain	5
Obeys commands	6
<b>Glasgow Coma score (E + V + M)</b>	<b>of 15</b>

GCS should be recorded for all athletes in case of subsequent deterioration.

### 2 Maddocks Score<sup>3</sup>

"I am going to ask you a few questions, please listen carefully and give your best effort."  
 Modified Maddocks questions (1 point for each correct answer)

What venue are we at today?	0	1
Which half is it now?	0	1
Who scored last in this match?	0	1
What team did you play last week/game?	0	1
Did your team win the last game?	0	1
<b>Maddocks score</b>	<b>0</b>	<b>of 5</b>

Maddocks score is validated for sideline diagnosis of concussion only and is not used for serial testing.

**Notes:** Mechanism of Injury ("tell me what happened?"):

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

**Any athlete with a suspected concussion should be REMOVE FROM PLAY, medically assessed, monitored for deterioration (i.e., should not be left alone) and should not drive a motor vehicle until cleared to do so by a medical professional. No athlete diagnosed with concussion should be returned to sports participation on the day of injury.**

## BACKGROUND

Name: \_\_\_\_\_ Date: \_\_\_\_\_  
 Examiner: \_\_\_\_\_  
 Sport/team/school: \_\_\_\_\_ Date/Time of injury: \_\_\_\_\_  
 Age: \_\_\_\_\_ Gender:  M  F  
 Years of education completed: \_\_\_\_\_  
 Dominant hand:  right  left  neither  
 How many concussions do you think you have had in the past? \_\_\_\_\_  
 When was the most recent concussion? \_\_\_\_\_  
 How long was your recovery from the most recent concussion? \_\_\_\_\_  
 Have you ever been hospitalized or had medical imaging done for a head injury?  Y  N  
 Have you ever been diagnosed with headaches or migraines?  Y  N  
 Do you have a learning disability, dyslexia, ADD/ADHD?  Y  N  
 Have you ever been diagnosed with depression, anxiety or other psychiatric disorder?  Y  N  
 Has anyone in your family ever been diagnosed with any of these problems?  Y  N  
 Are you on any medications? If yes, please list: \_\_\_\_\_

SCAT3 to be done in resting state. Best done 10 or more minutes post exercise.

## SYMPTOM EVALUATION

### 3 How do you feel?

"You should score yourself on the following symptoms, based on how you feel now".

	none	mid	moderate	severe			
Headache	0	1	2	3	4	5	6
"Pressure in head"	0	1	2	3	4	5	6
Neck Pain	0	1	2	3	4	5	6
Nausea or vomiting	0	1	2	3	4	5	6
Dizziness	0	1	2	3	4	5	6
Blurred vision	0	1	2	3	4	5	6
Balance problems	0	1	2	3	4	5	6
Sensitivity to light	0	1	2	3	4	5	6
Sensitivity to noise	0	1	2	3	4	5	6
Feeling slowed down	0	1	2	3	4	5	6
Feeling like "in a fog"	0	1	2	3	4	5	6
"Don't feel right"	0	1	2	3	4	5	6
Difficulty concentrating	0	1	2	3	4	5	6
Difficulty remembering	0	1	2	3	4	5	6
Fatigue or low energy	0	1	2	3	4	5	6
Confusion	0	1	2	3	4	5	6
Drowsiness	0	1	2	3	4	5	6
Trouble falling asleep	0	1	2	3	4	5	6
More emotional	0	1	2	3	4	5	6
Irritability	0	1	2	3	4	5	6
Sadness	0	1	2	3	4	5	6
Nervous or Anxious	0	1	2	3	4	5	6

**Total number of symptoms** (Maximum possible 12) \_\_\_\_\_

**Symptom severity score** (Maximum possible 132) \_\_\_\_\_

Do the symptoms get worse with physical activity?  Y  N  
 Do the symptoms get worse with mental activity?  Y  N  
 self rated  self rated and clinician monitored  
 clinician interview  self rated with parent input

**Overall rating:** If you know the athlete well prior to the injury, how different is the athlete acting compared to his/her usual self?

Please circle one response:  
 no different  very different  unsure  N/A

Scoring on the SCAT3 should not be used as a stand-alone method to diagnose concussion, measure recovery or make decisions about an athlete's readiness to return to competition after concussion. Since signs and symptoms may evolve over time, it is important to consider repeat evaluation in the acute assessment of concussion.

## COGNITIVE & PHYSICAL EVALUATION

### 4 Cognitive assessment

Standardized Assessment of Concussion (SAC)<sup>4</sup>

**Orientation** (1 point for each correct answer)

What month is it?	0	1
What is the date today?	0	1
What is the day of the week?	0	1
What year is it?	0	1
What time is it right now? (within 1 hour)	0	1
<b>Orientation score</b>	<b>0</b>	<b>of 5</b>

**Immediate memory**

list	Trial 1	Trial 2	Trial 3	Alternative word list					
elbow	0	1	0	1	0	1	candle	baby	finger
apple	0	1	0	1	0	1	paper	monkey	penny
carpet	0	1	0	1	0	1	sugar	perfume	blanket
saddle	0	1	0	1	0	1	sandwich	sunset	lemon
bubble	0	1	0	1	0	1	wagon	iron	insect
<b>Total</b>	<b>0</b>	<b>1</b>	<b>0</b>	<b>1</b>	<b>0</b>	<b>1</b>	<b>0</b>	<b>1</b>	<b>0</b>
<b>Immediate memory score total</b>	<b>of 15</b>								

**Concentration: Digits Backward**

list	Trial 1	Alternative digit list			
4-9-3	0	1	6-2-9	5-2-6	4-1-5
3-8-1-4	0	1	3-2-7-9	1-7-9-5	4-9-6-8
6-2-9-7-1	0	1	1-5-2-8-5	3-8-5-2-7	6-1-8-4-3
7-1-8-4-6-2	0	1	5-3-9-1-4-8	8-3-1-9-6-4	7-2-4-8-5-6
<b>Total of 4</b>	<b>0</b>	<b>1</b>	<b>0</b>	<b>1</b>	<b>0</b>

**Concentration: Month in Reverse Order** (1 pt. for entire sequence correct)

Dec-Nov-Oct-Sept-Aug-Jul-Jun-May-Apr-Mar-Feb-Jan	0	1
<b>Concentration score</b>	<b>0</b>	<b>of 5</b>

### 5 Neck Examination:

Range of motion \_\_\_\_\_ Tenderness \_\_\_\_\_ Upper and lower limb sensation & strength \_\_\_\_\_  
 Findings: \_\_\_\_\_

### 6 Balance examination

Do one or both of the following tests.

Footwear (shoes, barefoot, braces, tape, etc.) \_\_\_\_\_

**Modified Balance Error Scoring System (BESS) testing<sup>5</sup>**

Which foot was tested (i.e. which is the non-dominant foot)  Left  Right  
 Testing surface (hard floor, field, etc.) \_\_\_\_\_

**Condition**

Double leg stance:	_____	Errors
Single leg stance (non-dominant foot):	_____	Errors
Tandem stance (non-dominant foot at back):	_____	Errors

**And/Or**

**Tandem gait<sup>6</sup>**

Time (best of 4 trials): \_\_\_\_\_ seconds

### 7 Coordination examination

**Upper limb coordination**

Which arm was tested:  Left  Right  
**Coordination score** \_\_\_\_\_ of 1

### 8 SAC Delayed Recall<sup>4</sup>

**Delayed recall score** \_\_\_\_\_ of 5

# Child-SCAT3™



## Sport Concussion Assessment Tool for children ages 5 to 12 years

For use by medical professionals only

### What is childSCAT3?

The ChildSCAT3 is a standardized tool for evaluating injured children for concussion and can be used in children aged from 5 to 12 years. It supersedes the original SCAT and the SCAT2 published in 2005 and 2008, respectively. For older persons, ages 13 years and over, please use the SCAT3. The ChildSCAT3 is designed for use by medical professionals. If you are not qualified, please use the Sport Concussion Recognition Tool-Revision baseline testing with the ChildSCAT3 can be helpful for interpreting post-injury test scores.

Specific instructions for use of the ChildSCAT3 are provided on page 3. If you are not familiar with the ChildSCAT3, please read through these instructions carefully. This tool may be freely copied in its current form for distribution to individuals, teams, groups and organizations. Any revision and any reproduction in a digital form require approval by the Concussion in Sport Group.

**NOTE:** The diagnosis of a concussion is a clinical judgement, ideally made by a medical professional. The ChildSCAT3 should not be used solely to make, or exclude, the diagnosis of concussion in the absence of clinical judgement. An athlete may have a concussion even if their ChildSCAT3 is "normal".

### What is a concussion?

A concussion is a disturbance in brain function caused by a direct or indirect force to the head. It results in a variety of non-specific signs and/or symptoms (like those listed below) and most often does not involve loss of consciousness. Concussion should be suspected in the presence of any one or more of the following:

- Symptoms (e.g., headache), or
- Physical signs (e.g., unsteadiness), or
- Impaired brain function (e.g., confusion) or
- Abnormal behaviour (e.g., change in personality).

## SIDELINE ASSESSMENT

### Indications for Emergency Management

**NOTE:** A hit to the head can sometimes be associated with a more severe brain injury. If the concussed child displays any of the following, then do not proceed with the ChildSCAT3; instead activate emergency procedures and urgent transportation to the nearest hospital:

- Glasgow Coma score less than 15
- Deteriorating mental status
- Potential spinal injury
- Progressive, worsening symptoms or new neurologic signs
- Persistent vomiting
- Evidence of skull fracture
- Post traumatic seizures
- Coagulopathy
- History of Neurosurgery (eg Shunt)
- Multiple injuries

### 1 Glasgow coma scale (GCS)

Best eye response (E)	
No eye opening	1
Eye opening in response to pain	2
Eye opening to speech	3
Eyes opening spontaneously	4
Best verbal response (V)	
No verbal response	1
Incomprehensible sounds	2
Inappropriate words	3
Confused	4
Oriented	5
Best motor response (M)	
No motor response	1
Extension to pain	2
Abnormal flexion to pain	3
Flexion/Withdrawal to pain	4
Localizes to pain	5
Obeys commands	6
<b>Glasgow Coma score (E + V + M)</b>	<b>of 15</b>

GCS should be recorded for all athletes in case of subsequent deterioration.

### Potential signs of concussion?

If any of the following signs are observed after a direct or indirect blow to the head, the child should stop participation, be evaluated by a medical professional and **should not be permitted to return to sport the same day** if a concussion is suspected.

Any loss of consciousness?  Y  N  
 "If so, how long?" \_\_\_\_\_  
 Balance or motor incoordination (stumbles, slow/abnormal movements, etc)?  Y  N  
 Disorientation or confusion (inability to respond appropriately to questions)?  Y  N  
 Loss of memory:  Y  N  
 "If so, how long?" \_\_\_\_\_  
 "Before or after the injury?" \_\_\_\_\_  
 Blank or vacant look:  Y  N  
 Visible facial injury in combination with any of the above:  Y  N

### 2 Sideline Assessment – child-Maddocks Score?

"I am going to ask you a few questions, please listen carefully and give your best effort."  
 Modified Maddocks questions (1 point for each correct answer)

Where are we at now?  0  1  
 Is it before or after lunch?  0  1  
 What did you have last lesson/class?  0  1  
 What is your teacher's name?  0  1  
**Child-Maddocks score**  0  1  2  3  4

Child-Maddocks score is for sideline diagnosis of concussion only and is not used for serial testing.

**Any child with a suspected concussion should be REMOVED FROM PLAY, medically assessed and monitored for deterioration (i.e., should not be left alone). No child diagnosed with concussion should be returned to sports participation on the day of injury.**

## BACKGROUND

Name: \_\_\_\_\_ Date/Time of Injury: \_\_\_\_\_  
 Examiner: \_\_\_\_\_ Date of Assessment: \_\_\_\_\_  
 Sport/team/school: \_\_\_\_\_  
 Age: \_\_\_\_\_ Gender:  M  F  
 Current school year/grade: \_\_\_\_\_  
 Dominant hand:  right  left  neither  
 Mechanism of injury ("what happened?"): \_\_\_\_\_

### For Parent/carer to complete:

How many concussions has the child had in the past? \_\_\_\_\_  
 When was the most recent concussion? \_\_\_\_\_  
 How long was the recovery from the most recent concussion? \_\_\_\_\_  
 Has the child ever been hospitalized or had medical imaging done (CT or MRI) for a head injury?  Y  N  
 Has the child ever been diagnosed with headaches or migraines?  Y  N  
 Does the child have a learning disability, dyslexia, ADD/ADHD, seizure disorder?  Y  N  
 Has the child ever been diagnosed with depression, anxiety or other psychiatric disorder?  Y  N  
 Has anyone in the family ever been diagnosed with any of these problems?  Y  N  
 Is the child on any medications? If yes, please list:  Y  N

## SYMPTOM EVALUATION

### 3 Child report

Name: \_\_\_\_\_

	never	rarely	sometimes	often
I have trouble paying attention	0	1	2	3
I get distracted easily	0	1	2	3
I have a hard time concentrating	0	1	2	3
I have problems remembering what people tell me	0	1	2	3
I have problems following directions	0	1	2	3
I daydream too much	0	1	2	3
I get confused	0	1	2	3
I forget things	0	1	2	3
I have problems finishing things	0	1	2	3
I have trouble figuring things out	0	1	2	3
It's hard for me to learn new things	0	1	2	3
I have headaches	0	1	2	3
I feel dizzy	0	1	2	3
I feel like the room is spinning	0	1	2	3
I feel like I'm going to faint	0	1	2	3
Things are blurry when I look at them	0	1	2	3
I see double	0	1	2	3
I feel sick to my stomach	0	1	2	3
I get tired a lot	0	1	2	3
I get tired easily	0	1	2	3

**Total number of symptoms (Maximum possible 20)** \_\_\_\_\_  
**Symptom severity score (Maximum possible 20 x 3 = 60)** \_\_\_\_\_  
 self rated  clinician interview  self rated and clinician monitored

### 4 Parent report

The child \_\_\_\_\_

	never	rarely	sometimes	often
has trouble sustaining attention	0	1	2	3
is easily distracted	0	1	2	3
has difficulty concentrating	0	1	2	3
has problems remembering what he/she is told	0	1	2	3
has difficulty following directions	0	1	2	3
tends to daydream	0	1	2	3
gets confused	0	1	2	3
is forgetful	0	1	2	3
has difficulty completing tasks	0	1	2	3
has poor problem solving skills	0	1	2	3
has problems learning	0	1	2	3
has headaches	0	1	2	3
feels dizzy	0	1	2	3
has a feeling that the room is spinning	0	1	2	3
feels faint	0	1	2	3
has blurred vision	0	1	2	3
has double vision	0	1	2	3
experiences nausea	0	1	2	3
gets tired a lot	0	1	2	3
gets tired easily	0	1	2	3

**Total number of symptoms (Maximum possible 20)** \_\_\_\_\_  
**Symptom severity score (Maximum possible 20 x 3 = 60)** \_\_\_\_\_  
 parent self rated  clinician interview  parent self rated and clinician monitored

Do the symptoms get worse with physical activity?  Y  N  
 Do the symptoms get worse with mental activity?  Y  N

parent self rated  clinician interview  parent self rated and clinician monitored

**Overall rating for parent/teacher/coach/carer to answer.**

How different is the child acting compared to his/her usual self?

Please circle one option:

no different  very different  unsure  N/A

Name of person completing Parent-report: \_\_\_\_\_

Relationship to child of person completing Parent-report: \_\_\_\_\_

Scoring on the ChildSCAT3 should not be used as a stand-alone method to diagnose concussion, measure recovery or make decisions about an athlete's readiness to return to competition after concussion.

## COGNITIVE & PHYSICAL EVALUATION

### 5 Cognitive assessment

Standardized Assessment of Concussion – Child Version (SAC-C)\*

**Orientation** (1 point for each correct answer)

What month is it?  0  1  
 What is the date today?  0  1  
 What is the day of the week?  0  1  
 What year is it?  0  1

**Orientation score** \_\_\_\_\_ of 4

### Immediate memory

List	Trial 1	Trial 2	Trial 3	Alternative word list					
elbow	0	1	0	1	0	1	candle	monkey	finger
apple	0	1	0	1	0	1	paper	banana	penny
carpet	0	1	0	1	0	1	sugar	perfume	blanket
saddle	0	1	0	1	0	1	sandwich	sunset	lemon
bubble	0	1	0	1	0	1	wagon	iron	insect

**Total immediate memory score total** \_\_\_\_\_ of 15

### Concentration: Digits Backward

List	Total 1	Alternative digit list			
6-2	0	1	5-2	4-1	4-9
4-9-3	0	1	6-2-9	5-2-6	4-1-5
3-6-1-4	0	1	3-2-7-9	1-7-9-5	4-9-6-8
6-2-9-7-1	0	1	1-5-3-8-6	3-8-5-2-7	6-1-8-4-3
7-1-8-4-6-2	0	1	5-3-9-1-4-8	8-3-1-9-6-4	7-2-4-8-5-6

**Concentration: Days in Reverse Order** (1 pt. for entire sequence correct)

Sunday-Saturday-Friday-Thursday-Wednesday-Tuesday-Monday  0  1

**Concentration score** \_\_\_\_\_ of 6

### 6 Neck Examination:

Range of motion \_\_\_\_\_ Tenderness \_\_\_\_\_ Upper and lower limb sensation & strength \_\_\_\_\_  
**Findings:** \_\_\_\_\_

### 7 Balance examination

Do one or both of the following tests.  
 Footwear (shoes, barefoot, braces, tape, etc.) \_\_\_\_\_

**Modified Balance Error Scoring System (BESS) testing\***

Which foot was tested (i.e. which is the non-dominant foot)  Left  Right  
 Testing surface (hard floor, field, etc.) \_\_\_\_\_

**Condition**

Double leg stance: \_\_\_\_\_ Error: \_\_\_\_\_

Tandem stance (non-dominant foot at back): \_\_\_\_\_ Error: \_\_\_\_\_

**Tandem gait\***

Time taken to complete (see all 6 trials) \_\_\_\_\_ seconds

If child attempted, but unable to complete tandem gait, mark here

### 8 Coordination examination

**Upper limb coordination**

Which arm was tested:  Left  Right

**Coordination score** \_\_\_\_\_ of 1

### 9 SAC Delayed Recall\*

**Delayed recall score** \_\_\_\_\_ of 5

Since signs and symptoms may evolve over time, it is important to consider repeat evaluation in the acute assessment of concussion.

# Sport Concussion Assessment Tool – 2: Baseline Values for High School Athletes

Thomas M Jinguji,<sup>1</sup> Viviana Bompadre,<sup>1</sup> Kimberly G Harmon,<sup>2</sup> Emma K Satchell,<sup>1</sup>  
Kaiulani Gilbert,<sup>1</sup> Jennifer Wild,<sup>3</sup> Janet F Eary<sup>1,2</sup>

**Table 2** SCAT2 scores summarised by age and sex

SCAT2 Test domain	Age 13–15 mean (SD) (N=111)		Age 16–19 mean (SD) (N=103)		Overall mean (SD) (N=214)	
	Female (N=28)	Male (N=83)	Female (N=31)	Male (N=72)	Female (N=59)	Male (N=155)
Symptom score	20.89 (2.79)	20.14 (2.43)	18.59 (4.74)	19.37 (3.38)	19.64(4.10)	19.79(2.92)
Physical signs	2.00 (0.00)	2.00 (0.00)	2.00 (0.00)	2.00 (0.00)	2.00 (0.00)	2.00 (0.00)
Glasgow Coma Scale	15.00 (0.00)	15.00 (0.00)	15.00 (0.0)	15.00 (0.00)	15.00 (0.00)	15.00 (0.00)
Balance score	27.41 (2.14)	25.25 (3.51)	26.38 (3.00)	25.65 (3.78)	26.85 (2.67)	25.43 (3.63)
Coordination	0.96 (0.19)	0.92 (0.30)	0.91 (0.30)	0.85 (0.36)	0.93 (0.25)	0.88 (0.32)
<b>Subtotal</b>	<b>66.26 (3.44)</b>	<b>63.31 (4.45)</b>	<b>62.88 (5.42)</b>	<b>62.87 (5.27)</b>	<b>64.42 (4.89)</b>	<b>63.10 (2.79)</b>
Orientation	4.85 (1.61)	4.67 (0.66)	4.88 (0.34)	4.86 (0.54)	4.86 (0.39)	4.75 (0.62)
Immediate memory score	14.15 (1.61)	13.71 (1.41)	14.44 (0.98)	13.55 (2.29)	14.31 (1.30)	13.64 (1.86)
Concentration score	3.00 (1.00)	2.67 (1.32)	3.63 (1.13)	2.99 (1.45)	3.34 (1.11)	2.81 (1.39)
Delayed recall	4.07 (1.24)	4.01 (1.02)	3.72 (1.28)	4.01 (1.09)	3.88 (1.26)	3.99 (1.05)
<b>SAC subtotal</b>	<b>26.07 (3.02)</b>	<b>25.06 (2.50)</b>	<b>26.67 (2.59)</b>	<b>25.41 (3.69)</b>	<b>26.39 (4.87)</b>	<b>25.19 (3.10)</b>
<b>SCAT2 total</b>	<b>92.33 (4.29)</b>	<b>88.37 (5.49)</b>	<b>89.55 (6.47)</b>	<b>88.28 (6.39)</b>	<b>90.81 (5.71)</b>	<b>88.29 (5.90)</b>

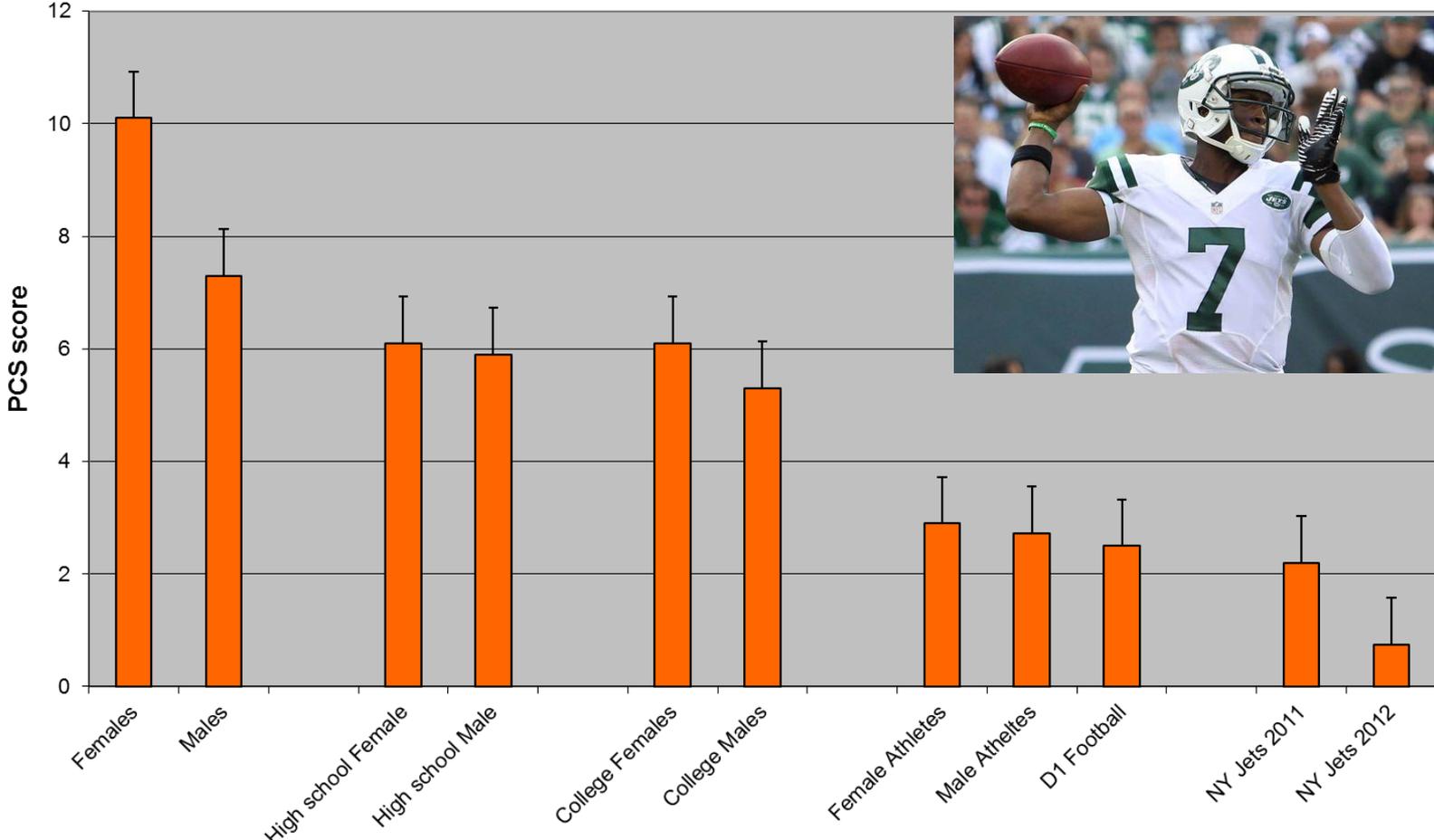
Values in parenthesis are SDs.

SAC, Standardised Assessment of Concussion; SCAT2, Sport Concussion Assessment Tool – 2.

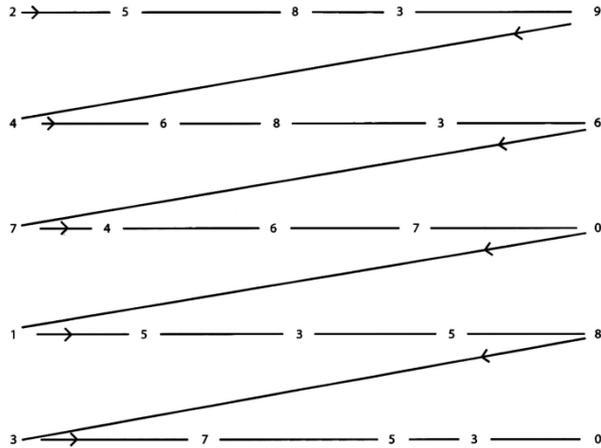


# NY Jets Baseline PCS score

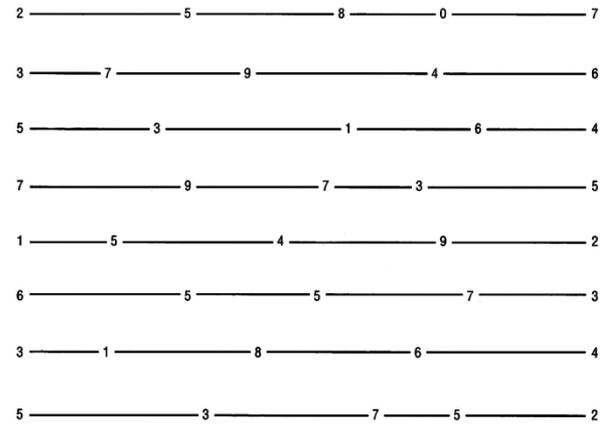
Comparison of Baseline PCS scores



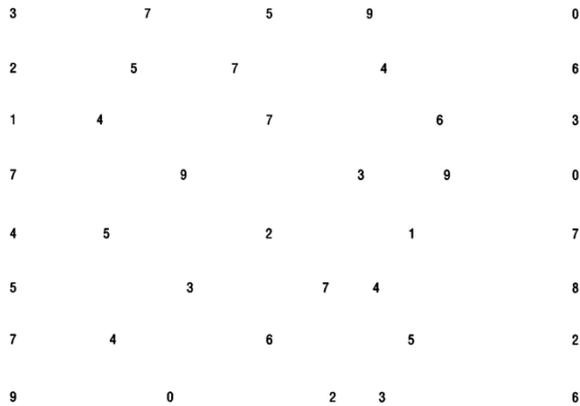
# King-Devick Test



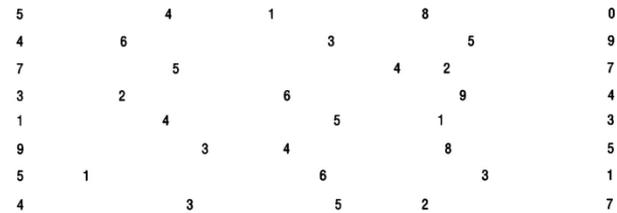
DEMONSTRATION CARD



TEST I



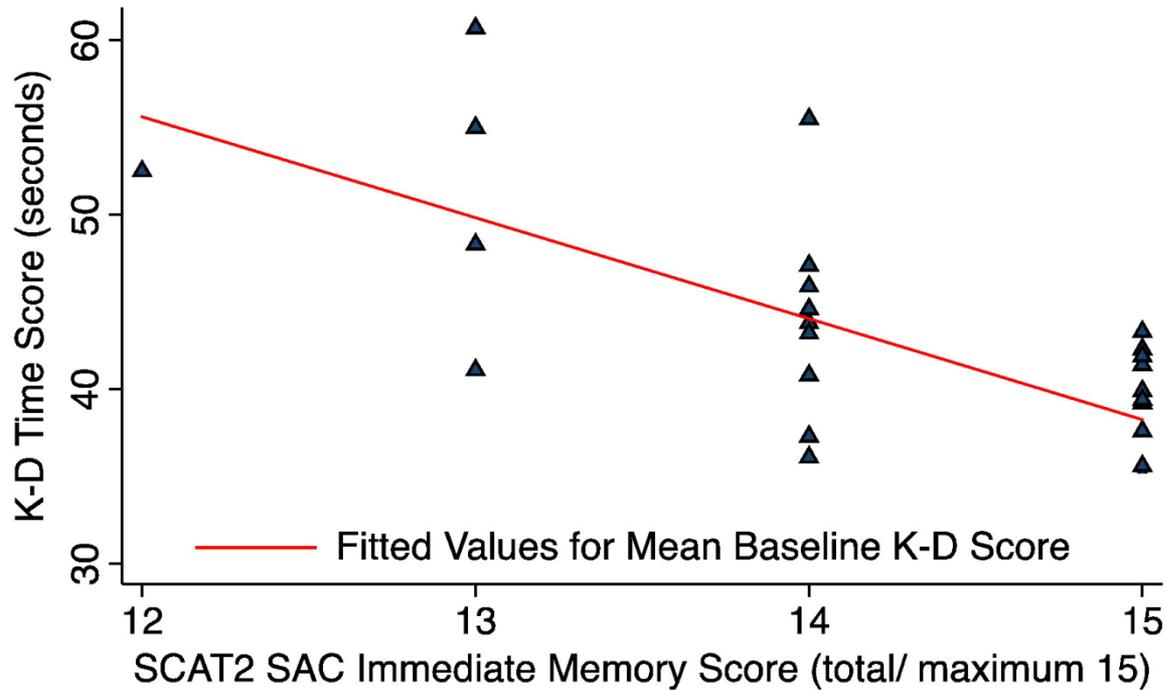
TEST II



TEST III

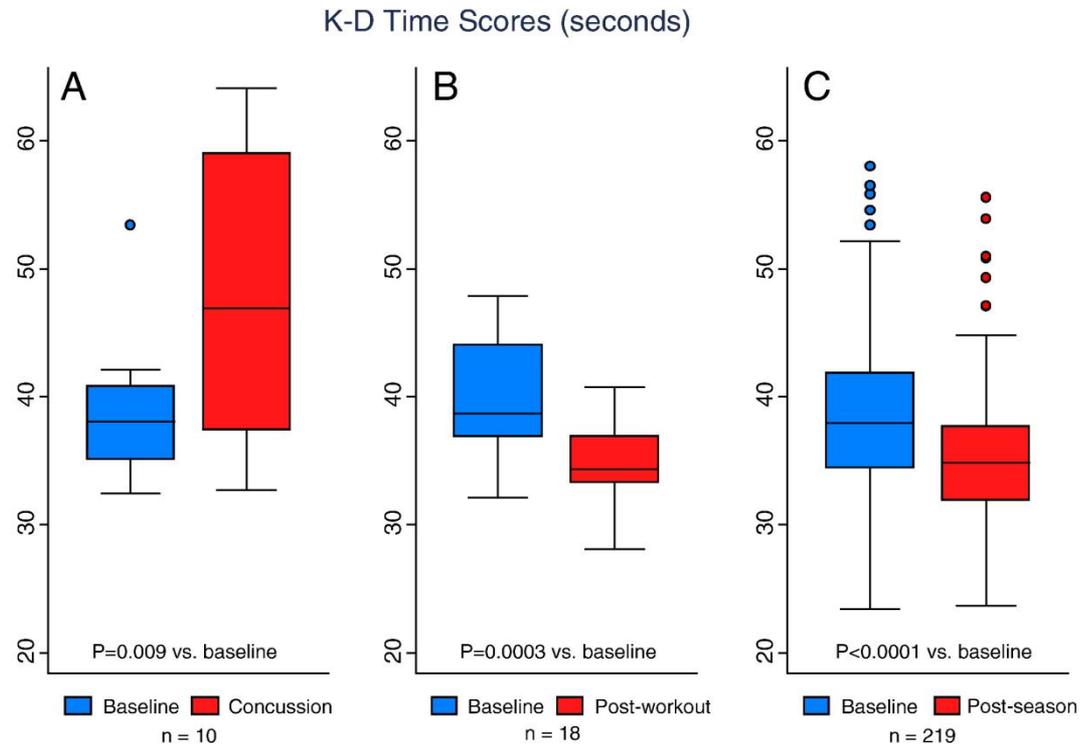


# King–Devick Test



Scatter plot and linear regression line showing the relation of baseline King–Devick (K–D) test time scores to SAC score. The regression line represents fitted values for the mean baseline K–D time score for each value of SCAT2 SAC Immediate Memory Score. Lower (worse) Immediate Memory Scores were associated with higher (worse) K–D time scores at baseline; on average, for every 1-point reduction in SAC Immediate Memory Score, we found a corresponding increase (worsening) of K–D time score of 7.3 s (95% CI 4.9, 9.7,  $p < 0.001$ ,  $R^2 = 0.62$ , linear regression, accounting for age).

# King–Devick Test



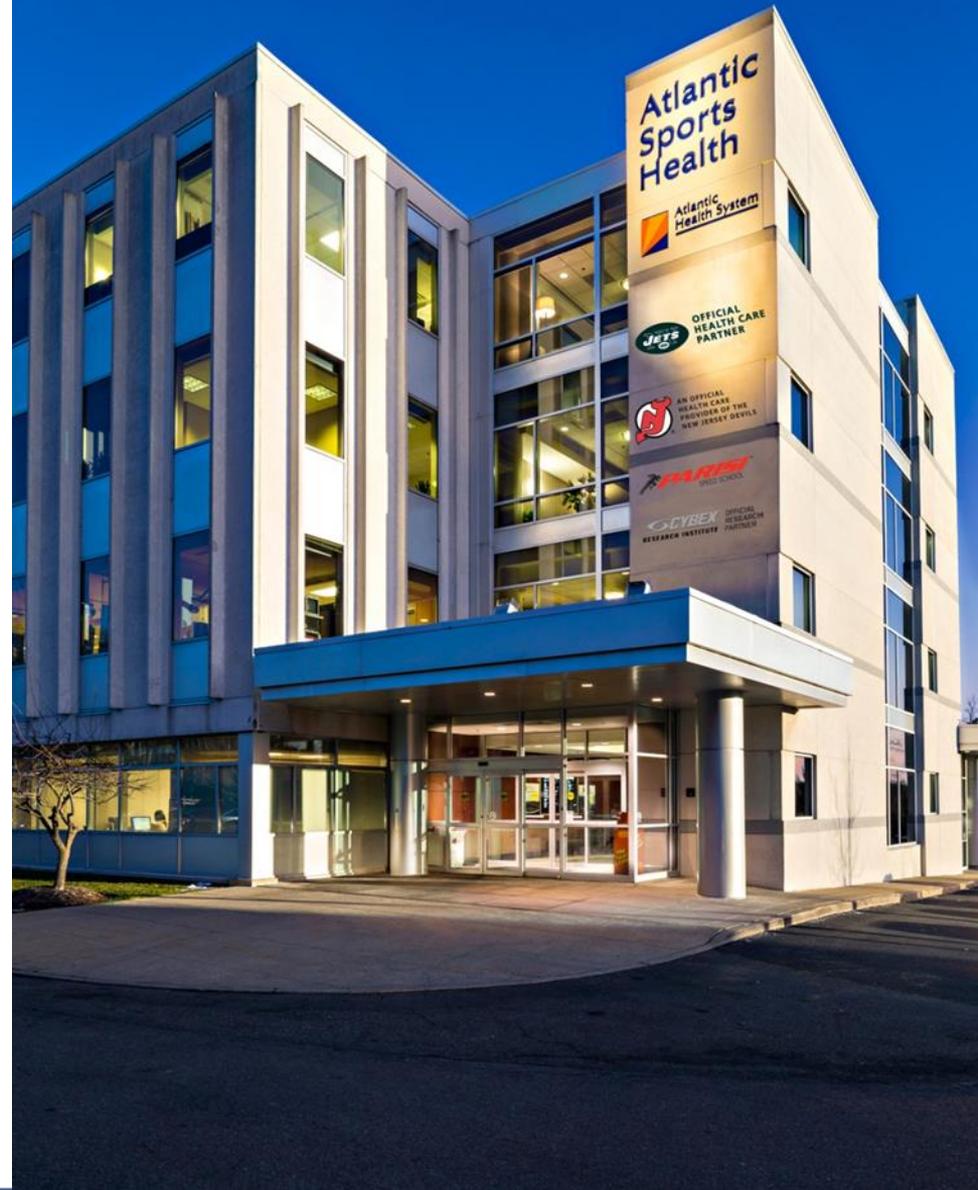
Box plots show the median K–D scores for (A) baseline and sideline testing for athletes with concussion during the playing season (n = 10) demonstrating worsening of scores, (B) baseline and post-scrimmage (post-workout) testing for men's basketball players (n = 18) showing improvement of scores following 2 h of vigorous exercise, and (C) baseline and post-season testing for all athletes (n = 219) demonstrating improvement of scores likely consistent with learning effects.

Galleta et al. *Journal of the Neurological Sciences*. 2011;309(1–2):34–39.



# Overview

- Signs and Symptoms
- On Field Assessment
  - PCS
  - SAC
  - SCAT III
  - King-Devick
  - Balance
- Predicting Outcome
- NFL Sideline Assessment



# Balance Testing

- Published studies using both force plate technology and Balance Error Scoring System (BESS), have identified **postural stability deficits lasting approximately 72 hours following sport-related concussion**
- Postural stability testing provides a useful tool for objectively assessing the motor domain of neurologic functioning and should be considered a **reliable and valid tool**



**FIRM (20 Sec each)**

**A - Double Leg Stance**



**B - Single Leg Stance  
(Non Dominant Leg)**



**C - Tandem Stance  
(Dominant Leg Forward)**



**FOAM (20 Sec each)**

**D - Double Leg Stance**



**E - Single Leg Stance  
(Non Dominant Leg)**



**F - Tandem Stance  
(Dominant Leg Forward)**



# Balance Assessment

**BESS**  
(Balance error scoring system)



## BESS scoring system

### Balance Error Scoring System (BESS) Test

All tests are performed for 20 second trials with the score equaling the number of errors that occurred. High Scores = poor performance. All tests are performed in bare feet or socks.

#### Errors:

- Lifting hands off the iliac crest
- Opening the eyes (when inappropriate)
- Stepping, stumbling, or falling
- Moving the hip more than 30 deg. of flexion or abduction
- Lifting the forefoot or heel
- Remaining out of the testing position greater than 5 seconds

Name / #: \_\_\_\_\_

Dominant Leg: \_\_\_\_\_

Maximum number of errors for any one condition is 10.  
Score is calculated by adding one (1) point for each error



## Theorized Reliabilities Using a Modified Protocol of 4 Conditions (Single-Leg Firm, Tandem-Leg Firm, Single-Leg Foam, and Tandem-Leg Foam) With Increases in the Number of Trials Administered

<b>Model</b>	<b>ICC Reliability</b>
1 trial 6 conditions	$R = 0.60$
1 trial 4 conditions	$R = 0.71$
2 trials 4 conditions	$R = 0.83$
3 trials 4 conditions	$R = 0.88$
4 trials 4 conditions	$R = 0.91$
5 trials 4 conditions	$R = 0.92$
6 trials 4 conditions	$R = 0.94$
7 trials 4 conditions	$R = 0.94$

ICC, intraclass correlation coefficient.

Clinical Journal of Sport Medicine



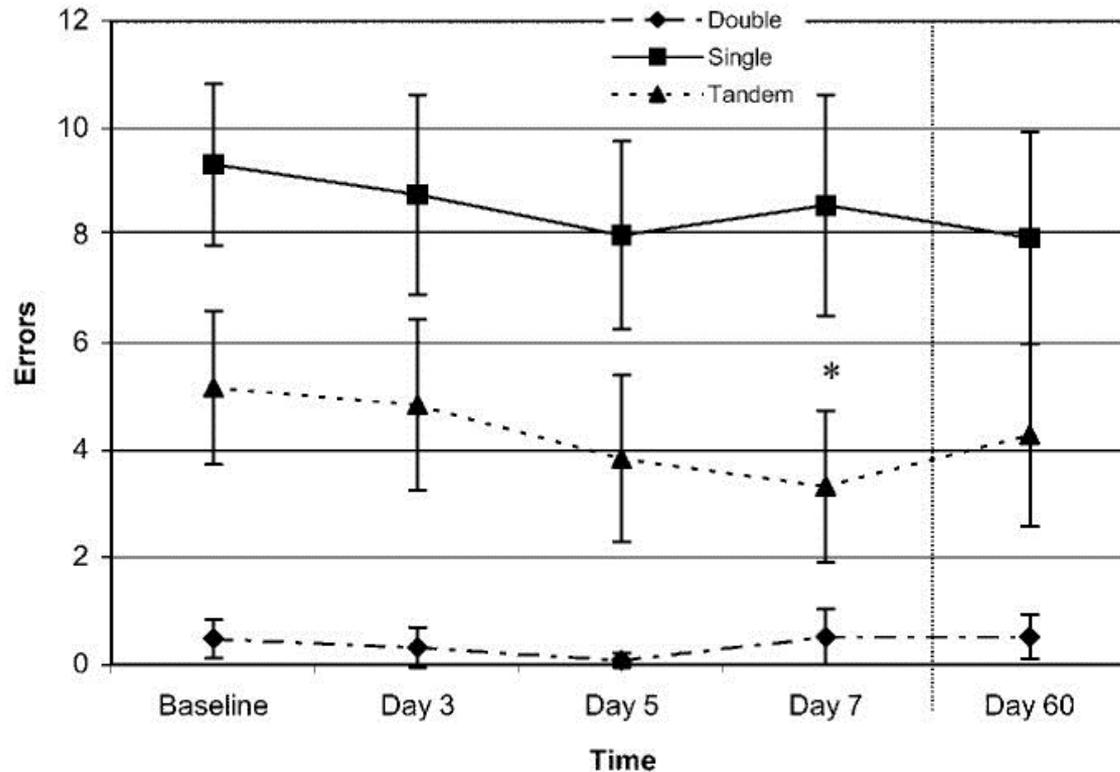
# Summary of Baseline BESS score

- Female Middle School-  $2.6 \pm 2.1$
- Female High school-  $3.6 \pm 3$
- Male Middle School-  $4.75 \pm 3.5$
- Male High School-  $4.35 \pm 3.8$
- D1 Football
  
- NY Jets
  - ☐  $14 \pm 6.27$
  - ☐ range: 3 – 35



# Serial Administration of Clinical Concussion Assessments and Learning Effects in Healthy Young Athletes

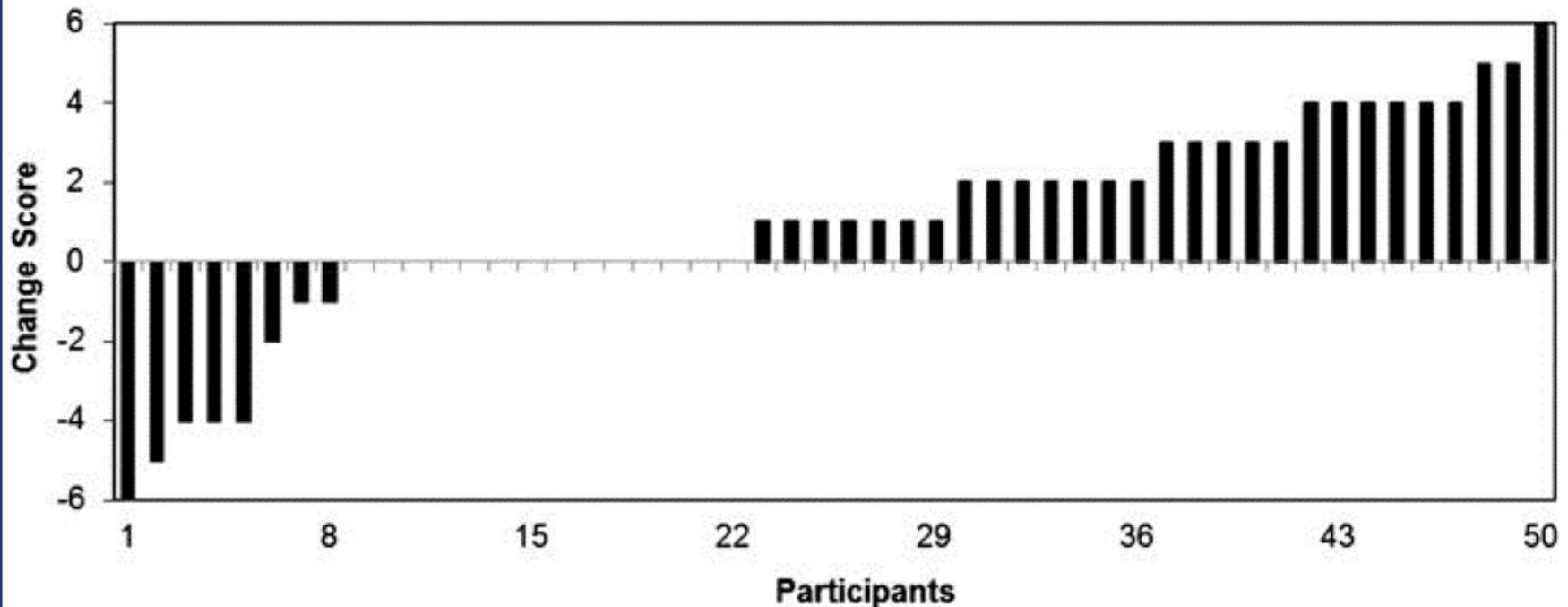
BESS scores within the practice group of the current investigation plotted against scores from a high school and collegiate populations.



Valovich McLeod, Tamara C.; Perrin, David H.; Guskiewicz, Kevin M.; Shultz, Sandra J.; Diamond, Robert; Gansneder, Bruce M. *Clinical Journal of Sport Medicine*. 14(5):287-295, September 2004. doi:

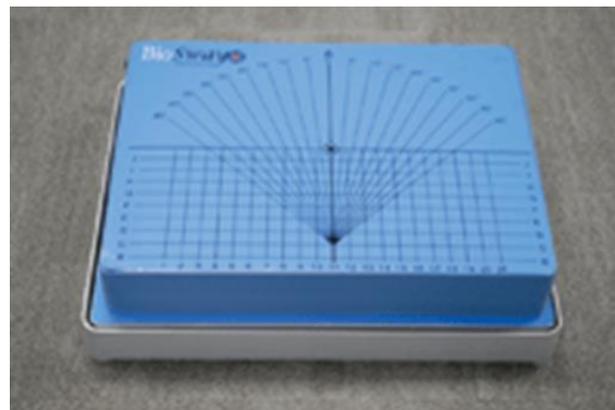
# Balance Error Scoring System Performance Changes After a Competitive Athletic Season

Ranked individual change scores for all participants. The score is calculated as PRE to POST such that a positive number indicated an improvement (fewer errors) in the POST.



Burk, John M.; Munkasy, Barry A.; Joyner, A. Barry; Buckley, Thomas A. *Clinical Journal of Sport Medicine*. 23(4):312-317, July 2013.doi: 10.1097/JSM.0b013e318285633f

# Computerized Balance Assessments



## BIODEX Concussion Management Balance Assessment

Athlete Name: Mike Adams      Facility: Northwest Field House      Cognitive Test: Yes - IMPACTS  
 ID: 107  
 Group: Major University  
 Sport: Football  
 Baseline Test Date: 8/5/2010  
 Injury Date: 11/5/2010  
 Note: Has ankle injury

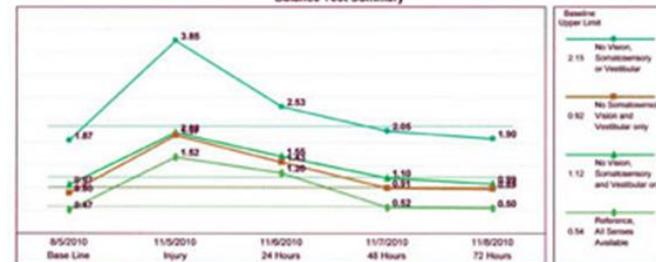
### Balance Test Results

Condition	Base Line 8/5/2010	24 Hours 11/5/2010	48 Hours 11/7/2010	72 Hours 11/9/2010
1 Eyes Open Firm Surface Reference condition Vision, Vestibular and Somatosensory available	0.47	1.02	1.2	0.92
2 Eyes Closed Firm Surface Somatosensory is predominant, Vestibular secondary. No visual input Note: Somatosensory normally have similar scores to Reference condition. ME and TOE will have higher sway values	0.67	2.02	1.95	1.1
3 Eyes Open Foam Surface Vision is predominant, Vestibular secondary, Somatosensory is altered Note: Somatosensory will sway slightly more on foam than on firm. ME and TOE will have higher sway values	0.8	1.97	1.43	0.91
4 Eyes Closed Foam Surface Vestibular is predominant, Vision not available, Somatosensory is altered Note: Somatosensory will have slightly higher sway scores with eyes closed on foam than with eyes open on foam, but remain stable. ME and TOE will sway significantly more	1.67	3.85	2.53	2.08

### Test Notes

Base Line: 8/5/2010      Feet swayed slight ankle sprain at time of baseline testing.  
 Injury: 11/5/2010      Symptoms were present but not remarkable. Withdrew from play. Balance scores considerably higher than baseline.  
 24 Hours: 11/6/2010      Symptoms resolving.  
 48 Hours: 11/7/2010      All conditions to within baseline upper limit, all test again in 24hrs to confirm.  
 72 Hours: 11/9/2010      All conditions have returned to within baseline upper limits.

### Balance Test Summary



### Comments:

- \* Lower numbers indicate less sway and more postural control
- \* Post injury scores should return to within 15% of Baseline score for the specific condition



# Clinical Test of Sensory Integration of Balance

Name ██████████  
 Height 73+"

Age 16

Date 08/29/2011 11:27 AM

	<u>Foot Placement</u>	
	Left	Right
Foot Angle	10	10
Heel Position	C5	C17

## Protocol

Conditions Modified  
Test Trial Time 20 secs  
Test Trials 1  
Cursor OFF

**Condition**  
**Eyes Open Firm Surface**  
 Baseline - Normals very stable

**Sway Index**

0.56

Better 0.50 Worse



**Eyes Closed Firm Surface**  
 Somatosensory is predominant, Vestibular is secondary  
 Normals have similar scores to eyes open firm

0.97

Better 1.00 Worse



**Eyes Open Foam Surface**  
 Vision is predominant, Vestibular is secondary  
 Normals sway more on foam than firm but remain stable

0.57

Better 0.75 Worse



**Eyes Closed Foam Surface**  
 Vestibular is predominant  
 Normals sway more with eyes closed on foam than with eyes open on foam, but remain stable

3.08

Better 2.25 Worse



# BESS vs BioSway:

## Height Comparison by Groups: Sway and BESS Test



	Height Group		p-value*
	<=72 inches (N = 13, 31%)	>72 inches (N = 29, 69%)	
<b>Sway Total Test 1 (Mean ± SD)</b>	<b>3.55 ± 0.57</b>	<b>3.67 ± 0.90</b>	<b>0.59</b>
<b>Median</b>	<b>3.43</b>	<b>3.67</b>	
<b>Sway Total Test 2 (Mean ± SD)</b>	<b>3.31 ± 0.58</b>	<b>3.40 ± 0.70</b>	<b>0.65</b>
<b>Median</b>	<b>3.16</b>	<b>3.28</b>	
<b>BESS (Mean ± SD)</b>	<b>15.31 ± 5.04</b>	<b>21.48 ± 7.53</b>	<b>0.004</b>
<b>Median</b>	<b>16</b>	<b>22</b>	

BESS was significantly different in the two height groups [mean ± SD for the height group of <=72 inches was 15.31± 5.04 vs. 21.48 ± 7.53 for others, p = 0.004, based on the Two-Sample T test]. Total sway measures were not statistically different in the two height groups (p>0.05).

*Martins D, Padavan D, Monaco R, Kahn A. Unpublished data 2013*



# BESS vs BioSway:

## Total Sway and BESS by History of Concussions

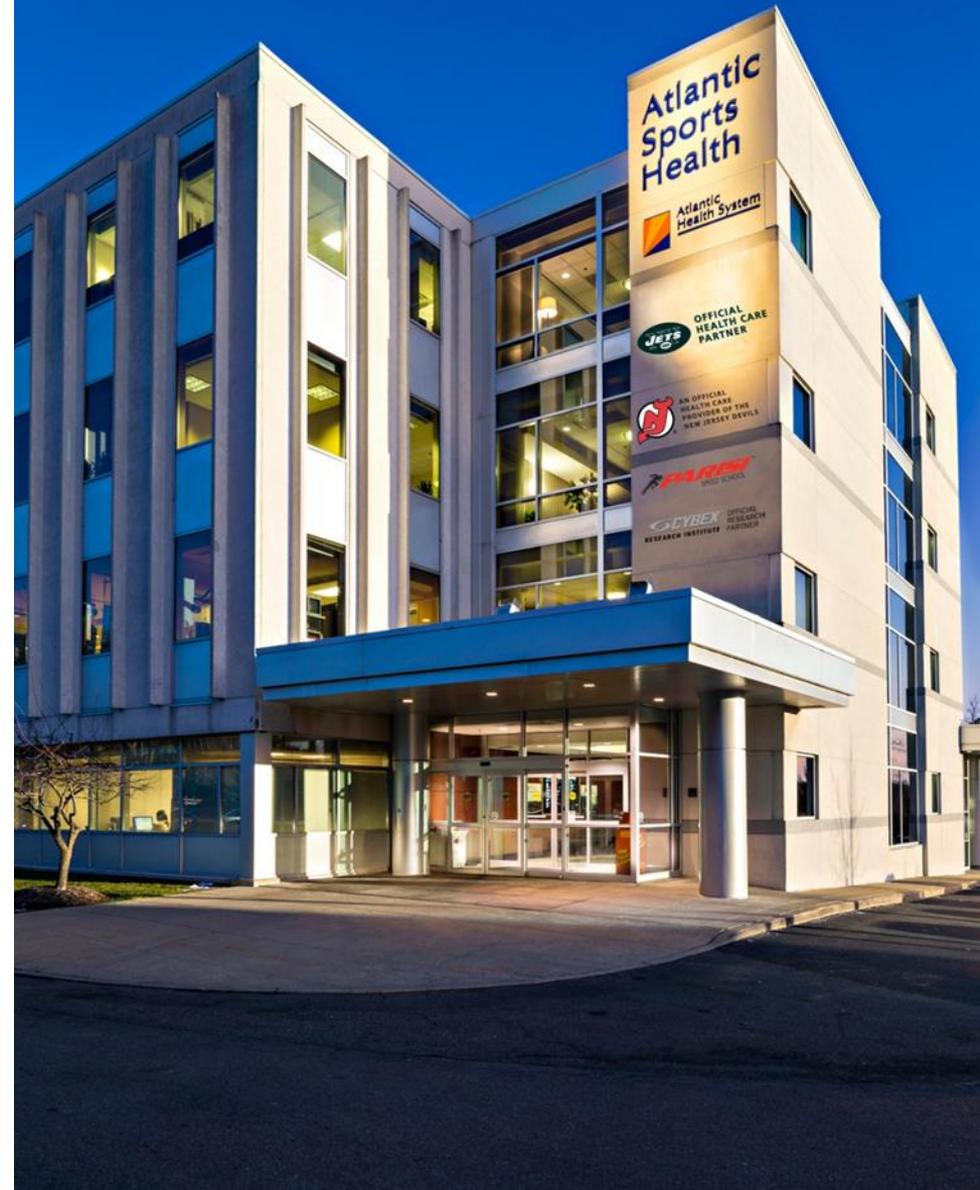
	History of Concussions		p-value*
	NO (N = 20, 48%)	YES (N = 22, 52%)	
Sway Total Test 1 (Mean ± SD)	3.41 ± 0.58	3.84 ± 0.93	0.075
Median	3.27	3.80	
Sway Total Test 2 (Mean ± SD)	3.15 ± 0.46	3.58 ± 0.75	0.029
Median	3.17	3.62	
BESS (Mean ± SD)	17.55 ± 5.93	21.41 ± 8.19	0.087
Median	17.5	20	

Total sway test 2 measure was significantly different by history of concussions status [mean ± SD for the group with no history of concussions was 3.15 ± 0.46 vs. 3.58 ± 0.75 for others, p = 0.029, based on the Two-Sample T test]

*Martins D, Padavan D, Monaco R, Kahn A. Unpublished data 2013*

## Overview

- Signs and Symptoms
- On Field Assessment
  - SCAT III
  - SCAT III Child
  - PCS
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# Which On-Field Markers of Concussion Predict Poor SubAcute Outcome?

- On-field retrograde amnesia were:
  - 10.0x more likely to have “poor” outcome at 3 days post-concussion
- On-field anterograde amnesia were:
  - 4.2x more likely to have “poor” outcome at 3 days post-concussion
- Brief LOC not predictive of outcome



# Markers that Predict Protracted Recovery (Post-Concussion Syndrome) ?

On-Field Marker	N	Chi <sup>2</sup>	P	Odds Ratio	95% Confidence Interval
Posttraumatic Amnesia	92	1.29	0.257	1.721	0.67-4.42
Retrograde Amnesia	97	.120	0.729	1.179	0.46-3.00
Confusion	98	.114	0.736	1.164	0.48-2.82
LOC	95	2.73	0.100	0.284	0.06-1.37

On-Field Symptom	N	Chi <sup>2</sup>	P	Odds Ratio	95% Confidence Interval
<b>Dizziness**</b>	<b>98</b>	<b>6.97</b>	<b>0.008</b>	<b>6.422</b>	<b>1.39-29.7</b>
Headache	98	0.64	0.43	2.422	0.26-22.4
Sensitivity LT/Noise	98	1.19	0.28	1.580	0.70-3.63
Visual Problems	97	0.62	0.43	1.400	0.61-3.22
Fatigue	97	0.04	0.85	1.080	0.48-2.47
Balance Problems	98	0.28	0.59	0.800	0.35-1.83
Personality Change	8	0.86	0.35	<b>0.630</b>	<b>.023-1.69</b>
Vomiting	97	0.68	0.41	0.600	0.18-2.04



# On Field Signs and Symptoms Predicting Recovery

University of Pittsburgh Medical Center, Center for Sports Medicine. Used data obtained from male high school football players from Pennsylvania that suffered a concussion during 2002-2006 seasons.

TABLE 1  
Participant Demographics<sup>a</sup>

	Total Sample (N = 107)	Rapid Recovery (≤7 Days, n = 58)	Protracted Recovery (≥21 Days, n = 31)
Mean age, y	16.02 (SD = 1.22)	16.01 (SD = 1.27)	15.83 (SD = 1.38)
Mean days to recovery	13.26 (SD = 9.05)	4.31 (SD = 1.74)	29.61 (SD = 6.65)
Mean days evaluation	2.4 (SD = 2.12)	2.11 (SD = 1.46)	2.94 (SD = 2.88)
Previous concussion	29 (27.1%)	16 (25.8%)	11 (30.56%)
History of headache	11 (10.3%)	5 (8.06%)	6 (16.67%)
History of migraine	11 (10.3%)	3 (4.84%)	3 (8.33%)
History of ADHD	4 (3.74%)	0 (0%)	3 (8.33%)
History of any learning disorder	2 (1.87%)	2 (3.23%)	0 (0%)

<sup>a</sup>Percentages represent the percentage with each group (total, rapid, or protracted). Previous concussion refers to patients with a history of at least 1 prior concussion; 29 athletes had at least 1 prior concussion, of whom 16 reported only 1 previous concussion and 13 reported 2 or more. SD, standard deviation; ADHD, attention deficit hyperactivity disorder.



# On Field predictors of protracted recovery

TABLE 2  
Frequencies of On-Field Sign/Symptoms and as Predictors of Protracted Recovery<sup>a</sup>

On-field Sign/Symptom	n	Rapid Recovery	Protracted Recovery	$\chi^2$	P	Odds Ratio	95% Confidence Interval
Dizziness <sup>b</sup>	87	45	34	6.97	.01	6.42	1.39-29.7
Headache	100	58	35	0.64	.43	2.41	0.26-22.47
Posttraumatic amnesia	36	14	11	1.29	.26	1.72	0.67-4.42
Sensitivity light/noise	53	24	18	1.19	.28	1.58	0.70-3.63
Visual problems	60	25	35	0.62	.43	1.40	0.61-3.2
Retrograde amnesia	29	15	10	0.12	.73	1.18	0.46-3.00
Confusion	71	41	25	0.11	.74	1.16	0.48-2.82
Fatigue	66	31	19	0.04	.85	1.08	0.48-2.47
Balance problems	55	31	16	0.28	.60	0.80	0.35-1.83
Personality changes	26	17	7	0.86	.35	0.63	0.23-1.6
Vomiting <sup>b</sup>	15	11	2	2.73	.10	0.28	0.06-1.37
Numbness	20	15	5	1.34	.25	0.52	0.17-1.59
Loss of consciousness <sup>b</sup>	13	11	2	2.73	.10	0.28	0.06-1.37



# Predictors of Early Postconcussion Impairments

**Moderate to strong evidence the following are associated with more severe / prolonged early cognitive impairment :**

- **Elevated PCS (1 Class I study, multiple Class II & III studies)**
- **Lower SAC score (2 Class 2 studies)**
- **Reduction in neuropsychological score (3 Class I, 3 Class II studies)**
- **Deficits in BESS (1 Class I study)**
- **Deficits in SOT (1 Class I, 1 Class II)**



# Predictors of Severe or Prolonged Postconcussion Impairments.

Probable risk factors for persistent neurocognitive problems or prolonged return to play (RTP) include:

- Ongoing clinical symptoms are associated with persistent neurocognitive impairments demonstrated on objective testing  
(1 Class I study, 2 Class II studies)
- high likelihood that history of concussion is associated with more severe/longer duration of symptoms and cognitive deficits  
(3 Class I studies, 2 Class III studies)



# Predictors of Severe or Prolonged Postconcussion Impairments

Probable risk factors for persistent neurocognitive problems or prolonged return to play (RTP) include:

- early posttraumatic headache (1 Class I, 5 Class II studies)
- fatigue/fogginess (1 Class I, 2 Class II studies)
- amnesia/disorientation/mental status change (1 CI, 1 CII, 2 CIII studies)
- younger age/level of play (2 Class I study)
- peewee hockey, body checking (1 Class I study)

Summary of evidence-based guideline update: Evaluation and management of concussion in sports. *Neurology* 2013; Published Ahead of Print on March 18, 2013 as 10.1212/WNL.0b013e31828d57dd



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This tool does not constitute, and is not intended to constitute, a standard of medical care. It is a guide derived from the Standardized Concussion Assessment Tool 2 (SCAT2) (McCrory, et al, BJSM '09) and represents a standardized method of evaluating NFL players for concussion consistent with the reasonable, objective practice of the healthcare profession. This guide is not intended to be a substitute for the clinical judgment of the treating healthcare professional and should be interpreted based on the individual needs of the patient and the specific facts and circumstances presented.

**NFL Sideline Concussion Assessment Tool: BASELINE TEST. Athlete completes blue sections. ATC/MD/DO completes sheet.**

Athlete \_\_\_\_\_ Position \_\_\_\_\_ Team \_\_\_\_\_ Athlete Initials \_\_\_\_\_

Date & Time of Baseline Test: Date \_\_\_\_\_ Time \_\_\_\_\_ am / pm Evaluator \_\_\_\_\_ ATC / MD / DO / Other \_\_\_\_\_

**RISK FACTORS:**

**Concussion History**

Have you EVER had a concussion, had your "bell rung", or had any of the symptoms below as a result of a head injury? Y N

If yes, previous number 0 1 2 3 4 5 6+

What type of symptoms did you have? \_\_\_\_\_

How long were you out of activity? \_\_\_\_\_

Have you ever lost consciousness as a result of a head injury? Y N If yes, how long? \_\_\_\_\_

Have you ever been hospitalized as a result of a head injury? Y N Details \_\_\_\_\_

Have you ever had any imaging tests of your brain (CT, MRI, DTL, other)? Y N Details \_\_\_\_\_

Date of most recent concussion? \_\_\_\_\_

**Additional Risk Factors: Personal History**

Have you ever been diagnosed with:

- Headache or migraines?
- Learning disability / dyslexia?
- ADD / ADHD?
- Depression, anxiety or other psychiatric disorder?
- Seizure disorder?

Are you on any medications? If yes please list \_\_\_\_\_

**Family History**

Has anyone in your family ever been diagnosed with:

- Headache or migraines?
- Learning disability / dyslexia?
- ADD / ADHD?
- Depression, anxiety or other psychiatric disorder?
- Seizure disorder?

**How do you feel?** The athlete should score themselves on the following symptoms, based on how they feel at the time.

(i.e. 0 = not present, 1 = mild, 3 = moderate, 6 = severe)

Headache / head pressure	0 1 2 3 4 5 6	Feeling slowed down	0 1 2 3 4 5 6
Nausea / vomiting	0 1 2 3 4 5 6	Sensitivity to noise	0 1 2 3 4 5 6
Neck pain	0 1 2 3 4 5 6	Sensitivity to light	0 1 2 3 4 5 6
Drowsiness	0 1 2 3 4 5 6	Visual problems /blurred vision	0 1 2 3 4 5 6
Balance problems	0 1 2 3 4 5 6	Sleeping more than usual	0 1 2 3 4 5 6
Dizziness	0 1 2 3 4 5 6	Sleeping less than usual	0 1 2 3 4 5 6
Fatigue / low energy	0 1 2 3 4 5 6	Trouble falling asleep	0 1 2 3 4 5 6
Confusion	0 1 2 3 4 5 6	Sadness	0 1 2 3 4 5 6
"Don't feel right"	0 1 2 3 4 5 6	Nervous or anxious	0 1 2 3 4 5 6
Feeling "in a fog"	0 1 2 3 4 5 6	Feeling more emotional	0 1 2 3 4 5 6
Difficulty remembering	0 1 2 3 4 5 6	Irritability	0 1 2 3 4 5 6
Difficulty concentrating	0 1 2 3 4 5 6	Numbness or tingling	0 1 2 3 4 5 6

Total # Symptoms: of 24 = \_\_\_\_\_ Symptom Severity Score: (max 24 symptoms X max 6 rating) of 104 = \_\_\_\_\_

Athlete should initial in upper right hand corner that information provided above is accurate to the best of their knowledge BELOW IS FOR ATC / MD / DO / OTHER PROVIDER USE ONLY

**Select Physical Signs or Symptoms: Screen for Cervical Spine and/or More Serious Brain Trauma**

Any reported neck pain, c-spine tenderness or decreased range of motion?	Y	N
Pupil reaction abnormal or pupils unequal?	Y	N
Extra-ocular movements abnormal and/or cause double vision?	Y	N
Asymmetry or abnormalities on screening motor or sensory exam?	Y	N
Other _____		

**NFL Sideline Concussion Assessment Tool: BASELINE TEST (continued)**

<b>ORIENTATION / SAC</b>	of 5 = _____
What month is it?	0 1
What is the date today?	0 1
What is the day of the week?	0 1
What year is it?	0 1
What time is it right now? (within an hour)	0 1

**SAC / Word Recall:** Read list of 5 words 1 per second, ask athlete to repeat list, in any order. (Use of specific lists below optional) For Trial 2 & 3, read the same list of words again and have athlete repeat them back, in any order. One point for each word remembered. You must conduct all 3 trials regardless of their success on trial 1. Do not tell athlete that delayed recall will be tested

<b>List 1</b>	<b>Immediate Recall Trials</b>	<b>Alternative Lists</b>	<b>Delayed recall (perform at end of all sideline testing, at least &gt; 5 minutes)</b>
	<b>#1</b>	<b>#2</b>	<b>#3</b>
elbow	_____	_____	_____
apple	_____	_____	_____
carpet	_____	_____	_____
saddle	_____	_____	_____
bubble	_____	_____	_____
		candle	baby
		paper	monkey
		sugar	perfume
		sandwich	sunset
		wagon	iron

Total of all three immediate word recalls: out of 15 = \_\_\_\_\_ Total delayed recall: out of 5 = \_\_\_\_\_

**SAC / Concentration:** Read string of numbers, ask athlete to repeat backwards. (Use of specific numbers below optional). If correct go to the next string length. If incorrect, read second string (same length) 1 point for each string length correct. Stop after incorrect on both trials. Read digits at rate of 1 digit/sec

<b>Digits Backward:</b>	<b>Alternative digit lists</b>
4-9-3	0 1 6-2-9 5-2-6
3-8-1-4	0 1 3-2-7-9 1-7-9-5
6-2-9-7-1	0 1 1-5-2-8-6 3-8-5-2-7
7-1-8-4-6-2	0 1 5-3-9-1-4-8 8-3-1-9-6-4

**SAC / Concentration cont. Months in reverse order**  
Dec - Nov - Oct - Sept - Aug - Jul - Jun - May - Apr - Mar - Feb - Jan

1 point for months in reverse correctly (< 30 sec) = \_\_\_\_\_

1 point for each sequence correct of 4 = \_\_\_\_\_ Total of SAC Concentration of 5 = \_\_\_\_\_

**Modified BESS:** This is calculated by adding 1 error point for each error during the three 20-sec tests. The maximum total # of errors for any single condition is 10. The higher the score, the worse is the player's balance.

**Balance testing – 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

Which foot tested (non-dominant foot)  L  R

Double leg stance (feet together) # errors \_\_\_\_\_

Single leg stance (non dominant foot) # errors \_\_\_\_\_

Tandem stance (non dominant foot at back) # errors \_\_\_\_\_

**BALANCE SCORE: (summed # of errors) = \_\_\_\_\_**

**SCORING:**

All SAC scores (summed orange boxes) = \_\_\_\_\_ of 30

BALANCE Score: (summed BESS Errors) = \_\_\_\_\_

Symptom Score: (# symptoms reported) = \_\_\_\_\_ of 24

**ADDITIONAL COMMENTS:** \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_



This tool does not constitute, and is not intended to constitute, a standard of medical care. It is a guide derived from the Standardized Concussion Assessment Tool 2 (SCAT2) (McCrory, et al, BJSM 09) and represents a standardized method of evaluating NFL players for concussion consistent with the reasonable, objective practice of the healthcare profession. This guide is not intended to be a substitute for the clinical judgment of the treating healthcare professional and should be interpreted based on the individual needs of the patient and the specific facts and circumstances presented.

**NFL Sideline Concussion Assessment Tool: Completed by healthcare professional. Athlete completes symptoms at bottom.**

Athlete \_\_\_\_\_ Position \_\_\_\_\_ Team \_\_\_\_\_ Evaluator \_\_\_\_\_ ATC / MD / DO \_\_\_\_\_

Evaluation date \_\_\_\_\_ time \_\_\_\_\_ am / pm Injury date \_\_\_\_\_ time \_\_\_\_\_ am / pm during  Game  Practice  Other \_\_\_\_\_

Mechanism of injury  head to head  elbow to head  knee to head  ground to head  blow to body  
 other mechanism \_\_\_\_\_  unknown mechanism \_\_\_\_\_

Penalty called  Yes  No Other circumstances \_\_\_\_\_

This concussion assessment tool contains an assessment of orientation, memory, concentration, balance & symptoms. This tool is intended to be used in conjunction with your clinical judgment. If **ANY** significant abnormality is found, a conservative, "safety first" approach should be adopted. An athlete suspected of sustaining a concussion is a "No Go" and does not return to play in the same game or practice.

**ANY OF THE FOLLOWING ARE OBVIOUS SIGNS OF DISQUALIFICATION (i.e. "No Go"):**

- LOC or unresponsiveness? (for any period of time) If so, how long? \_\_\_\_\_  Y N
  - Confusion? (any disorientation or inability to respond appropriately to questions) \_\_\_\_\_  Y N
  - Amnesia (retrograde / anterograde)? If so, how long? \_\_\_\_\_  Y N
  - New and/or persistent symptoms: see checklist? (e.g. headache, nausea, dizziness) \_\_\_\_\_  Y N
  - Abnormal neurological finding? (any motor, sensory, cranial nerve, balance issues, seizures) or \_\_\_\_\_  Y N
  - Progressive, persistent or worsening symptoms? If so, consider cervical spine and/or a more serious brain injury (See box below) \_\_\_\_\_  Y N
- Other \_\_\_\_\_ Total Physical Signs Score: (total above  Yes scores) of 6 = \_\_\_\_\_

**Neurological Screen for Cervical Spine and/or More Serious Brain Trauma**

Deteriorating mental status? \_\_\_\_\_ Y N  
Any reported neck pain, cervical spine tenderness or decreased range of motion? \_\_\_\_\_ Y N  
Pupil reaction abnormal or pupils unequal? \_\_\_\_\_ Y N  
Extra-ocular movements abnormal and/or cause double vision? (difficulty tracking and/or reading) \_\_\_\_\_ Y N  
Asymmetry or abnormalities on screening motor or sensory exam? \_\_\_\_\_ Y N

**ORIENTATION / SAC of 5 = \_\_\_\_\_**

What month is it? 0 1  
What is the date today? 0 1  
What is the day of the week? 0 1  
What year is it? 0 1  
What time is it right now? (within an hour) 0 1

**ORIENTATION / Maddock's Questions of 5 = \_\_\_\_\_**

Where are we? 0 1  
What quarter is it right now? 0 1  
Who scored last in the practice / game? 0 1  
Who did we play last game? 0 1  
Did we win the last game? 0 1

**SAC / Word Recall:** Read list of 5 words 1 per second, ask athlete to repeat list, in any order. (Use of specific lists below optional). For Trial 2 & 3, read the same list of words again and have athlete repeat them back, in any order. One point for each word remembered. You must conduct all 3 trials regardless of their success on trial 1. Do not tell athlete that delayed recall will be tested

List 1	Immediate Recall Trials			Alternative Lists		Delayed recall (perform at end of all sideline testing, at least > 5 minutes)
	#1	#2	#3			
elbow	_____	_____	_____	candle	baby	_____
apple	_____	_____	_____	paper	monkey	_____
carpet	_____	_____	_____	sugar	perfume	_____
saddle	_____	_____	_____	sandwich	sunset	_____
bubble	_____	_____	_____	wagon	iron	_____

Total of all three immediate word recalls: out of 15 = \_\_\_\_\_ Total delayed recall: out of 5 = \_\_\_\_\_

**NFL Sideline Concussion Assessment Tool (continued)**

**Overall Rating:** If you know the athlete well p/t the injury, how different is the athlete acting compared to his usual self?

Check one;  No different  Very different  Unsure

**SAC / Concentration:** Read string of numbers, ask athlete to repeat backwards. (Use of specific numbers below optional). If correct go to the next string length. If incorrect, read second string (same length) 1 point for each string length correct. Stop after incorrect on both trials. Read digits at rate of 1 digit /sec

**Digits Backward:** 4-9-3 0 1 6-2-9 5-2-6  
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6-2-9-7-1 0 1 1-5-2-8-6 3-8-5-2-7  
7-1-8-4-6-2 0 1 5-3-9-1-4-8 8-3-1-9-6-4

**SAC / Concentration cont. Months in reverse order**  
Dec - Nov - Oct - Sept - Aug - Jul - Jun - May - Apr - Mar - Feb - Jan

1 point for months in reverse correctly (<30 sec) = \_\_\_\_\_

1 point for each sequence correct of 4 = \_\_\_\_\_

Total of SAC Concentration of 5 = \_\_\_\_\_

**Modified BESS:** This is calculated by adding 1 error point for each error during the three 20-sec tests. The maximum total # of errors for any single condition is 10. The higher the score, the worse is the player's balance.

**Balance testing – types of errors**

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

Which foot tested (non-dominant foot)  L  R

Double leg stance (feet together) # errors \_\_\_\_\_

Single leg stance (non dominant foot) # errors \_\_\_\_\_

Tandem stance (non dominant foot at back) # errors \_\_\_\_\_

**BALANCE SCORE: (summed # of errors) = \_\_\_\_\_**

Signs and symptoms of concussion may be delayed, and therefore it may be prudent to remove an athlete from play, not leave them alone, and serially monitor them over a period of time. **WHEN IN DOUBT, TAKE A "TIME OUT"**

**SCORING**  
All Physical Signs Score: (total #  Yes) = \_\_\_ of 6  
Maddock's score: = \_\_\_ of 5  
All SAC scores: (summed orange boxes) = \_\_\_ of 30  
Balance Score: (summed BESS Errors) = \_\_\_  
Symptom Score: (# symptoms reported) = \_\_\_ of 24  
**ALL SCORES SHOULD BE COMPARED WITH BASELINE VALUES FOR THE INDIVIDUAL ATHLETE**

**The following symptom checklist should be completed by the athlete**

**How do you feel?** The athlete should score themselves on the following symptoms, as applicable, based on how they feel at the time. (i.e. 0 = not present, 1 = mild, 3 = moderate, 6 = severe)

Headache / head pressure	0 1 2 3 4 5 6	Feeling slowed down	0 1 2 3 4 5 6
Nausea / vomiting	0 1 2 3 4 5 6	Sensitivity to noise	0 1 2 3 4 5 6
Neck pain	0 1 2 3 4 5 6	Sensitivity to light	0 1 2 3 4 5 6
Drowsiness	0 1 2 3 4 5 6	Visual problems/ blurred vision	0 1 2 3 4 5 6
Balance problems	0 1 2 3 4 5 6	Sleeping more than usual	0 1 2 3 4 5 6
Dizziness	0 1 2 3 4 5 6	Sleeping less than usual	0 1 2 3 4 5 6
Fatigue / low energy	0 1 2 3 4 5 6	Trouble falling asleep	0 1 2 3 4 5 6
Confusion	0 1 2 3 4 5 6	Sadness	0 1 2 3 4 5 6
"Don't feel right"	0 1 2 3 4 5 6	Nervous or anxious	0 1 2 3 4 5 6
Feeling "in a fog"	0 1 2 3 4 5 6	Feeling more emotional	0 1 2 3 4 5 6
Difficulty remembering	0 1 2 3 4 5 6	Irritability	0 1 2 3 4 5 6
Difficulty concentrating	0 1 2 3 4 5 6	Numbness or tingling	0 1 2 3 4 5 6

Do symptoms worsen with physical activity? Y N Total # symptoms = \_\_\_ of 24

Do symptoms worsen with mental activity? Y N Symptom Severity (max 24 X max 6) = \_\_\_ of 104