

# BrainScope®

## BrainScope One User Manual

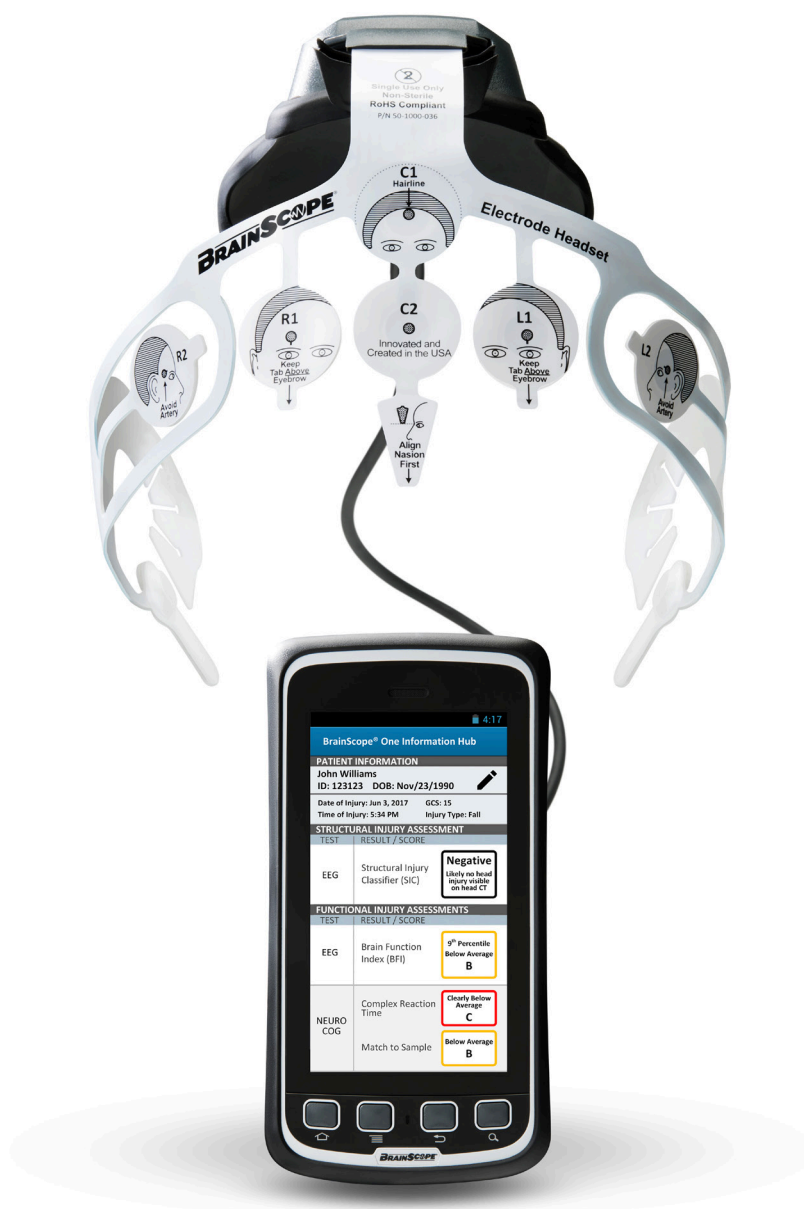
Rx ONLY

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**Supported Model : Ahead 300**

**SPC-00087**



## Customer Responsibility

This product and its components will perform reliably only when operated and maintained in accordance with the instructions contained in this manual, accompanying labels, and/or inserts. A defective product should not be used. Parts which may be broken or missing or are plainly worn, distorted or contaminated should be replaced immediately with clean, genuine replacement parts manufactured by or available from BrainScope Company, Inc. The responsibility of BrainScope Company, Inc., for a malfunctioning product is limited by the warranty set forth in this manual. Should repair or replacement of this product become necessary after the warranty period, the customer should seek advice from BrainScope Company, Inc., prior to such repair or replacement. If this product is in need of repair it should not be used until all repairs have been made and the unit is functioning properly and ready for use. The owner of this product has sole responsibility for any malfunction resulting from improper use or maintenance, or repair by anyone other than BrainScope Company, Inc., and from any malfunction caused by parts that are damaged or modified by anyone other than BrainScope Company, Inc.

## Software License Notice

The BrainScope Company, Inc., BrainScope One contains software that is installed by BrainScope Company, Inc. ("BrainScope"). BrainScope owns this software and it is subject to the licensing terms and conditions outlined at <http://www.brainscope.com/brainscope-one-terms-and-conditions>.

## Patents and Trademarks

BrainScope® and Ahead® are registered trademarks of BrainScope Company, Inc., in the United States or other countries.

For a full list of US patents covering BrainScope One, visit [www.brainscope.com/patents](http://www.brainscope.com/patents).



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## CHAPTER 1: General Information

### 1.1 About this Manual

This user manual is designed to provide information on the proper use of BrainScope One, its functions, specifications, operation, and routine operator care and maintenance. It is recommended that the user read this entire manual, specifically the safety-related information, before operating BrainScope One. Although this manual is intended for trained medical personnel, it does not assume prior knowledge or experience with operator-programmable medical electronics devices.

### 1.2 About BrainScope One

BrainScope One Head Injury Assessment Tools:

1. EEG (see Chapter 4 for detailed instructions)
  - Structural Injury Classifier (SIC)
  - Brain Function Index (BFI)
2. Cognitive Performance (see Appendix 1 for detailed instructions)
  - Complex Reaction Time (Procedural Reaction Time)
  - Match to Sample (Visuospatial Processing)
3. Vestibular / Ocular Function\* (See Appendix 19 for detailed instructions)
  - Vestibular/Ocular Motor Screening (VOMS)
  - Near Point Convergence
  - Accommodation
4. Vestibular / Balance\* (see Appendix 3 for detailed instructions)
  - Balance Error Scoring System (BESS)
  - Modified Balance Error Scoring System (mBESS)
5. Standard Clinical Assessments\* (see Appendix 4 through 18 and Appendix 20 for detailed instructions)
  - Concussion Symptom Inventory (CSI)
  - Graded Symptom Checklist (GSC)
  - Sport Concussion Assessment Tool 3 and 5 (SCAT3 & SCAT5)
  - NFL Sport Concussion Assessment Tool (NFL SCAT)
  - Standardized Assessment of Concussion (SAC)
  - Military Acute Concussion Evaluation (MACE)
  - Acute Concussion Evaluation (ACE)
    - Sports (ACE-Sports), Emergency Department (ACE-ED) and Physician / Clinician Office (ACE-PH)
  - Maddocks Memory Function (Maddocks)
  - Rivermead Post Concussion Questionnaire (Rivermead)

- Primary Care PTSD Screen (PC-PTSD)
- PTSD Checklist (PCL)
  - Civilian (PCL-C), Specific (PCL-S) and Military (PCL-M)

\*BrainScope One may be configured to allow the user to select the standard clinical tools that meet their needs.

## 1.3 Intended Use

Intended for use to analyze a patient's electroencephalograph (EEG) to provide an interpretation of the patient's neuropsychiatric condition.

Intended use as an adjunct to standard clinical practice to aid in the triage of patients who are suspected of a traumatically induced structural brain injury.

Intended to record, measure, and display brain electrical activity.

Intended to be used in Emergency Departments, Urgent Care Centers, Clinics and other environments where trained medical professionals and practitioners practice medicine under the direction of a physician.

## 1.4 BrainScope One Indications for Use



**NOTE:** BrainScope One was cleared by the U.S. Food and Drug Administration under the Trade/Device Name Ahead 300, K#161068. Subsequent clarification to Indications for Use regarding "concussion/mTBI" capabilities was cleared in May 2018 with K#181179

BrainScope One is indicated for use as an adjunct to standard clinical practice to aid in the evaluation of patients who are being considered for a head CT, who sustained a closed head injury within 72 hours, present with a Glasgow Coma Scale score (GCS) of 13-15 (including concussion / mild Traumatic Brain Injury (mTBI)), and are between the ages of 18-85 years. BrainScope One should not be used as a substitute for a CT scan.

The BrainScope One device is intended to record, measure, analyze, and display brain electrical activity utilizing the calculation of standard quantitative EEG (qEEG) parameters from frontal locations on a patient's forehead.

BrainScope One calculates and displays raw measures for the following standard qEEG measures: Absolute and Relative Power, Asymmetry, Coherence and Fractal Dimension. These raw measures are intended to be used for post hoc analysis of EEG signals for interpretation by a qualified user.

A negative BrainScope One Structural Injury Classification using brain electrical activity in patients who sustained a closed head injury within 72 hours, likely corresponds to those with no structural brain injury visible on head CT.

A positive BrainScope One Structural Injury Classification using brain electrical activity in patients who sustained a closed head injury within 72 hours, likely corresponds to those with a structural brain injury visible on head CT.

An equivocal BrainScope One Structural Injury Classification using brain electrical activity in patients who sustained a closed head injury within 72 hours, may correspond to structural brain injury visible on head CT or may indicate the need for further observation or evaluation.

BrainScope One provides a measure of brain function (EEG Brain Function Index, (BFI)) for the statistical evaluation of the human electroencephalogram (EEG).

BrainScope One also provides clinicians with quantitative measures of cognitive performance to aid in the assessment of an individual's level of cognitive function. These measures do not interact with any other device measures, and are stand alone.

BrainScope One also stores and displays electronic versions of standardized clinical assessment tools that should be used in accordance with the assessment tools' general instructions. These tools do not interact with any other device measures, and are stand alone.

## 1.5 Considerations for Using BrainScope One

This device is intended to be used in patients who sustained a closed head injury with a Glasgow Coma Scale (GCS) score of 13-15. The safety and effectiveness of BrainScope One in patients with GCS scores less than 13 has not been established.

BrainScope One is a prescription use device.

Clinical decisions about patients will be made by medical professionals, and BrainScope One is an adjunct to standard clinical practice. Clinical judgment should always be used when interpreting the BrainScope One clinical outputs, and the device should not be used as a stand-alone diagnostic device.

As with any monitored physiological parameter, artifacts and poor signal quality may lead to inappropriate BrainScope One performance.

## 1.6 Intended Operators

BrainScope One is intended as an adjunctive tool for use by properly trained medical professionals and practitioners. Training of BrainScope One operations will be provided by qualified BrainScope Company, Inc. staff through didactic and hands-on education.

## 1.7 Clinical Trial Summary (B-AHEAD III Trial)

The B-AHEAD III Trial was a multi-center, prospective clinical trial with subjects enrolled at 11 clinical sites in the U.S. It was established as a non-significant risk trial in accordance with 21 CFR 812.2(b) (1) (ii). The trial was conducted in accordance with the ethical principles of Good Clinical Practice (GCP).

**Patient Population:** Subjects included males and females ages 18 to 85 (the entire age range) who were admitted to the ED and suspected of a traumatic, closed head injury within 72 hours. The GCS needed to be between 12-15 closest to Ahead 200iC (investigational study device) assessment even if GCS was lower prior to arrival to the ED (e.g., at the time of injury).

**Methods:** The validation was accomplished by comparing the BrainScope One output score to the adjudicated result of the CT scan. CT Scans performed at the clinical sites were submitted in DICOM format for independent review and over-read by experts at the Johns Hopkins University School of Medicine Brain Injury Outcomes Center (BIOS) and final classification of the CT was determined. In cases where subjects were not referred for CT scans by standard clinical practice, they were deemed CT negative if the subject met the following conditions: Glasgow Coma Scale score (GCS) of 15, and sustained a loss of consciousness (LOC) or amnesia and did not have any "clinical" items on the New Orleans Criteria.

## Study Objectives

**Primary Objective(s):** The primary objective of this study was to validate the clinical utility of the BrainScope One device for the acute identification of structural brain injuries in an independent prospective TBI population, following closed head injury. In addition, the study aimed to extend findings of the B-AHEAD II Trial in a large population and replicated and extended the trial using BrainScope One device with respect to the device's target intended use and indications for use.

### Secondary Objective(s):

1. Demonstrate the utility of the EEG Brain Function Index (BFI) score from a given subject presented a percentile of the normal population and an index score.
2. Evaluate the utility of creating a three-tier system for likely CT+ (CT-, Equivocal Zone, and CT+).

**Results:** The total number of completed cases subjects in this trial was 720 resulting in 564 classified as patients without structural brain injury visible on CT (CT-) and 156 classified as patients with structural brain injury visible on CT (CT+). The mean Glasgow Coma Scale (GCS) score for the entire group was 14.97 (SD=0.23), with 99.86% being between 13-15.

The co-primary endpoints successfully achieved statistical significance against performance goals. The estimate of sensitivity is 92.31% with 95% two-sided confidence limits of (86.95%, 95.96%). The estimate for specificity is 51.60% with 95% two-sided confidence limits of (47.38%, 55.79%). Thus these endpoints achieved their respective performance goals at a one-sided alpha of 0.025.

The first and second secondary endpoints demonstrated that the Brain Function Index was associated with functional injury impairment and that the classifier for structural injury visible on CT can be presented in three meaningful groups instead of two (Negative, Equivocal, and Positive). The third secondary endpoint, the predictive values estimated across prevalence values more likely to be found in practice indicated that the negative predictive values was consistently above 95% for prevalence below 25% and was 99% at a prevalence of 5%.

There were only six adverse events reported in this trial with only one related to the device. One subject complained of a reported a burning sensation on the forehead  $1/969 = 0.10\%$  (0.00%, 0.57%). The remaining five adverse events were serious adverse events (SAE) associated with the injury and not associated with the device. The estimated rate for SAE is  $5/981=0.52\%$  (0.17%, 1.20%).

In previous data sets, the Brain Function Index percentile and raw score have been shown to be predictive of the severity of TBI, i.e., there was a continuum of functional abnormality which was demonstrated by increasing abnormality in the metric. The table below shows the percentage of each subgroup (with increasing functional impairment) from an independent hold-out population that fell below the 10th percentile of a normal, non-injured population. This data demonstrates that the BFI was associated with functional injury impairment.

Table 1.7-1 Classes of Non-Head Injured Subjects by the EEG Brain Function Index for the Hold Out Population<sup>a</sup>




Description/ Category	Uninjured Normal Controls (0)	Head Injured Controls (1)	Mild Functional Abnormality (2)	Moderate Functional Abnormality (3)	CT+ (No Measurable Blood) (4)	CT+ (Measurable Blood) (5)
N	318	167	166	153	68	28
<10 <sup>th</sup> Percentile	10.06%	9.82%	16.02%	23.30%	39.46%	52.96%
Standard Deviation	0.00	1.28	3.23	4.32	6.22	7.10

<sup>a</sup> The hold out population is comprised of categories 1-5 that were not used in the creation of the normal percentiles.



## 1.8 Safety Summary

The words WARNING, CAUTION and NOTE have special meaning and should be reviewed.

 <b>WARNING!</b>	Users should pay particular attention to <b>WARNING</b> information. Disregarding <b>WARNING</b> information may compromise the safety of the patient and/or health care staff and may result in injury.
 <b>CAUTION</b>	Users should pay particular attention to <b>CAUTION</b> information. Disregarding <b>CAUTION</b> information may compromise product reliability and may result in damage.
 <b>NOTE</b>	<b>NOTE</b> information supplements and/or clarifies procedural information.



### WARNING!

1. Only trained and experienced health care professionals should use this equipment. Before using any system component or any component compatible with this system, read and understand the instructions.
2. This device is intended to be used in patients who sustained a closed head injury with a Glasgow Coma Scale (GCS) score of 13-15.
3. The safety and effectiveness of BrainScope One in patients with GCS scores less than 13 has not been established.
4. BrainScope One is intended for use by physicians, or under the direction of a physician, who have been trained in the use of the device.
5. Clinical decisions about patients will be made by medical professionals, and BrainScope One is an adjunct to standard clinical practice.
6. Clinical judgment should always be used when interpreting BrainScope One clinical results and the device should not be used as a stand-alone diagnostic device.
7. A positive BrainScope One Structural Injury Classification does not establish the presence of a structural brain injury visible on head CT, since a positive result may be obtained on individuals with abnormal brain electrical activity that do not have a structural brain injury visible on head CT.
8. The Cognitive Performance tests do not identify the presence or absence of clinical diagnoses.
9. When evaluating patients using BrainScope One, take into consideration any medications that the patients may be taking.



## WARNING!

10. As with any monitored physiological parameter, artifacts and poor signal quality may lead to inappropriate BrainScope One performance.
11. Standard clinical assessment of the patient should proceed in the event that insufficient clean (artifact-free) EEG data is collected.
12. Pay special attention to WARNING information. Become familiar with the system components prior to use. Failure to comply may result in patient and/or health care staff injury.
13. If BFI only is configured and SIC disabled, information related to the likelihood of a structural injury will NOT be displayed. The BFI does not indicate the presence or absence of structural brain injury.
14. Upon initial receipt and before each use, inspect system components for damage. DO NOT use if damage is identified. If the internal battery appears to be damaged or leaking, avoid direct contact with the battery and do not use BrainScope One.
15. Only trained and experienced health care professionals should maintain this equipment. Failure to comply may result in patient and/or health care staff injury.
16. This equipment/system may cause radio interference or may disrupt the operation of nearby equipment. It may be necessary to take mitigation measures, such as re-orientation or relocation of the device or shielding the location.
17. DO NOT use BrainScope One for uses other than specified by the Indications for Use.
18. DO NOT attach BrainScope One to the patient when connected to the USB-A Charger.
19. BrainScope One is powered by an internal lithium-ion battery. To prevent injury and/or property damage: do not expose BrainScope One to temperatures in excess of 70 °C (158 °F), do not drop, open, or puncture the battery, and avoid exposure and/or immersion in liquid.
20. DO NOT use BrainScope One on a patient being defibrillated.
21. The DAB module may become hot during prolonged, continuous operation. Monitor the patient as they may experience pain or discomfort. Limit exposure of the DAB to the scalp/hair to minimize any potential hazard.
22. The maximum temperature of the enclosure under worst-case ambient conditions is 42.1°C (107.8°F). Heat transmission to the patient is reduced by ensuring the DAB jacket is in place during operation.
23. Never use the device without the DAB jacket attached to the base of the module.
24. Explosion Hazard: DO NOT use BrainScope One in a flammable atmosphere or where concentration of flammable anesthetics may occur.
25. To reduce the hazard of burns, DO NOT use BrainScope One with high-frequency surgical equipment.



## WARNING!

26. Shock Hazard: DO NOT remove the device covers.
  27. Shock Hazard: BrainScope One meets the ground leakage current and the patient safety current limits specified by the applicable safety standards. As a matter of safe practice, the institution should conduct periodic tests to verify these currents. In the event of spillage of blood or solutions, re-test before further use.
  28. Shock hazard: DO NOT attempt to disconnect the power cord with wet hands. Ensure your hands are clean and dry before touching the power cord.
  29. Shock hazard: Keep the device away from water and other fluids. Ingress protection is not guaranteed during battery charging. Avoid charging the BrainScope One battery outdoors or in wet environments.
  30. Routinely inspect system components for possible exposure to liquid.
  31. BrainScope One should not be used adjacent to or stacked with other equipment. If adjacent or stacked use is necessary, the equipment should be observed to verify normal operation in the configuration in which it will be used.
32. No modification of this equipment is allowed.
  33. BrainScope One is “MR Unsafe” and while its safety in Magnetic Resonance Imaging (MRI) environments has not been specifically evaluated, it contains materials that are known to pose hazards in all MRI environments.
  34. MR Unsafe - Keep the device and system components away from magnetic resonance imaging (MRI) equipment.

## 1.9 User's Manual Conventions

In this User's Manual, the following conventions are used to explain operation of BrainScope One:

- Phrases in bold and all capital letters refer to **BUTTONS** on the handheld screen that should be pressed to execute a specific action.
  - Example: **SETUP** – takes you to the set up screen to set date and time, enter new operators, etc.
- Phrases in bold and italics represent ***Screen Names*** that are displayed at the top left on the handheld and can help with navigation.
  - Example: ***Information Hub*** – the first screen you see when the handheld is ready for use.

## CHAPTER 2: Quick Start Guide



### WARNING!

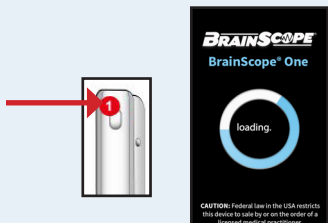
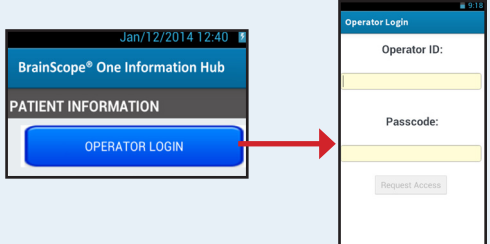

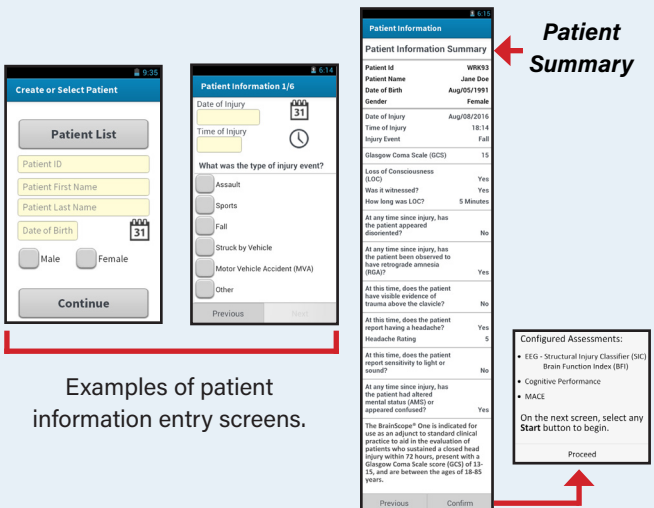
This "Quick Start Guide" is intended only as an operating checklist for users already familiar with BrainScope One. Do not proceed unless you have read the "Safety Summary" (Chapter 1 of this manual).

When you log in to the device you will be presented with the assessments configured by the Administrator. You are then able to perform the configured battery of assessments sequentially. You will be guided through a patient session by always starting at and returning to the **BrainScope One Information Hub**. This process is described below:



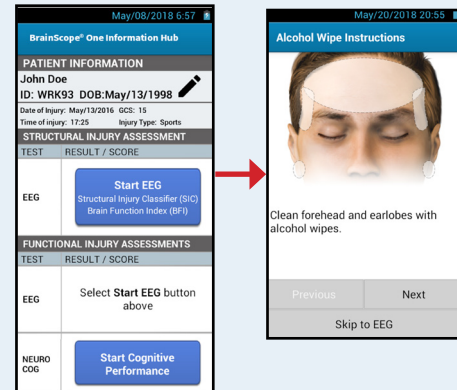
### NOTE:

- Only assessments configured in **TEST CONFIGURATION** will be accessible. See Section 3.5.2 for detailed instructions.
- If issues arise during device operation, see Chapter 7 of the manual for troubleshooting.

<p>1. Power <b>ON</b> BrainScope One.</p>	
<p>2. Perform <b>Operator Authentication</b>.</p>	
<p>3. Enter patient information and injury details. When all details have been entered, on the <b>Patient Summary</b> press <b>CONFIRM</b> that the information for that patient is accurate. The device will then provide a list of <b>Configured Assessments</b>. Press <b>PROCEED</b> to return to the <b>Information Hub</b> to begin any of the configured assessments.</p> <p> <b>WARNING:</b> Patient must be between 18-85 years of age, closed head injury within 72 hours, and GCS 13-15. Must read the questions and enter responses accurately.</p>	<p><b>Examples of patient information entry screens.</b></p>  <p><b>Patient Summary</b></p> <p><b>Configured Assessments:</b></p> <ul style="list-style-type: none"> <li>• EEG - Structural Injury Classifier (SIC)</li> <li>• Brain Function Index (BFI)</li> <li>• Cognitive Performance</li> <li>• MACE</li> </ul> <p>On the next screen, select any Start button to begin.</p> <p>Proceed</p>

4. Press **START EEG** for the first assessment (in the figure on the right, the first assessment is performing the Structural Injury Assessment).

The device will then provide onboard steps for preparing the patient for the headset. Press **NEXT** to follow the onboard steps or press **SKIP TO EEG** to proceed to impedance check.



5. Prep the forehead, temples and earlobes with the alcohol wipe and the skin prep pad included in the headset package.

- 1) Clean the forehead, temples and earlobes with the alcohol wipe.
- 2) Prep the forehead by using firm pressure and a steady wiping motion with the skin prep pad in an inverted T formation over the forehead, the temples and earlobes. Wipe the areas two times each with the skin prep pad.



6. Center headset and align the nasion tab properly. Apply the headset to the patient, starting from the center and working outward toward the ears. Place ear loops behind each ear.



**NOTE:** Remove electrode covers prior to placing electrodes.

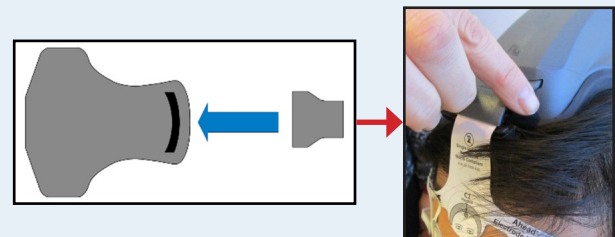


7. Connect the headset to the DAB.

Insert the headset straight and level into the device port until resistance is met.

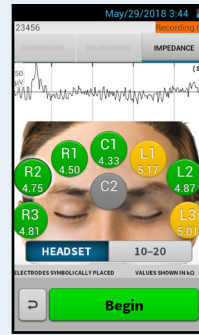
- The headset will not click when inserted.
- If necessary, disconnect the headset in a straight outward path.
- Avoid insertion or removal at any angle.

Once the headset has been applied press **NEXT** to begin impedance testing.

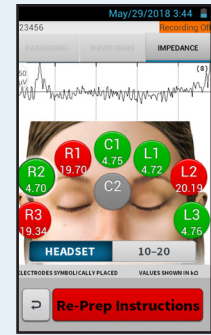


## 9. Check impedance values.

- If yellow or green ( $< 10 \text{ k}\Omega$ ), then press **BEGIN** to start recording.
- If red ( $> 10 \text{ k}\Omega$ ), then press **RE-PREP INSTRUCTIONS** to see steps to re-prepare the area until acceptable:
  - Press electrode firmly in place
  - If remains red, lift electrode and wipe skin again with skin prep pad
  - Replace the electrode and firmly press in place



Press **BEGIN** to start recording.



Re-prepare the area under the red electrodes.

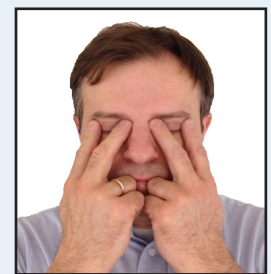
## 10. Instruct the patient to close their eyes and stay relaxed (figure a).

Troubleshooting instructions if artifacts detected during EEG data collection:

- Gently place your fingers on the inner and outer corners of the eyes (figure b)
- Stare straight ahead with eyes closed
- Open your mouth to relax your jaw
- Dim the lights



a

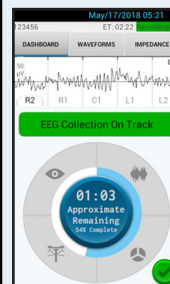


b

## 11. Perform the EEG data collection process until BrainScope One has indicated that there is enough clean data to provide results.

Enough clean data will be collected when the blue circle is filled, or 10 minutes have passed. A **Patient Information Confirmation** message will display. Review the Patient Information and press **CONFIRM** to proceed with calculating the classification results.

If not enough clean data was collected, then no results will be computed, re-attempt session.



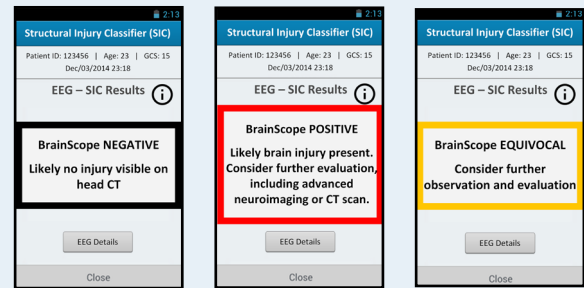
Confirm Patient Information  
Please confirm the accuracy of the Patient Information before EEG results are calculated. The patient's Date of Birth cannot be modified after EEG results have been calculated.

EEG Recording Status  
The EEG Recording session has completed successfully. Now computing TBI results.  
Note: Please do not connect the device to power while calculating results.

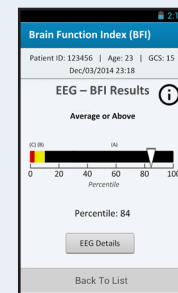


12. Review the Results presented (Both the Structural Injury Classifier (SIC) and if configured, the Brain Function Index (BFI))

- A Negative Result indicates it likely corresponds to those with no structural brain injury visible on head CT.
- A Positive Result indicates it likely corresponds to those with structural brain injury visible on head CT.
- An Equivocal Result indicates it may correspond to structural brain injury visible on head CT or may indicate the need for further observation or evaluation.



**SIC Results**



**BFI Results**

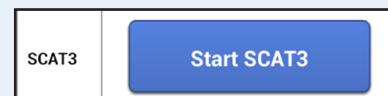
13. Return to the **Information Hub**

- The EEG Results are now displayed in place of **START**

STRUCTURAL INJURY ASSESSMENT		
TEST	RESULT / SCORE	
EEG	Structural Injury Classifier (SIC)	<b>Negative</b> Likely no head injury visible on head CT
FUNCTIONAL INJURY ASSESSMENTS		
TEST	RESULT / SCORE	
EEG	Brain Function Index (BFI)	<b>52<sup>nd</sup> Percentile</b> Average or Above <b>A</b>

14. The cycle above is then repeated for the next selected test.

15. Press **START** for the next assessment (In the figure the example is SCAT3)



16. Conduct the assessment and record the SCAT3 responses



## 17. Review the Detailed Results presented

**SCAT3 Sideline**

**Sideline Assessment Summary**

**Patient ID: 123456**

**Potential signs of concussion:**

Any loss of consciousness?	Yes
If so, how long?	0
Balance or motor incoordination (stumbles, slow/ laboured movements, etc.)?	None
Disorientation or confusion (inability to respond appropriately to questions)?	None
Loss of memory:	None
If so, how long?	None
Before or after the injury?	None
Blank or vacant look:	None
Visible facial injury in combination with any of the above:	None
<b>Glasgow coma scale (GCS)</b>	<b>0</b>
<b>Maddocks Score</b>	<b>0</b>

Any athlete with a suspected concussion should be REMOVED 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.

Previous Confirm

## 18. Return to the **Information Hub**

- The SCAT3 results are now displayed in place of **START**

Sideline Assessment	View
Symptom Count	17/22
Symptom Severity Score	72/132
SAC	10/30
mBESS	8 Errors
Tandem Gait	N/A
Coordination	0

The cycle continues for any further assessments or until the operator exits or powers **OFF** BrainScope One.

## CHAPTER 3: Getting Started

**WARNING!**

- To avoid injury, read important safety information in Section 1.8 before using BrainScope One.

This section provides information for preparing BrainScope One for the first time. It also can be used as a reference for setting up the device at a later time.

### 3.1 System Equipment and Supplies

BrainScope One consists of the following system equipment (Figure 3-1):

1. EEG Acquisition Unit (Handheld Computer for data collection and results display)
  - a. The touch screen is the primary interface for handheld operation. The screens change as the handheld is operated.
  - b. The front panel has four buttons, an indicator light, and a touch screen display.
2. Data Acquisition Board (DAB) Module
  - a. The DAB connects to the handheld and is the interface between the headset and the handheld for data acquisition. The DAB will be placed on top of the patient's head when the headset is applied. The DAB also contains a micro-USB port that allows for charging of the system when not applied to a patient.
3. International Charging Kit
  - a. International Charging Kit for recharging the internal rechargeable battery pack in the BrainScope One handheld.
  - b. Connects to the DAB while charging.



**Figure 3-1:**  
**BrainScope One System Equipment**

BrainScope One consists of the following accessories (Figure 3-2):

1. Electrode Headset (a proprietary electrode sensor)
  - a. Collects EEG signals from the frontal regions of the brain and sends them to the handheld.



**Figure 3-2:**  
**Electrode Headset (package and insert)**

## 3.2 International Charging Kit



### **WARNING!**

- Use only the International Charging Kit shipped with BrainScope One to charge the BrainScope One EEG Acquisition Unit (Figure 3-1). Unapproved power supplies may cause damage to the device and increase the risk of electrical shock. Use of the International Charging Kit to power other devices could cause damage.
- Do not utilize a computer using the USB connector as a primary method to recharge the device's battery. Use of the International Charging Kit on other devices could damage them.
- The handheld contains a lithium-ion rechargeable battery. If the battery becomes worn out or damaged, it must be removed by a qualified service technician and disposed of or recycled in accordance with national, state and local laws. Do not attempt to incinerate or dispose of the device or the battery yourself. Improper disposal poses a risk of fire or explosion.



**CAUTION:** DO NOT disconnect or reconnect the DAB cable with the system power turned on. Damage to the handheld may occur.

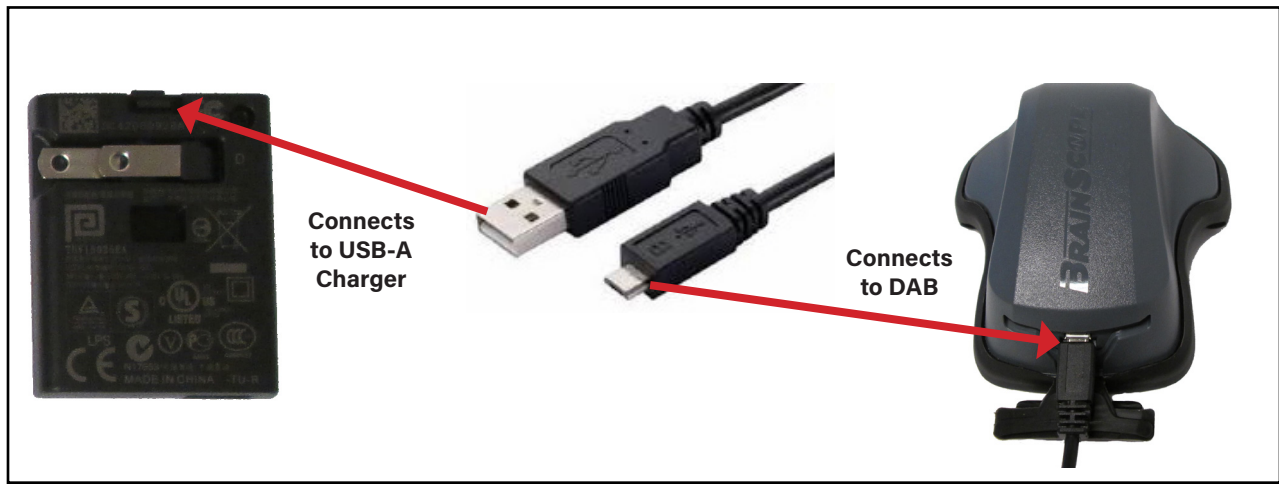
BrainScope One is internally powered by a lithium-ion rechargeable battery pack. A separate International Charging Kit is provided for battery charging (Figure 3-3). A new BrainScope One will come with the battery partially charged and it will be necessary to charge the battery completely before using it for the first time. The battery should be charged for four hours to recharge it fully. If the battery has been stored for longer than six months, charge it completely before use.

## Charging BrainScope One:



**NOTE:** When using the International Charging Kit, make sure that it is fully assembled prior to plugging it into a power outlet.

1. Plug the USB-A end of the USB-A to Micro-B USB Cable into the USB-A port on the USB-A Charger.
2. Plug the other end of the USB-A to Micro-B USB Cable into the receptacle on the front on the DAB.
3. Insert the plug of the USB-A Charger into an AC outlet (100-240 V, 50-60 Hz).



**Figure 3-3:**  
**Assembly of the International Charging Kit**

The battery will charge continuously when the handheld is connected to the USB-A Charger and the USB-A Charger is plugged into an outlet, even when the handheld is turned off.



**NOTE:** While the Micro-B USB port is connected to a power source, the DAB Module electronics are powered off for safety purposes.

Unplugging the International Charging Kit from the handheld or from the AC outlet automatically switches the handheld to battery mode. Prior to complete battery discharge, an indication will appear notifying the operator of the handheld's low battery status.

The handheld will have to be returned for service should the battery need replacement. The handheld should **never** be opened by the operator.



**NOTE:** The LED on the handheld indicates the battery power or charging status, and operating system notifications, as shown below:

LED State	Handheld/Battery State
Solid Orange	Battery is charging
Flashing Orange	Battery is charging, operating system notification; or, operating system notification, battery is not charging
Solid Red	Low battery charge
Flashing Red	Low battery charge, operating system notification
Solid Green	Battery fully charged
Flashing Green	Battery fully charged, operating system notification

## 3.3 Battery Gauge Icon

On every screen, a battery gauge icon (Figure 3-4) in the upper right corner indicates the remaining battery level in the internal rechargeable battery.

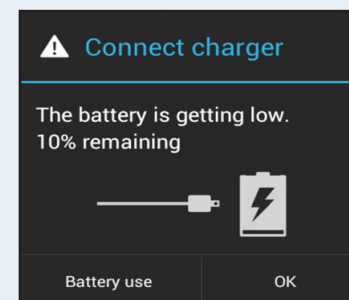
When the battery level has less than 16% remaining, a warning indication will appear requesting to check the battery status before continuing with testing. (Figure 3-5)

If use of the handheld is continued without charging, the battery warning indication will continue to appear until the handheld has been connected to the International Charging Kit.

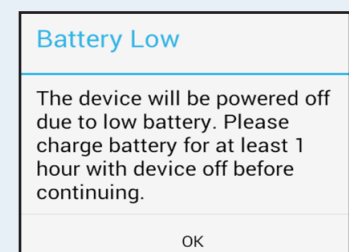
If the battery becomes less than 12% charged and a session is not running, a warning indication will appear. Pressing **OK** on the warning screen shuts down the handheld. (Figure 3-6)



**Figure 3-4:**  
Battery Gauge Icon



**Figure 3-5:**  
Warning that 16% of battery level remains



**Figure 3-6:**  
Warning the handheld will power off

## 3.4 Buttons

### 3.4.1 Physical Buttons

Most of the buttons on the BrainScope One handheld are virtual ones on the touchscreen. A few physical buttons control basic functions, such as powering BrainScope One ON/OFF or quick access to the **Main Menu** or **Information Hub**.

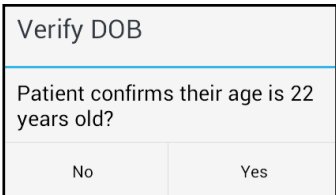

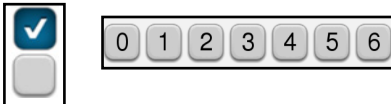

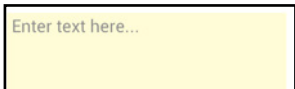




Figure 3-7:  
BrainScope One Front Panel Buttons


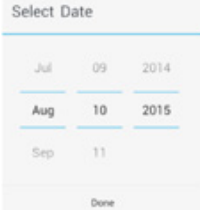

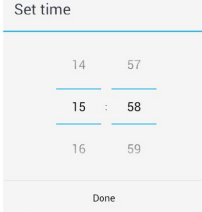
Front Panel Buttons	
Home	<ul style="list-style-type: none"> <li>Returns to the <b>Information Hub</b>. If you are performing an assessment, a dialog box will appear once pressed asking if you are sure you want to exit and inform you that data will not be saved if exited out of current screen. When pressed during EEG, the EEG menu appears.</li> </ul>
Menu	<ul style="list-style-type: none"> <li>Opens the <b>Main Menu</b> for accessing device settings, operators, software/firmware versions, etc.</li> <li>The Menu button is disabled during an EEG recording.</li> </ul>
Back	<ul style="list-style-type: none"> <li>When not currently in an assessment test, returns to the <b>Previous Screen</b> or dismisses the currently displayed message or menu.</li> <li>If pressed during an assessment test, will return to the <b>Information Hub</b>. You will be asked if you are sure you want to exit the current screen. Data loss if exited from an assessment will occur.</li> <li>When pressed during EEG, the EEG menu appears.</li> </ul>
Search	<ul style="list-style-type: none"> <li>This button is disabled in all screens. Pressing the button will not perform any action.</li> </ul>
Power	<ul style="list-style-type: none"> <li>Powers on and off the device.</li> </ul>

## 3.4.2 Touchscreen Buttons

The main operation of BrainScope One is controlled via the touchscreen interface display, which comprises touch-sensitive display fields and buttons for entering, navigating and displaying information on BrainScope One. When a button is pressed, additional screens may appear to allow for data entry, navigation and selection of actions. To use touchscreen buttons, press the buttons on the touchscreen with a fingertip. Examples of each of the common touchscreen buttons are provided below:

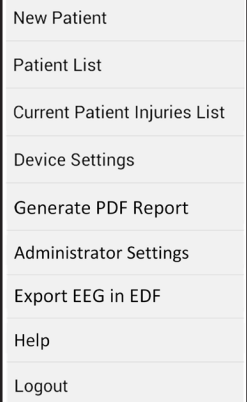
Type of Button	Example	Action
<b>Dialog Box Buttons</b>	Ok, Dismiss, Save, Quit, Done, Yes, No  Example of a dialog box button: 	<ul style="list-style-type: none"> <li>Shown at the bottom of the dialog box. Pressing the button will perform an action such as closing the dialog box.</li> </ul>
<b>Screen Navigation Buttons</b>	Next, Close, Save, Confirm, Previous, Proceed  Example of a screen navigation button: 	<ul style="list-style-type: none"> <li>Displayed at the bottom of a screen. These buttons allow for navigating to next or previous screens, saving and closing screens, etc. When a button is deactivated it will be greyed out.</li> </ul>
<b>Boxes</b>	Checkboxes, scoring 	<ul style="list-style-type: none"> <li>Box that can be selected or deselected by pressing.</li> </ul>
<b>Start Button</b>		<ul style="list-style-type: none"> <li>The start button is displayed on the <b>Information Hub</b> next to each assessment.</li> </ul>
<b>Text entry fields</b>		<ul style="list-style-type: none"> <li>Text entry fields are identified with a yellow box and a text prompt. When pressed the onscreen keyboard will appear allowing text entry.</li> </ul>
<b>Onscreen Keyboard</b>		<ul style="list-style-type: none"> <li>The onscreen keyboard lets you enter text when needed. Pressing <b>DONE</b> or <b>NEXT</b> on the onscreen keyboard will close the keyboard.</li> </ul>
<b>Pencil Icon</b>		<ul style="list-style-type: none"> <li>Button that allows editing of data.</li> </ul>



Type of Button	Example	Action
<b>Calendar Button</b>	 	<ul style="list-style-type: none"> <li>Pressing the calendar icon button will display a dialog box. Using your finger, swipe vertically through each field to set the month (Jan, Feb, Mar, Apr, etc.), date (1-31), and year (e.g. 1980, 1981, etc.). Press <b>DONE</b> when all information is entered.</li> </ul>
<b>Time Button</b>	 	<ul style="list-style-type: none"> <li>Pressing the time icon button will display a dialog box. Using your finger, swipe vertically through each field to set the hour (01, 02, 14, 18, etc.) and the minute (01, 02, 55, etc.). Press <b>DONE</b> when all information is entered.</li> </ul>

## 3.5 Set Up - Main Menu

The **Main Menu** appears when the physical **MENU** button is pressed on the handheld. (Figure 3-8)

Main Menu Screen	Menu Item	Access Level	Options
 <p><b>Figure 3-8: Main Menu</b></p>	New Patient	All Users	Add new patients to the database. When selected proceeds to the Patient Information screens (refer to sections 4.3 and 5.2 for instructions)
	Patient List	All Users	When selected proceeds to the patient database list where patient information can be reviewed and edited. (refer to section 5.1 for instructions)
	Current Patient Injuries List	All Users	Returns to the list of injuries for the current patient.
	Device Settings	All Users	Additional options under device settings includes: screen brightness, battery information, settle time, date and time and about (serial numbers).
	Generate PDF Report	All Users	Allows the user to generate a report of tests that were completed on a specific patient.
	Administrator Settings	Administrators Only	Allows for setting operator specific settings such as user name and password.
	Export EEG in EDF	All Users	Initiates EEG data to export to EDF on the SD Card.
	Help	All Users	Provides access to help topics for the device such as training videos and device troubleshooting.
	Logout	All Users	Logs out the current user of the device.



## 3.5.1 New Operator

At the initial set up of a new handheld, an initial Administrator must be setup with privileges to add new operators who will be granted access to use the BrainScope One. (See section 4.3.1 for detailed instructions)

Only Administrators have access to add new operators.

1. Press the physical **MENU** button on the handheld.
2. Press **ADMINISTRATOR SETTINGS** and log in to the device.
3. Select **NEW OPERATOR** from the list of options.
4. Press Operator ID and the onscreen keyboard will appear.
5. Enter an Operator ID (i.e. initials or Employee ID).



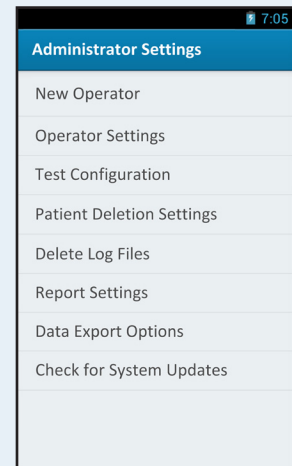
**NOTE:** If the new operator is not to be granted rights to be an Administrator, uncheck the box.

6. Press the cursor under the Operator First Name and enter the operator's first name. Repeat and enter the operator's last name.
7. Press the cursor under the Operator Password and enter a password to be assigned to this operator.
8. When complete, press **ADD**.

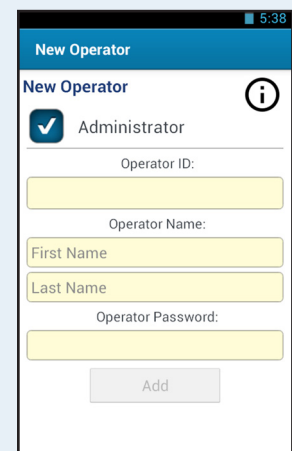


**NOTE:** To add more operators, repeat steps 4 through 8 to enter new operator(s) authorized to use the BrainScope One handheld.

9. When complete, press the physical **BACK** button to return to the **Administrator Settings Menu**.



**Figure 3-9:**  
**Administrator Settings Menu**



**Figure 3-10:**  
**Initial Operator Set-up**

## 3.5.2 Test Configuration

The Administrator can configure BrainScope One for which assessments will be available to users.



**NOTE:** Only an Administrator can access the Test Configuration.

1. Press the physical **MENU** button on the handheld.
2. Press **ADMINISTRATOR SETTINGS**
3. Enter the Administrator ID and Password and press **REQUEST ACCESS**.
4. Press **TEST CONFIGURATION**.
5. To enable or disable specific tests available on BrainScope One, select from the list by pressing the checkbox next to the test. A checkmark will appear for the tests selected.
  - a. The Brain Electrical Activity section offers the following three options:
    - i. Structural Injury Classifier (SIC) EEG Assessment only,
    - ii. Brain Function Index (BFI) EEG Assessment only, or
    - iii. Both EEG Assessments can be chosen.
  - b. Remaining tests can be chosen individually.



**NOTE:** Any assessment checked on this screen will be present on the **Information Hub**.

6. When complete, press the physical **BACK** button to return to the **Administrator Settings Menu**.



### WARNING!

- If BFI only is selected and SIC disabled, information related to the likelihood of a structural injury will NOT be displayed. The BFI does not indicate the presence or absence of structural brain injury.

Test Category	Test Name	Status
BRAIN ELECTRICAL ACTIVITY - EEG	Structural Injury Classifier EEG Assessment	<input type="checkbox"/>
	Brain Function Index EEG Assessment	<input type="checkbox"/>
	Both EEG Assessments	<input checked="" type="checkbox"/>
COGNITIVE PERFORMANCE	Cognitive Performance Assessment	<input checked="" type="checkbox"/>
	Vestibular/Ocular Motor Screening (VOMS)	<input checked="" type="checkbox"/>
VESTIBULAR / OCULAR FUNCTION	Near Point Convergence	<input type="checkbox"/>
	Accommodation	<input type="checkbox"/>
	Vestibular / BALANCE	BESS
	mBESS	<input checked="" type="checkbox"/>
	SYMPTOMS CHECKLISTS	Concussion Symptom Inventory (CSI)
Graded Symptom Checklist (GSC)		<input checked="" type="checkbox"/>
STANDARD CLINICAL ASSESSMENTS	MACE	<input checked="" type="checkbox"/>
	ACE-Emergency Department	<input type="checkbox"/>
	ACE-Physician Office	<input type="checkbox"/>
	ACE-Sports	<input checked="" type="checkbox"/>
	SAC	<input type="checkbox"/>
	SCAT3	<input checked="" type="checkbox"/>
	SCAT5	<input type="checkbox"/>
	NFL SCAT	<input type="checkbox"/>
	Maddocks Score	<input type="checkbox"/>
	Rivermead Post-Concussion Symptoms Questionnaire	<input type="checkbox"/>
	Primary Care PTSD Screen (PC-PTSD)	<input checked="" type="checkbox"/>
	PTSD Checklist – Civilian Version (PCL-C)	<input checked="" type="checkbox"/>
	PTSD Checklist – Civilian Version (PCL-S)	<input type="checkbox"/>
	PTSD Checklist – Military Version (PCL-M)	<input type="checkbox"/>

**Figure 3-11:**  
**Test Configuration Set-up**

## 3.5.3 Device Settings - Device

### Brightness:

1. Press the physical **MENU** button on the handheld.
2. Press **DEVICE SETTINGS**.
3. Press **BRIGHTNESS** and a pop-up box will appear.
4. Choose either:
  - a. Auto Brightness to automatically adjust the screen brightness based on the current environment, or
  - b. Use your finger and slide the blue dot to make the screen brightness darker or lighter.
5. Press **OK** when complete or **CANCEL** to reject changes made.

### Battery:

Under Device in Device Settings you can view the remaining percentage (%) of battery level. The percentage will be displayed next to Battery.

## 3.5.4 Device Settings - EEG

### Settle Time:

Settle time will delay the recording of the EEG data for a specified time (0 seconds, 30 seconds, or 1 minute). This time allows for the patient to relax and prepare for clean EEG data to be recorded. The handheld defaults to 0 seconds.

The settle time selections in Device Settings will result in the following:

- Selecting 0 seconds will result in the timer on EEG Acquisition starting at 0:00 seconds
- Selecting 30 seconds will result in the timer on EEG Acquisition starting at -0:30 seconds
- Selecting 1 minute will result in the timer on EEG Acquisition starting at -1:00 minute

### Show Elapsed Time:

Elapsed time will allow for displaying elapsed time during an EEG recording. When the **OFF** switch is shown, the application will not display the elapsed time and will instead display the estimated time to completion inside the blue circle on the **EEG Acquisition Dashboard**. When the **ON** switch is selected the application shall display the elapsed time in the blue circle and the estimated time to completion in the header of the **EEG Acquisition Dashboard**.

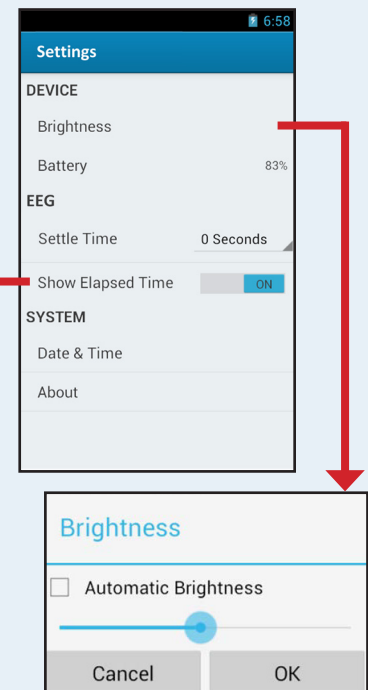


Figure 3-12:  
Brightness Settings

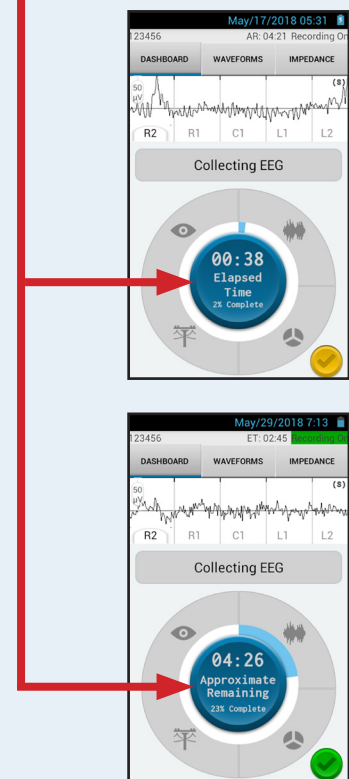


Figure 3-13:  
Examples of Elapsed and  
Approximate Remaining Time on  
the EEG Acquisition Dashboard

## 3.5.5 Device Settings - System

### Date and Time:

1. Press the physical **MENU** button on the handheld.
2. Press **DEVICE SETTINGS**.
3. Press **DATE & TIME**

#### Set Time Format

Press **24 HOUR** to toggle between 24 hour and 12 hour.

#### Set Time Zone

1. Press **SET TIME ZONE** and a dialog box will appear.
2. Press on the current time zone and a list of time zones will appear.
3. Use your finger to scroll and set the desired time zone.
4. Press **APPLY AND SHUT DOWN** when complete. The BrainScope One handheld will power OFF to apply the change to the current time zone.

#### Set Date & Time Using GPS

1. Press **SET DATE & TIME USING GPS** and a dialog box will appear showing the handheld is acquiring the GPS Time. A pop-up box will appear when the date and time are acquired.
2. Press **DISMISS** when complete.

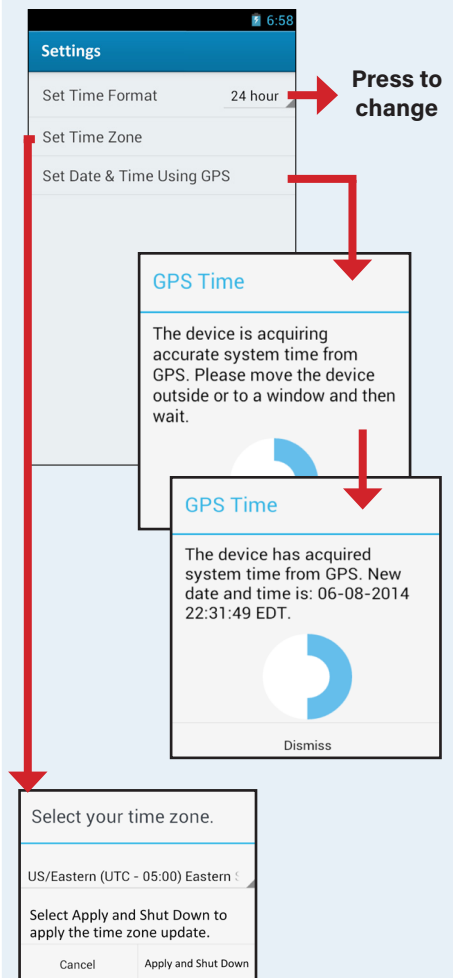


**NOTE:** For best results, the handheld should be outdoors with a clear view of the sky while acquiring GPS time. The handheld should not be connected to a charger while acquiring GPS Time so that the clocks on both the handheld and DAB can be set to the correct time.

### About

To lookup handheld specific information such as Serial Number, Software version, etc.:

1. Press the physical **MENU** button on the handheld.
2. Press **DEVICE SETTINGS** from the list.
3. Press **ABOUT** and a dialog box will appear displaying the information.
4. Press **SHOW LICENSES** to display all supporting software libraries with required licensing information.
5. Press **DISMISS** and the About box will close.



**Figure 3-14:**  
**Setting Date and Time**



**Figure 3-15:**  
**About BrainScope One**

## 3.5.6 Operator Settings

The Operator Settings option allows the Administrator to set an operator timeout that will automatically log an operator out after a set amount of inactivity. This option also allows the Administrator to edit passwords and change Administrator rights. Only Administrators have access to Operator Settings.

1. Press the physical **MENU** button on the handheld.
2. Press **ADMINISTRATOR SETTINGS** and log in to the device. Press **Operator Settings** and the **Operator Settings Menu** will display (Figure 3-16).
3. When the **Operator Timeout** is set to **OFF**, the operator timeout is disabled. When the **Operator Timeout** is set to **ON**, the operator timeout is enabled.
4. The time of inactivity can be set to either 10, 15, 20, or 30 minutes.

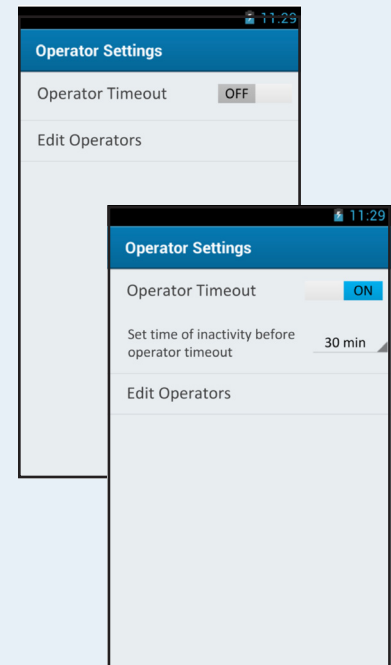


**NOTE:** After 35 minutes of inactivity, the device will automatically power down.

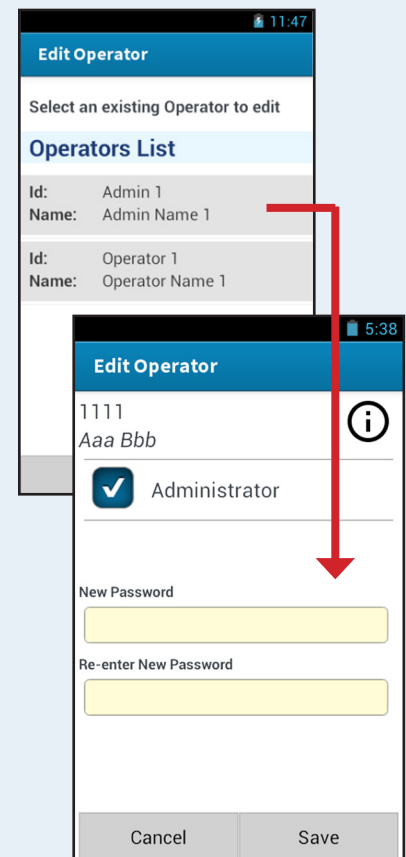
5. Press **EDIT OPERATORS** and the **Operators List** will display listing the Operator ID and Operator Name associated with the handheld.
6. Select the Operator ID from the list to go to **Edit Operator**. Follow the guidelines below when creating and editing operator passwords:
  - a. Operator Password must:
    - Be between 7 and 20 characters
    - Contain letters and at least one number/special character (except @)
    - Not be one of the last 7 passwords
7. Press the New Password field and enter a new password.
8. Press the Re-enter New Password field and re-enter the new password assigned.
9. Press **SAVE** to save the record.
10. Press **CANCEL** to exit the screen and return to the **Operators List**.
11. Check the Administrator box if the operator is being given Administrator rights.
  - a. Un-check the Administrator box and the operator will be removed from the administrator list.



**NOTE:** Only Administrators have rights to check and un-check this box.



**Figure 3-16:**  
**Operator Settings Menu**



**Figure 3-17:**  
**Operator Settings**

## 3.5.7 Patient Deletion Settings

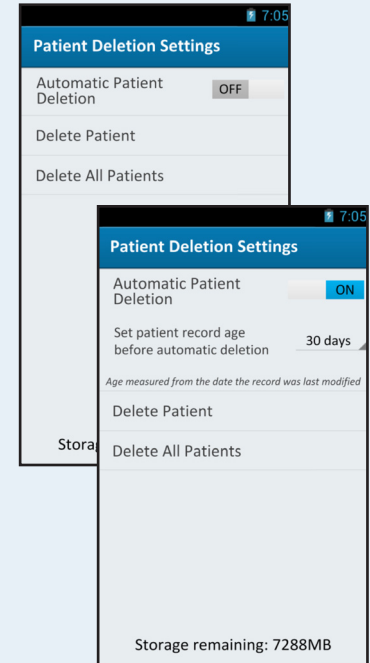
The patient deletion settings allow an administrator to select automatic deletion settings to manage data storage on the handheld, as well as delete all patients on the handheld. Only Administrators have access to Patient Deletion Settings.

1. Press the physical **MENU** button on the handheld.
2. Press **ADMINISTRATOR SETTINGS** and log in to the device. Press **Patient Deletion Settings** and the **Patient Deletion Settings Menu** will display (Figure 3-18).
3. When the **Automatic Patient Deletion** is set to **OFF**, the automatic patient deletion feature is disabled. When the **Automatic Patient Deletion** is set to **ON**, patient data is automatically deleted.
4. When **Automatic Patient Deletion** is set to **ON**, the administrator must set record age (in days) before automatic deletion will occur. Choose the following options from the drop down list - 10, 15, or 30 days. The handheld will prompt a confirmation when **Automatic Patient Deletion** is selected.

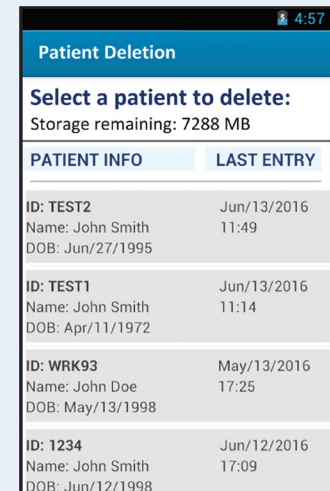


**NOTE:** For example, if the set record age was set at "10 days", patient records would remain on the device for 10 days. On the 11<sup>th</sup> day, at device start-up, that patient record would be deleted automatically.

5. The **Patient Deletion Settings** allow for the following manual deletion actions:
  - Delete Patient - review and select individual patient records to delete (Figure 3-19).
  - Delete All Patients - all patient data will be permanently deleted from the handheld. Press **CONTINUE** to confirm deletion. Press **CANCEL** to return to **Patient Deletion Settings**.
6. The amount of internal database storage available in megabytes (MB) is displayed on the **Patient Deletion Settings Menu**.



**Figure 3-18:**  
**Patient Deletion Settings Menu**



**Figure 3-19:**  
**Patient Deletion**



### 3.5.8 Delete Log File

BrainScope One allows an administrator to delete log files from internal storage on the device. All log files, except for the unencrypted Device Log, will be deleted when selecting Delete Log Files from Administrator Settings.

1. Press the physical **MENU** button on the handheld.
2. Press **ADMINISTRATOR SETTINGS** and log in to the device. Press **Delete Log Files** and the a message screen will display (Figure 3-20).
3. Press **CONTINUE** to proceed with deleting the log files. A message will indicate when the deletion of the files was a success.

### 3.5.9 Report Settings

The Report Settings option allows the operator to turn on/off automatic report generation and configure specific patient information fields on the report. Only Administrators have access to Report Settings.

When the Automatic Report Generation switch is set to ON, patient reports will automatically generate when leaving a session. To turn off the automatic generation, toggle the switch to the OFF position. Operators can still generate the Patient Report manually from the **MENU** button.

The Administrator can toggle on/off patient information fields on the patient report. To populate the report header with *Patient Name*, *Patient Date of Birth*, and/or *Patient Gender*, slide the toggle switch from OFF to ON.

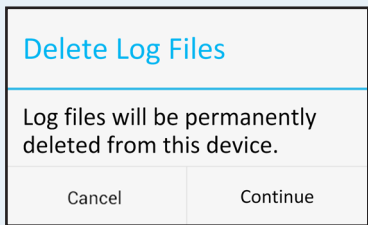


**NOTE:** The Automatic Report Generation will default to the ON position.

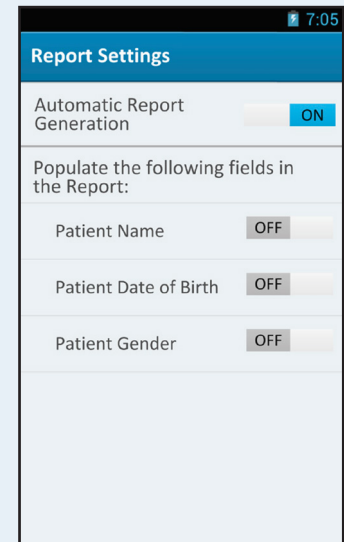


#### **WARNING!**

By populating these fields, Protected Health Information (PHI) data will be printed on the report. Take necessary steps to protect the privacy and security of the content as mandated by HIPAA.



**Figure 3-20:**  
**Delete Log Files**



**Figure 3-21:**  
**Report Settings**

## 3.5.10 Help Menu

The **Help Menu** provides access to useful information about the operation of the device and troubleshooting tips.

1. Press the physical **MENU** button on the handheld.
2. Press **HELP** to enter the **Help Menu**.

Once in the **Help Menu**, there are options to view a refresher training video, instructions for PDF Report Printing and troubleshooting topics.

- **View Refresher Training Video** - onscreen video of the BrainScope One training.
- **PDF Report Printing Instructions** - instructions for how to print a PDF Report.
- **Impedance Troubleshooting** - tips to help with unacceptable impedance values and if impedance values indicate OFF.
- **Handheld Troubleshooting** - tips to help with the handheld not responding to user commands, incorrect Date and Time, and battery depletion.
- **EEG Data Troubleshooting** - tips to help with EEG data connection failure and insufficient data collected.
- **SD Card Troubleshooting** - tips to help when the SD card is full.

## 3.5.11 Logout

The Logout option allows the operator to logout of the handheld.

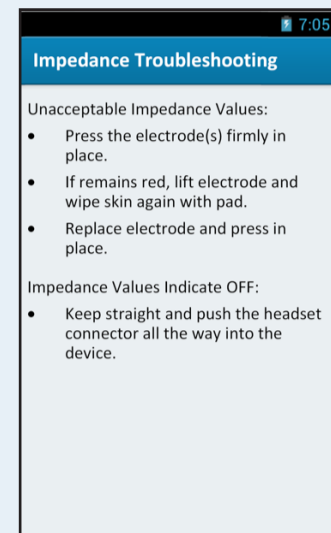
1. Press the physical **MENU** button on the handheld.
2. Press **LOGOUT** and the current operator will be logged out.
3. The application will navigate to the **Disabled Information Hub** (see Section 4.3.1 for more information on the **Information Hub**).



**Figure 3-22:**  
**Help Menu**



**Figure 3-23:**  
**Refresher Training Video**



**Figure 3-24:**  
**Example of troubleshooting tips**



## CHAPTER 4: Principles of Operation

### 4.1 Introduction

This section describes the principles of device operation. It is assumed that the BrainScope One handheld has been set up with operators and test configurations already. If initial set up has not been completed, please refer to Chapter 3 for instructions on how to do so before proceeding with this chapter.

Read this chapter before operating BrainScope One in a clinical setting.

### 4.2 Power ON / OFF

Turn on the handheld by pressing the power switch (1) located on the right side of the handheld (Figure 4-1).

Before collecting data, make sure that BrainScope One has sufficient charge. The Battery Gauge icon should indicate at least 15%. If not, recharge the battery (see Chapter 3).

To power off the handheld, press and hold the power button. A dialog box will appear: press **POWER OFF** and a second dialog box will appear to confirm shutdown. Press **OK** to confirm the shutdown and the handheld will power off. Operator can also press **CANCEL** to cancel the shutdown and return to the screen.

### 4.3 Session Initiation – Information Hub and Patient Information

#### 4.3.1 Initial Set Up

At the initial set up of a new handheld, an initial Administrator must be setup with privileges to add new operators who will be granted access to use BrainScope One.

1. Press the **OPERATOR LOGIN** from the *Disabled Information Hub*.
2. Enter the default password that has been provided by BrainScope.
3. Press **REQUEST ACCESS**.
  - a. The **New Operator** screen will then be displayed with the Administrator field checked.
4. Press Operator ID and the onscreen keyboard will appear.



Figure 4-1: Power ON/OFF

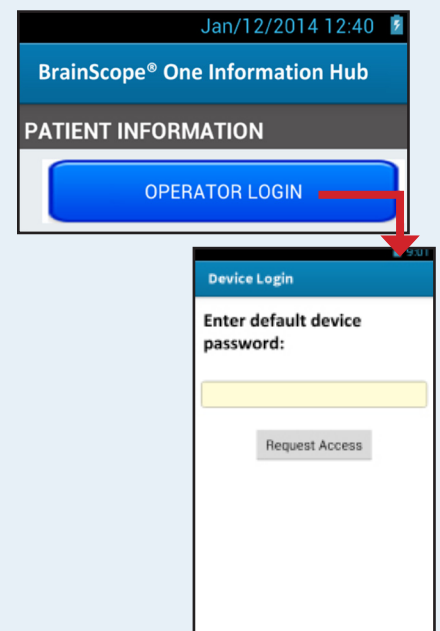


Figure 4-2:  
Initial Device Operator Set Up

5. Enter an Operator ID (i.e. initials or Employee ID).
6. Press the cursor under the Operator First Name and enter the operator's first name. Repeat and enter the operator's last name.
7. Press the cursor under the Operator Password and enter a password to be assigned to this operator.
8. When complete, press **ADD**.
9. Once the Administrator has been added press **NEXT** and the Administrator/Operator will navigate to a **Warning**. Press **PROCEED** to advance to the **New Patient Entry** to either create or select a patient (See section 4.3.3 for detailed information).



**NOTE:** When an operator is logged into the device and the device remains inactive for a set amount of time (defined in the Administrative Settings) the device will timeout and shutdown. See section 3.5.7 Operator Settings for details.

## 4.3.2 BrainScope One Information Hub

The **Information Hub** is the BrainScope One home screen that provides the following functions:

- Managing Patient Information – patient demographics as well as injury specific information
- Access all assessment modules that have been configured – starting a new test, reviewing test results and entering detailed tests results screens
- Operator Authentication

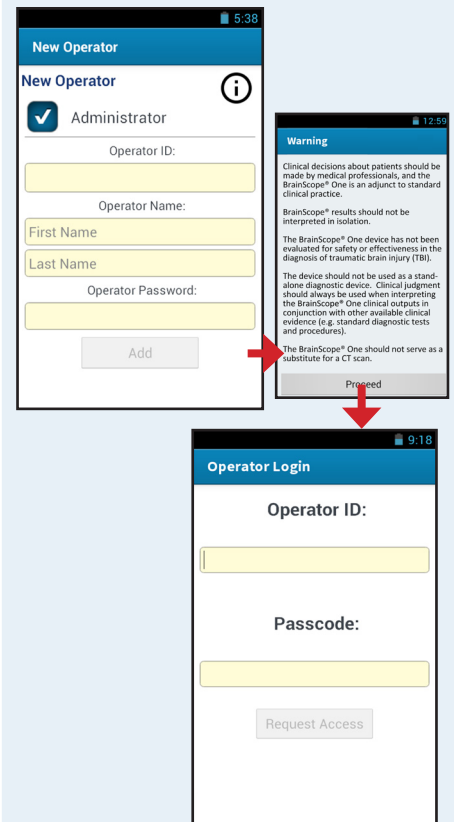
Upon initial use of BrainScope One, whether powered on for first use or an operator has “logged off”, the **Information Hub** will appear as disabled until Operator Authentication has been completed.

### To perform Operator Authentication:

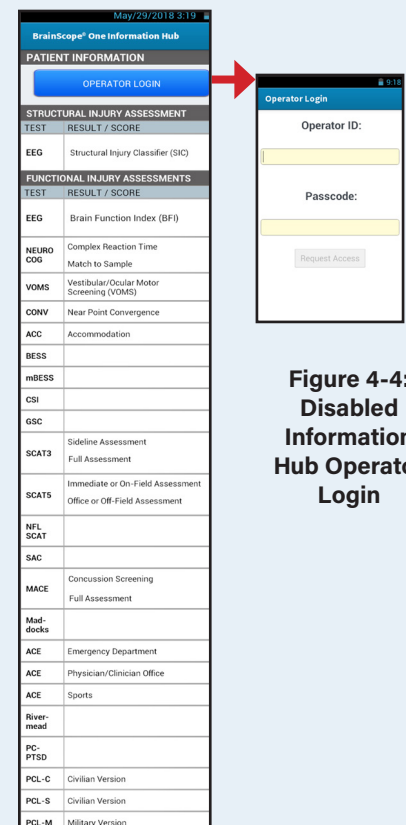
1. Press **OPERATOR LOGIN**.
2. Enter the Operator ID field via the onscreen keyboard.
3. Press ‘Next’ on the keyboard, or press the Passcode field and enter the corresponding password.
4. When complete, press ‘Done’ on the onscreen keyboard.
5. Press **REQUEST ACCESS**.



**NOTE:** If the Operator ID and the Passcode do not match, contact your authorized user for proper credentials.



**Figure 4-3:**  
Initial Administrator Operator Entry



**Figure 4-4:**  
Disabled  
Information  
Hub Operator  
Login

The following describes each area of the **Information Hub**:

## Patient Information Section:

The Patient Information section displays the information entered on the Patient Information screens including the Date/Time of Injury and the GCS score entered. Pressing the pencil icon will allow you to review and edit detailed patient information.

## Assessments Sections:

Each assessment configured on BrainScope One will be listed on the **Information Hub**. If an assessment is not configured it will not be listed.

The BrainScope One **Information Hub** is segmented into 2 main Assessment Sections:

1. Structural Injury Assessment
2. Functional Injury Assessment

Assessments that have been configured for use, by the Administrator in the Test Configuration settings, will display **START** to the right in the Result/Score area until a test has been completed.

Once a test has been completed the test summary Result/Score will be displayed in place of **START**.

SCAT5	Symptom Number	10/22
	Symptom Severity Score	13/132
	Orientation	4/5
	Immediate Memory	15/15
	Concentration	4/5
	Neuro Exam	Abnormal
	Balance Errors	7/30
	Delayed Recall	3/5

Figure 4-5: Active Information Hub

When the operator leaves the **Information Hub** by proceeding to the **Main Menu** (see Section 3.5 for more information) and selecting any option except Device Settings, Generate Report, or Administrator Settings, the application will advance to **Leave Session** to confirm.

When **NO** is selected, the application will return to the **Information Hub**.

When the **YES** is selected, the application will display one of the following screens:

- **Report Notes** (Figure 4-6), if not all assessments available on the **Information Hub** were completed.
- **Report Generation Progress Message** if all assessments available on the **Home** screen were completed. The application will navigate to the **Home** screen.
- **New Patient Entry** (Figure 4-7), if all assessments on the **Information Hub** were completed and the operator selected **NEW PATIENT** on the **Main Menu**.
- **Existing Patient** screen if the operator selects to Leave Session.
- **Patient List** (Figure 4-8), if all assessments on the **Information Hub** were completed and the operator selected **PATIENT LIST** on the **Main Menu**.
- **Disabled Information Hub** (Figure 4-9), if all assessments on the **Information Hub** were completed and the operator selected **LOGOUT** on the **Main Menu**.



**NOTE: Report Notes** (Figure 4-6) allows the operator to enter any relevant information about each assessment that the clinician can document in the permanent record. The comments made in the **Report Notes** will be viewable on the exported PDF report for this patient. (See Appendix 2-Reports)

INCOMPLETE ASSESSMENTS	
Assessment	Score
EEG	
COG	
BESS	
mBESS	
CSI	
GSC	
SCAT3	

Figure 4-6: Report Notes

Figure 4-7:  
New Patient Entry

Patient ID	Name	DOB	Last Entry
TEST2	John Smith	Jun/13/2016	11:49
TEST1	John Smith	Apr/11/1972	11:14
WRK93	John Doe	May/13/1998	17:25
1234	John Smith	Jun/12/2016	17:09

Figure 4-8:  
Patient List

DISABLED ASSESSMENTS	
Assessment	Score
EEG	
COG	
BESS	
mBESS	
CSI	
GSC	
SCAT3	
SCATS	
NFL SCAT	
SAC	
MACE	
Mad-dicks	
ACE	
River-mead	
PC-PTSD	
PCL-C	
PCL-S	
PCL-M	

Figure 4-9: Disabled Information  
Hub Operator Logged On

## 4.3.3 New Patient Entry

Once the operator has been authenticated the handheld will advance to **New Patient Entry** screens.

Prior to starting a test, the following patient information is required.

- Patient ID
- Date of Birth (DOB)
- Gender



**CAUTION:** The patient ID appears in unencrypted files generated by BrainScope One, such as the PDF Report and Device Log.

1. Enter all of the information by selecting the field and typing the information using the onscreen keyboard.
  - a. Press 'Done' on the onscreen keyboard when completed with that field.
  - b. Press the **CALENDAR** to enter the patient's Date of Birth (DOB).
  - c. Press the checkbox to select the gender.
2. When complete, press **CONTINUE**.



**NOTE:**

- If the Patient ID entered matches a Patient ID that exists in the handheld database, the Patient Name, Date of Birth, and Gender are automatically populated, but disabled. The calendar icon and gender checkboxes will be disabled.
- If **CONTINUE** is selected and the Patient ID, DOB, and/or Gender is not populated, a dialog box will appear informing the operator to enter the information.

3. Verify the DOB in the dialog box:
  - a. If the age calculated from the DOB is correct, press **YES** to continue.
  - b. If the age is not correct, press **NO** and the dialog box will return the operator to **New Patient Entry** to edit the DOB. Re-enter the correct DOB using the instructions above.



**NOTE:** The date of each test will be automatically entered into the patient's record when the test is initiated. Age will be automatically calculated from the DOB.

**Figure 4-10:**  
**New Patient Entry**

**Figure 4-11:**  
**Verify DOB Message**

## 4.3.4 Patient Information and Injury Entry

The **Patient Information** and **Injury Entry** screens gather patient signs and symptoms information, as well as details about the injury event.

There are 6 **Patient Information** and **Injury Entry** screens (one example is shown in Figure 4-12) to record the following information:

- Date and Time of Injury
- Type of Injury Event
- GCS (time of assessment)
- Loss of Consciousness (witnessed and duration)
- Orientation
- Amnesia
- Trauma Above the Clavicle
- Headache(s)
- Light Sensitivity
- Altered Mental Status

Information entered on each of the screens will be entered by a combination of checkboxes, text fields, calendar and time entry.

At the bottom of each screen press either **NEXT** to navigate to the next screen or **PREVIOUS** to return to the previous screen.



### NOTE:

- On **Patient Information 2/6** press **SHOW GCS TABLE** for a reference of the GCS Table. Display of the GCS Table is optional and not required to enter the GCS or continue with the test. If the GCS is less than 13, press the **SELECT** field and a drop down box will appear. Choose the GCS value.
- On **Patient Information 3/6** decimal minutes can be entered, such as 2.5 to indicate 2 minutes and 30 seconds.

When all information is entered, the information entered will display in the **Patient Information Summary** (Figure 4-13). The **Patient Information Summary** provides a comprehensive assessment list with results for the clinician to use in their clinical assessment of the patient.

When all information has been reviewed, press **CONFIRM**. The device will then provide a list of **Configured Assessments**. Press **PROCEED** to navigate to the **Information Hub**.

If any of the responses need to be corrected, press **PREVIOUS** to return back to the last data entry screen. **NEXT** and **PREVIOUS** can be used to navigate through the various screens for the purpose of making corrections. For more information on reviewing and editing patient information see Section 5.2.

**Figure 4-12:**  
Example of a Patient Information screen

**Figure 4-13:**  
Patient Information Summary



## 4.4 Electrode Headset Preparation

The headset (Figure 4-14) is a single-use, disposable intended to be rapidly and easily applied to the patient's forehead. The headset utilizes an adjustable array of integral electrodes with an ergonomic and aesthetic design that focuses purely on the forehead and ears.

The electrodes on the headset are attached to the patient at the following locations: Fp1, Fp2, AFz, F7, F8, Fpz, A1, and A2, in accordance with the expanded International 10-20 System of Electrode Placement.

The table below shows the corresponding headset labeling and position on the patients head.

Headset Labeling	International 10-20 System Labeling
L1, R1, C1, C2	Fp1, Fp2, AFz, Fpz
L2	F7
R2	F8
L3	A1
R3	A2



**Figure 4-14:**  
Electrode Headset

The headset is packaged with skin preparation materials to aid in the preparation of the patient: (Figures 4-15 and 4-16):

- 2 individually sealed alcohol wipes, and
- 1 headset skin prep pad



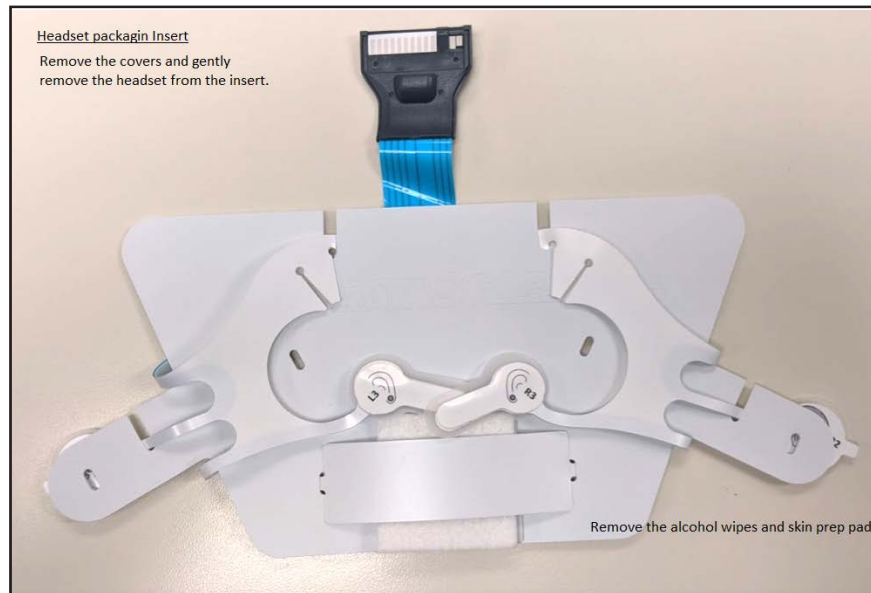
**Figure 4-15:** Electrode Headset and Skin Preparation Materials





**NOTE:** The packaging pouch that the headset is packaged in contains instructions for use as well as important safety and manufacturing information.

To prepare a headset for application, the headset and skin preparation materials will need to be removed from the plastic packaging insert. Figure 4-16 shows the headset and skin preparation materials still packaged in the plastic insert. Remove the three plastic covers and gently detach the headset from the plastic insert.



**Figure 4-16:**  
**Electrode Headset packaging removal**

## 4.4.1 Electrode Headset Placement on Patient's Forehead



### **WARNING!**

- Observe universal precautions to prevent contact with blood or other potentially infectious materials.
- Moderate to severe skin reactions from the headset can occur in patients with very sensitive skin. Use caution when using the headset prep pad.
- The disposable headset is intended for Single Patient Use Only and should be discarded after use. Place contaminated materials in a regulated waste container.
- Do not use the Electrode Headset if the packaging pouch is damaged.
- If the headset cannot be applied per the instructions (i.e. the electrodes are not able to be positioned over the target anatomical locations), the test should not be performed.
- More than one headset may be required to conduct a complete test should the electrode adhesive become compromised.
- Reuse, including cleaning, disinfecting, or other efforts made in an attempt to reuse the headset may compromise system performance and may cause a potential patient hazard. Performance is not guaranteed if reused.



## WARNING!

- The DAB module may become hot during prolonged, continuous operation.
- Monitor the patient as they may experience minor pain or discomfort. Limit exposure of the DAB to the scalp/hair to minimize any potential hazard.
- The maximum temperature of the enclosure under worst-case ambient conditions is 42.1°C (107.8°F). Heat transmission to the patient is reduced by ensuring the DAB jacket is in place during operation.
- Never use the device without the DAB jacket attached to the base of the module.



## CAUTION!

- Proper Electrode Headset placement is critical to the operation of BrainScope One. Pay close attention to headset placement.
- Handle the headset with care. Do not fold or crease the plastic ribbon containing the lead wire(s).
- BrainScope One should not be used if the headset does not sufficiently fit the patient, such as the electrodes are not able to be positioned over the target anatomical sites.



## NOTE:

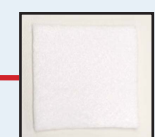
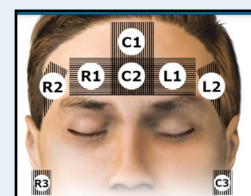
- Avoid areas where skin is broken, irritated, or inflamed and avoid applying excess pressure if a skull fracture is suspected.
- The BrainScope One handheld must be used in conjunction with the headset that incorporates integrated electrodes. Application instructions can be found on the headset packaging pouch.

Prior to conducting a new EEG test, the patient's skin should be prepared for placement of the headset. Before beginning skin preparation, ensure patient's hair has been pulled back to expose the forehead. When **START EEG** has been pressed the device will provide onscreen steps for preparing the patient for the headset. Press **NEXT** to follow the onscreen steps or press **SKIP TO EEG** to proceed to impedance check.

1. Start preparing the skin by using an alcohol wipes to remove dirt, oil, and / or make-up from the forehead, temples and earlobes. Pay special attention to the earlobes, which can contain an excessive amount of oil.



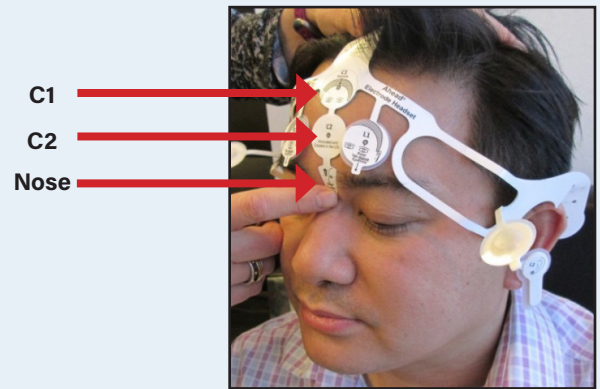
2. Using the headset skin prep pad, apply firm pressure to the skin while using a wiping motion over the cleaned areas: forehead, temporal areas and earlobes. This will ensure that skin is properly exfoliated. For the forehead area, trace an inverted **T** as shown in the picture below. Wipe the areas two times each with the skin prep pad.



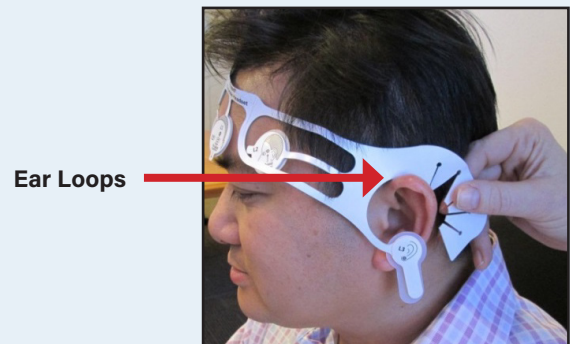
- Before placing headset, align the lower edge of the nose tab with the bridge of the patient's nose and check to see whether the C1 electrode will fall in the hairline. If C1 falls under the hairline, remove adhesive backing from center electrodes C1 and C2, and apply the electrodes making sure the headset is centered.

If C1 is in the hair, lower the headset by the minimal distance needed to affix C1 just below the hairline. It is acceptable if part of the adhesive ring is in the hairline, but no hairs should fall under the electrode or gel area.

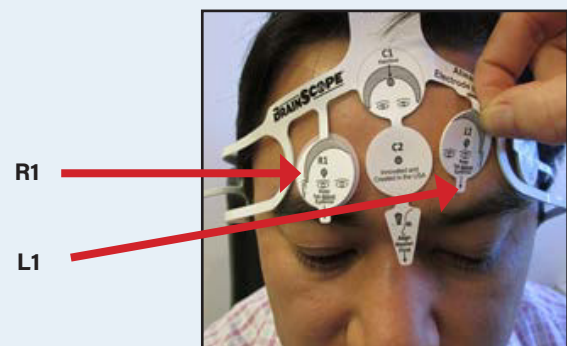
Once the headset appears to be centered, it may be applied to the skin. Ensure that both electrodes are firmly affixed to the skin by pressing down on the electrode.



- Place the ear loops behind each ear securing the headset. DO NOT apply the electrodes to the earlobes at this point.



- Locate L1 and R1 above the eyebrows. If the tab on either electrode is touching the eyebrows, raise the electrode upwards so the end of the tab touches the eyebrow but is out of the eyebrow hairs. Ensure that the electrode falls just above the eyebrow bone and firmly affix it to the skin by pressing down on the electrode. Keep in mind that the two electrodes should lie on the same horizontal line, and equidistant from the C2 electrode.

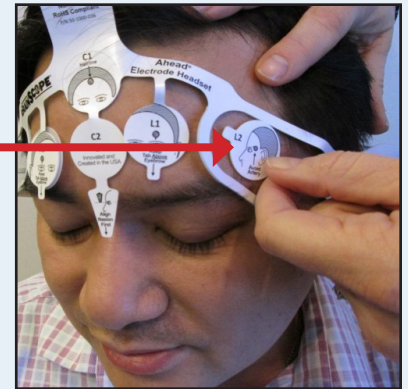


6. Locate L2 (left) and R2 (right) approximately 1 cm to the side of the eye and 1 cm above the eyebrow. Remove cover and place the electrodes.



**NOTE:** Avoid placing the electrodes directly on top of the temporal artery where the person's pulse will be detected. It is also important to provide symmetry between the R2 and L2 locations. As a guide for placement, the distance between R1 and R2 or L1 and L2 should be the same as the distance between the R1 and L1 electrodes.

L2  
R2 (same position as L2 only on right side)



7. After removing the adhesive to the earlobe electrodes locate and place electrodes on the center of each earlobe, L3 (left) and R3 (right). Once applied, the earlobe tab should be bent behind the earlobe for additional support and stability



**NOTE:** If the patient has small and/or attached earlobes, pull them gently away from the skin to ensure the earlobe tab properly bends behind the earlobe.



8. Once the headset is firmly in place, apply pressure to all of the electrodes to ensure adhesion to the patient's skin.

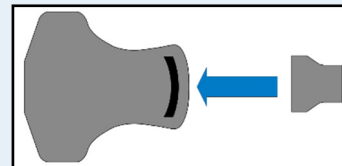
9. Alternatively, all Left side electrodes (L1, L2 and L3) and then all Right side electrodes (R1, R2 and R3) (or vice-versa) can be placed if convenient for the operator. Ensure to keep electrode symmetry in placement as noted above.

10. Place the DAB on top of the patient's head. Connect the headset to the DAB. Insert the headset straight and level into the device port until resistance is met.

- The headset will not click when inserted.
- If necessary, disconnect the headset in a straight outward path.
- Avoid insertion or removal at any angle.



**NOTE:** The single-use headset can be inserted and removed as many times as possible. However, the time between first insertion and last insertion must be within 60 minutes.





## 4.5 Performing an EEG Session



**CAUTION:** The operator will need to monitor the patient during data collection to observe the patient for excessive movement, excessive sweating, or shivering as these conditions will affect clean data acquisition. The operator should address these conditions if they arise and are impeding clean data collection.

Once the Patient Information has been entered and the headset has been attached to the patient and connected to the DAB the BrainScope One is ready to perform an EEG session.

Prior to starting the test, for ease and speed of collection the patient should be instructed to relax with eyes closed in a comfortable position.

1. Press **START EEG** in the Structural Injury Assessment section on the **Information Hub**.
2. The **EEG Acquisition Dashboard** will display the **Impedance** tab and begin measuring impedance.
3. The device will navigate through the **Headset Placement Instructions**. Press **NEXT** to navigate through the instructions or press **SKIP TO EEG** to navigate to the impedance check.



**NOTE:** While impedance is being measured the other tabs (**Dashboard** and **Waveforms**) on the **EEG Acquisition Dashboard** will be grayed out.

Impedance - Displays the status of the measured electrode impedance for each electrode (Figure 4-17)

- Green - The impedance value is within the normal range (0.5 kΩ – 5 kΩ).
- Yellow - The impedance value is acceptable (5 kΩ – <10 kΩ).
- Red - The impedance value is unacceptably high ( $\geq 10$  kΩ). Re-prepping is required before recording can continue. If red, then re-prep the area until acceptable. Press **RE-PREP INSTRUCTIONS** for assistance (Figure 4-18). (Refer to Chapter 7 for additional support troubleshooting impedance)
- Gray - The C2 electrode is the electrical ground and will not display an impedance value.

To view the electrode labels using the 10-20 System, press the **10-20** button.

3. When all electrodes (except C2) are displaying acceptable impedances (Green or Yellow), press **BEGIN** to begin the recording.

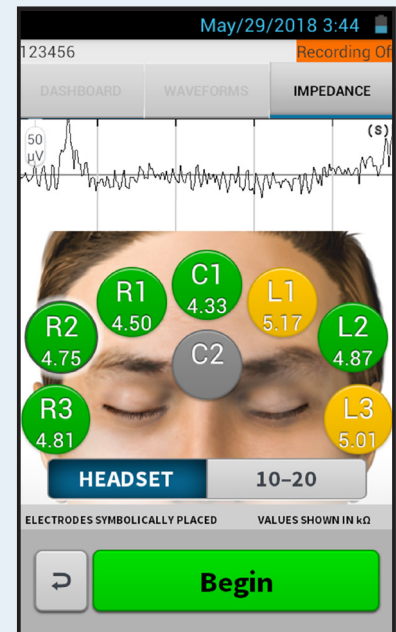


Figure 4-17:  
Impedance Screen - Begin  
(Headset)

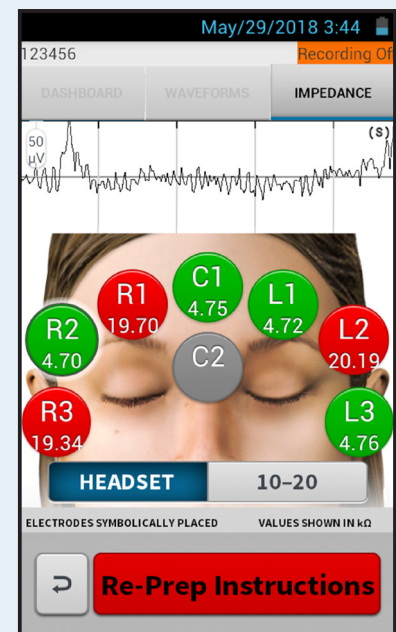


Figure 4-18:  
Impedance Screen Re-Prep -  
(Headset)



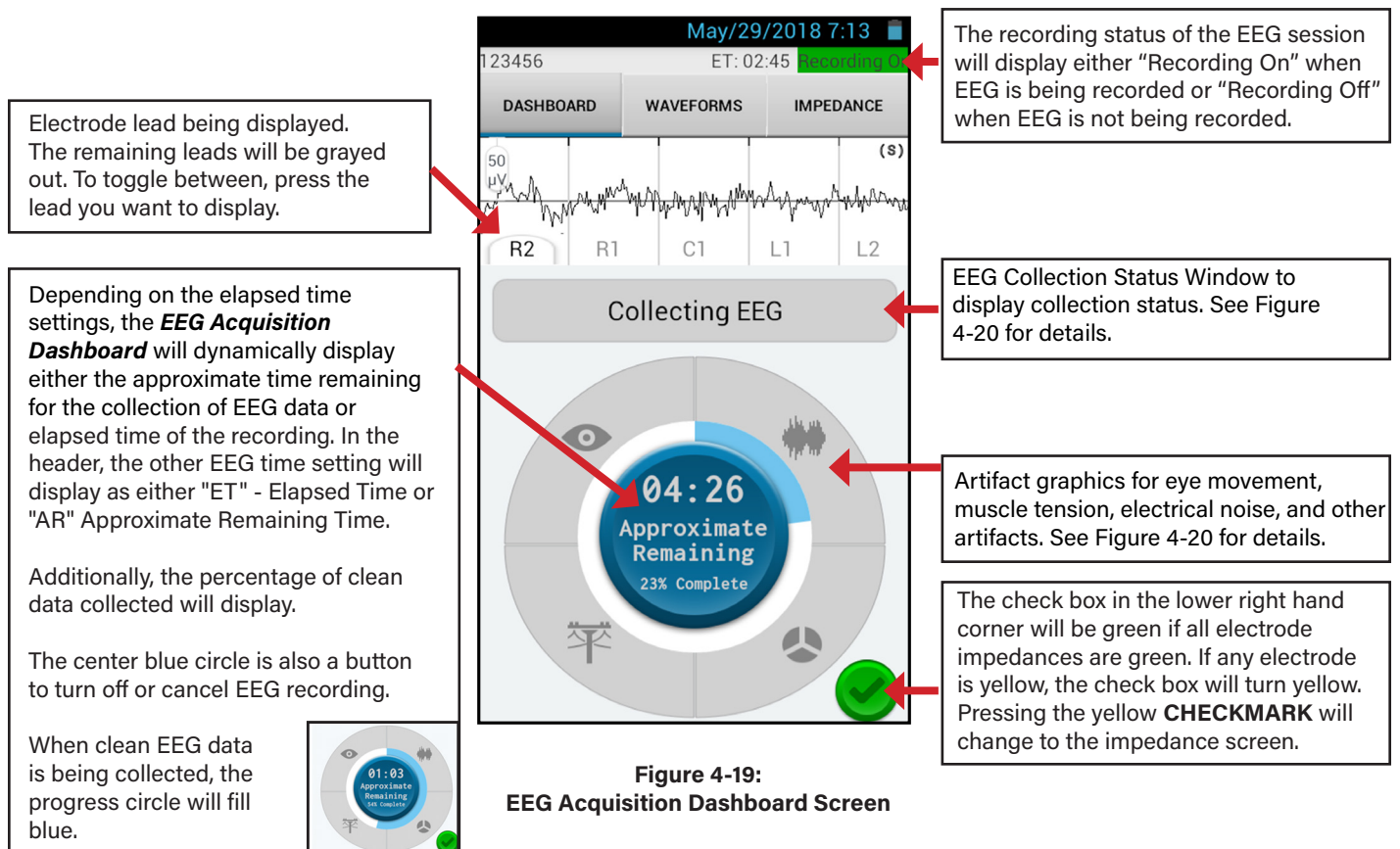
## NOTE:

- The headset is a single-use component. There are checks within the handheld to prevent the user from re-using a headset and that the age of the headset is within the expiration date. Although the headset is not re-usable, the user is permitted to insert the headset into the DAB multiple times, but completion of the collection must be completed within 60 minutes from the first insertion. The headset can only be used three times to calculate results within this 60 minute period.
- Headset Connectivity Messages appear when the headset is connected or disconnected from the DAB. Press **OK** to dismiss the message.
- Warning messages will appear on the Impedance screen if using a headset that cannot be authenticated and the handheld will not allow the user to continue to a recording. Press **OK** to dismiss the warning message and obtain a new headset to complete the test.

## 4.5.1 EEG Recording

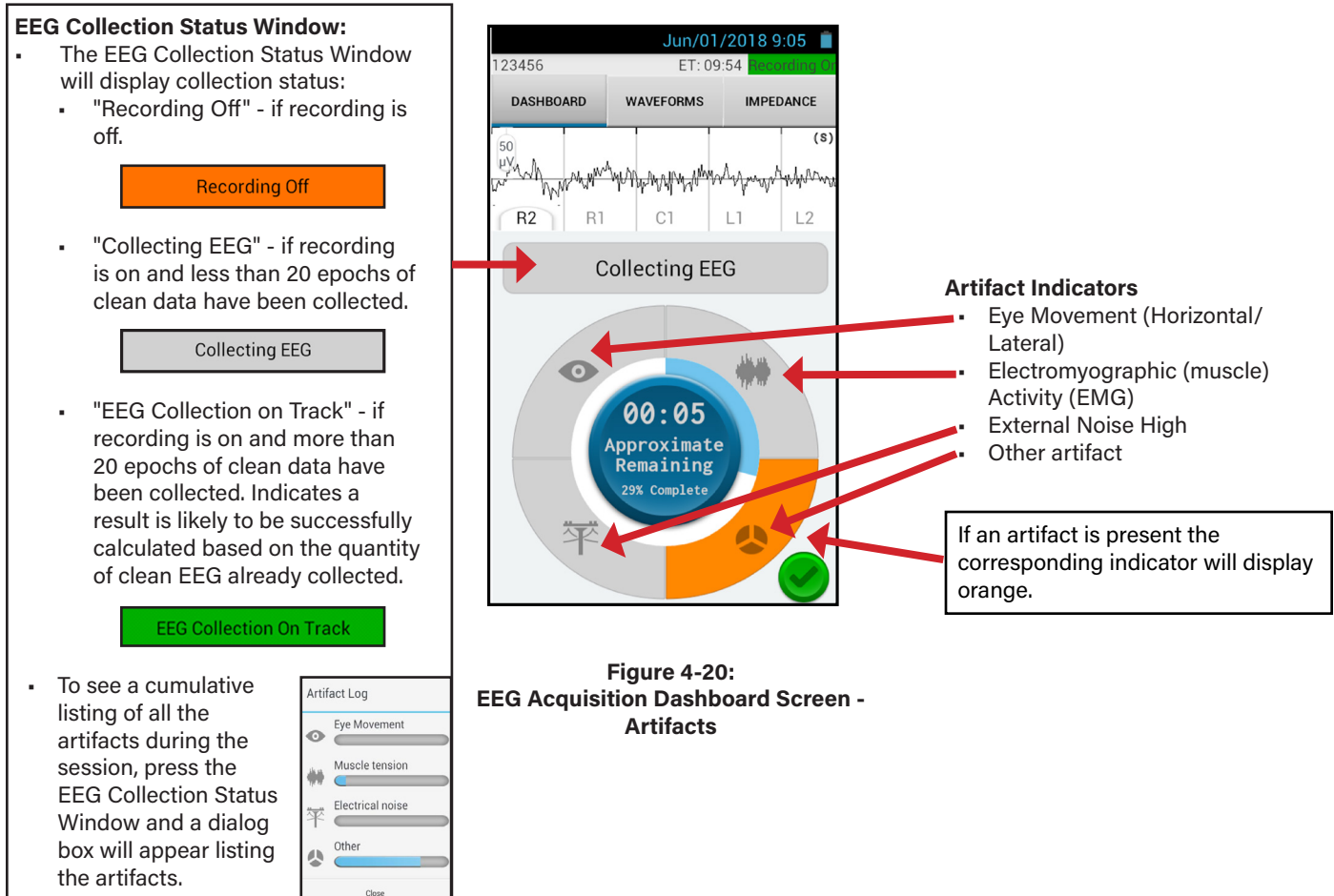
### EEG Acquisition Dashboard

The **EEG Acquisition Dashboard** will be displayed by default once the EEG recording has started. The **EEG Acquisition Dashboard** displays the EEG recording of a single lead (e.g. R2, R1, C1, etc.) (Figure 4-19)



**Figure 4-19:**  
**EEG Acquisition Dashboard Screen**

The BrainScope One handheld includes software for automatic identification and rejection of non-brain-generated artifacts (Figure 4-20). This system replicates the process of visual editing usually performed by trained EEG technologists. The operator should pay attention to the circular display to identify artifacts that will hinder collecting clean EEG data. Four (4) types of artifacts will be displayed if detected by the handheld.



**Figure 4-20:**  
EEG Acquisition Dashboard Screen - Artifacts



## Turning off/on or cancel an EEG recording

To turn off the recording, press the dark blue button in the center of the circle. A dialog box will appear (Figure 4-21) allowing the user to turn off the recording, cancel the EEG, or dismiss the dialog box and return to the **EEG Acquisition Dashboard**.

Press **RECORDING OFF** to pause the recording, the button will then be labeled **RECORDING ON**. The **EEG Recording Menu** will close, the EEG will not be recorded, and the EEG Collection Status Window will read "Recording Off". To re-start the recording press the dark blue button and the dialog box will appear again. Press the **RECORDING ON** button. The **EEG Recording Menu** will close and the EEG will be recorded.

To cancel the test, press the dark blue button and the dialog box will appear again, press **CANCEL EEG**. A dialog box (Figure 4-22) will appear asking to confirm. Press **YES** to cancel the test, Press **NO** to return to the **EEG Acquisition Dashboard**.



**NOTE:** After 15 minutes of inactivity (no interaction with the user interface, physical buttons, or headset insertion/removal) in Recording Off mode, the application will return to the **Information Hub**.

## Waveforms

To view real-time wave forms during data collection, press the **WAVEFORMS** tab (Figure 4-23).

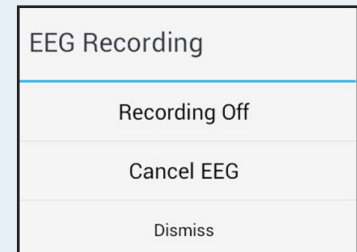
The Waveform screen displays up to 7 real-time EEG waveforms as they are collected during the session (Figure 4-23). The labels are displayed according to the user setting (Headset or 10-20).

- R2 - A = Fp2-A
- R1 - A = Fp1-A
- C1- A = AFz-A
- L1 - A = Fp2-A
- L2 - A = F8 - A
- L3 - AFz = A1 - AFz
- R3 - AFz = A2 - AFz

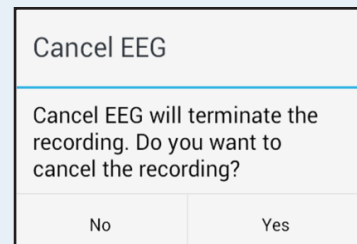
where "A" designates the linked ears reference channel  $(A1 + A2) / 2$  and the other electrode designations are according to the expanded International 10-20 System of Electrode Placement.

This screen also displays information about:

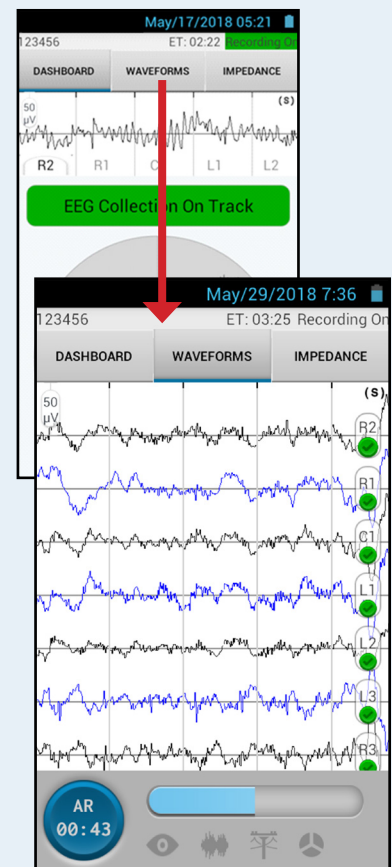
- Elapsed or approximate recording time
- Test progress indication as a status bar percentage complete to a sufficient amount of artifact-free data.



**Figure 4-21:**  
**EEG Recording Dialog Box**



**Figure 4-22:**  
**EEG Recording Cancel EEG**



**Figure 4-23:**  
**Waveforms Screen**

## Recording Complete

Once sufficient artifact-free EEG data has been collected from the patient, the handheld will stop the EEG recording and compute the Structural Injury Classifier results. A **Patient Information Confirmation** message will display (Figure 4-24) advising the user to confirm patient information before the EEG results are calculated.

Disconnect the headset from the DAB. A pop up message will appear on the screen indicating that the headset is disconnected.



**NOTE:** The **Data Quality Failure** dialog box will appear if enough clean epochs are collected, but the data quality is inadequate to calculate results. (Figure 4-25).



**NOTE:** Typically sufficient clean data is acquired within 5 minutes of EEG recording. If sufficient clean data is not acquired, a **Artifacts Detected** dialog box will appear (Figure 4-26) when less than 10 epochs of clean data have been collected in a moving window of 2 minutes and when elapsed time is less than 9 minutes. The message will indicate the amount of time completed for the EEG session, as well as the percent of clean data collected. In addition, a list of the top two artifacts detected along with tips to correct these artifacts will be displayed. Press **DISMISS** to return to the **EEG Acquisition Dashboard** (if greater than or equal to 20 epochs have been collected).

### Confirm Patient Information

Please confirm the accuracy of the Patient Information before EEG results are calculated. The patient's Date of Birth cannot be modified after EEG results have been calculated.

OK

**Figure 4-24:**  
**Patient Information Confirmation**

### Data Quality Failure

Inadequate data quality to reliably calculate results. Results will not be available. Consider re-conducting EEG with new headset.

OK

**Figure 4-25:**  
**Data Quality Failure**

### Artifacts Detected

14% Clean Data Collected  
02:00 minutes complete of 10 minute maximum

#### Tips to Avoid Detected Artifacts:

- If inside, dim the lights



Muscle tension detected, instruct patient to:

- Open mouth slightly
- Relax forehead



Eye movement detected, instruct patient to:

- Lightly place fingers on corners of eyes
- Focus eyes straight ahead while closed

Dismiss

**Figure 4-26:**  
**Artifacts Detected Message**

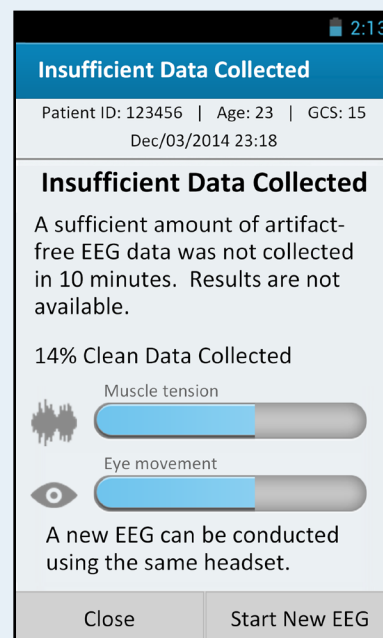


**NOTE:** The recording continues up to the max duration of 10 minutes. After the max duration of EEG recording, collected clean data is typically considered sufficient and the recording is complete. If after the max duration of EEG recording the minimum required 20 clean epochs has not been collected, data will be considered insufficient to calculate results. Data will not be stored (Figure 4-27). Press **CLOSE** to return to the **Information Hub** or press **START NEW EEG** to begin a new recording using the same headset. When the **START NEW EEG** button is pressed **Tips to Avoid Detected Artifacts** will appear (Figure 4-28).

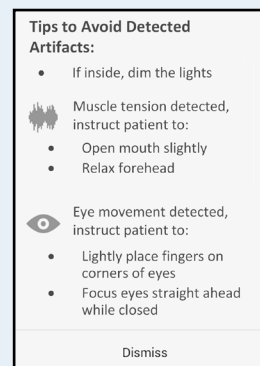


## WARNING!

- Standard clinical assessment of the patient should proceed in the event that insufficient clean (artifact-free) EEG data is collected



**Figure 4-27:**  
**No results EEG Recording Status**



**Figure 4-28:**  
**Artifact Free Data Tips Message**

## 4.5.2 EEG Results

### Structural Injury Classifier Assessment

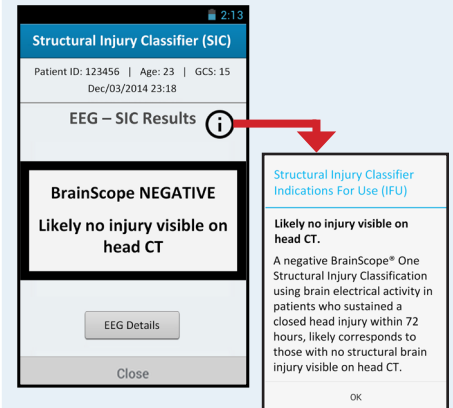
The **Structural Injury Classifier Summary** displays the result of the structural injury classification algorithms, indicating the presence or absence of structural brain injury.

The results screen includes an EEG Details button to view EEG details and review EEG Data. See Section 5.3 for detailed instructions.

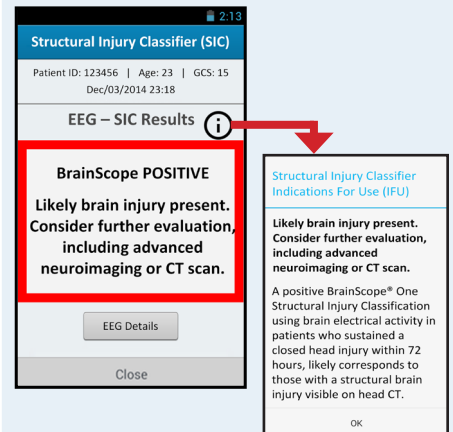
BrainScope One places a patient into one of three categories based on the patient's brain electrical activity. The classifications and their corresponding instructions are to be used in conjunction with other clinical assessments. The Structural Injury Information Messages appear when **INFORMATION** is selected on each of the Structural Injury Classifier Summary screens.

- A negative BrainScope One Structural Injury Classification using brain electrical activity in patients who sustained a closed head injury within 72 hours and GCS 13-15, likely corresponds to those with no structural brain injury visible on head CT.
- A positive BrainScope One Structural Injury Classification using brain electrical activity in patients who sustained a closed head injury within 72 hours and GCS 13-15, likely corresponds to those with a structural brain injury visible on head CT.
- An equivocal BrainScope One Structural Injury Classification using brain electrical activity in patients who sustained a closed head injury within 72 hours and GCS 13-15, may correspond to structural brain injury visible on head CT or may indicate the need for further observation or evaluation.

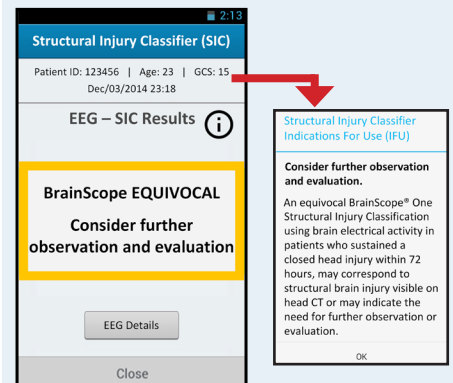
Press **CLOSE** when finished reviewing the results.



**Figure 4-29:**  
**Negative Results**



**Figure 4-30:**  
**Positive Results**



**Figure 4-31:**  
**Equivocal Results**

If BrainScope One is configured to display the Brain Function Index (BFI), the handheld will navigate to the **Brain Function Index** screen. If BrainScope One is configured for Structural Injury Classifier Assessment only, the handheld will return to the **Information Hub**.

After a Structural Injury Classifier session has been completed, the Structural Injury Classifier section of the **Information Hub** (Figure 4-32) will display the results of the test.

## Brain Function Index

The **Brain Function Index Summary** summarizes the results of the EEG - Brain Function Index assessment (Figure 4-33).



### NOTE:

- The Brain Function Index does not indicate the presence or absence of structural brain injury.

The **Brain Function Index Summary** provides the following option:

- EEG Details – provides detailed information about the recording

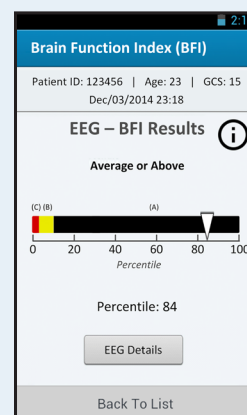
See EEG View Details and EEG Data Review in Chapter 5 for detailed instructions.

STRUCTURAL INJURY ASSESSMENT	
TEST	RESULT / SCORE
EEG	Structural Injury Classifier (SIC) <b>Negative</b> Likely no head injury visible on head CT

STRUCTURAL INJURY ASSESSMENT	
TEST	RESULT / SCORE
EEG	Structural Injury Classifier (SIC) <b>Positive</b> Consider advanced neuro imaging or CT

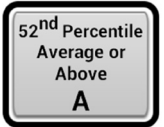
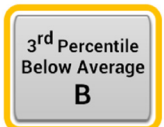
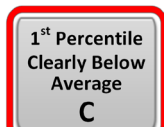
STRUCTURAL INJURY ASSESSMENT	
TEST	RESULT / SCORE
EEG	Structural Injury Classifier (SIC) <b>Equivocal</b> Consider further observation and evaluation

**Figure 4-32:**  
Structural Injury Classifier section of the Information Hub



**Figure 4-33:**  
Brain Function Index Results

After a Brain Function Index session has been completed, the Brain Function Index section of the **Information Hub** screen (See Section 4.3.1 **Information Hub**) will display the results of the test.

EEG	Brain Function Index (BFI)		<b>Average or above</b> – patient's BFI result was equal to or above the 10th percentile to the 100th percentile.
EEG	Brain Function Index (BFI)		<b>Below average</b> – patient's BFI results was equal to or above the 2.5th percentile to the 10th percentile.
EEG	Brain Function Index (BFI)		<b>Clearly below average</b> – patient's BFI was equal to or above the 0th percentile to the 2.5th percentile.

The BrainScope One's BFI provides an indication of functional brain impairment following a head injury. The index is a composite measure which includes features associated in the scientific literature with functional brain impairment reflecting the physiological changes associated with mTBI.

The BFI obtained in a patient is presented as a percentile of a non-injured normal population. Thus, addressing the question of how likely is this value to occur in a non-injured individual. The lower the percentile score the less the brain function of the patient resembles that of the non-injured population. More specifically, if the patient's score falls below the 10th percentile, it indicates that it is highly unlikely that the score would be obtained in a non-injured individual and is shown as "below average." When the score falls below the 2.5% (more than 2 standard deviations away from the mean of the non-injured population), it is statistically very unlikely that it would occur in an uninjured individual, and is shown as "clearly below average."

The BFI provides information not contained in the Structural Injury Classifier alone. The BFI is associated with brain function impairment. As an adjunct to standard clinical assessment, the BFI provides an objective measure of EEG brain function related to expected normal values.

## 4.6 Patient Session Closure and Summary Report

To exit the current patient session, select the physical **MENU** button on the handheld to access the **Main Menu** (Figure 3-8). See page 4-4 for more information. When exiting a patient session, if all assessments on the Information Hub screen were completed and the Automatic Report Generation option is enabled (See section 3.5.10), the PDF Report message will appear indicating that a PDF summary report is being generated for the session. If the Automatic Report Generation option is disabled, the operator must generate the report manually. A sample PDF summary report that includes all assessments available on BrainScope One can be found in Appendix 2.

The PDF report is stored on the SD card. For technical specifications, please see section 5.4.

To print the report:

1. Connect the device to a computer running Windows 7 or Windows 10 using the micro USB cable (P/N 40-1000-013).
2. Be sure the handheld device is turned ON.
3. BrainScope One will appear on the PC as a MTP (media transfer protocol) device.
4. On your computer navigate to the SD Card, then click **BRAINSCOPE** folder, then **REPORTS**.
5. Choose the appropriate patient folder identified by Patient ID and locate the PDF within the sub-folder.



**NOTE:** There will only be one PDF report for each patient injury. When new assessments associated with that injury are performed, the PDF is recreated with the newest assessment. Data that was collected previously will also be reflected in the new PDF.



## CHAPTER 5: The Patient Database

The Patient Database stores patient information and all test results performed on the BrainScope One handheld. This chapter describes the procedures to access the following:

- Patient list
  - Patient demographics and injury information (review and edit)
- Previous tests
  - Detailed results (data review) for EEG

Instructions on how to access previous tests and review details for Vestibular/Balance, Vestibular/Ocular, and Standard Clinical Assessment tests can be found in their respective appendices.

### 5.1 The Patient List

The **Patient List** (Figure 5-1) provides access to all stored information on patients that have been entered into the BrainScope One handheld.

To access the **Patient List**:

1. Press the physical **MENU** button on the handheld.
2. Press **PATIENT LIST** and login.
  - The **Patient List** will populate a list of patients in the database sorted by the time of the last patient entry, with the latest patient entry at the top.
3. Press on the row of patient name/ID number that you want to view.
4. The **Patient Injury List** will display in list form all "Previous Injuries" recorded for that patient.
5. The **Patient Injury List** allows for the following actions:
  - New Injury - entry of new injury details (See Section 4.3.4 Patient Information and Injury Entry for instructions)
  - Review - review detailed results on tests performed for that injury (See Section 5.2, 5.3 and 5.4 for instructions)
  - Resume - resume testing for that injury (See Section 4.3.1 BrainScope One Information Hub for instructions)
  - Delete Patient - press **DELETE PATIENT** to delete the patient's data from the handheld



**NOTE:** The **Patient Injury List** can also be accessed by selecting **CURRENT PATIENT INJURIES LIST** from the **MENU** during a patient session.



**Figure 5-1:**  
**Patient List screens**

## 5.2 Patient Information - Review and Edit

Once patient information has been entered you can go back to review and edit the information at any time from the **Information Hub**.

**Patient Information Detailed Results** can be accessed by pressing the pencil icon next to the patient summary while in the **Information Hub** (Figure 5-2).

**Patient Information Detailed Results** (Figure 5-3) will display the summary of patient signs and symptoms information, as well as details about the injury event that were gathered during **Patient Information and Injury Entry** (See Section 4.3.4 Patient Information and Injury Entry for more information).

The **Patient Information Summary** (Figure 5-3) contains two options to select from:

- Review – access results of all entries
- Edit – edit data recorded



**NOTE:** While reviewing and editing patient information the screen header will contain “Review” and “Edit” to inform the operator that they are currently in review or edit mode.

**Figure 5-2:**  
Access to review and edit stored Patient Information

**Figure 5-3:**  
Patient Information Detailed Results

## Patient Information – Review

Press **REVIEW** from the *Patient Information Summary* to navigate to the *Patient Information Review* screens.

An example of a *Patient Information Review* screen is shown in Figure 5-4.

To navigate through the *Patient Information* screens press **NEXT**.

The *Patient Information Review* screens will appear in exact order of *Patient Information* and *Injury Entry* screens.

At any time press **PREVIOUS** to navigate to the previous page.

From the *Patient Information Summary Review* screen press **CONFIRM** to exit review mode and return to the *Patient Information Detailed Results* (Figure 5-3).

## Patient Information – Edit

The *Patient Information Edit* screens will allow for editing the responses to any of the questions from the *Patient Information* and *Injury Entry* screens.

Press **EDIT** from the *Patient Information Summary* to navigate to the *Patient Information Edit* screens.

An example of a *Patient Information Edit* screen is shown in Figure 5-5.

The *Patient Information Edit* screens will appear in exact order of the *Patient Information* and *Injury Entry* screens.

All fields on all screens will allow for editing. To navigate through the *Patient Information Edit* screens press **NEXT**.

At any time press **PREVIOUS** to navigate to the previous page.

From the *Patient Information Summary Edit* screen press **CONFIRM** to exit edit mode and return to the *Patient Information Detailed Results* (Figure 5-3).

**Patient Information 1/6 (Review)**

Date of Injury: Aug/08/2016

Time of Injury: 18:14

What was the type of injury event?

- ☐ Assault
- ☐ Sports
- ☒ Fall
- ☐ Struck by Vehicle
- ☐ Motor Vehicle Accident (MVA)
- ☐ Other

Previous Next

**Figure 5-4:**  
**Patient Information Review**

**Patient Information 1/6 (Edit)**

Date of Injury: Aug/08/2016

Time of Injury: 18:14

What was the type of injury event?

- ☐ Assault
- ☐ Sports
- ☒ Fall
- ☐ Struck by Vehicle
- ☐ Motor Vehicle Accident (MVA)
- ☐ Other

Previous Next

**Figure 5-5:**  
**Patient Information Edit**

## 5.3 EEG Results

Detailed results on current and previous EEG tests are stored in the patient database and can be accessed from the **Information Hub**.

In the detailed results screens the operator can review all tests recorded and start a new EEG test.

### 5.3.1 Structural Injury Classifier Detailed Results

To access the **Structural Injury Classifier Detailed Results**, press the "Structural Injury Classifier" result (Figure 5-6) from the **Information Hub**.



**NOTE:** The **Structural Injury Classifier Detailed Results** will default to view the **CURRENT TEST** tab.

#### Current Test Tab

**Structural Injury Classifier Current Test - Summary** (Figure 5-7) contains two options to select from:

- EEG Details – provides detailed information about the recording and playback of the EEG Data session.
- New EEG – start a new EEG test

Press **CLOSE** to return to the **Information Hub**.

#### Previous Test Tab

To view previous tests, select the **PREVIOUS TESTS** tab from the **Structural Injury Classifier Current Test - Summary** screen.

**Structural Injury Classifier Previous Tests Detailed Results** (Figure 5-8) lists all tests recorded by test date, time and summary of results.

To view detailed results from a previous test, press the desired test from the "Structural Injury Classifier Tests List".

STRUCTURAL INJURY ASSESSMENT	
TEST	RESULT / SCORE
EEG	Structural Injury Classifier (SIC) <b>Negative</b> Likely no head injury visible on head CT

**Figure 5-6:**  
Brain Electrical Activity results area from the **Information Hub**

2:13

Structural Injury Classifier (SIC)

CURRENT TEST

PREVIOUS TESTS

Structural Injury Classifier Summary

New EEG

Patient ID: 123456 | Age: 18 | GCS: 15

Dec/03/2014 23:18

EEG – SIC Results ⓘ

BrainScope NEGATIVE

Likely no injury visible on head CT

EEG Details

Close

**Figure 5-7:**  
Summary of Structural Injury Classifier (Current Test)

Structural Injury Classifier (SIC)	
CURRENT TEST	PREVIOUS TESTS
Structural Injury Classifier Tests List	
Patient ID: 123456	
Test Date	Summary
Aug/05/2016 14:13	Negative
Aug/05/2016 14:03	Positive
Aug/05/2016 13:54	Equivocal
Aug/05/2016 14:03	Data Quality Failure
Aug/05/2016 13:54	Insufficient Data Collected
Close	

**Figure 5-8:**  
Test list of previous test results

Once a test has been selected from the test lists the **Structural Injury Classifier Previous Test - Summary** (Figure 5-9) will appear displaying the test results.

**Structural Injury Classifier Previous Test - Summary** (Figure 5-9) contains the following option to select from:

- EEG Details – provides detailed information about the recording and playback of the EEG Data session.

Press **BACK TO LIST** to return to **Structural Injury Classifier Previous Tests Detailed Results**.

## 5.3.2 Brain Function Index Detailed Results

To access **Brain Function Index Detailed Test Results**, press the "Brain Function Index" result (Figure 5-10) from the **Information Hub**.



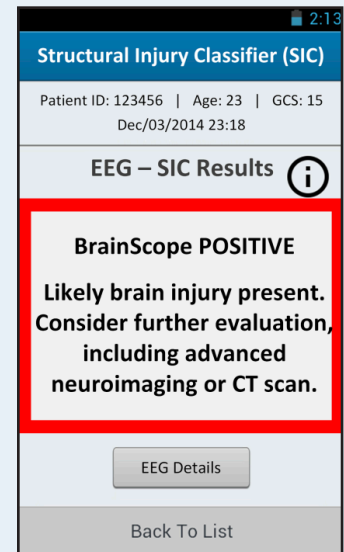
**NOTE:** The **Brain Function Index Detailed Test Results** will default to view the **CURRENT TEST** tab.

### Current Test Tab

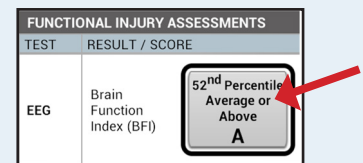
The **Brain Function Index Current Test - Summary** (Figure 5-11) contains three options to select from:

- EEG Details – provides detailed information about the recording and playback of the EEG Data session.
- New EEG – start a new EEG test

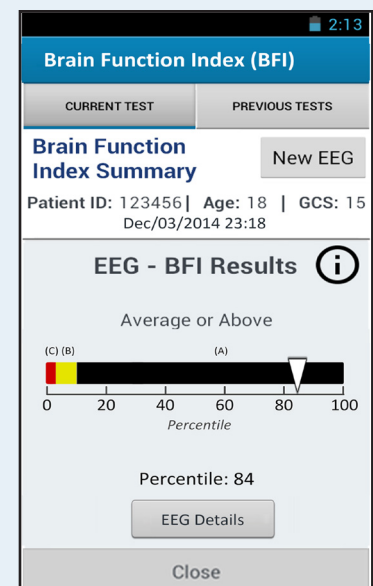
Press **CLOSE** to return to the **Information Hub**.



**Figure 5-9:**  
Summary of EEG - Structural Injury Classifier (Previous Test)



**Figure 5-10:**  
Brain Electrical Activity results area from the **Information Hub**



**Figure 5-11:**  
Summary of Brain Function Index (Current Test)

## Previous Test Tab

To view previous tests, select the **PREVIOUS TESTS** tab from the **Brain Function Index Detailed Results** screen.

**Brain Function Index Previous Tests Detailed Results** (Figure 5-12) lists all tests recorded by test date, time and summary of results.

To view detailed results from a previous test, press the desired test from the "Brain Function Index Tests List"

Once the test has been selected the **Brain Function Index Previous Test - Summary** screen (Figure 5-13) will appear displaying the test results.

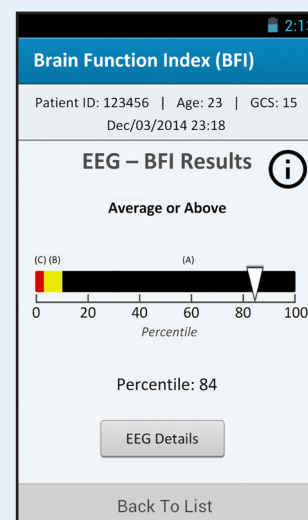
**Brain Function Index Previous Test - Summary** (Figure 5-13) contains the following option to select from:

- EEG Details – provides detailed information about the recording and playback of the EEG Data session.

Press **BACK TO LIST** to return to the **Brain Function Index Previous Tests Detailed Results**.

Brain Function Index (BFI)	
CURRENT TEST	PREVIOUS TESTS
<b>Brain Function Index Tests List</b>	
Patient ID: 123456	
Test Date	Summary
Start: May/20/2018 01:06 End: May/20/2018 01:17	85 <sup>th</sup> Percentile Average or Above <b>A</b>
Start: May/20/2018 00:56 End: May/20/2018 01:01	Data Quality Failure
Start: May/20/2018 00:20 End: May/20/2018 00:34	Insufficient Data Collected
Close	

**Figure 5-12:**  
Test list of previous test results



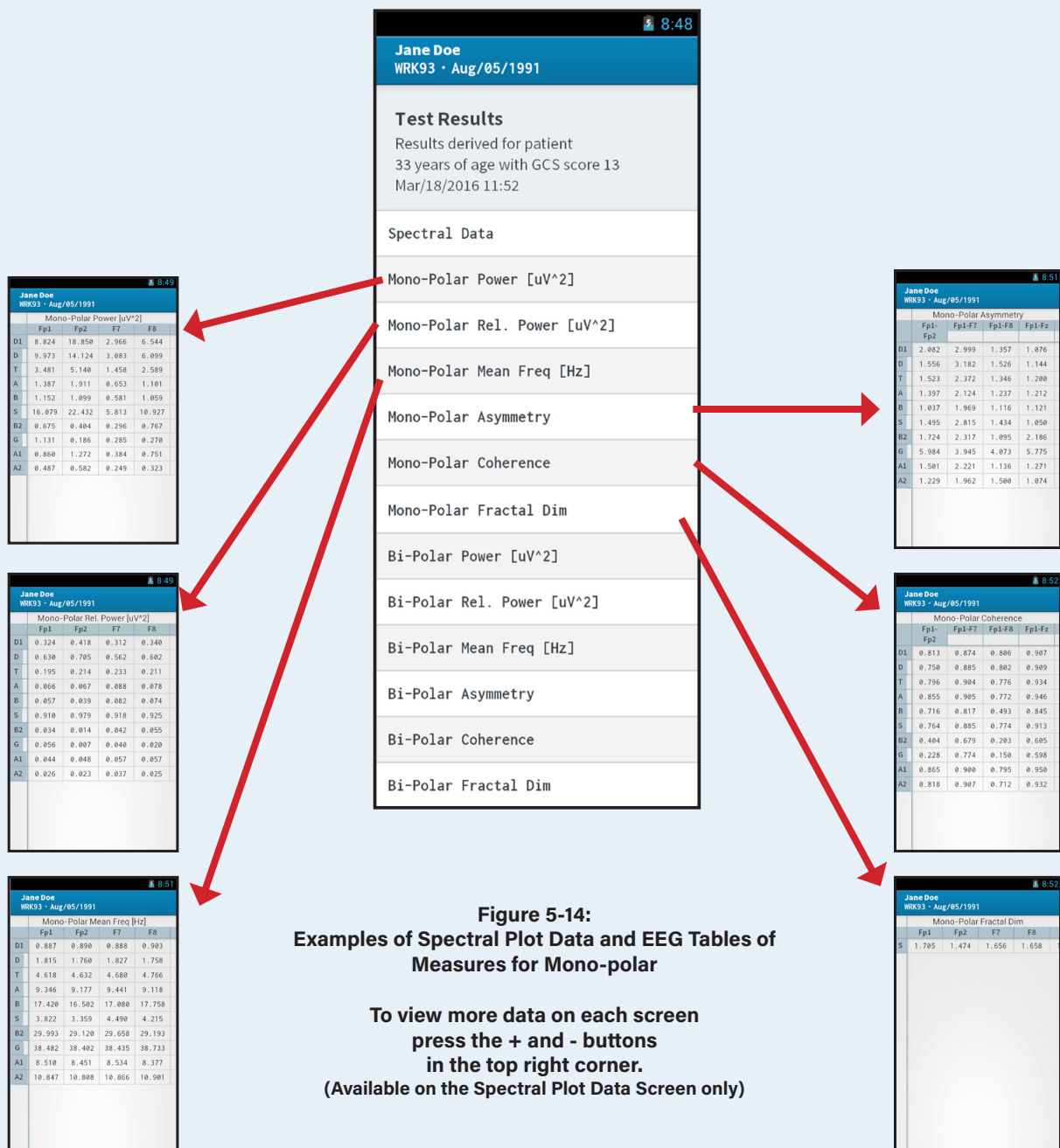
**Figure 5-13:**  
Summary of Brain Function Index  
(Previous Test)



## 5.3.3 EEG Details

BrainScope One extracts various quantitative features from the EEG in the traditional EEG frequency bands. Computed raw EEG features such as monopolar and bipolar relative power are available for review. When **EEG DETAILS** is available on an EEG results screen you can view EEG measures extracted from the patient's EEG recording. Note that these are not specific to the classification algorithms.

Choose the feature from the on-screen list by pressing the name of the feature. A sample of each of the tables and graphs are provided below (Figure 5-14 and 5-15).





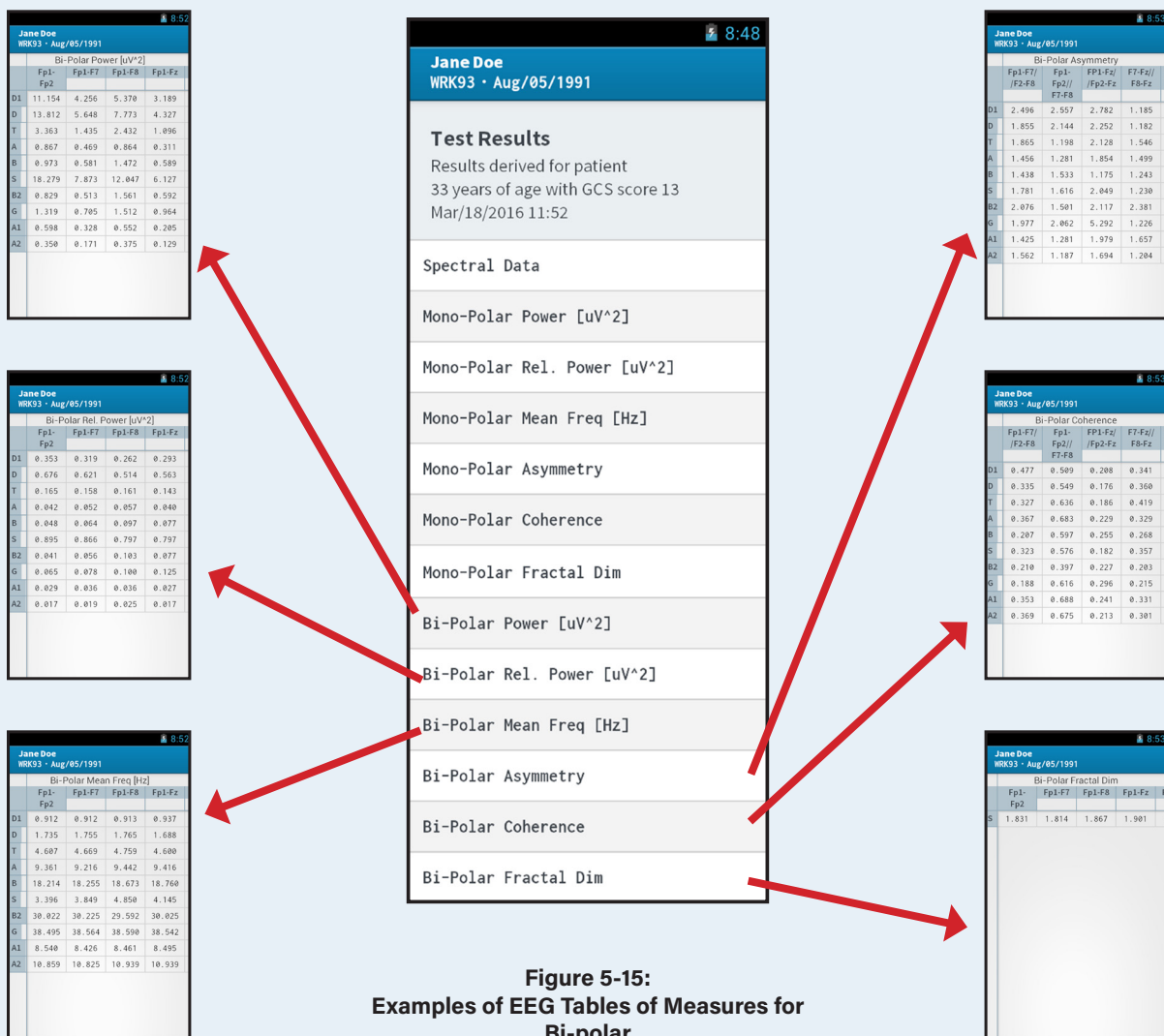


Figure 5-15:  
Examples of EEG Tables of Measures for  
Bi-polar

## 5.3.4 EEG Data Review

The EEG Data Review function allows the operator to playback the EEG waveforms of the test that was chosen.

From any of the EEG detailed results screens press **EEG DETAILS** and then **DATA REVIEW** in the message box to navigate to **Data Review**.

**Data Review** provides the following options:

- Back button – returns to the previous screen
- Round Timer Counter button – displays the Playback Control Menu (Figure 5-17)

**Data Review** will automatically begin playback of the recorded EEG. Seven (7) raw EEG waveforms will be displayed relative to linked ears (Figure 5-17):

1. "R2", "R1", "C1", "L1", "L2", "L3" and "R3" from the top down if the HEADSET button is selected on the **Impedance** screen (Figure 4-17), or
2. "F8", "Fp2", "AFz", "Fp1", "F7", "A1", and "A2" from the top down if the 10-20 button is selected on the **Impedance** screen (Figure 4-16).

The **ROUND TIMER COUNTER** button will display EEG recording timer in Minutes and Seconds (MIN:SEC). The horizontal blue EEG Progress Bar will progress when clean epochs are detected, completely filling at 48 clean epochs.

At the bottom of the screen, Artifact Indicators for eye movement, muscle tension, electrical noise, and other artifacts will illuminate when the corresponding artifact is detected.

To access Playback Controls, press the **ROUND TIMER COUNTER** button and the **Playback Control Menu** screen will appear (Figure 5-17).

The **Playback Control Menu** provides the following options:

- PLAY – when selected, the screen will begin playback of the selected recording
- PLAY FROM START – when selected, the screen will begin playback of the selected recording from the beginning
- DISMISS – when selected, the **Playback Control Menu** will close and return the user to the **Data Review**.

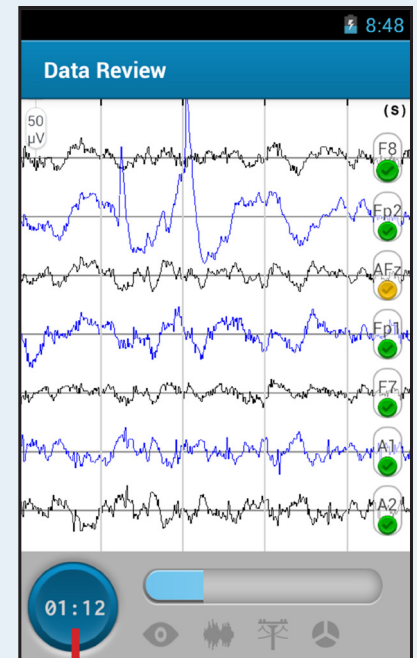


Figure 5-16:  
EEG Data Review

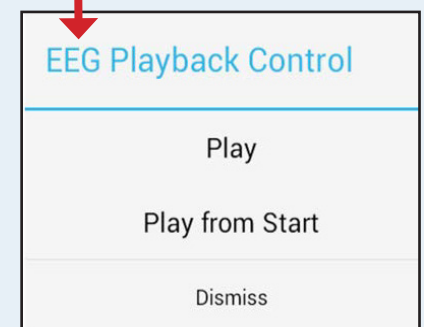


Figure 5-17:  
EEG Playback Control

### 5.3.5 New EEG

To start a new EEG from any of the EEG detailed results screens press **NEW EEG**. The handheld will navigate to **Headset Placement Instructions** where testing can begin. (Refer to Section 4.5 for detailed instructions).

## 5.4 Patient Data Transfer and Networking

Use the USB-A to Micro-B USB Cable (40-1000-013) to connect the device to a computer running Windows 7 or Windows 10. The BrainScope One device will appear on the PC as a MTP (media transfer protocol) device presenting the contents of the SD card. The patient's PDF formatted summary report or data exported can be located on the SD card, using the patient's ID, and then transferred to the desired location on the PC. BrainScope One software updates shall not be performed by the user of the device, see Section 6.4.

Host laptop or PC requirements:

- Operating System: Windows 7 or Windows 10
- Supports USB 2.0 MTP protocol
- No additional USB drivers are necessary beyond those that are standard in the Operating Systems above.



### CAUTION:

- Only Windows 7 and Windows 10 operating systems are supported. All other operating systems are not supported and may result in data transfer failure.
- Connection of BrainScope One to third-party equipment for the purposes of data transfer could result in previously unidentified risks to patients, operators, or third parties. The Organization utilizing BrainScope One should identify, analyze, evaluate, and control these risks. In addition, changes to the third-party equipment could introduce new risks that require additional analysis.

\* Organization is accountable to Use or Maintenance of BrainScope One.

## 5.5 Exporting Data

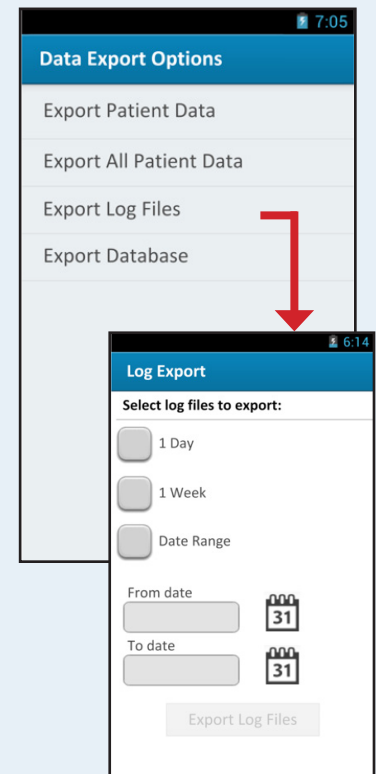
The data export options include exporting individual patient data, exporting all patient data, and exporting log files for technical support purposes. The data exported will be available on the handheld via USB connection. See section 5.4 Patient Data Transfer and Networking for information on transferring data from the handheld to a PC. Only Administrators have access to **Data Export Options**.

1. Press the physical **MENU** button on the handheld.
2. Press **ADMINISTRATOR SETTINGS** and log in to the device. Press **Data Export Options** and a menu of options will display (Figure 5-18).
3. The **Data Export Options** allow for the following manual data export actions:
  - Export Patient Data - select individual patient records to export (Figure 5-19). Press **CONTINUE** to confirm data export. Press **CANCEL** to return to **Data Export Options**.
  - Export All Patient Data - all patient data stored on the handheld will be exported. Press **CONTINUE** to confirm data export for all patients. Press **CANCEL** to return to **Data Export Options**.
  - Export Log Files - log files stored on the handheld can be exported. Press **EXPORT LOG FILES** and select the log files to export based on date range. Press **EXPORT LOG FILES** to initiate log file export. Press **CONTINUE** to confirm log file export. Press **CANCEL** to return to **Data Export Options**.
  - Export Database - the entire database stored on the handheld will be exported. Press **CONTINUE** to confirm database export. Press **CANCEL** to return to **Data Export Options**.

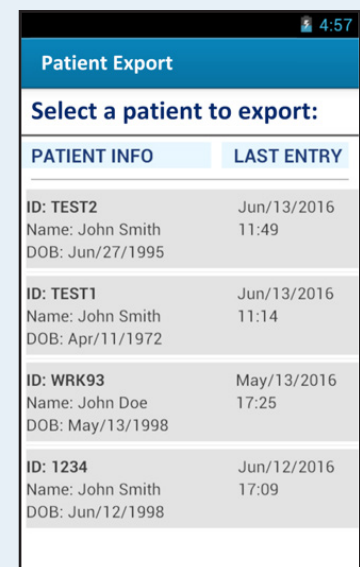


**NOTE:** Exported files may include patient data files, device log files, etc. Some of these files may contain PHI that may not be encrypted when exported from the device. Follow your internal procedures to ensure privacy and security of patient information. Contact BrainScope customer support for further details.

**NOTE:** All patient data is exported in multiple formats including binary files and XML format. The database export will create a database file only (ex. BrainScopeDB.db). All data is stored on the SD Card after the export process is complete.



**Figure 5-18:**  
Data Export Options Menu



**Figure 5-19:**  
Patient Export

## CHAPTER 6: Maintenance

### 6.1 Cleaning BrainScope One

**WARNING!**

- Follow the current local regulations governing biohazard waste to safely handle the system components.
- Electrode Headsets are single use only.
- Disconnect the handheld from the AC power source before cleaning. After cleaning, do not connect to AC power source until the handheld is thoroughly dry.
- Avoid exposing Charger to excess moisture, as this can lead to an electrical shock or fire hazard.
- Turn off the handheld before cleaning. Pay particular attention around controls, connectors, and panel edges.
- Do not use abrasives.

**CAUTION:**

- DO NOT allow moisture in any seams, openings or electrical connectors.
- DO NOT use solvents, lubricants, or other chemicals, unless otherwise specified. Failure to comply may result in product damage.
- DO NOT use an aerosol spray directly on the touch screen and DO NOT scratch the touch screen.
- If the handheld is exposed to biohazard substances, clean the handheld with 10:1 water/bleach solution. However, repeated cleaning with a bleach solution can degrade the plastic case.
- The handheld MUST NOT be immersed in liquids.

**To clean the handheld:**

- Apply mild detergent and warm water or a glass cleaner to a soft cloth and gently wipe the touch screen.
- Gently wipe the handheld with a soft cloth or sponge dampened with a non-abrasive, hospital disinfectant (e.g. Medline Micro-Kill Germicidal Wipes or an equivalent EPA-registered disinfectant) or mild detergent and water.

**To clean the patient interface cable and DAB Module:**

- Visually inspect the patient interface cable for damage. DO NOT use if damage is apparent.
- Wipe the cable clean with a mild detergent and water or isopropyl alcohol.
- Dry the cable with a lint-free towel. If available, use medical-grade compressed air.

**To clean the International Charging Kit:**

- The International Charging Kit requires cleaning only if soiling is observed. If cleaning is required, wipe the exterior surfaces with a cloth dampened with isopropyl alcohol.
- Before cleaning, ensure the USB-A **C**harger is unplugged from AC power source.

## 6.2 General Maintenance

There are no user-serviceable parts contained within the BrainScope One EEG Acquisition Unit, patient interface, or the International Charging Kit. DO NOT attempt to open or service these units.

Contact BrainScope Technical Support for any issues. Opening the instrument, patient interface cable, or International Charging Kit will void the warranty and may adversely impact handheld performance and safety.

## 6.3 Preventative Maintenance

Periodic factory maintenance is not required but intermittent battery replacement may be needed. Contact BrainScope Technical Support.

## 6.4 Software Update

All software updates shall be performed by BrainScope personnel. If you encounter software related issues please contact BrainScope Technical Support (See Section 6.5).

## 6.5 Technical Support

Contact us at:

BrainScope Company, Inc.  
5404 Wisconsin Avenue, Suite 300  
Chevy Chase, MD 20815  
USA

Phone: 1-855-9-BRAIN-1 (927-2461)  
Email: CustomerCare@BrainScope.com

[www.BrainScope.com](http://www.BrainScope.com)

## 6.6 Product Life

The BrainScope One EEG Acquisition Unit life is expected to be 5 years with battery replacement expected every 2 years, depending on use. The headset shelf life is 24 months\*. The battery is intended to be replaced only by the manufacturer. A special tool and knowledge of the handheld's assembly is required for its removal.



**NOTE:** Ensure all patient data including any PHI is deleted prior to returning devices to BrainScope Company, Inc.

\* Maximum headset shelf life of 24 months can be achieved when product is stored in temperatures equal to or under 25°C or 77°F within intact and undamaged packaging.

## 6.7 Service - Returning a Device

Delete all patient data such as protected health information (PHI) from the device prior to sending the device back to BrainScope for servicing unless specifically instructed otherwise. Instructions on how to transfer or export and then delete all such files can be found in Sections 3.5.8 Patient Deletion Settings, 3.5.9 Delete Log File Settings, 5.4 Patient Data Transfer and Networking and 5.5 Exporting Data.



## CHAPTER 7: Troubleshooting

### 7.1 Impedance

Message	Meaning	Corrective Action(s)
Unacceptable Impedance Values	Impedance values are higher than acceptable range.	<ul style="list-style-type: none"> <li>Press the electrode(s) firmly in place to ensure adhesion to the patient's skin.</li> <li>If the unacceptable impedance value remains, lift electrode, wipe the skin again with the headset skin prep pad (See Section 4.4). Replace the electrode and apply firm pressure to ensure adhesion to the patient's skin.</li> </ul>
Impedance Values Indicate OFF	Headset connector not connected.	<ul style="list-style-type: none"> <li>Keep straight and push the headset connector all the way into the DAB.</li> </ul>


### 7.2 Handheld

Message	Corrective Action(s)
Handheld Not Responding to User Commands	<ul style="list-style-type: none"> <li>Push the power button and hold for more than 10 seconds.</li> <li>The handheld will re-boot automatically. If the handheld does not respond to a 10 second push of the power button, connect the device to its charger and push the power button and hold for more than 60 seconds. The handheld will reboot automatically.</li> </ul>
Incorrect Date and Time	<ul style="list-style-type: none"> <li>When the BrainScope One battery is fully drained, the BrainScope One's clock will be reset to January 11, 2014.</li> <li>To correct the problem: <ol style="list-style-type: none"> <li>Connect the charger and recharge the battery for at least 2 hours with the handheld powered off.</li> <li>Then disconnect the charger and power on the handheld.</li> </ol> </li> <li>The clock should be set correctly after the application starts up and the EEG data connection to the DAB is established.</li> <li>The handheld will not be able to get the correct date and time from the DAB while the charger is connected.</li> <li>Check the time in the status bar at the upper right corner of the screen.</li> <li>If the handheld's date is not correct, power off and then power back on with the charger disconnected to re-synchronize the handheld's clock with the DAB.</li> </ul>

Message	Corrective Action(s)
Incorrect Date and Time (Cont.)	<ul style="list-style-type: none"> <li>Daylight Savings Time is handled automatically by BrainScope One, but the software may not immediately apply the automatic change to or from Daylight Savings Time. Restart BrainScope One to force it to apply the change. Occasionally, multiple restarts may be necessary for the clock to be adjusted correctly.</li> <li>If the Date/Time is still incorrect, follow the instructions in Section 3.5.7 Device Settings - Date and Time to set the clock using GPS. Make sure the unit is outdoors with a clear view of the sky and that it is not connected to a charger when setting the clock using GPS. The clocks on both the handheld and DAB will be updated to the correct time.</li> <li>If the Date/Time is still incorrect, contact BrainScope (See Chapter 10).</li> </ul>
Battery Depletion	<ul style="list-style-type: none"> <li>If BrainScope One shuts down because the battery is fully depleted (see section 3.2), recharge the handheld for a minimum of 4 hours.</li> <li>If the handheld does not turn on when the green power button is pressed after battery depletion, press and hold the green power button for 30 seconds, then release. The handheld should reboot.</li> <li>If the handheld does not respond by rebooting, connect the charger. Then press and hold the green power button for 60 seconds, then release. The handheld should reboot.</li> <li>After the handheld reboots, if the battery level is still low, power off the handheld and connect the charger.</li> </ul>

## 7.3 EEG Data

Message	Meaning	Corrective Action(s)
EEG Data Connection Failed	The handheld has lost USB communication with the DAB for more than 30 seconds. The spinning circle indicates that the handheld is attempting to re-establish communication with the DAB.	<ul style="list-style-type: none"> <li>When the connection is re-established, the <b>EEG Data Connection Successful</b> message will display. Press <b>OK</b> to dismiss.</li> <li>If the connection is not re-established in 30 seconds, the handheld will power off in 60 seconds.</li> <li>Press <b>CANCEL</b> to dismiss the message. Press <b>POWER OFF NOW</b> to power down the handheld.</li> </ul>

Message	Meaning	Corrective Action(s)
Insufficient Data Collected	A sufficient amount of artifact-free EEG data has not been collected in 10 minutes. Therefore, results cannot be calculated.	<ul style="list-style-type: none"> <li>Press <b>OK</b> to return to the home screen.</li> <li>If you wish to start a new EEG session, press <b>INSUFFICIENT DATA COLLECTED</b> next to the EEG result and then press <b>NEW EEG</b> in the upper right corner.</li> <li>The same headset can be used for up to 3 EEG sessions.</li> <li>Follow artifact troubleshooting instructions to reduce artifacts (see Chapter 2, Page 2-3, Step 10)</li> </ul>
 <b>WARNING!</b> Standard clinical assessment of the patient should proceed in the event that insufficient clean (artifact-free) EEG data is collected.		

## 7.4 Micro SD Card

Message	Meaning	Corrective Action(s)
SD Card Full	The SD card has less than 1GB of free space available	<ul style="list-style-type: none"> <li>Move data off of the SD card, shut down the handheld and re-start the handheld before continuing.</li> </ul>

## 7.5 Other Operational Problems

There are no user-serviceable parts contained within the BrainScope One handheld, DAB, or the International Charging Kit.

DO NOT attempt to open or service these units.

For a complete list of known software issues, refer to the software release notes (R-00295) located on the Micro SD Card.

Contact BrainScope Technical Support for any technical issue. See Section 6.5 for more information.

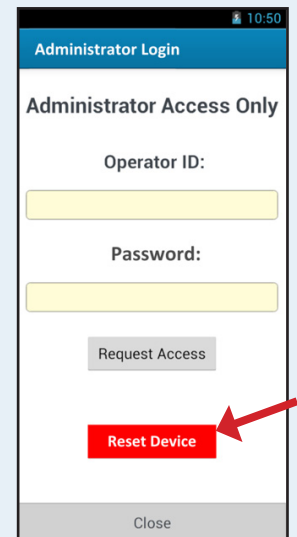
## 7.6 Device Reset

The device can be reset back to the original factory settings.

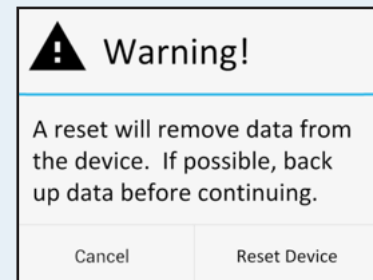


**CAUTION:** Resetting the device will remove ALL data from the handheld. Consider backing up data before performing a reset.

1. Press the physical **MENU** button on the handheld.
2. Press **ADMINISTRATOR SETTINGS**.
3. Scroll down on the screen and press **RESET DEVICE** (Figure 7-1).
4. A warning box will appear (Figure 7-2). Press **CANCEL** to exit the message and return to the **Administrator Login** screen.
5. Press **RESET DEVICE** to initiate the reset.
6. When all patient and operator data have been removed, the handheld will navigate to the **Information Hub** (See Section 4.3).



**Figure 7-1:**  
**Adminstrator Login**



**Figure 7-2:**  
**Reset Warning Message**

## CHAPTER 8: Regulatory Standards

BrainScope One is designed and developed in accordance with the following –

### Electrical Safety Standards

#### BASE

- IEC 60601-1/A1:2012 Medical Electrical Equipment – Part 1: General Requirements for Basic Safety and Essential Performance
- ANSI/AAMI ES60601-1/A1:2012 Medical Electrical Equipment – Part 1: General Requirements for Basic Safety and Essential Performance
- EN 60601-1/A1:2012 Medical Electrical Equipment – Part 1: General Requirements for Basic Safety and Essential Performance
- CAN/CSA-C22.2 No. 60601-1:2014 Medical Electrical Equipment – Part 1: General Requirements for Basic Safety and Essential Performance

#### COLLATERAL

- IEC 60601-1-2: 2007 Medical electrical equipment - Part 1-2: General requirements for basic safety and essential performance - Collateral standard: Electromagnetic compatibility - Requirements and tests (Emission & Clause 6.2 Immunity Non-Life Supporting Equipment)
- EN 60601-1-2: 2007: AC: 2010 Medical electrical equipment - Part 1-2: General requirements for basic safety and essential performance - Collateral standard: Electromagnetic compatibility - Requirements and tests (Emission & Clause 6.2 Immunity Non-Life Supporting Equipment)
- EN 55011:2009 + A1:2010 (Group 1 Class B Limit)
- ETSI EN 301 489-3 V1.6.1: 2013 (Clause 7.2 Immunity)
- ICES-001, Issue 4: 2006
- FCC Part 15 Subpart B (Class B Limit)
- IEC 60601-1-6/A1:2013 General Requirements For Basic Safety And Essential Performance – Collateral Standard: Usability

#### PARTICULAR

- IEC 60601-2-26:2012 Particular requirements for the basic safety and essential performance of electroencephalographs

BrainScope One is intended for continuous operation, is internally powered and has a protective classification of Type BF. Refer to section 10.6 for additional details.

BrainScope One RF emissions are compliant with Group I, Class B.

The standards listed above cover the Base, Collateral (EMC) and Particular (EEG specific) standards. Performance standards are not listed.

## Disposable Electrode Standard

- ANSI/AAMI EC12:2000/(R)2010 Disposable ECG Electrodes

## Biocompatibility

- ANSI/AAMI/ISO 10993-1:2009 Biological evaluation of medical devices – Part 1: Evaluation and testing within a risk management process
- ANSI/AAMI/ISO 10993-5:2009/(R) 2014 Biological Evaluation of Medical Devices – Part 5: Tests for In Vitro Cytotoxicity
- ANSI/AAMI/ISO 10993-10:2010 Biological evaluation of medical devices – Part 10: Test for irritation and skin sensitization

BrainScope One is intended for contact duration less than 24 hours (level A) and evaluated for Cytotoxicity, Sensitization and Irritation.

## Environmental Standards

- MIL-STD-810G, Department of Defense Test Method Standard for Environmental Engineering Considerations and Laboratory Tests

## Ingress Protection

- IEC 60529 (2004) Degree of Protection Provided by Enclosures

## Packaging Performance Standards

- ASTM D4169 – 09, Standard Practice for Performance Testing of Shipping Containers and Systems

The BrainScope One packaging is designed for Distribution Cycle 13 and meets the requirements of Assurance Level I. BrainScope One is designed and manufactured in accordance with an ISO 13485 certified quality assurance system.

## CHAPTER 9: BrainScope Contact Information

BrainScope Company, Inc.  
5404 Wisconsin Avenue, Suite 300  
Chevy Chase, MD 20815  
USA

Phone: 1-855-9-BRAIN-1 (927-2461)  
Email: [CustomerCare@BrainScope.com](mailto:CustomerCare@BrainScope.com)













[www.BrainScope.com](http://www.BrainScope.com)














## CHAPTER 10: Specifications

### 10.1 Labeling Symbols

This section contains various international symbols which may appear on BrainScope One and/or system components and the Electrode Headset.

Symbol	Description
	Warning!
	Caution
	Note
	Stand-by/Power
	DC Current
	Type BF Applied Part
	Alternating Current
	DO NOT Dispose in Fire
	DO NOT Recycle
<b>R<sub>x</sub> Only</b>	Prescription Use
	Reference Number
	Serial Number
	Part Number

Symbol	Description
	Lot Number
	DO NOT Reuse
	Polyvinyl Chloride Free
	Storage/Operational Temperature Limit
	Use-by Date
	Read Usage Instructions
	Upper Limit of Temperature
	Manufacturing Date
	Non Sterile
	MR Unsafe
	Information
<b>IPN<sub>1</sub>N<sub>2</sub></b>	Ingress Protection N1N2 = Rating

## 10.2 BrainScope One Part Numbers

Item	Part Number
BrainScope One Kit	99-1403-002
EEG Acquisition Unit (Handheld and DAB)	99-1403-004
Micro SD Card	40-1000-070
International Charging Kit	99-1403-028
International Charging Clips with USB-A Charger	50-1000-035
USB-A Charger	40-1000-012
USB-A to Micro-B USB 1ft Cable	40-1000-013
Quick Start Guide	50-1000-172
Safety Summary	50-1000-181
Case Insert	50-1000-040
Electrode Headset	99-1403-202



**NOTE:** The Micro SD Card stores all data records on the BrainScope One handheld (after data export) along with other important information about the recording including all patient information. High reliability Micro SD cards are supplied by BrainScope for use with the BrainScope One handheld.



### **WARNING!**

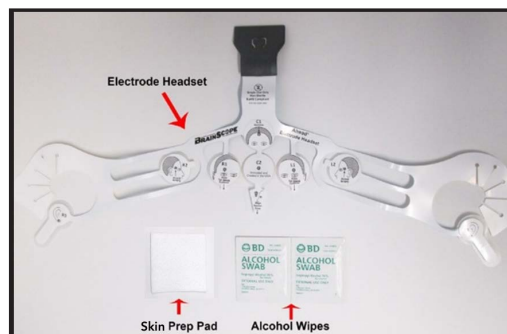
- The BrainScope One handheld will only work properly when used with the Electrode Headset.
- Explosion Hazard: DO NOT use BrainScope One in a flammable atmosphere or where concentrations of flammable anesthetics may occur.
- Operate the BrainScope One EEG Acquisition Unit only with the Micro SD cards supplied by BrainScope. Use of any other Micro SD cards could increase the risk of device malfunction and / or cause Micro SD card corruption.

The following BrainScope One EEG Acquisition Unit and Accessories are packaged together as a kit (99-1403-002):



- A** - EEG Acquisition Unit
  - A1 - Data Acquisition Board (DAB) Module
  - A2 - Handheld
- B** - International charging Kit
  - B1 - USB-A to Micro-B USB 1ft Cable
  - B2 - USB-A Charger
  - B3 - International Charging Clips with USB-A Charger
- C** - Quick Start Guide and Safety Summary
- D** - Case Insert

The Electrode Headset (99-1403-202) is not included as part of the packaged system. Headsets are obtained separately from BrainScope. The user should obtain only Electrode Headsets for use with the BrainScope One EEG Acquisition Unit.



## 10.3 Technical Specifications

BrainScope One EEG Acquisition Unit Components Physical Dimensions	
Size (nominal)	Handheld: 82 mm (3.2") x 155mm (6.1") x 25 mm (0.9") DAB: 135 mm (5.31") x 127 mm (5.00") x 49 mm (1.93") Handheld to DAB cable: 1.20 m (47.24")
Weight (nominal)	Handheld: 0.4 kg (0.88 lb) DAB: 0.206 kg (0.45 lb)
BrainScope One EEG Acquisition Unit Components Operational Environment	
Ingress Protection	IP54 with DAB Jacket plug inserted
Temperature	0°C to 38°C (32°F to 100°F)
BrainScope One EEG Acquisition Unit Components Transportation and Storage Environment	
Temperature	-40°C to 71°C (-40°F to 160°F)
Altitude	14,000 ft. (4,267 m)
Electrode Headset Operational Environment	
Temperature	0°C to 38°C (32°F to 100°F)
Electrode Headset Storage Environment	
Temperature	Upper limit of 25°C (77°F)
Shelf Life	24 months <sup>1</sup>
Digital Signal Characteristics	
ADC Resolution	24 bits
Raw Data Sampling Rate	1 kHz and 100 Hz data streams
Measurement Bandwidth	1 kHz data: DC to 300 Hz 100 Hz data: 0.67 Hz to 43 Hz
Storage Capacity	
EEG Data	Minimum 150 raw EEG data recordings and 500 processed results
Total Capacity	Maximum 32 GB
Amplifier	
Data Channels	7
Common Mode Rejection Ratio (CMRR)	< -100dB
System Noise <sup>2</sup>	< 0.4 microvolt RMS in 0.67 Hz to 43 Hz bandwidth
Impedance Measurement	
Range	0.1 kΩ to 200 kΩ combined electrodes
Accuracy	Maximum of ±15% or ±500Ω

<sup>1</sup> Maximum headset shelf life can be achieved when product is stored in temperatures equal to or under 25°C or 77°F.

<sup>2</sup> Noise contribution by amplifier hardware only. Additional noise may be contributed by the electrode headset.

Artifact Detection and Rejection	
Automatic detection of 8 types of artifact or abnormal electrical activity	Eye Movement: <ul style="list-style-type: none"> <li>Horizontal/Lateral Eye Movement (HEM/LEM)</li> <li>Vertical Eye Movement (VEM)</li> </ul> Muscle Activity (EMG) High External Noise (ENH) Other Artifacts: <ul style="list-style-type: none"> <li>Patient/Cable Movement (PCM)</li> <li>Impulse (IMP)</li> <li>Significantly Low Amplitude Signal (SLAS)</li> <li>Atypical Electrical Activity Pattern (AEAP)</li> </ul>
Display/Touch Screen	
Type	High contrast, digital, graphic color, multi-point capacitive
Resolution	WVGA (480px x 800px)
Size	4.3" diagonal
Battery	
Chemistry	Lithium-ion
Nominal Voltage	3.7 V
Nominal Capacity	3300 mAh
Run-Time	160 minutes assuming equal EEG and non-EEG assessment use. Run-time will vary based on usage.
Longevity	At least 80% of original full capacity after 2 years of active use (total of 500 cycles, – based on heavy usage of 250 recharge cycles per year)
Safety Considerations	The battery pack is equipped with a protection circuit to prevent excessive charge and discharge currents.
Charging	Full recharge in less than 4 hours with device off
Electrical	
Input Voltage	5 V DC from wall converter
Current Consumption	2 A maximum during charging
Patient Connections	All patient probes and electrodes are Type BF Applied Parts
IEC 60601-1 Classifications	Internally powered, hand-held, body-worn

## 10.4 Protective Classification

BrainScope One is intended for continuous operation and has protective classification of internally powered equipment with a Type BF applied part (per IEC 60601-1) ordinary equipment, not suitable for use in the presence of flammable anesthetics. The BrainScope One Charger is for charging the handheld. An internal battery powers the handheld.



**NOTE:** The handheld should never be used for any patient assessment while BrainScope One is connected to an external power source.

## 10.5 Environment

### BrainScope One Components Shipping and Storage

Protect the BrainScope One from sudden temperature changes that can cause condensation within the instrument.

To minimize condensation, avoid moving the system between heated buildings and outside storage. Once moved inside, allow the device to equilibrate in the unopened shipping container before unpacking. Before use, wipe down all visible condensation and allow the system to equilibrate to room temperature.

The BrainScope One EEG Acquisition Unit complies with established electromagnetic compatibility (EMC) standards for medical devices.

The BrainScope One DAB jacket includes a rubber plug that must be inserted into the headset/charging port in order to meet the specified IP54 rating. Ingress protection is not guaranteed when this plug is not in place. Keep BrainScope One away from water and other fluids, do not use in wet conditions, and routinely inspect system components for possible exposure to liquid.

## 10.6 Power Requirements and System Grounding

Use only the BrainScope One USB-A Charger (40-1000-012) and USB-A to Micro-B USB 1ft Cable (40-1000-013) packaged with the BrainScope One Kit.



### **WARNING!**

The BrainScope One USB-A Charger is for charging purpose only. The handheld is intended to be operated from the internal battery. The handheld should never be used for any patient assessment while BrainScope One is connected to an external power source.

### Isolation from the Supply Mains

A plug and socket are suitable means of equipment isolation from the supply mains. Unplugging the AC plug ensures removal of all external power. The equipment is internally powered and is connected to the mains via plug only during battery charging.

### Electromagnetic Compatibility (EMC)



### **NOTE:**

- Medical electrical equipment such as BrainScope One needs special precautions regarding electromagnetic compatibility (EMC) and needs to be installed and put into service according to the EMC information provided in the Instruction Manual.
- All types of electronic equipment may characteristically cause electromagnetic interference with other equipment, transmitted either through air or connecting cables. The term “electromagnetic compatibility” (EMC) indicates the capability of the equipment to curb electromagnetic influence from other equipment, while at the same time not affecting other equipment with similar electromagnetic radiation. Radiated or conducted electromagnetic signals can cause distortion, degradation, or artifacts which may impair BrainScope One’s essential performance (see page

10-7 for table of essential performance). There is no guarantee that interference will not occur in a particular installation. If this equipment is found to cause or respond to interference, attempt to correct the problem by one or more of the following measures:

- Re-orient or re-locate BrainScope One
- Increase the separation between BrainScope One and affected device
- Consult Technical Support (see Section 6.5 for further suggestions)
- The manufacturer is not responsible for any interference or responses caused by the use of cables and accessories other than those provided (see page 10-11 for list of cables and cable accessories). To comply with the regulations on electromagnetic interference, all cables must be shielded and properly grounded. Use of cables not properly shielded and grounded may result in the equipment causing or responding to radio frequency interference, in violation of FCC regulations.
- Portable and mobile radio frequency (RF) communications equipment can affect medical electrical equipment such as BrainScope One. Intrinsic RF transmitters such as cellular phones, radio transceivers, mobile radio transmitters, radio-controlled toys, and so on, should preferably not be operated near BrainScope One. See table on page 10-10 for recommended minimum separation distances between portable and mobile RF communications equipment and BrainScope One. Any electrical device can unintentionally emit electromagnetic waves. However, minimum device separation distances cannot be calculated for such unspecified radiation. When BrainScope One is used adjacent to or in close proximity to other equipment the user should be attentive to unexpected device behavior which may be caused by such radiation. BrainScope One is intended for use in the electromagnetic environment specified in the tables below. The user of BrainScope One should assure that the device is used in such an environment.

BrainScope One is designed to be compliant with the EMC standard IEC 60601-1-2. As required by that standard, the following tables are provided for guidance related to the operation of the system with respect to the electromagnetic environment.

Guidance and Manufacturer's Declaration — Electromagnetic Emissions		
BrainScope One is intended for use in the electromagnetic environment specified below. The customer or the user of BrainScope One should assure that it is used in such an environment.		
Emissions Test	Compliance	Electromagnetic Environment—Guidance
RF emissions CISPR 11	Group I	BrainScope One uses RF energy only for its internal function. Therefore, its RF emissions are very low and are not likely to cause any interference in nearby electronic equipment.
RF emissions CISPR 11	Class B	BrainScope One is suitable for use in all establishments, including domestic establishments and those directly connected to the public low-voltage power supply network that supplies buildings used for domestic purposes.
Voltage fluctuations/flicker emissions IEC 61000-3-3	Compliant	




The Essential Performance of BrainScope One is:

- The ability to display accurate results based on clean EEG data
- The ability to measure and display accurate impedance data for each EEG channel, and to prevent display of results if impedance is too high
- The ability to record EEG data with RMS noise below 0.4  $\mu\text{V}$  between 0.67 Hz and 43Hz on all channels
- The ability to prevent display of results if an inauthentic or expired electrode headset is being used for EEG data collection

Guidance and Manufacturer's Declaration — Electromagnetic Immunity			
BrainScope One is intended for use in the electromagnetic environment specified below. The customer or the user of BrainScope One should assure that it is used in such an environment			
Immunity Test	IEC 60601 Test Level	Compliance Level	Electromagnetic Environment—Guidance
Electrostatic discharge (ESD) IEC 61000-4-2	$\pm 6$ kV contact $\pm 8$ kV air	$\pm 6$ kV contact $\pm 8$ kV air	Floors should be wood, concrete, or ceramic tile. If floors are covered with synthetic material, the relative humidity should be at least 30%.
Electrical fast transient/burst IEC 61000-4-4	$\pm 2$ kV for power supply lines	$\pm 2$ kV for power supply lines	Mains power quality should be that of a typical commercial or hospital environment.
Surge IEC 61000-4-5	$\pm 1$ kV differential $\pm 2$ kV common	$\pm 1$ kV differential $\pm 2$ kV common	Mains power quality should be that of a typical commercial or hospital environment.
Voltage dips, short interruptions and voltage variations on power supply input lines IEC 61000-4-11	$<5\% U_T$ ( $>95\%$ dip in $U_T$ ) for 0.5 cycle $40\% U_T$ (60% dip in $U_T$ ) for 5 cycles $70\% U_T$ (30% dip in $U_T$ ) for 25 cycles $<5\% U_T$ ( $>95\%$ dip in $U_T$ ) for 5 s	$<5\% U_T$ ( $>95\%$ dip in $U_T$ ) for 0.5 cycle $40\% U_T$ (60% dip in $U_T$ ) for 5 cycles $70\% U_T$ (30% dip in $U_T$ ) for 25 cycles $<5\% U_T$ ( $>95\%$ dip in $U_T$ ) for 5 s	Mains power quality should be that of a typical commercial or hospital environment.
Power frequency (50/60 Hz) magnetic field IEC 61000-4-8	3 A/m	3 A/m	Mains power quality should be that of a typical commercial or hospital environment.
<b>NOTE:</b> $U_T$ is the a.c. mains voltage prior to application of the test level.			

## Guidance and Manufacturer's Declaration — Electromagnetic Immunity

BrainScope One is intended for use in the electromagnetic environment specified below.  
The customer or the user of BrainScope One should assure that it is used in such an environment.

Immunity Test	IEC 60601 Test Level	Compliance Level	Electromagnetic Environment — Guidance
Conducted RF IEC 61000-4-6	3 Vrms 150 kHz to 80 MHz	3 V	Portable and mobile RF communications equipment should be used no closer to any part of the BrainScope One, including cables, than the recommended separation distance calculated from the equation applicable to the frequency of the transmitter.  Recommended Separation Distance  $d = 1.2 \sqrt{P}$
Radiated RF IEC 61000-4-3	3 V/m 80 MHz to 2.5 GHz	3 V/m	$d = 1.2 \sqrt{P}$ 80 MHz to 800 MHz $d = 2.3 \sqrt{P}$ 800 MHz to 2.5 GHz  where P is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer and d is the recommended separation distance in meters (m).  Field strengths from fixed RF transmitters, as determined by an electromagnetic site survey, <sup>a</sup> should be less than the compliance level in each frequency range. <sup>b</sup>  Interference may occur in the vicinity of equipment marked with the following symbol:  

**NOTE 1:** At 80 MHz and 800 MHz, the higher frequency range applies.

**NOTE 2:** These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects, and people.

<sup>a</sup> Field strengths from fixed transmitters, such as base stations for radio (cellular/cordless) telephones and land mobile radios, amateur radio, AM and FM radio broadcast, and TV broadcast cannot be predicted theoretically with accuracy. To assess the electromagnetic environment due to fixed RF transmitters, an electromagnetic site survey should be considered. If the measured field strength in the location in which BrainScope One is used exceeds the applicable RF compliance level above, BrainScope One should be observed to verify normal operation. If abnormal performance is observed, additional measures may be necessary, such as re-orienting or relocating BrainScope One.

<sup>b</sup> Over the frequency range 150 kHz to 80 MHz, field strengths should be less than 3 V/m.

## Recommended Separation Distances Between Portable and Mobile RF Communications Equipment and BrainScope One

BrainScope One is intended for use in an electromagnetic environment in which radiated RF disturbances are controlled. The customer or the user of BrainScope One can help prevent electromagnetic interference by maintaining a minimum distance between portable and mobile RF communications equipment (transmitters) and BrainScope One as recommended below, according to the maximum output power of the communications equipment.

Rated Maximum Output Power of Transmitter W	Separation Distance According to Frequency of Transmitter m		
	150 kHz to 80 MHz $d = 1.2 \sqrt{P}$	80 MHz to 800 MHz $d = 1.2 \sqrt{P}$	800 MHz to 2.5 GHz $d = 2.3 \sqrt{P}$
0.01	0.12	0.12	0.23
0.1	0.37	0.37	0.73
1	1.2	1.2	2.3
10	3.7	3.7	7.3
100	12	12	23
For transmitters rated at a maximum output power not listed above, the recommended separation distance d in meters (m) can be estimated using the equation applicable to the frequency of the transmitter, where P is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer.			
<p><b>NOTE 1:</b> At 80 MHz and 800 MHz, the separation distance for the higher frequency range applies.</p> <p><b>NOTE 2:</b> These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects, and people.</p>			

BrainScope One is supplied with the following cables and charging accessories:

BrainScope P/N	Cable/Accessory Type	Specifications
40-1000-012  Manufacturer: Phihong USA Corporation  Manufacturer P/N: PSA10F-050Q, PSA10F-050QR	USB-A Charger	DC Output Voltage: 5+/- 0.25V Min. Load: 0A Max Load: 2A AC Input Voltage Rating: 100 VAC – 240 VAC AC Input Frequency: 50 Hz – 60 Hz AC Input Current: 0.3A RMS max @ 120 VAC 0.15A RMS max @ 240 VAC Output Power: 10W continuous Standby Power: <150mW at 230VAC
40-1000-013  Manufacturer: StarTech  Manufacturer P/N: UUSBHAUB1	USB-A to Micro-B USB 1ft Cable	Connector Plating: Nickel Cable Jacket Type: PVC Cable Shield Type: Aluminum-Mylar Foil with Braid Connector A: 1 – USB A (4 pin) Male Connector B: 1 – USB Micro-B (5 pin) Male Color: Black Wire Gauge: 28 AWG Cable Length: 1 ft (0.3 m) Product Weight: 0.6 oz (17 g)



## WARNING!

The use of accessories, transducers and cables other than those specified could result in increased electromagnetic emissions or decreased electromagnetic immunity.



**NOTE:** In order to satisfy the electromagnetic emissions and immunity requirements, BrainScope One must be used with the following accessories included in the International Charging Kit (99-1403-028):

- USB-A Charger (PSA10F-050Q, PSA10F-050QR)
- USB-A to Micro-B USB 1ft Cable (40-1000-013)
- International Charging Clips (included in 50-1000-035)

## Limited Warranty

BrainScope Company, Inc., ("BrainScope") warrants, to the original purchaser ("Customer"), that the BrainScope One Reusable System unit(s) (herein referred to as the "Products"), excluding any disposables or consumable supplies provided with or purchased for such units, such as disposable electrode headsets, patient single-use supplies or other accessories, purchased by Customer from BrainScope or a BrainScope authorized distributor are free from defects in materials or workmanship under normal use by Customer for a period of twelve (12) months from the date of shipment. Under this Limited Warranty, BrainScope will repair or replace, at its discretion, any manufacturer's defect in materials or workmanship (subject to the limitations and exclusions set forth below), on Products(s) purchased by Customer from BrainScope or an authorized BrainScope distributor and retained by the Customer. This Limited Warranty is non-transferable. THIS LIMITED WARRANTY SHALL BE IN LIEU OF ANY AND ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING WITHOUT LIMITATION, ANY IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, NON-INFRINGEMENT, NON-INTERFERENCE, SYSTEM INTEGRATION, INFORMATIONAL CONTENT OR DATA ACCURACY, ALL OF WHICH ARE EXPRESSLY DISCLAIMED BY BRAINSOPE. REPAIR OR REPLACEMENT AS PROVIDED UNDER THIS WARRANTY IS THE CUSTOMER'S SOLE REMEDY. BRAINSOPE SHALL NOT BE LIABLE FOR ANY INDIRECT, INCIDENTAL, OR CONSEQUENTIAL DAMAGES AND EXPENSES, INCLUDING DAMAGES OR INJURY TO PERSON OR PROPERTY, IN CONNECTION WITH ANY BREACH OF THIS WARRANTY. SOME STATES AND JURISDICTIONS MAY NOT ALLOW THESE LIMITATIONS ON WARRANTIES. THIS WARRANTY GIVES YOU SPECIFIC LEGAL RIGHTS, AND YOU MAY ALSO HAVE OTHER RIGHTS, WHICH VARY FROM STATE TO STATE OR JURISDICTION TO JURISDICTION.

### Warranty coverage includes:

- Parts\* and labor
- BrainScope Customer Technical Support by phone, 24 hours a day 7 days a week
- Loaner unit while out for repair
- Transportation of Products for repair
- Basic functionality training (one time)\*\*
- Software upgrades

\* Excludes consumable components such as disposable electrode headsets, patient single-use supplies, filters, batteries, etc.

\*\* Customer will receive training on the operation of the Products after the sale is final, at the Customer's location, at a time that is mutually agreed upon. A User Manual and other user documentation will be provided with each Product, which may not be copied or re-distributed.

\*\* Customer will receive training on the operation of the Products after the sale is final, at the Customer's location, at a time that is mutually agreed upon. A User Manual will be provided with each Product, which may not be copied or re-distributed.

## **WARRANTY EXCLUSIONS:**

This Limited Warranty does not extend to any Products that has been damaged or rendered defective: (1) through normal wear and tear; (2) as a result of failure to follow Products instructions for use and published specifications and/or proper maintenance procedures as described in the Product labeling and published operations and maintenance information; (3) as a result of accident, neglect, misuse or abuse; (4) by the use of parts not manufactured, sold or otherwise authorized by BrainScope for use in or with the Products; (5) by modification of the Products without express written authorization of BrainScope; (6) as a result of service or repair by anyone other than BrainScope authorized repair personnel (other than routine service performed in accordance with the Product's published operations and maintenance information that is not expressly limited to BrainScope authorized personnel), or (7) if Customer uses a Products for non-medical or entertainment purposes or outside the United States. This Limited Warranty does not extend to: (1) damage, including corrosion or Products failure, due to causes beyond BrainScope's control such as, but not limited to, theft, fire, flood, wind, lightening, storm, natural disaster, electrical or power outages and surges, and acts of third parties.

## **THIS LIMITED WARRANTY IS VOID IF:**

- Proof of Customer's original purchase cannot be provided by the Customer; or
- The factory applied serial number has been altered or removed; or
- The Products are used or stored in a manner inconsistent with specifications, including but not limited to electrical systems for which the Products is not designed; or
- Any component parts or patient single-use disposables that are not intended for use with the Products, other than those expressly approved by BrainScope, are used.

## **CUSTOMER SUPPORT:**

BrainScope Customer Support is available by phone to answer questions and provide product-related technical support. To access this service, please call 1-855-9-BRAIN-1 (1-855-927-2461) and ask for product technical assistance.

## Appendix 1: Cognitive Performance



**Note:** The Cognitive Performance test will only display if this assessment is selected in the **Test Configuration** screen. (See Set Up Section 3.5)

Prior to starting the test, inform the patient of the following:

- "There are no grades for this test and you cannot pass or fail it, but I would like for you to try as hard as you can."
- "You need to read the instructions carefully before starting each section. If you do not understand the instructions or have any questions during the test, please tell me."

The full description of the Normative Data can be found at the end of this section.

### Complex Reaction Time

The **Complex Reaction Time** test measures information processing speed, visuomotor reaction time, simple decision making, and attention. The patient is presented with a number (2, 3, 4, or 5). The patient is instructed to press one designated button for a "low" number (2 or 3) and another designated button for a "high" number (4 or 5).

After the patient information has been entered, the device will display the **Information Hub**.

Instruct the patient that the BrainScope One handheld will be handed to him or her and to read the instructions on the screen. The patient will follow the instructions on the screen to complete the test.

1. To perform a Cognitive Performance session, press **START** on the **Information Hub**.

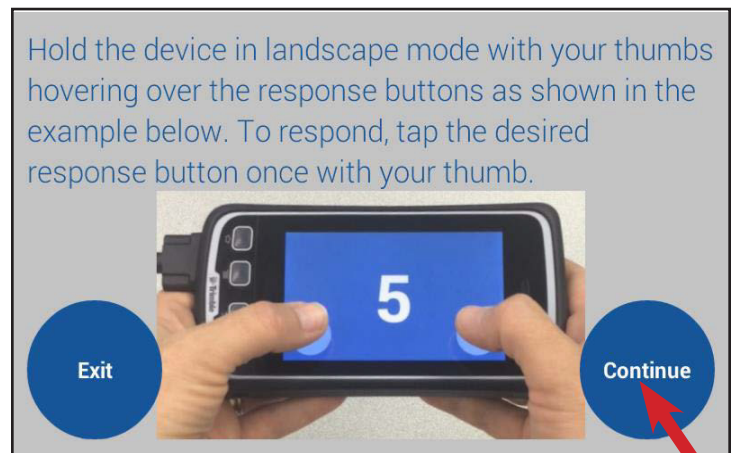


**NOTE:** A message will display prompting you to hand the patient the handheld.

2. Hand the handheld to the patient and confirm that the handheld is positioned properly so the patient can read the instructions (Figure A1-1).
3. The **Vista Cognitive Performance** test will appear. Instruct the patient to read the instructions, then press **CONTINUE** when ready. Press **EXIT** to return to the **Information Hub**.



**NOTE:** The operator cannot exit the Cognitive Performance test after **CONTINUE** is pressed and the test begins.



**Figure A1-1: Handheld Position while performing Cognitive Performance assessment. EXIT and CONTINUE buttons displayed in lower corners of the screen.**



1. The handheld will continue to instruct the patient on how to perform the **Complex Reaction Time** (also referred to as **Procedural Reaction Time**) test (Figure A1-2). The operator should monitor the patient to be sure that the patient is reading and understanding the instructions given.

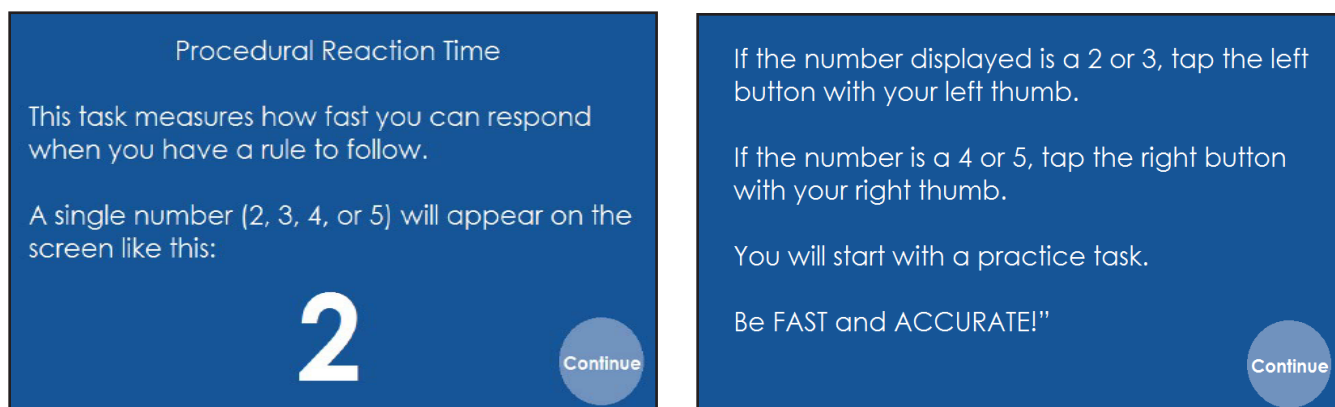


Figure A1-2:  
Procedural Reaction Time Instructions

2. Before moving to the next screen ask the patient if they understand the instructions.
3. After being presented with a number (2, 3, 4, or 5), the patient is instructed to press one designated button for a "low" number (2 or 3) and another designated button for a "high" number (4 or 5). The patient should respond as quickly as possible to different sets of stimuli based on simple rules.
4. Once a number appears on the screen, the patient will press the left button if he/she sees a 2 or 3 and the right button if he/she sees a 4 or 5. In this example, the **LEFT** button is the correct answer. (Figure A1-3)



Figure A1-3:  
Example of Number to React to

After the test is complete, the handheld will navigate to the **Match To Sample** test.

## Match To Sample

The **Match To Sample** test measures visual-spatial processing, working memory, and visual short-term recognition memory. During this test the patient views a pattern produced by eight shaded cells in a 4x4 sample grid. The sample is then removed and two comparison patterns are displayed side by side. The patient is to press a designated button to select the grid that matches the sample.

The patient will be presented with a 4x4 visual pattern (Figure A1-4).

Instruct the patient to read the instructions, then press the **CONTINUE** button when ready.

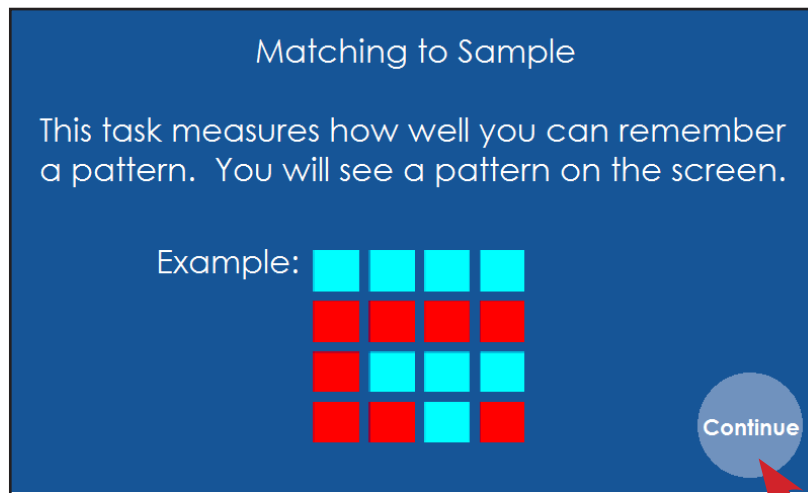


Figure A1-4:  
Match to Sample Instructions

The patient must attempt to memorize the pattern so he/she can remember it later. They should look carefully at the pattern because it will go away (Figure A1-5).

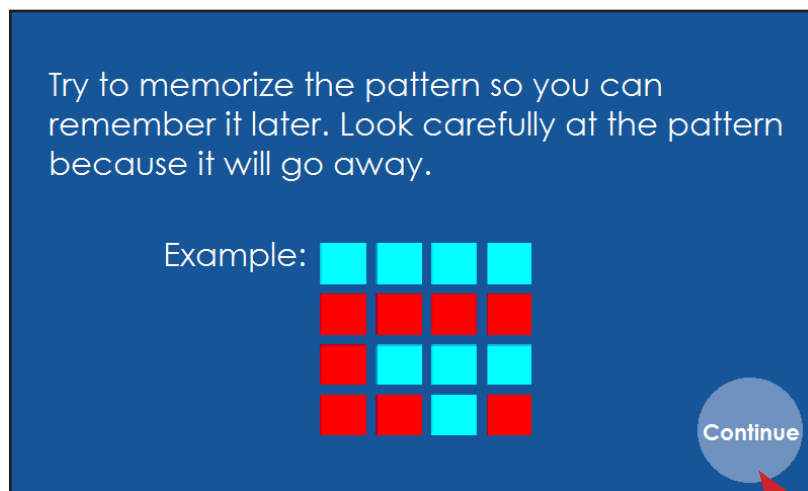
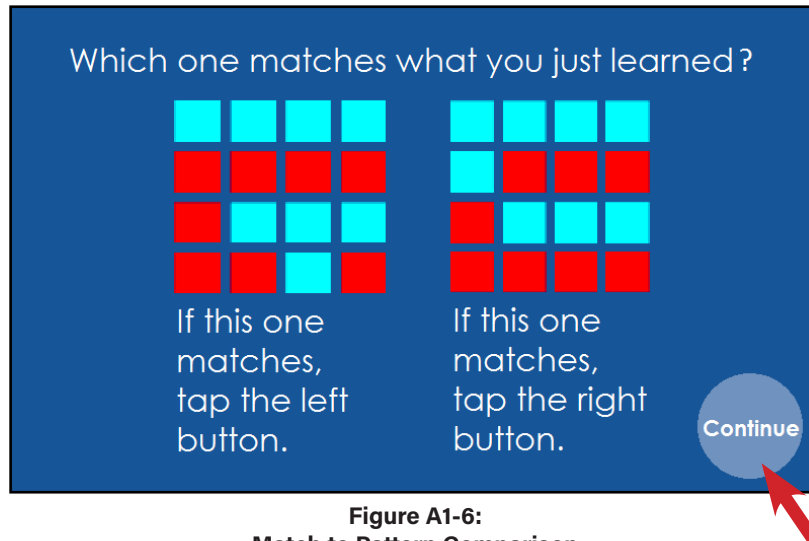


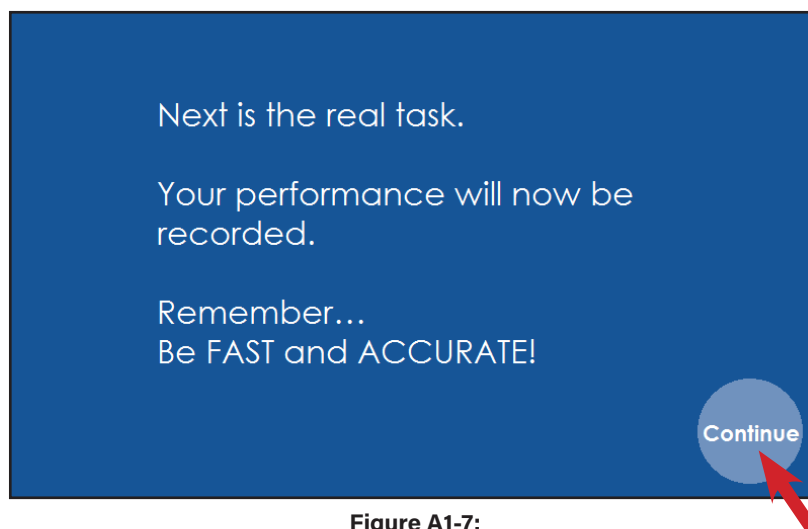
Figure A1-5:  
Match to Sample Pattern

Two comparison patterns are presented side-by-side during the test. Pick the pattern that matches the one that was just memorized by pressing either the right or left button next to the comparison pattern that matches the sample pattern (Figure A1-6).



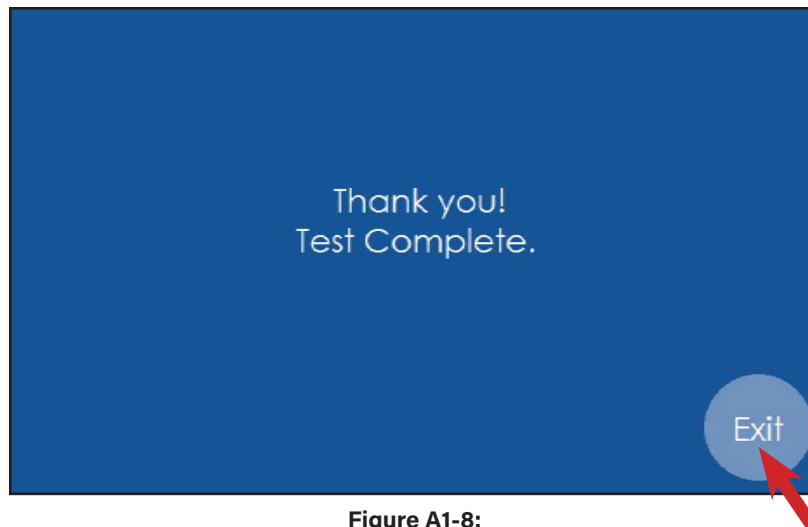
**Figure A1-6:**  
Match to Pattern Comparison

The application will have the patient conduct a practice test prior to the actual test beginning. The patient should follow the on screen instructions to complete the test (Figure A1-7).



**Figure A1-7:**  
Start test

After the series of tests are run, the Match To Sample test will conclude and a **Test Complete** screen will appear (Figure A1-8). Press **EXIT** to return to the **Cognitive Performance Summary**.

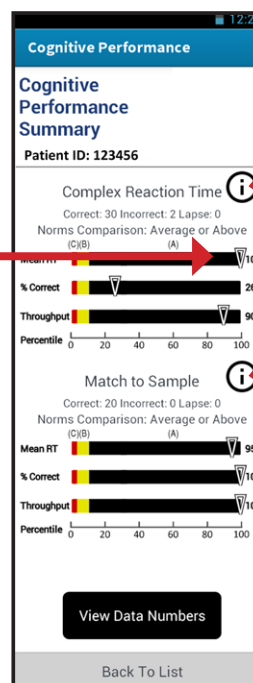


**Figure A1-8:**  
**Test Complete**

## Cognitive Performance Summary

After a Cognitive Performance session has been completed, the **Cognitive Performance Summary** will display (Figure A1-9). For each test, one of three statements is displayed which represents how the patient performed in comparison to normative data. Three variables (Mean Reaction Time for correct responses, Percent Correct, and Throughput) are examined in comparison to the normative data and summarized for the operator (Figure A1-9).

Each variable scale will display an arrow indicating the patient's resulting percentile on the scale and the percentile number will be displayed on the right.



When either information button is selected the following messages will appear:

- The Cognitive Performance Average or Above Summary Information Message, if an Average or Above result was obtained.
- The Cognitive Performance Below Average Information Message if a Below Average result was obtained.
- The Cognitive Performance Clearly Below Average Information Message if a Clearly Below Average result was obtained.

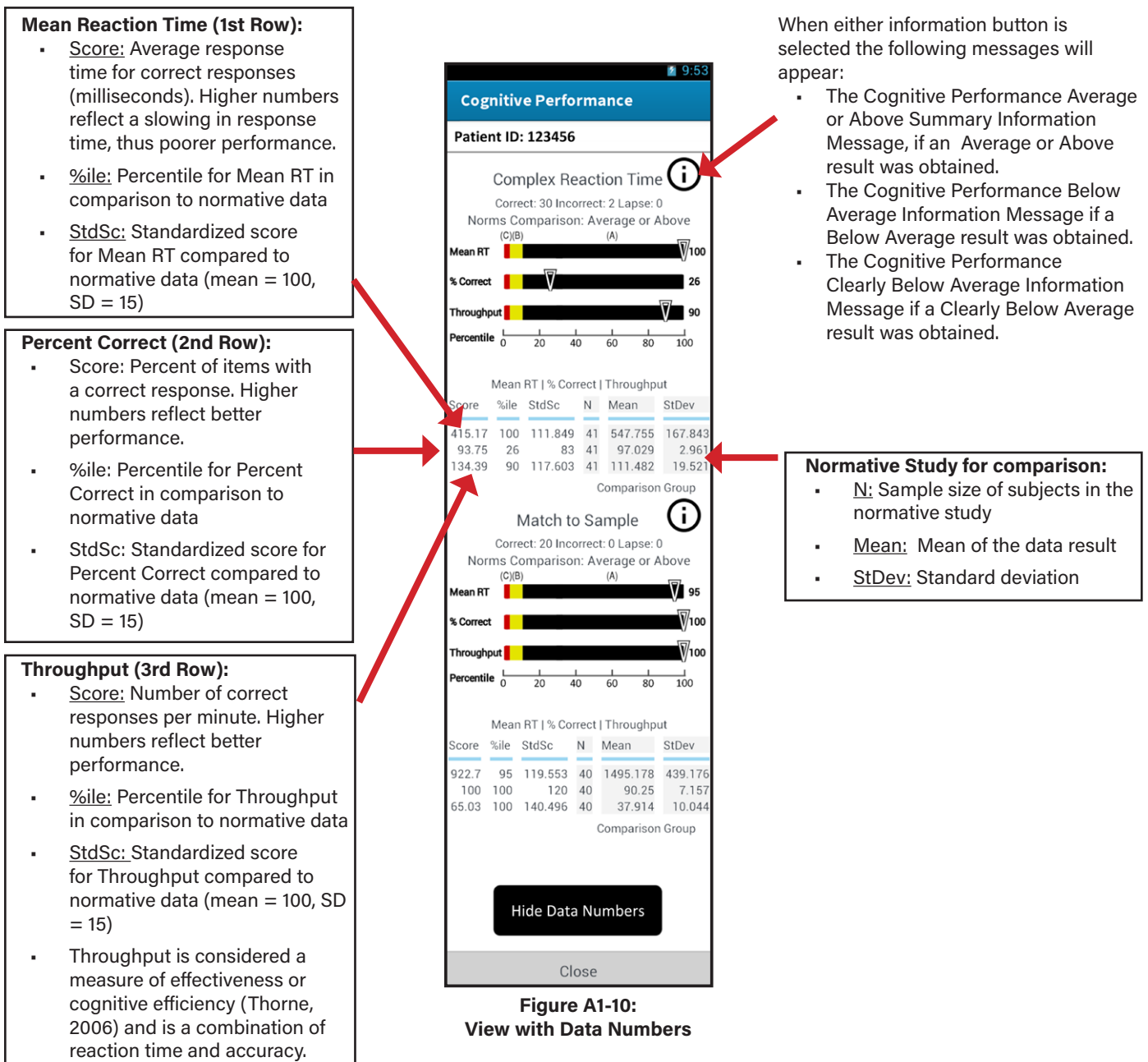
**Figure A1-9:**  
**Cognitive Performance Summary**

Press **VIEW DATA NUMBERS** to review the patient's results in comparison to the normative group in the database (Figure A1-10).

The Data Numbers are displayed in six columns and three rows. The first three columns are the results for the patient tested. The last three columns (shaded grey) display the results from the Normative Study for comparison.

Press **REMOVE DATA NUMBERS** to hide the detailed results.

Press **CLOSE** to return to the *Information Hub*.



The Cognitive Performance section of the **Information Hub** (See Section 4.3.1 Information Hub Screen) will display the results of the test using letters A, B, or C (Figure A1-11).



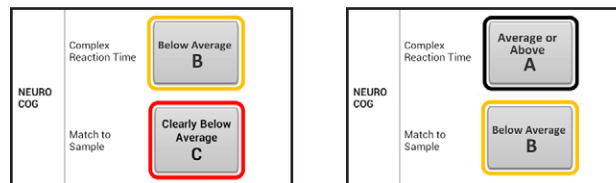
**Average or above** – patient's test results were all equal to or above the 10th percentile.



**Below average** – patient's test results place them in the 9th to 3rd percentile.



**Clearly below average** – patient's test results in the 2nd percentile or below.



**Figure A1-11:**  
Cognitive Performance results once an assessment has been completed.

## Cognitive Performance Detailed Results

To access the **Cognitive Performance Detailed Results** screen, press the Cognitive Performance result (Figure A1-12) from the **Information Hub** screen.



**NOTE:** The **Cognitive Performance Detailed Results** will default to view the **CURRENT TEST** tab.

### Current Test Tab

**Cognitive Performance Current Test - Summary** (Figure A1-13) contains two options to select from:

- View Data Numbers
- New Test – start a new cognitive performance session

Press **CLOSE** to return to the **Information Hub** screen.

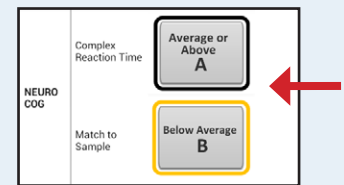
Press **VIEW DATA NUMBERS** to navigate to the **Cognitive Performance Current Test - Summary (with data numbers)** (Figure 5-21).

For details on the data numbers see Page A1-6.

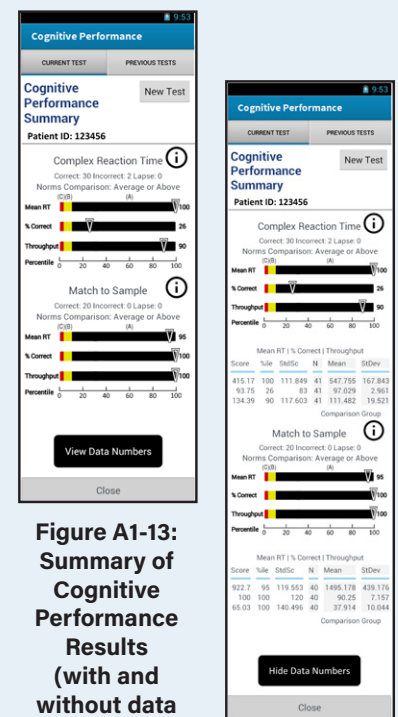
Press **REMOVE DATA NUMBERS** to return to the **Cognitive Performance Current Test - Summary (without data numbers)** screen (Figure A1-13).

Press **CLOSE** to return to the **Information Hub**.

Press **NEW TEST** to navigate to the **Cognitive Performance** screen.



**Figure A1-12:**  
Cognitive Performance results area from the **Information Hub**



**Figure A1-13:**  
Summary of Cognitive Performance Results (with and without data numbers)

## Previous Test Tab

To view previous tests, select the **PREVIOUS TESTS** tab from the **Cognitive Performance Current Test - Summary** screen.

**Cognitive Performance Previous Tests Detailed Results** (Figure A1-14) lists all tests recorded by test date, time and summary of results.

To view detailed results from a previous test, press the desired test from the "Cognitive Performance Tests List".

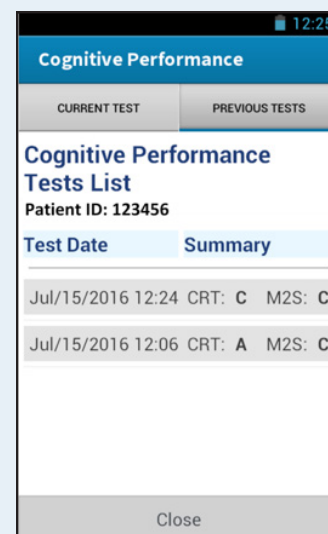
Once the test has been selected the **Cognitive Performance Previous Test - Summary (without data numbers)** (Figure A1-15) will appear displaying the test results).

Press **VIEW DATA NUMBERS** to view the **Cognitive Performance Previous Test - Summary (with data numbers)** (Figure A1-15).

For details on the data numbers see Page A1-6.

Press **REMOVE DATA NUMBERS** to return to the **Cognitive Performance Previous Test - Summary (without data numbers)** (Figure A-15).

Press **CLOSE** to return to the **Information Hub**.



Test Date	Summary
Jul/15/2016 12:24	CRT: C M2S: C
Jul/15/2016 12:06	CRT: A M2S: C

Figure A1-14:  
Test list of previous test results

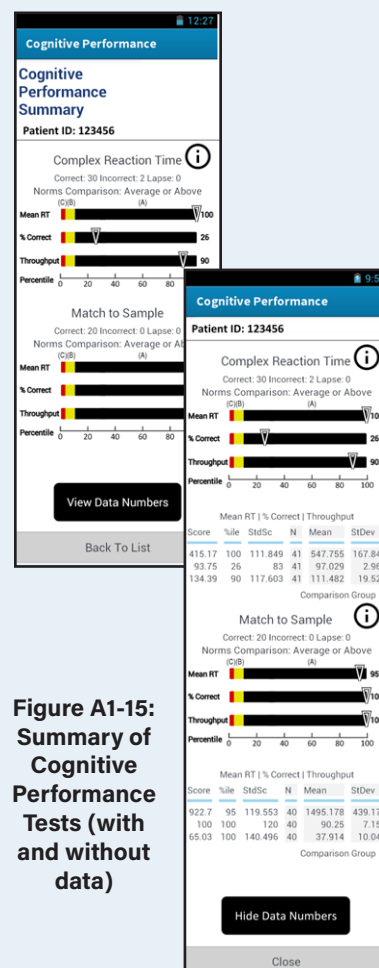


Figure A1-15:  
Summary of  
Cognitive  
Performance  
Tests (with  
and without  
data)



## Normative Data for Cognitive Performance Tests

The normative data was developed from a community sample obtained from the US population. The sample was stratified by age and sex. Recruitment sites were identified to maximize the representativeness of the target population and included the following geographic regions: Colorado, Texas, Ohio, Virginia, and Oklahoma.

All participants were administered the test battery on the BrainScope One handheld computer. Tests administered included the Complex (Procedural) Reaction Time test and the Match to Sample test. All testing was conducted by trained test administrators. Summary tables of norms for each of the tests were prepared stratified by age and sex (Tables 1 & 2). Descriptive statistics presented in the summary tables include means and standard deviations, as well as selected percentiles (minimum, 2nd percentile, 9th percentile, 25th percentile, median, 50th percentile, 91st percentile, 98th percentile, maximum).

Data are presented for mean reaction time for correct responses (MeanRTCorr), percent correct (PercCorr), and Throughput for each ANAM test as a function of various groupings of Gender and Age as follows:

Means, standard deviations, and percentiles organized according to age and gender are presented in Tables 3-6. The final normative sample consists of approximately 550 community dwelling adults (exact number varies by test).

Table 1: Mean, Standard Deviation, and Percentile Scores for ANAM Matching to Sample Test

Variable	Sex	Age	n	Mean ± SD	Percentile								
					0	2	9	25	50	75	91	98	100
Mean RT	Female	All	551	1744 ± 651	5303	3460	2706	2076	1586	1276	1075	821	724
		18-30	71	1389 ± 354	2350	2328	1928	1609	1316	1150	920	799	797
		31-40	47	1569 ± 566	2979	2979	2492	1922	1430	1148	941	756	756
		41-50	45	1679 ± 506	3143	3143	2385	2046	1618	1311	1099	755	755
		51-60	50	1980 ± 588	3460	3454	2735	2310	2075	1542	1045	1007	989
		61-70	56	1971 ± 649	3868	3757	2817	2273	1909	1461	1190	1045	1020
		71-80	34	2368 ± 881	5303	5303	3280	2895	2169	1710	1498	1172	1172
	Male	18-30	62	1444 ± 411	2552	2517	2071	1642	1319	1178	970	837	724
		31-40	40	1495 ± 439	2708	2708	2271	1594	1406	1273	1036	763	763
		41-50	38	1692 ± 668	3467	3467	2960	1935	1511	1222	1042	817	817
		51-60	33	1667 ± 446	2932	2932	2199	1833	1675	1365	1096	765	765
		61-70	41	2108 ± 790	4302	4302	3463	2573	1881	1528	1307	1089	1089
		71-80	34	2009 ± 803	5189	5189	2891	2213	1765	1502	1315	1056	1056
	All		551	89.6 ± 8.2	60	70	75	85	90	95	100	100	100
Correct (%)	Female	18-30	71	91.8 ± 7.8	70	70	80	85	95	100	100	100	100
		31-40	47	89.8 ± 7.6	65	65	80	85	90	95	100	100	100
		41-50	45	91.2 ± 8.6	60	60	80	90	90	100	100	100	100
		51-60	50	89.4 ± 7.2	75	75	80	85	90	95	100	100	100
		61-70	56	88 ± 8.4	70	70	75	82.6	90	95	100	100	100
		71-80	34	86.8 ± 8.6	70	70	75	80	87.6	95	100	100	100
	Male	18-30	62	92.6 ± 5	80	85	85	90	95	95	100	100	100
		31-40	40	90.2 ± 7.2	70	70	80	85	90	95	100	100	100
		41-50	38	91.2 ± 9.4	65	65	80	85	92.6	100	100	100	100
		51-60	33	86.6 ± 8.4	70	70	70	80	90	90	100	100	100
		61-70	41	88 ± 8.6	65	65	75	85	90	95	95	100	100
		71-80	34	86 ± 9.4	60	60	75	80	87.6	95	95	100	100
	All		551	33.8 ± 12.2	10.2	14.2	18.8	24.2	32.2	41.4	49.8	63.4	75.8
Throughput	Female	18-30	71	41.2 ± 11.4	20	25	26.8	32.2	41	47.6	58.2	71.8	73
		31-40	47	37.6 ± 14	12.8	12.8	20.8	28	36.2	48	52.8	75.8	75.8
		41-50	45	34 ± 12.2	17.2	17.2	21.2	25.8	30.8	40.6	53.4	61.8	61.8
		51-60	50	29.2 ± 11	12.8	13.2	18.8	21	24.4	35.8	47	56.4	57.4
		61-70	56	28.6 ± 9.2	13.8	14.8	18.4	21	27.2	34.4	41.6	48.8	49.4
		71-80	34	23.4 ± 8	11.4	11.4	14.8	16.8	21.2	29.8	35	40.2	40.2
	Male	18-30	62	40.6 ± 11.4	20.8	22.6	25.6	31.8	40.8	47.2	55.8	68.2	70.2
		31-40	40	38 ± 10	18.6	18.6	22.4	33.4	38.2	43.4	51.2	63.4	63.4
		41-50	38	36.8 ± 13	12	12	18	30.2	38.4	42.8	53.8	69.6	69.6
		51-60	33	31.6 ± 10.8	16	16	20.4	24.6	29	35.4	51.6	62.6	62.6
		61-70	41	27 ± 9.4	12.2	12.2	14.4	19.2	25.8	34	42.2	46.8	46.8
		71-80	34	27.4 ± 7.6	10.2	10.2	18.4	22.2	28.4	32	37.2	43.8	43.8

Table 2: Mean, Standard Deviation, and Percentile Scores for ANAM Procedural Reaction Time Test

Variable	Sex	Age	n	Mean ± SD	Percentile								
					0	2	9	25	50	75	91	98	100
Mean RT	Female	All	544	625 ± 204	2036	1354	848	683	579	499	448	412	364
		18-30	67	521 ± 84	777	772	630	557	500	470	423	403	395
		31-40	49	577 ± 114	909	909	775	617	545	498	461	426	426
		41-50	45	609 ± 195	1477	1477	848	647	565	500	465	424	424
		51-60	48	703 ± 200	1369	1369	941	765	676	559	501	447	447
		61-70	55	663 ± 111	1022	901	811	727	646	593	534	508	431
		71-80	34	842 ± 396	2036	2036	1658	838	733	612	544	480	480
	Male	18-30	61	511 ± 82	767	711	618	558	505	459	409	384	364
		31-40	41	548 ± 168	1453	1453	679	581	496	473	440	422	422
		41-50	38	599 ± 232	1658	1658	848	635	511	471	440	413	413
		51-60	33	652 ± 206	1494	1494	914	659	595	546	460	411	411
		61-70	40	696 ± 216	1440	1440	1038	728	610	559	531	446	446
		71-80	33	750 ± 164	1191	1191	1047	852	716	644	562	537	537
Correct (%)	Female	All	544	96.6 ± 5.4	56.2	78.2	90.6	96.8	96.8	100	100	100	100
		18-30	67	96.8 ± 3.2	87.6	90.6	90.6	93.8	96.8	100	100	100	100
		31-40	49	97.6 ± 3.2	84.4	84.4	93.8	96.8	100	100	100	100	100
		41-50	45	96.8 ± 7	56.2	56.2	93.6	96.8	100	100	100	100	100
		51-60	48	95.2 ± 9	56.2	56.2	81.2	96.8	96.8	100	100	100	100
		61-70	55	96.8 ± 5.6	71.8	77.4	90.6	96.8	100	100	100	100	100
		71-80	34	97.6 ± 6.4	65.6	65.6	93.8	96.8	100	100	100	100	100
	Male	18-30	61	96.2 ± 5.8	71.8	75	90.6	93.8	96.8	100	100	100	100
		31-40	41	97 ± 3	90.6	90.6	93.8	93.8	96.8	100	100	100	100
		41-50	38	96.4 ± 4	87.6	87.6	90.6	93.8	96.8	100	100	100	100
		51-60	33	98.2 ± 4.2	78.2	78.2	93.8	96.8	100	100	100	100	100
		61-70	40	95.6 ± 6.2	71.8	71.8	84.4	93.8	96.8	100	100	100	100
		71-80	33	96.4 ± 3.2	84.4	84.4	93.6	93.8	96.8	100	100	100	100
Throughput	Female	All	544	99.8 ± 23.8	24	40.2	67.8	85	101.4	116.6	129.2	140.8	165
		18-30	67	114.2 ± 16.6	73.8	75.8	88.2	104.8	115	126.6	134.2	141.6	145.6
		31-40	49	104.8 ± 18.8	58	58	76.8	92.8	108.4	117.2	128.2	137.8	137.8
		41-50	45	102.2 ± 24	40.6	40.6	64.6	91.2	104.8	120	129	138.2	138.2
		51-60	48	87.4 ± 23.6	25.4	25.4	56.6	75.2	88.8	105.4	117.4	130.8	130.8
		61-70	55	90 ± 14	45.6	61	69.8	82	90.8	99.2	110	114.6	117.4
		71-80	34	80.2 ± 24.4	26.2	26.2	34.6	71.6	81.4	98	110.2	119.8	119.8
	Male	18-30	61	115.8 ± 19.2	75	75.8	88	105.4	116.4	127.4	140.6	151.4	165
		31-40	41	111.4 ± 19.6	41.2	41.2	84.6	99.4	116.6	125.8	134.4	136.4	136.4
		41-50	38	104.8 ± 26.2	36.2	36.2	63.2	90.2	113.2	123.2	134	141.2	141.2
		51-60	33	96.8 ± 23.2	40.2	40.2	65.6	90.2	100.2	107.8	126.8	145.8	145.8
		61-70	40	88.2 ± 23.8	24	24	47	78.8	96.6	103.6	113	120.8	120.8
		71-80	33	80.8 ± 16	46.6	46.6	56.4	67.8	81.6	91	104	107.8	107.8

Table 3: Mean, Standard Deviation, and Percentile Scores for Matching to Sample Test (Females)

Percentile	Mean RT, Correct Response						Percent Correct						Throughput						Percentile
	18-30	31-40	41-50	51-60	61-70	71-80	18-30	31-40	41-50	51-60	61-70	71-80	18-30	31-40	41-50	51-60	61-70	71-80	
1	2350.1	2979.3	3143.4	3459.8	3867.8	5302.7	70.0	65.0	60.0	75.0	70.0	70.0	20.1	12.8	17.2	12.8	13.8	11.3	1
2	2350.1	2979.3	3143.4	3459.8	3867.8	5302.7	70.0	65.0	60.0	75.0	70.0	70.0	24.9	12.8	17.2	13.2	14.9	11.3	2
3	2328.2	2979.3	3143.4	3453.9	3757.4	5302.7	75.0	75.0	75.0	75.0	70.0	75.0	25.0	18.9	17.3	13.7	14.9	14.4	3
4	2111.5	2861.0	2744.7	3448.1	3757.4	4161.4	75.0	75.0	75.0	75.0	70.0	75.0	25.0	18.9	17.3	15.8	15.3	14.4	4
5	2111.5	2861.0	2744.7	3119.1	2977.4	4161.4	75.0	75.0	75.0	75.0	70.0	75.0	25.8	20.1	17.8	17.9	15.3	14.4	5
6	2044.2	2845.3	2564.7	2790.0	2977.4	4161.4	75.0	75.0	75.0	75.0	70.0	75.0	26.3	20.1	17.8	18.0	16.0	14.7	6
7	1995.6	2845.3	2564.7	2780.3	2927.9	3561.6	75.0	80.0	80.0	75.0	70.0	75.0	26.3	20.7	20.7	18.1	16.0	14.7	7
8	1995.6	2659.8	2390.2	2770.6	2927.9	3561.6	80.0	80.0	80.0	77.5	75.0	75.0	26.6	20.7	20.7	18.5	17.7	14.7	8
9	1983.1	2659.8	2390.2	2752.8	2866.8	3561.6	80.0	80.0	80.0	80.0	75.0	75.0	26.7	20.9	21.3	18.9	18.5	14.9	9
10	1928.2	2492.2	2385.0	2734.9	2816.6	3280.4	80.0	80.0	80.0	80.0	75.0	75.0	26.9	20.9	21.3	19.1	18.5	14.9	10
11	1862.2	2492.2	2385.0	2698.9	2816.6	3280.4	80.0	80.0	80.0	80.0	80.0	75.0	26.9	22.6	21.3	19.3	18.6	14.9	11
12	1862.2	2195.9	2385.0	2662.9	2797.9	3280.4	85.0	80.0	80.0	80.0	80.0	75.0	28.4	22.6	21.3	19.3	18.6	15.0	12
13	1810.0	2195.9	2260.2	2641.5	2797.9	3226.0	85.0	80.0	80.0	80.0	80.0	75.0	28.7	22.7	21.3	19.4	18.8	15.0	13
14	1809.3	2179.5	2260.2	2620.1	2771.2	3226.0	85.0	80.0	80.0	80.0	80.0	75.0	28.7	22.7	23.4	19.4	18.8	15.0	14
15	1809.3	2179.5	2216.2	2581.5	2771.2	3226.0	85.0	85.0	80.0	80.0	80.0	75.0	29.0	23.6	23.4	19.4	19.1	15.3	15
16	1780.9	2120.8	2216.2	2543.0	2749.0	3084.5	85.0	85.0	85.0	82.5	80.0	75.0	29.3	23.6	23.7	19.5	19.1	15.3	16
17	1696.3	2120.8	2198.2	2534.5	2749.0	3084.5	85.0	85.0	85.0	85.0	80.0	75.0	29.8	23.6	23.7	19.7	19.2	15.3	17
18	1672.9	2120.8	2198.2	2526.0	2696.9	3084.5	85.0	85.0	85.0	85.0	80.0	75.0	29.8	24.2	23.9	19.7	19.6	15.6	18
19	1672.9	2096.2	2157.7	2448.3	2655.3	2944.5	85.0	85.0	85.0	85.0	80.0	75.0	30.1	24.2	23.9	19.8	19.6	15.6	19
20	1664.9	2096.2	2157.7	2370.6	2655.3	2944.5	85.0	85.0	85.0	85.0	80.0	75.0	31.2	25.7	24.1	20.0	19.7	15.6	20
21	1653.3	1985.5	2109.1	2368.6	2474.9	2944.5	85.0	85.0	85.0	85.0	80.0	80.0	31.2	25.7	24.3	20.2	19.7	15.7	21
22	1653.3	1985.5	2060.6	2366.6	2474.9	2906.9	85.0	85.0	85.0	85.0	80.0	80.0	31.6	26.6	24.3	20.5	20.0	15.7	22
23	1647.0	1973.3	2060.6	2342.2	2419.5	2906.9	85.0	85.0	85.0	85.0	80.0	80.0	31.8	26.6	25.6	20.9	20.0	15.7	23
24	1634.8	1973.3	2056.7	2317.7	2419.5	2906.9	85.0	85.0	85.0	85.0	80.0	80.0	32.1	28.0	25.6	20.9	20.9	16.9	24
25	1608.9	1922.2	2056.7	2313.9	2315.7	2895.4	85.0	85.0	90.0	85.0	82.5	80.0	32.1	28.0	25.7	20.9	21.0	16.9	25
26	1608.9	1922.2	2046.0	2310.1	2272.8	2895.4	90.0	85.0	90.0	85.0	85.0	80.0	32.6	28.6	25.7	21.1	21.0	16.9	26
27	1574.6	1842.8	2046.0	2301.9	2230.0	2895.4	90.0	85.0	90.0	85.0	85.0	80.0	33.2	28.6	26.3	21.4	21.2	17.3	27
28	1556.3	1842.8	1908.5	2293.8	2219.2	2864.8	90.0	85.0	90.0	85.0	85.0	80.0	33.2	28.6	26.3	21.7	21.2	17.3	28
29	1556.3	1833.2	1908.5	2291.1	2219.2	2864.8	90.0	85.0	90.0	85.0	85.0	80.0	33.8	28.6	26.4	22.0	21.5	17.3	29
30	1530.8	1833.2	1895.4	2288.5	2208.3	2864.8	90.0	85.0	90.0	85.0	85.0	80.0	35.3	29.2	26.4	22.0	21.5	18.1	30
31	1506.5	1810.4	1895.4	2275.1	2208.3	2717.0	90.0	85.0	90.0	85.0	85.0	80.0	36.0	29.2	26.4	22.0	21.8	18.1	31
32	1499.7	1810.4	1895.4	2261.8	2179.4	2717.0	90.0	90.0	90.0	85.0	85.0	80.0	36.0	29.2	26.7	22.3	21.8	18.1	32
33	1499.7	1772.2	1874.2	2253.2	2179.4	2717.0	90.0	90.0	90.0	85.0	85.0	80.0	36.1	29.2	26.7	22.6	22.7	18.8	33
34	1499.0	1772.2	1874.2	2244.5	2159.1	2716.2	90.0	90.0	90.0	85.0	85.0	80.0	36.3	29.2	26.8	22.6	23.7	18.8	34
35	1489.3	1772.2	1745.7	2231.5	2116.4	2716.2	90.0	90.0	90.0	85.0	85.0	80.0	36.3	30.1	26.8	22.7	23.7	18.8	35
36	1489.3	1630.0	1745.7	2218.4	2116.4	2716.2	90.0	90.0	90.0	85.0	85.0	80.0	36.4	30.1	26.8	22.7	23.8	18.9	36
37	1477.4	1630.0	1709.3	2197.4	2109.5	2652.8	90.0	90.0	90.0	85.0	85.0	80.0	36.4	30.3	26.8	22.7	23.8	18.9	37
38	1472.5	1582.3	1709.3	2176.4	2109.5	2652.8	90.0	90.0	90.0	85.0	85.0	80.0	36.4	30.3	26.9	22.9	24.0	18.9	38
39	1472.5	1582.3	1706.5	2170.7	2093.1	2652.8	90.0	90.0	90.0	85.0	85.0	80.0	36.7	32.3	26.9	23.1	24.0	20.0	39
40	1469.3	1556.8	1706.5	2165.1	2093.1	2447.6	90.0	90.0	90.0	87.5	85.0	80.0	37.3	32.3	27.0	23.2	24.1	20.0	40
41	1462.7	1556.8	1703.3	2164.9	2059.1	2447.6	90.0	90.0	90.0	85.0	85.0	80.0	38.4	32.8	27.1	23.3	24.1	20.0	41
42	1433.8	1540.1	1700.1	2164.8	2059.1	2447.6	90.0	90.0	90.0	85.0	85.0	80.0	38.4	32.8	27.1	23.4	25.9	20.0	42
43	1433.8	1540.1	1700.1	2154.8	2058.9	2342.1	90.0	90.0	90.0	90.0	85.0	85.0	39.4	32.8	27.9	23.4	26.2	20.0	43
44	1425.4	1481.6	1677.8	2144.8	2002.6	2342.1	90.0	90.0	90.0	90.0	85.0	85.0	40.0	32.8	27.9	23.5	26.2	20.0	44
45	1385.1	1481.6	1677.8	2134.6	2002.6	2342.1	90.0	90.0	90.0	90.0	85.0	85.0	40.0	33.4	29.1	23.7	26.2	21.0	45
46	1385.1	1479.5	1640.0	2124.3	1959.2	2326.4	95.0	90.0	90.0	90.0	85.0	85.0	40.3	33.4	29.1	23.9	26.2	21.0	46
47	1378.8	1479.5	1640.0	2105.7	1959.2	2326.4	95.0	90.0	90.0	90.0	90.0	85.0	40.3	34.4	29.3	24.1	26.4	21.0	47
48	1370.1	1457.8	1632.9	2087.1	1927.9	2326.4	95.0	90.0	90.0	90.0	90.0	85.0	40.5	34.4	29.3	24.1	26.4	21.2	48
49	1362.3	1457.8	1632.9	2083.7	1927.9	2215.9	95.0	90.0	90.0	90.0	90.0	85.0	40.5	36.1	30.8	24.1	26.6	21.2	49
50	1362.3	1429.9	1617.8	2080.3	1917.6	2215.9	95.0	90.0	90.0	90.0	90.0	87.5	40.9	36.1	30.8	24.5	27.1	21.2	50
51	1316.4	1429.9	1617.8	2075.1	1909.3	2168.9	95.0	90.0	90.0	90.0	90.0	90.0	41.0	36.1	30.8	24.8	27.6	21.3	51
52	1315.5	1429.9	1617.8	2069.9	1900.9	2121.8	95.0	90.0	90.0	90.0	90.0	90.0	41.0</						



Table 4: Mean, Standard Deviation, and Percentile Scores for Matching to Sample Test (Males)

	Mean RT, Correct Responses						Percent Correct						Throughput						Percentile
	18-30	31-40	41-50	51-60	61-70	71-80	18-30	31-40	41-50	51-60	61-70	71-80	18-30	31-40	41-50	51-60	61-70	71-80	
1	2552.4	2707.9	3467.3	2932.1	4302.1	5189.4	80.0	70.0	65.0	70.0	65.0	60.0	20.8	18.5	12.0	16.0	12.1	10.2	1
2	2552.4	2707.9	3467.3	2932.1	4302.1	5189.4	85.0	70.0	65.0	70.0	65.0	60.0	22.6	18.5	12.0	16.0	12.1	10.2	2
3	2517.1	2707.9	3467.3	2932.1	4302.1	5189.4	85.0	75.0	65.0	70.0	75.0	65.0	22.6	18.6	14.3	16.0	13.5	12.4	3
4	2517.1	2633.6	3063.9	2932.1	4148.3	3439.7	85.0	75.0	65.0	70.0	75.0	65.0	23.1	18.6	14.3	19.5	13.5	12.4	4
5	2418.7	2633.6	3063.9	2674.8	4148.3	3439.7	85.0	77.5	65.0	70.0	75.0	65.0	23.7	19.6	14.3	19.5	13.8	12.4	5
6	2201.4	2610.6	3063.9	2674.8	3666.2	3439.7	85.0	80.0	70.0	70.0	75.0	75.0	23.7	20.6	16.1	19.5	13.8	15.9	6
7	2201.4	2587.5	3060.0	2674.8	3666.2	3305.0	85.0	80.0	70.0	70.0	75.0	75.0	24.2	20.6	16.1	20.5	13.8	15.9	7
8	2147.5	2587.5	3060.0	2199.1	3666.2	3305.0	85.0	80.0	80.0	70.0	75.0	75.0	24.2	22.5	17.9	20.5	14.4	15.9	8
9	2147.5	2270.6	2960.0	2199.1	3463.0	3305.0	85.0	80.0	80.0	70.0	75.0	75.0	25.6	22.5	17.9	20.5	14.4	18.3	9
10	2070.9	2270.6	2960.0	2199.1	3463.0	2890.6	85.0	80.0	80.0	75.0	75.0	75.0	26.0	23.0	17.9	20.8	14.4	18.3	10
11	2045.4	2169.4	2960.0	2169.8	3222.1	2890.6	85.0	80.0	85.0	75.0	75.0	75.0	26.0	23.5	19.6	20.8	14.4	18.3	11
12	2045.4	2068.3	2742.7	2169.8	3222.1	2890.6	85.0	80.0	85.0	75.0	75.0	75.0	26.7	23.5	19.6	20.8	14.4	18.8	12
13	2022.2	2068.3	2742.7	2169.8	3222.1	2705.8	85.0	80.0	85.0	75.0	75.0	75.0	27.5	25.0	19.6	21.0	16.6	18.8	13
14	1944.5	1840.4	2742.7	2044.1	3063.9	2705.8	85.0	80.0	85.0	75.0	75.0	75.0	27.5	25.0	19.8	21.0	16.6	18.8	14
15	1944.5	1840.4	2485.9	2044.1	3063.9	2705.8	85.0	82.5	85.0	75.0	75.0	75.0	28.1	27.3	19.8	21.0	16.9	20.2	15
16	1855.1	1798.4	2485.9	2044.1	2714.9	2529.6	85.0	85.0	85.0	80.0	75.0	75.0	28.1	29.7	22.2	22.0	16.9	20.2	16
17	1855.1	1756.3	2403.9	1919.4	2714.9	2529.6	85.0	85.0	85.0	80.0	75.0	75.0	28.4	29.7	22.2	22.0	16.9	20.2	17
18	1783.3	1756.3	2403.9	1919.4	2714.9	2529.6	85.0	85.0	85.0	80.0	75.0	80.0	29.8	30.5	22.2	22.0	18.4	20.8	18
19	1780.0	1668.4	2403.9	1919.4	2665.2	2495.0	85.0	85.0	85.0	80.0	75.0	80.0	29.8	30.5	23.1	23.7	18.4	20.8	19
20	1780.0	1668.4	2174.8	1888.4	2665.2	2495.0	90.0	85.0	85.0	80.0	80.0	80.0	31.2	31.1	23.1	23.7	18.5	20.8	20
21	1713.5	1665.9	2174.8	1888.4	2590.4	2495.0	90.0	85.0	85.0	80.0	80.0	80.0	31.5	31.7	23.1	23.7	18.5	21.3	21
22	1700.8	1663.3	2174.8	1888.4	2590.4	2442.9	90.0	85.0	85.0	80.0	80.0	80.0	31.5	31.7	23.6	24.3	18.6	21.3	22
23	1700.8	1663.3	2141.7	1848.7	2585.2	2442.9	90.0	85.0	85.0	80.0	80.0	80.0	31.6	32.3	23.6	24.3	18.6	21.3	23
24	1699.1	1606.3	2141.7	1848.7	2585.2	2442.9	90.0	85.0	85.0	80.0	80.0	80.0	31.6	32.3	30.1	24.3	18.6	22.1	24
25	1699.1	1606.3	1935.1	1848.7	2585.2	2212.8	90.0	85.0	85.0	80.0	85.0	80.0	31.8	33.3	30.1	24.6	19.2	22.1	25
26	1642.3	1594.2	1935.1	1832.6	2573.2	2212.8	90.0	85.0	85.0	80.0	85.0	80.0	32.2	34.3	30.1	24.6	19.2	22.1	26
27	1634.3	1582.1	1935.1	1832.6	2573.2	2212.8	90.0	85.0	85.0	80.0	85.0	80.0	32.2	34.3	31.0	24.6	20.3	23.0	27
28	1634.3	1582.1	1897.0	1832.6	2351.7	2196.9	90.0	85.0	85.0	85.0	85.0	80.0	32.2	34.4	31.0	24.7	20.3	23.0	28
29	1595.4	1567.5	1897.0	1832.3	2351.7	2196.9	90.0	85.0	90.0	85.0	85.0	80.0	32.2	34.4	33.5	24.7	20.3	23.0	29
30	1595.4	1567.5	1722.7	1832.3	2351.7	2196.9	90.0	87.5	90.0	85.0	85.0	80.0	32.3	34.4	33.5	24.7	21.3	24.1	30
31	1583.4	1556.9	1722.7	1832.3	2262.8	2101.6	90.0	90.0	90.0	85.0	85.0	80.0	32.3	34.4	33.5	25.6	21.3	24.1	31
32	1571.1	1546.3	1722.7	1816.2	2262.8	2101.6	90.0	90.0	90.0	85.0	85.0	80.0	32.3	34.4	34.0	25.6	23.0	24.1	32
33	1571.1	1546.3	1721.2	1816.2	2190.8	2101.6	90.0	90.0	90.0	85.0	85.0	85.0	33.8	34.6	34.0	25.6	23.0	24.4	33
34	1544.3	1517.7	1721.2	1816.2	2190.8	2055.1	90.0	90.0	90.0	85.0	85.0	85.0	34.1	34.6	34.0	26.2	23.0	24.4	34
35	1541.4	1517.7	1721.2	1812.7	2190.8	2055.1	90.0	90.0	90.0	85.0	85.0	85.0	34.1	34.9	34.2	26.2	23.1	24.4	35
36	1541.4	1503.0	1699.4	1812.7	2174.9	2055.1	90.0	90.0	90.0	85.0	85.0	85.0	34.8	35.1	34.2	26.2	23.1	25.1	36
37	1510.1	1488.3	1699.4	1812.7	2174.9	2033.5	90.0	90.0	90.0	85.0	90.0	85.0	34.8	35.1	35.3	27.2	23.3	25.1	37
38	1510.1	1488.3	1643.1	1808.6	2135.1	2033.5	90.0	90.0	90.0	85.0	90.0	85.0	35.3	35.3	35.3	27.2	23.3	25.1	38
39	1508.4	1480.2	1643.1	1808.6	2135.1	2033.5	90.0	90.0	90.0	85.0	90.0	85.0	36.8	35.3	35.3	27.2	23.3	26.8	39
40	1481.4	1480.2	1643.1	1808.6	2135.1	1995.5	90.0	90.0	90.0	85.0	90.0	85.0	36.8	35.3	35.5	27.5	24.1	26.8	40
41	1481.4	1475.4	1559.2	1755.5	2128.7	1995.5	90.0	90.0	90.0	85.0	90.0	85.0	37.1	35.3	35.5	27.5	24.1	26.8	41
42	1467.2	1470.5	1559.2	1755.5	2128.7	1995.5	90.0	90.0	90.0	85.0	90.0	85.0	38.4	35.3	35.5	27.5	24.8	27.0	42
43	1459.9	1470.5	1559.2	1755.5	2094.6	1826.2	95.0	90.0	90.0	85.0	90.0	85.0	38.4	36.1	36.5	28.2	24.8	27.0	43
44	1459.9	1432.6	1539.5	1728.3	2094.6	1826.2	95.0	90.0	90.0	85.0	90.0	85.0	38.4	36.1	36.5	28.2	25.5	27.0	44
45	1457.4	1432.6	1539.5	1728.3	2018.3	1826.2	95.0	90.0	90.0	85.0	90.0	85.0	38.4	36.7	37.9	28.2	25.5	28.1	45
46	1457.4	1426.4	1535.8	1728.3	2018.3	1825.2	95.0	90.0	90.0	85.0	90.0	85.0	40.0	37.4	37.9	28.6	25.5	28.1	46
47	1438.1	1420.1	1535.8	1719.5	2018.3	1825.2	95.0	90.0	90.0	85.0	90.0	85.0	40.2	37.4	37.9	28.6	25.7	28.1	47
48	1330.5	1420.1	1535.8	1719.5	1980.3	1825.2	95.0	90.0	90.0	85.0	90.0	85.0	40.2	37.9	38.2	28.6	25.7	28.4	48
49	1330.5	1410.9	1523.2	1719.5	1980.3	1771.3	95.0	90.0	90.0	90.0	90.0	85.0	40.4	37.9	38.2	29.0	25.8	28.4	49
50	1322.4	1410.9	1523.2	1674.5	1880.5	1771.3	95.0	90.0	92.5	90.0	90.0	87.5	40.7	38.1	38.4	29.0	25.8	28.5	50
51	1318.9	1406.3	1511.0	1674.5	1880.5	1765.4	95.0	90.0	95.0	90.0	90.0	90.0	41.1	38.3	38.5	29.0	25.8	28.5	51
52	1315.5	1401.8	1498.8	1674.5	1880.5	1759.4	95.0	90.0	95.0	90.0	90.0	90.0	41.4						

Table 5: Mean, Standard Deviation, and Percentile Scores for Procedural Reaction Time Test (Females)

Percentile	Mean RT, Correct Responses						Percent Correct						Throughput						Percentile
	18-30	31-40	41-50	51-60	61-70	71-80	18-30	31-40	41-50	51-60	61-70	71-80	18-30	31-40	41-50	51-60	61-70	71-80	
1	776.6	908.9	1477.1	1369.4	1021.8	2035.8	87.5	84.4	56.3	56.3	71.9	65.6	73.7	58.0	40.6	25.5	45.6	26.3	1
2	776.6	908.9	1477.1	1369.4	1021.8	2035.8	90.6	84.4	56.3	56.3	77.4	65.6	75.8	58.0	40.6	25.5	61.1	26.3	2
3	772.4	908.9	1477.1	1369.4	901.5	2035.8	90.6	90.6	87.5	68.8	77.4	87.5	79.3	68.3	46.8	27.0	61.1	29.5	3
4	720.9	875.4	1156.1	1354.0	901.5	1892.7	90.6	90.6	87.5	68.8	84.4	87.5	79.3	68.3	46.8	27.0	66.7	29.5	4
5	720.9	875.4	1156.1	1354.0	899.0	1892.7	90.6	93.8	90.6	71.9	84.4	87.5	81.1	68.5	51.9	37.6	66.7	29.5	5
6	713.6	781.5	908.5	1102.3	899.0	1892.7	90.6	93.8	90.6	71.9	87.1	90.6	83.2	68.5	51.9	37.6	67.7	30.1	6
7	694.3	781.5	908.5	1102.3	845.7	1735.8	90.6	93.8	90.6	81.3	87.1	90.6	83.2	76.7	63.0	46.5	67.7	30.1	7
8	694.3	776.0	877.2	963.6	845.7	1735.8	90.6	93.8	90.6	81.3	90.6	90.6	87.4	76.7	63.0	46.5	69.8	30.1	8
9	648.1	776.0	877.2	963.6	810.9	1735.8	90.6	93.8	93.6	81.3	90.6	93.8	88.1	76.8	64.7	56.6	69.8	34.6	9
10	630.4	775.4	848.4	941.4	810.9	1658.3	90.6	93.8	93.6	81.3	90.6	93.8	88.1	76.8	64.7	56.6	74.0	34.6	10
11	630.4	775.4	848.4	941.4	804.0	1658.3	93.8	93.8	93.6	84.4	90.6	93.8	93.0	77.3	64.7	65.4	74.6	34.6	11
12	616.0	775.3	848.4	917.7	788.8	1658.3	93.8	93.8	93.8	84.4	90.6	93.8	95.7	77.3	68.4	65.4	74.6	47.9	12
13	603.2	775.3	805.9	917.7	788.8	1215.3	93.8	93.8	93.8	93.8	90.6	93.8	95.7	77.4	68.4	67.0	76.1	47.9	13
14	603.2	724.3	805.9	895.1	783.5	1215.3	93.8	93.8	93.8	93.8	90.6	93.8	97.4	77.4	72.5	67.0	76.1	47.9	14
15	594.6	724.3	709.0	895.1	783.5	1215.3	93.8	93.8	93.8	93.8	93.8	96.9	98.3	82.8	72.5	67.5	76.6	59.8	15
16	591.9	702.5	709.0	844.2	776.3	895.6	93.8	93.8	93.8	93.8	93.8	96.9	98.3	82.8	84.3	67.5	76.6	59.8	16
17	591.9	702.5	684.1	844.2	776.3	895.6	93.8	93.8	93.8	93.8	93.8	96.9	98.6	85.4	84.3	69.7	77.3	59.8	17
18	588.6	664.6	684.1	820.7	760.0	895.6	93.8	93.8	93.8	93.8	93.8	96.9	99.3	85.4	84.6	69.7	77.3	69.5	18
19	583.4	664.6	671.6	820.7	760.0	863.4	93.8	93.8	93.8	93.8	96.9	96.9	99.3	85.5	84.6	70.9	78.4	69.5	19
20	583.4	653.4	671.6	818.4	733.0	863.4	93.8	93.8	93.8	93.8	96.9	96.9	99.8	85.5	86.2	70.9	78.7	69.5	20
21	581.7	653.4	669.6	818.4	732.2	863.4	93.8	96.9	93.8	93.8	96.9	96.9	101.4	91.3	87.7	71.1	79.0	71.3	21
22	571.2	642.4	667.6	808.2	731.5	841.6	93.8	96.9	93.8	93.8	96.9	96.9	101.4	91.3	87.7	71.1	79.8	71.3	22
23	571.2	642.4	667.6	808.2	730.8	841.6	93.8	96.9	96.9	96.8	96.9	96.9	103.2	92.1	89.3	73.3	79.8	71.3	23
24	558.9	641.5	657.2	771.2	730.8	841.6	93.8	96.9	96.9	96.8	96.9	96.9	104.8	92.1	89.3	73.3	82.0	71.6	24
25	557.0	641.5	657.2	771.2	727.1	837.7	93.8	96.9	96.9	96.8	96.9	96.9	104.8	92.8	91.3	75.2	82.0	71.6	25
26	557.0	616.9	647.0	765.3	727.1	837.7	93.8	96.9	96.9	96.9	96.9	96.9	105.0	92.8	91.3	77.2	82.1	71.6	26
27	552.3	616.9	647.0	759.5	725.1	837.7	93.8	96.9	96.9	96.9	96.9	96.9	107.7	93.5	92.3	77.2	82.1	72.2	27
28	551.2	600.6	641.9	759.5	725.1	831.0	93.8	96.9	96.9	96.9	96.9	96.9	107.7	93.5	92.3	79.0	82.8	72.2	28
29	551.2	600.6	641.9	759.3	715.6	831.0	96.9	96.9	96.9	96.9	96.9	96.9	107.8	100.1	93.5	79.0	82.8	72.2	29
30	545.3	599.6	602.1	759.3	715.6	831.0	96.9	96.9	96.9	96.9	96.9	100.0	108.8	100.1	93.5	80.1	83.9	72.2	30
31	545.2	599.6	602.1	738.5	707.9	830.6	96.9	96.9	96.9	96.9	96.9	100.0	108.8	100.6	93.5	80.1	84.0	72.2	31
32	545.2	596.6	602.1	738.5	686.3	830.6	96.9	96.9	96.9	96.9	96.9	100.0	108.9	100.6	95.9	81.3	84.0	72.2	32
33	533.4	596.6	593.0	734.8	686.3	830.6	96.9	96.9	96.9	96.9	96.9	100.0	109.2	100.8	95.9	81.3	86.7	77.4	33
34	530.4	595.2	593.0	734.8	685.6	774.8	96.9	96.9	96.9	96.9	96.9	100.0	109.2	100.8	96.6	81.3	86.7	77.4	34
35	530.4	595.2	591.6	723.5	685.6	774.8	96.9	96.9	96.9	96.9	96.9	100.0	109.2	101.0	96.6	81.3	86.8	77.4	35
36	527.5	593.8	591.6	723.5	682.4	774.8	96.9	96.9	96.9	96.9	96.9	100.0	109.4	101.0	98.9	82.4	86.8	77.5	36
37	525.3	593.8	586.0	718.1	682.4	774.0	96.9	96.9	96.9	96.9	96.9	100.0	109.4	101.3	98.9	82.4	87.4	77.5	37
38	525.3	586.1	586.0	718.1	682.4	774.0	96.9	96.9	96.9	96.9	96.9	100.0	110.0	101.3	100.9	82.9	87.4	77.5	38
39	521.8	586.1	585.8	712.0	682.4	774.0	96.9	96.9	96.9	96.9	96.9	100.0	112.4	101.7	100.9	82.9	87.5	78.8	39
40	519.7	573.3	585.8	712.0	674.7	761.4	96.9	96.9	96.9	96.9	96.9	100.0	112.4	101.7	101.6	83.6	87.7	78.8	40
41	519.7	573.3	584.9	710.9	669.7	761.4	96.9	96.9	96.9	96.9	96.9	100.0	112.5	102.4	102.4	83.6	87.9	78.8	41
42	519.1	563.2	584.0	710.9	664.7	761.4	96.9	96.9	96.9	96.9	96.9	100.0	113.1	102.4	102.4	86.0	87.9	79.1	42
43	518.7	563.2	584.0	698.1	660.8	759.0	96.9	96.9	96.9	96.9	96.9	100.0	113.1	102.4	102.7	86.0	87.9	79.1	43
44	518.7	557.8	579.0	698.1	660.8	759.0	96.9	96.9	96.9	96.9	96.9	100.0	113.3	102.4	102.7	86.6	88.7	79.1	44
45	517.3	557.8	579.0	692.6	659.8	759.0	96.9	96.9	96.9	96.9	96.9	100.0	113.5	102.6	103.6	86.6	88.7	79.5	45
46	513.0	553.9	573.0	692.6	659.8	754.5	96.9	96.9	96.9	96.9	96.9	100.0	113.5	102.6	103.6	87.9	89.4	79.5	46
47	513.0	553.9	573.0	682.8	655.4	754.5	96.9	100.0	100.0	96.9	100.0	100.0	114.8	107.2	103.7	87.9	89.4	79.5	47
48	506.2	553.5	565.6	682.8	655.4	754.5	96.9	100.0	100.0	96.9	100.0	100.0	114.8	107.2	103.7	88.2	90.3	80.5	48
49	505.0	553.5	565.6	680.4	653.8	745.3	96.9	100.0	100.0	96.9	100.0	100.0	114.8	108.3	104.7	88.2	90.3	80.5	49
50	505.0	545.1	564.6	680.4	653.8	745.3	96.9	100.0	100.0	96.9	100.0	100.0	115.0	108.3	104.7	88.7	90.8	81.3	50
51	500.4	545.1	564.6	676.3	645.9	733.4	96.9	100.0	100.0	96.9	100.0	100.0	115.7	108.3	104.7	89.3	90.9	82.2	51
52	498.3	545.1	564.6	672.2	645.3	721.5	96.9	100.0	100.0	96.9	100.0	100.0	115.7	108.4	107.3	89.3	90.9	82.2	52
53	498.3	542.8	557.3	672.2	645.3	721.5	96.9	100.0	100.0	100.0	100.0	100.0							



Table 6: Mean, Standard Deviation, and Percentile Scores for Procedural Reaction Time Test (Males)

Percentile	Mean RT, Correct Responses						Percent Correct						Throughput						Percentile
	18-30	31-40	41-50	51-60	61-70	71-80	18-30	31-40	41-50	51-60	61-70	71-80	18-30	31-40	41-50	51-60	61-70	71-80	
1	767.1	1453.3	1658.2	1494.3	1439.6	1190.8	71.9	90.6	87.5	78.1	71.9	84.4	75.1	41.3	36.2	40.2	24.0	46.6	1
2	767.1	1453.3	1658.2	1494.3	1439.6	1190.8	75.0	90.6	87.5	78.1	71.9	84.4	75.9	41.3	36.2	40.2	24.0	46.6	2
3	710.8	1453.3	1658.2	1494.3	1439.6	1190.8	75.0	90.6	87.5	78.1	78.1	84.4	75.9	70.7	50.0	40.2	33.7	46.6	3
4	710.8	848.5	1102.2	1494.3	1249.0	1190.8	78.1	90.6	87.5	90.6	78.1	90.6	78.2	70.7	50.0	44.6	33.7	48.5	4
5	681.3	848.5	1102.2	994.0	1249.0	1167.2	90.6	90.6	87.5	90.6	81.3	90.6	82.9	82.7	50.0	44.6	38.4	48.5	5
6	642.3	685.5	1102.2	994.0	1188.0	1167.2	90.6	90.6	87.5	90.6	84.4	90.6	82.9	82.7	52.6	44.6	43.2	48.5	6
7	642.3	685.5	950.4	994.0	1126.9	1167.2	90.6	90.6	87.5	93.8	84.4	93.6	84.4	82.7	52.6	65.6	43.2	56.3	7
8	622.0	685.5	950.4	914.3	1126.9	1046.9	90.6	93.8	90.6	93.8	84.4	93.6	84.4	84.6	63.1	65.6	47.1	56.3	8
9	622.0	678.8	848.0	914.3	1037.7	1046.9	90.6	93.8	90.6	93.8	84.4	93.6	88.1	84.6	63.1	65.6	47.1	56.3	9
10	618.0	678.8	848.0	914.3	1037.7	1046.9	90.6	93.8	90.6	96.9	85.9	93.8	93.4	89.9	63.1	67.2	47.5	63.0	10
11	614.7	648.9	848.0	893.1	1011.5	915.2	90.6	93.8	90.6	96.9	87.5	93.8	93.4	89.9	68.4	67.2	48.0	63.0	11
12	614.7	648.9	817.2	893.1	985.3	915.2	90.6	93.8	90.6	96.9	87.5	93.8	93.8	89.9	68.4	67.2	48.0	63.0	12
13	614.3	648.9	817.2	893.1	985.3	915.2	90.6	93.8	90.6	96.9	93.8	93.8	93.8	92.8	68.4	72.2	51.5	66.4	13
14	614.3	610.5	817.2	831.2	950.0	889.9	90.6	93.8	93.8	96.9	93.8	93.8	94.9	92.8	75.8	72.2	51.5	66.4	14
15	600.3	610.5	760.8	831.2	950.0	889.9	90.6	93.8	93.8	96.9	93.8	93.8	95.3	96.8	75.8	72.2	57.5	66.4	15
16	588.5	603.8	760.8	831.2	946.8	889.9	90.6	93.8	93.8	96.9	93.8	93.8	95.3	96.8	84.1	75.1	63.6	67.4	16
17	588.5	603.8	649.9	799.0	943.7	889.2	93.8	93.8	93.8	96.9	93.8	93.8	96.5	96.8	84.1	75.1	63.6	67.4	17
18	583.4	603.8	649.9	799.0	943.7	889.2	93.8	93.8	93.8	96.9	93.8	93.8	96.5	97.1	84.1	75.1	74.6	67.4	18
19	583.4	593.8	649.9	799.0	804.2	889.2	93.8	93.8	93.8	96.9	93.8	93.8	99.8	97.1	87.7	76.1	74.6	67.5	19
20	575.1	593.8	644.8	788.1	804.2	861.1	93.8	93.8	93.8	96.9	93.8	93.8	100.8	97.1	87.7	76.1	76.6	67.5	20
21	569.6	590.2	644.8	788.1	775.2	861.1	93.8	93.8	93.8	96.9	93.8	93.8	100.8	97.1	87.7	76.1	78.7	67.5	21
22	569.6	590.2	644.8	788.1	746.2	861.1	93.8	93.8	93.8	96.9	93.8	93.8	102.0	99.4	89.0	77.5	78.7	67.5	22
23	568.4	586.5	643.7	773.9	746.2	854.3	93.8	93.8	93.8	96.9	93.8	93.8	102.8	99.4	89.0	77.5	78.8	67.5	23
24	559.5	586.5	643.7	773.9	736.8	854.3	93.8	93.8	93.8	96.9	93.8	93.8	102.8	99.4	90.2	77.5	78.8	67.5	24
25	559.5	586.5	634.7	773.9	736.8	854.3	93.8	93.8	93.8	96.9	93.8	93.8	105.3	99.4	90.2	90.2	78.8	67.7	25
26	558.0	580.9	634.7	659.3	728.1	851.7	93.8	93.8	93.8	96.9	93.8	93.8	105.3	99.4	90.2	90.2	78.9	67.7	26
27	558.0	580.9	634.7	659.3	719.3	851.7	96.9	96.9	93.8	96.9	93.8	93.8	105.6	101.7	92.3	90.2	78.9	67.7	27
28	553.9	579.9	608.4	659.3	719.3	851.7	96.9	96.9	93.8	96.9	93.8	96.9	107.2	101.7	92.3	91.0	82.7	68.8	28
29	553.7	579.9	608.4	637.3	701.8	846.6	96.9	96.9	93.8	96.9	93.8	96.9	107.2	101.7	94.0	91.0	82.7	68.8	29
30	553.7	579.9	605.8	637.3	701.8	846.6	96.9	96.9	93.8	96.9	95.3	96.9	107.5	105.0	94.0	91.0	83.2	68.8	30
31	543.6	547.9	605.8	637.3	699.2	846.6	96.9	96.9	93.8	96.9	96.9	96.9	107.5	105.0	94.0	94.1	83.7	69.9	31
32	543.6	547.9	605.8	633.0	696.6	818.1	96.9	96.9	93.8	96.9	96.9	96.9	108.3	106.2	94.1	94.1	83.7	69.9	32
33	541.2	547.2	597.6	633.0	696.6	818.1	96.9	96.9	93.8	96.9	96.9	96.9	108.3	106.2	94.1	94.1	85.2	69.9	33
34	540.3	547.2	597.6	633.0	690.2	818.1	96.9	96.9	93.8	100.0	96.9	96.9	108.3	106.2	94.1	94.8	85.2	70.8	34
35	540.3	547.2	597.6	633.0	690.2	771.0	96.9	96.9	93.8	100.0	96.9	96.9	108.4	106.6	98.7	94.8	85.3	70.8	35
36	533.2	530.8	586.1	633.0	680.4	771.0	96.9	96.9	93.8	100.0	96.9	96.9	108.4	106.6	98.7	94.8	85.3	70.8	36
37	533.2	530.8	586.1	633.0	670.6	771.0	96.9	96.9	96.9	100.0	96.9	96.9	109.5	107.0	98.8	94.8	85.3	76.9	37
38	531.2	526.1	571.0	614.7	670.6	738.9	96.9	96.9	96.9	100.0	96.9	96.9	111.0	107.0	98.8	94.8	86.2	76.9	38
39	531.0	526.1	571.0	614.7	661.5	738.9	96.9	96.9	96.9	100.0	96.9	96.9	111.0	107.0	98.8	94.8	86.2	76.9	39
40	531.0	526.1	571.0	614.7	661.5	738.9	96.9	96.9	96.9	100.0	96.9	96.9	111.3	109.5	101.8	95.1	88.1	77.8	40
41	521.4	524.3	563.9	612.3	657.7	735.5	96.9	96.9	96.9	100.0	96.9	96.9	111.8	109.5	101.8	95.1	90.1	77.8	41
42	516.7	524.3	563.9	612.3	653.9	735.5	96.9	96.9	96.9	100.0	96.9	96.9	111.8	110.4	101.8	95.1	90.1	77.8	42
43	516.7	519.7	563.9	612.3	653.9	735.5	96.9	96.9	96.9	100.0	96.9	96.9	112.5	110.4	102.4	96.9	91.8	80.2	43
44	515.4	519.7	553.5	609.7	647.3	723.5	96.9	96.9	96.9	100.0	96.9	96.9	112.5	113.0	102.4	96.9	91.8	80.2	44
45	515.4	514.3	553.5	609.7	647.3	723.5	96.9	96.9	96.9	100.0	96.9	96.9	112.7	113.0	108.4	96.9	93.6	80.2	45
46	511.0	514.3	543.8	609.7	631.9	723.5	96.9	96.9	96.9	100.0	96.9	96.9	114.1	113.0	108.4	98.4	95.5	81.2	46
47	509.0	514.3	543.8	599.3	616.5	723.1	96.9	96.9	96.9	100.0	96.9	96.9	114.1	113.3	108.4	98.4	95.5	81.2	47
48	509.0	509.7	543.8	599.3	616.5	723.1	96.9	96.9	96.9	100.0	96.9	96.9	115.4	113.3	112.3	98.4	95.7	81.2	48
49	507.2	509.7	520.6	599.3	616.0	723.1	96.9	96.9	96.9	100.0	96.9	96.9	115.4	116.7	112.3	100.1	95.7	81.6	49
50	507.2	496.4	520.6	594.6	616.0	715.7	96.9	96.9	96.9	100.0	96.9	96.9	116.3	116.7	113.1	100.1	96.5	81.6	50
51	505.2	496.4	511.2	594.6	610.4	715.7	96.9	96.9	96.9	100.0	96.9	96.9	116.4	116.7	113.9	100.1	97.3	81.6	51
52	503.3	496.4	501.8	594.6	604.9	715.7	96.9	96.9	96.9	100.0	96.9	96.9	116.4	117.7	113.9	100.9	97.3	82.2	52
53	503.3	493.3	501.8	590.1	604.9	701.0	96.9	96.9	96.9	100.0	96.9	96.9	116.						

## Appendix 2: Sample PDF Summary Report



### BrainScope® One Report Generated Jun/07/2018 20:05

Patient Name: John Doe  
Patient Date of Birth: 10/23/1980  
Patient Gender: Male  
Patient ID: WRK93

#### Assessment Summary

STRUCTURAL INJURY ASSESSMENT		
TEST	RESULT / SCORE	
EEG	Structural Injury Classifier	<b>Negative</b> Likely no head injury visible on head CT
FUNCTIONAL INJURY ASSESSMENTS		
TEST	RESULT / SCORE	
EEG	Brain Function Index	<b>76th Percentile</b> Average or Above <b>A</b>
CPA	Complex Reaction Time	<b>Clearly Below</b> Average <b>C</b>
	Match to Sample	<b>Clearly Below</b> Average <b>C</b>
VOMS	Vestibular/Ocular Motor Screening (VOMS)	Completed, see detailed results
CONV	Near Point Convergence	Completed, see detailed results
ACC	Accommodation	Left: 5 cm Right: 6 cm
BESS	Firm+Foam:	24 Errors
mBESS	Firm:	6 Errors
CSI		48/72
GSC		26/162



## Assessment Summary (cont.)

FUNCTIONAL INJURY ASSESSMENTS		
TEST		RESULT / SCORE
SCAT3 Sideline	Completed, see detailed results	
SCAT3	Symptom Count	21/22
	Symptom Severity Score	69/132
	SAC	13/30
	mBESS	12 Errors
	Tandem Gait	1.112 seconds
	Coordination	0
SCAT5 Immediate or On-Field Assessment	Completed, see detailed results	
SCAT5 Office or Off-Field Assessment	Symptom Number	22/22
	Symptom Severity Score	58/132
	Orientation	5/5
	Immediate Memory	19/30
	Concentration	3/5
	Neuro Exam	Abnormal
	Balance Errors	16/30
	Delayed Recall	4/10
NFL SCAT	Physical Signs	3/6
	Maddocks Score	4/5
	SAC	19/30
	mBESS	10 Errors
	Symptom Count	24/24
SAC		12/30
MACE	Cognitive Results	16/30
	Neurological Results	RED
	Symptom Result	B
MADDOCKS		3/5
ACE	Emergency Department	Concussion (Unspecified) 850.9
ACE	Physician/Clinician Office	No diagnosis
ACE	Sports	Completed, see detailed results
Rivermead	RPQ-3	0/12
	RPQ-13	15/52
PC-PTSD	PC-PTSD	Positive
PCL-C	PCL-C Score	85
PCL-S	PCL-S Score	17
PCL-M	PCL-M Score	51



### Patient Information

Date of Injury	Dec/12/2016
Time of Injury	19:45
Injury Event	Fall
Glasgow Coma Scale (GCS)	15
Loss of Consciousness (LOC)	No
Was it witnessed?	
How long was LOC?	N/A
At any time since injury, has the patient appeared disoriented?	No
At any time since injury, has the patient been observed to have retrograde amnesia (RGA)?	No
At this time, does the patient have visible evidence of trauma above the clavicle?	No
At this time, does the patient report having a headache?	No
Headache Rating	
At this time, does the patient report sensitivity to light or sound?	No
At any time since injury, has the patient had altered mental status (AMS) or appeared confused?	No



Date and Time of Assessment: Oct/20/2017 13:31, Patient ID: WRK93

## Brain Electrical Activity - EEG

Assessment Start Date and Time: Oct/20/2017 13:31

Assessment End Date and Time: Oct/20/2017 13:31

Patient Name:	Removed for confidentiality
Date of Birth:	Removed for confidentiality
Patient ID:	WRK93
Gender:	Removed for confidentiality
Date\Time of Injury:	Dec/12/2016 19:45
Injury Event:	Fall
Glasgow Coma Scale (GCS):	15
Loss of Consciousness (LOC):	No
Was it witnessed?	N/A
How long was LOC?	N/A
At any time since injury, has the patient appeared disoriented?	No
At any time since injury, has the patient been observed to have retrograde amnesia (RGA)?	No
At this time, does the patient have visible evidence of trauma above the clavicle?	No
At this time, does the patient report having a headache?	No
Headache Rating	N/A
At this time, does the patient report sensitivity to light or sound?	No
At any time since injury, has the patient had altered mental status (AMS) or appeared confused?	No

## Structural Injury Classifier (SIC)

**BrainScope NEGATIVE**  
Likely no injury visible on head CT

Structural Injury Classifier Indications For Use(IFU): Likely no injury visible on head CT. A negative BrainScope® One Structural Injury Classification using brain electrical activity in patients who sustained a closed head injury within 72 hours, likely corresponds to those with no structural brain injury visible on head CT.

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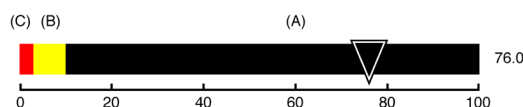
Date and Time of Assessment: Oct/20/2017 01:31 PM, Patient ID: WRK93

## Brain Electrical Activity - EEG

Assessment Date and Time: Oct/20/2017 01:31 PM

### Brain Function Index (BFI)

#### Average or Above Result



#### Percentile

Brain Function Index Information: The BrainScope® One BFI provides a measure of brain function for the statistical evaluation of the patient's electroencephalogram (EEG). This measure does not interact with any other device measures, and is stand alone. The BFI does not indicate the likelihood of the presence or absence of structural brain injury.

Statements displayed represent how the patient performed in comparison to normative data.

Average or above – patient's BFI result was equal to or above the 10th percentile to the 100th percentile.

Below average – patient's BFI result was equal to or above the 2.5th percentile to the 10th percentile.

Clearly below average – patient's BFI result was equal to or above the 0th percentile to the 2.5th percentile.



Date and Time of Assessment: Oct/20/2017 02:11 PM, Patient ID: WRK93

## Cognitive Performance Assessment

Assessment Date and Time: Oct/20/2017 02:11 PM

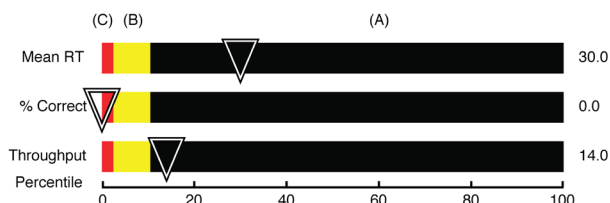
### Patient Information

Patient Name: John Doe  
Date of Birth: 10/23/1980  
Patient ID: WRK93

### Complex Reaction Time

Correct: 28 Incorrect: 4 Lapse: 0

Norms Comparison: Clearly Below Average



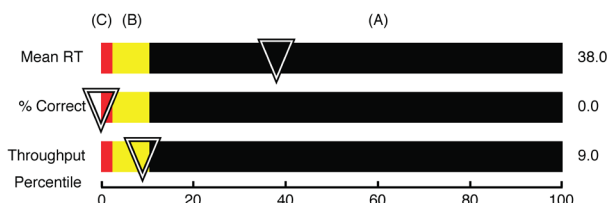
Mean RT   % Correct   Throughput					
Score	%ile	StdSc	N	Mean	StDev
555.82	30	99.279	41	547.755	167.843
87.5	0	52	41	97.029	2.961
95.02	14	87.351	41	111.482	19.521

Comparison Group

### Match to Sample

Correct: 13 Incorrect: 7 Lapse: 0

Norms Comparison: Clearly Below Average



Mean RT   % Correct   Throughput					
Score	%ile	StdSc	N	Mean	StDev
1486.69	38	100.29	40	1495.178	439.176
65	0	47	40	90.25	7.157
22.56	9	77.07	40	37.914	10.044

Comparison Group

### Cognitive Performance Summary Information:

For each test, one of three statements is displayed which represents how the patient performed in comparison to normative data. Three variables (Mean Reaction Time for correct responses, Percent Correct, and Throughput) are examined in comparison to the normative data and summarized for the operator.

Average or above – patient's test results were all equal to or above the 10th percentile.

Below average – patient's test results place them in the 9th to 3rd percentile.

Clearly below average – patient's test results in the 2nd percentile or below.

The Cognitive Performance section of the Information Hub screen will display the results of the test using letters A, B, or C.

Date and Time of Assessment: Oct/20/2017 01:53 PM, Patient ID: WRK93

### Vestibular/Ocular-Motor Screening (VOMS) for Concussion

Vestibular/Ocular Motor Test:	Not Tested	Headache 0-10	Dizziness 0-10	Nausea 0-10	Fogginess 0-10	Comments
BASELINE SYMPTOMS:	N/A	4	5	6	6	Comment
Smooth Pursuits	✗					N/A
Saccades – Horizontal	✗					N/A
Saccades – Vertical	✗					N/A
Convergence (Near Point)		4	7	5	8	(Near Point in cm): Measure 1: 6 Measure 2: 8 Measure 3: 10
VOR – Horizontal	✗					N/A
VOR – Vertical	✗					N/A
Visual Motion Sensitivity Test		7	7	7	7	N/A

#### Instructions:

**Interpretation:** This test is designed for use with subjects ages 9-40. When used with patients outside this age range, interpretation may vary. Abnormal findings or provocation of symptoms with any test may indicate dysfunction – and should trigger a referral to the appropriate health care professional for more detailed assessment and management.

**Equipment:** Tape measure (cm); Metronome; Target w/ 14 point font print.

**Baseline Symptoms** – Record: Headache, Dizziness, Nausea & Fogginess on 0-10 scale prior to beginning screening

- **Smooth Pursuits** - Test the ability to follow a slowly moving target. The patient and the examiner are seated. The examiner holds a fingertip at a distance of 3 ft. from the patient. The patient is instructed to maintain focus on the target as the examiner moves the target smoothly in the horizontal direction 1.5 ft. to the right and 1.5 ft. to the left of midline. One repetition is complete when the target moves back and forth to the starting position, and 2 repetitions are performed. The target should be moved at a rate requiring approximately 2 seconds to go fully from left to right and 2 seconds to go fully from right to left. The test is repeated with the examiner moving the target smoothly and slowly in the vertical direction 1.5 ft. above and 1.5 ft. below midline for 2 complete repetitions up and down. Again, the target should be moved at a rate requiring approximately 2 seconds to move the eyes fully upward and 2 seconds to move fully downward. Record: Headache, Dizziness, Nausea & Fogginess ratings after the test. (Figure 1)
- **Saccades** – Test the ability of the eyes to move quickly between targets. The patient and the examiner are seated.
  - **Horizontal Saccades:** The examiner holds two single points (fingertips) horizontally at a distance of 3 ft. from the patient, and 1.5 ft. to the right and 1.5 ft. to the left of midline so that the patient must gaze 30 degrees to left and 30 degrees to the right. Instruct the patient to move their eyes as quickly as possible from point to point. One repetition is complete when the eyes move back and forth to the starting position, and 10 repetitions are performed. Record: Headache, Dizziness, Nausea & Fogginess ratings after the test. (Figure 2)

Date and Time of Assessment: Oct/20/2017 01:53 PM, Patient ID: WRK93

- **Vertical Saccades:** Repeat the test with 2 points held vertically at a distance of 3 ft. from the patient, and 1.5 feet above and 1.5 feet below midline so that the patient must gaze 30 degrees upward and 30 degrees downward. Instruct the patient to move their eyes as quickly as possible from point to point. One repetition is complete when the eyes move up and down to the starting position, and 10 repetitions are performed. Record: Headache, Dizziness, Nausea & Foggiess ratings after the test. (Figure 3)
- **Convergence** – Measure the ability to view a near target without double vision. The patient is seated and wearing corrective lenses (if needed). The examiner is seated front of the patient and observes their eye movement during this test. The patient focuses on a small target (approximately 14 point font size) at arm's length and slowly brings it toward the tip of their nose. The patient is instructed to stop moving the target when they see two distinct images or when the examiner observes an outward deviation of one eye. Blurring of the image is ignored. The distance in cm. between target and the tip of nose is measured and recorded. This is repeated a total of 3 times with measures recorded each time. Record: Headache, Dizziness, Nausea & Foggiess ratings after the test. Abnormal: Near Point of convergence  $\geq 6$  cm from the tip of the nose. (Figure 4)
- **Vestibular-Ocular Reflex (VOR) Test** – Assess the ability to stabilize vision as the head moves. The patient and the examiner are seated. The examiner holds a target of approximately 14 point font size in front of the patient in midline at a distance of 3 ft.
  - **Horizontal VOR Test:** The patient is asked to rotate their head horizontally while maintaining focus on the target. The head is moved at an amplitude of 20 degrees to each side and a metronome is used to ensure the speed of rotation is maintained at 180 beats/minute (one beat in each direction). One repetition is complete when the head moves back and forth to the starting position, and 10 repetitions are performed. Record: Headache, Dizziness, Nausea and Foggiess ratings 10 sec after the test is completed. (Figure 5)
  - **Vertical VOR Test:** The test is repeated with the patient moving their head vertically. The head is moved in an amplitude of 20 degrees up and 20 degrees down and a metronome is used to ensure the speed of movement is maintained at 180 beats/minute (one beat in each direction). One repetition is complete when the head moves up and down to the starting position, and 10 repetitions are performed. Record: Headache, Dizziness, Nausea and Foggiess ratings after the test. (Figure 6)
- **Visual Motion Sensitivity (VMS) Test** – Test visual motion sensitivity and the ability to inhibit vestibular-induced eye movements using vision. The patient stands with feet shoulder width apart, facing a busy area of the clinic. The examiner stands next to and slightly behind the patient, so that the patient is guarded but the movement can be performed freely. The patient holds arm outstretched and focuses on their thumb. Maintaining focus on their thumb, the patient rotates, together as a unit, their head, eyes and trunk at an amplitude of 80 degrees to the right and 80 degrees to the left. A metronome is used to ensure the speed of rotation is maintained at 50 beats/min (one beat in each direction). One repetition is complete when the trunk rotates back and forth to the starting position, and 5 repetitions are performed. Record: Headache, Dizziness, Nausea & Foggiess ratings after the test. (Figure 7)





Date and Time of Assessment: Oct/20/2017 02:31 PM, Patient ID: WRK93

Near Point Convergence Summary

Assessment Date and Time: Oct/20/2017 02:31 PM

Measure 1	8 cm
Measure 2	9 cm
Measure 3	10 cm



Date and Time of Assessment: Oct/20/2017 02:31 PM, Patient ID: WRK93

Accommodation Summary

Assessment Date and Time: Oct/20/2017 02:31 PM

Near point of accommodation (NPA) measures:

Left Eye	5 cm
Right Eye	6 cm



Date and Time of Assessment: Oct/20/2017 02:57 PM, Patient ID: WRK93

### BESS Assessment Summary

Patient Name: John Doe  
Patient ID: WRK93  
Assessment Date and Time: Oct/20/2017 02:57 PM

Non Dominant Foot: Right  
Testing surface: field

BESS - FIRM Surface

Double Leg Stance Score:	2
Single Leg Stance Score:	5
Tandem Leg Stance Score:	3
Total Score:	10

BESS - FOAM Surface

Double Leg Stance Score:	7
Single Leg Stance Score:	3
Tandem Leg Stance Score:	4
Total Score:	14

BESS Total Score: 24



Date and Time of Assessment: Oct/20/2017 02:59 PM, Patient ID: WRK93

mBESS Assessment Summary

Patient Name: John Doe  
Patient ID: WRK93  
Assessment Date and Time: Oct/20/2017 02:59 PM

Non Dominant Foot: Left  
Testing surface: hard floor

mBESS Scores	
Double Leg Stance Score:	2
Single Leg Stance Score:	2
Tandem Leg Stance Score:	2
mBESS Total Score:	6

<h2 style="margin: 0;">Concussion Symptom Inventory (CSI)</h2> <p style="margin: 0;">Randolph, Millis, Barr, McCrea, Guskiewicz, Hammeke, &amp; Kelly (2008)</p> <p style="margin: 0; font-size: small;">Date and Time of Assessment: Oct/20/2017 04:22 PM, Patient ID: WRK93</p>								
Player Name: <u>John Doe</u>								
Date of injury: <u>Dec/12/2016</u> Date of exam: <u>Oct/20/2017</u>								
	absent	<i>mild</i>		<i>moderate</i>		<i>severe</i>		
	0	1	2	3	4	5	6	Score
Headache								4
Nausea								4
Balance problems/Dizziness								4
Fatigue								4
Drowsiness								4
Feeling like "in a fog"								4
Difficulty concentrating								4
Difficulty remembering								4
Sensitivity to light								4
Sensitivity to noise								4
Blurred vision								4
Feeling slowed down								4
<b>TOTAL:</b>								48
Other symptoms evident since injury?: Symptom								

Date and Time of Assessment: Oct/20/2017 04:23 PM, Patient ID: WRK93

## Graded Symptom Scale Checklist

*Modified from various published symptom checklists<sup>27-30</sup>*

Evaluate all signs and symptoms, ranking each on a scale of 0-6. **Establish baseline score prior to the start of the athletic season.** After a concussive injury, re-assess the athlete for each symptom. Add columns and compare to baseline score. Only consider return to activity if scores are comparable to baseline score. Continue testing every 2-3 days if symptoms do not resolve. Use with SAC and/or BESS to determine appropriate time for return to play.

	None		Moderate		Severe		
Score According to Severity	0	1	2	3	4	5	6

Symptom	Preseason Baseline	Time of Injury	24 Hours Post-Injury	Day 3 Post-Injury	Day 4 Post-Injury	Day 5 Post-Injury
Blurred Vision					1	
Dizziness					1	
Drowsiness					1	
Sleeping More than Usual					1	
Easily Distracted					1	
Fatigue					1	
Feeling "In a Fog"					1	
Feeling "Slowed Down"					1	
Headache					1	
Unusually Emotional					1	
Irritability					1	
Loss of Consciousness					1	
Loss of Orientation					1	
Memory Problems					1	
Nauseous					1	
Nervousness					1	
Personality Changes					1	
Poor Balance/Coordination					1	
Ring in the Ears					1	
Sadness					1	
Seeing Stars					1	
Sensitivity to Light					1	
Sensitivity to Noise					1	
Sleep Disturbances					1	
Vacant Stares/Glassy Eyes					1	
Vomiting					1	
<b>TOTAL SYMPTOM SCORE:</b>					26	

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Date and Time of Assessment:  
Oct/20/2017 04:28 PM, Patient ID: WRK93

## SCAT3™



FIFA®



FEI

### Sport Concussion Assessment Tool – 3rd Edition

For use by medical professionals only

Name **John Doe**

Date/Time of Injury: **Dec/12/2016 19:45**  
Date of Assessment: **Oct/20/2017**

Examiner: **Aaa Bbb**

#### What is the SCAT3?¹

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, respectively². 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 Tool³. Preseason 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?	<input type="checkbox"/> Y <input checked="" type="checkbox"/> N
"If so, how long?"	
Balance or motor incoordination (stumbles, slow/laboured movements, etc.)?	<input type="checkbox"/> Y <input checked="" type="checkbox"/> N
Disorientation or confusion (inability to respond appropriately to questions)?	<input type="checkbox"/> Y <input checked="" type="checkbox"/> N
Loss of memory:	<input checked="" type="checkbox"/> Y <input type="checkbox"/> N
"If so, how long?"	<b>3</b>
"Before or after the injury?"	<b>AFTER</b>
Blank or vacant look:	<input type="checkbox"/> Y <input checked="" type="checkbox"/> N
Visible facial injury in combination with any of the above:	<input type="checkbox"/> Y <input checked="" type="checkbox"/> N

#### 1 Glasgow coma scale (GCS)

##### Best eye response (E)

No eye opening	1
Eye opening in response to pain	<b>2</b>
Eye opening to speech	3
Eyes opening spontaneously	4

##### Best verbal response (V)

No verbal response	1
Incomprehensible sounds	<b>2</b>
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	<b>4</b>
Localizes to pain	5
Obeys commands	6

**Glasgow Coma score (E + V + M)** **8** of 15

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

#### 2 Maddocks Score³

"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?	<b>0</b>	1
Which half is it now?	<b>0</b>	1
Who scored last in this match?	<b>0</b>	1
What team did you play last week/game?	<b>0</b>	<b>1</b>
Did your team win the last game?	<b>0</b>	<b>1</b>
<b>Maddocks score</b>	<b>2</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?"):

**Mechanism**

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**Any athlete with a suspected concussion should be REMOVED 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: John Doe Date: Oct/20/2017  
Examiner: Aaa Bbb  
Sport/team/school: team Date/time of injury: Dec/12/2016 19:45  
Age: 36 Gender: ☒ M ☐ F  
Years of education completed: 10  
Dominant hand: ☐ right ☐ left ☒ neither  
How many concussions do you think you have had in the past? 10  
When was the most recent concussion? 05/04/2016  
How long was your recovery from the most recent concussion? 10 days  
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: ☐ Y ☒ N

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	mild	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 22) 21  
Symptom severity score (Maximum possible 132) 69

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	0

Orientation score 1 of 5

Immediate memory

List	Trial 1	Trial 2	Trial 3	Alternative word list
elbow	0	1	0	candle baby finger
apple	0	1	0	paper monkey penny
carpet	0	0	0	sugar perfume blanket
saddle	0	1	0	sandwich sunset lemon
bubble	0	1	0	wagon iron insect
Total	4	4	1	

Immediate memory score total 9 of 15

Concentration: Digits Backward

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

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

Dec-Nov-Oct-Sept-Aug-Jul-Jun-May-Apr-Mar-Feb-Jan 0 0 of 5

### 5 Neck Examination:

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

### 6 Balance examination

Do one or both of the following tests.

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

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: 5 Errors  
Single leg stance (non-dominant foot): 8 Errors  
Tandem stance (non-dominant foot at back): 4 Errors

And/Or

Tandem gait<sup>6,7</sup>

Time (best of 4 trials): 1.112 seconds

### 7 Coordination examination

Upper limb coordination

Which arm was tested: ☒ Left ☐ Right

Coordination score 0 of 1

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

Delayed recall score 0 of 5

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## INSTRUCTIONS

Words in *italics* throughout the SCAT3 are the instructions given to the athlete by the tester.

### Symptom Scale

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

To be completed by the athlete. In situations where the symptom scale is being completed after exercise, it should still be done in a resting state, at least 10 minutes post exercise.

For total number of symptoms, maximum possible is 22.

For Symptom severity score, add all scores in table, maximum possible is 22x6=132.

### SAC<sup>4</sup>

#### Immediate Memory

*"I am going to test your memory. I will read you a list of words and when I am done, repeat back as many words as you can remember, in any order."*

#### Trials 2 & 3:

*"I am going to repeat the same list again. Repeat back as many words as you can remember in any order, even if you said the word before."*

Complete all 3 trials regardless of score on trial 1 & 2. Read the words at a rate of one per second.

**Score 1 pt. for each correct response.** Total score equals sum across all 3 trials. Do not inform the athlete that delayed recall will be tested.

#### Concentration

##### Digits backward

*"I am going to read you a string of numbers and when I am done, you repeat them back to me backwards, in reverse order of how I read them to you. For example, if I say 7-1-9, you would say 9-1-7."*

If correct, go to next string length. If incorrect, read trial 2. **One point possible for each string length.** Stop after incorrect on both trials. The digits should be read at the rate of one per second.

#### Months in reverse order

*"Now tell me the months of the year in reverse order. Start with the last month and go backward. So you'll say December, November ... Go ahead"*

**1 pt. for entire sequence correct**

#### Delayed Recall

The delayed recall should be performed after completion of the Balance and Coordination Examination.

*"Do you remember that list of words I read a few times earlier? Tell me as many words from the list as you can remember in any order."*

**Score 1 pt. for each correct response**

## Balance Examination

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

This balance testing is based on a modified version of the Balance Error Scoring System (BESS)<sup>5</sup>. A stopwatch or watch with a second hand is required for this testing.

*"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 three twenty second tests with different stances."*

#### (a) Double leg stance:

*"The first stance is standing with your feet together with your hands on your hips and with your eyes closed. You should try to maintain stability in that position for 20 seconds. I will be counting the number of times you move out of this position. I will start timing when you are set and have closed your eyes."*

#### (b) Single leg stance:

*"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. 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 hands on your hips and your eyes closed. I will be counting the number of times you move out of this position. If you stumble out of this position, open your eyes and return to the start position and continue balancing. I will start timing when you are set and have closed your eyes."*

#### (c) Tandem stance:

*"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 hands on your hips and your eyes closed. I will be counting the number of times you move out of this position. If you stumble out of this position, open your eyes and return to the start position and continue balancing. I will start timing when you are set and have closed your eyes."*

### 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

Each of the 20-second trials is scored by counting the errors, or deviations from the proper stance, accumulated by the athlete. The examiner will begin counting errors only after the individual has assumed the proper start position. **The modified BESS is calculated by adding one error point for each error during the three 20-second tests. The maximum total number of errors for any single condition is 10.** If a athlete commits multiple errors simultaneously, only one error is recorded but the athlete should quickly return to the testing position, and counting should resume once subject is set. Subjects that are unable to maintain the testing procedure for a minimum of **five seconds** at the start are assigned the highest possible score, ten, for that testing condition.

**OPTION:** For further assessment, the same 3 stances can be performed on a surface of medium density foam (e.g., approximately 50 cm x 40 cm x 6 cm).

### Tandem Gait<sup>6,7</sup>

*Participants are instructed to stand with their feet together behind a starting line (the test is best done with footwear removed). Then, they walk in a forward direction as quickly and as accurately as possible along a 38mm wide (sports tape), 3 meter line with an alternate foot heel-to-toe gait ensuring that they approximate their heel and toe on each step. Once they cross the end of the 3m line, they turn 180 degrees and return to the starting point using the same gait. A total of 4 trials are done and the best time is retained. Athletes should complete the test in 14 seconds. Athletes fail the test if they step off the line, have a separation between their heel and toe, or if they touch or grab the examiner or an object. In this case, the time is not recorded and the trial repeated, if appropriate.*

## Coordination Examination

### Upper limb coordination

Finger-to-nose (FTN) task:

*"I am going to test your coordination now. Please sit comfortably on the chair with your eyes open and your arm (either right or left) outstretched (shoulder flexed to 90 degrees and elbow and fingers extended), pointing in front of you. When I give a start signal, I would like you to perform five successive finger to nose repetitions using your index finger to touch the tip of the nose, and then return to the starting position, as quickly and as accurately as possible."*

**Scoring: 5 correct repetitions in < 4 seconds = 1**

**Note for testers:** Athletes fail the test if they do not touch their nose, do not fully extend their elbow or do not perform five repetitions. **Failure should be scored as 0.**

## References & Footnotes

1. This tool has been developed by a group of international experts at the 4th International Consensus meeting on Concussion in Sport held in Zurich, Switzerland in November 2012. The full details of the conference outcomes and the authors of the tool are published in The BJSM Injury Prevention and Health Protection, 2013, Volume 47, Issue 5. The outcome paper will also be simultaneously co-published in other leading biomedical journals with the copyright held by the Concussion in Sport Group, to allow unrestricted distribution, providing no alterations are made.
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3. Maddocks, DL; Dicker, GD; Saling, MM. The assessment of orientation following concussion in athletes. Clinical Journal of Sport Medicine. 1995; 5(1): 32–3.
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6. Schneiders, A.G., Sullivan, S.J., Gray, A., Hammond-Tooke, G. & McCrory, P. Normative values for 16-37 year old subjects for three clinical measures of motor performance used in the assessment of sports concussions. Journal of Science and Medicine in Sport. 2010; 13(2): 196–201.
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## ATHLETE INFORMATION

Any athlete suspected of having a concussion should be removed from play, and then seek medical evaluation.

### Signs to watch for

Problems could arise over the first 24–48 hours. The athlete should not be left alone and must go to a hospital at once if they:

- Have a headache that gets worse
- Are very drowsy or can't be awakened
- Can't recognize people or places
- Have repeated vomiting
- Behave unusually or seem confused; are very irritable
- Have seizures (arms and legs jerk uncontrollably)
- Have weak or numb arms or legs
- Are unsteady on their feet: have slurred speech

Remember, it is better to be safe.

**Consult your doctor after a suspected concussion.**

[Return to play](#)

Athletes should not be returned to play the same day of injury.

When returning athletes to play, they should be **medically cleared and then follow a stepwise supervised program**, with stages of progression.

For example:

Rehabilitation stage	Functional exercise at each stage of rehabilitation	Objective of each stage
No activity	Physical and cognitive rest	Recovery
Light aerobic exercise	Walking, swimming or stationary cycling keeping intensity 70% maximum predicted heart rate. No resistance training	Increase heart rate
Sport-specific exercise	Skating drills in ice hockey, running drills in soccer. No head impact activities	Add movement
Non-contact training drills	Progression to more complex training drills, e.g passing drills in football and ice hockey. May start progressive resistance training	Exercise, coordination, and cognitive load
Full contact practice	Following medical clearance participate in normal training activities	Restore confidence and assess functional skills by coaching staff
Return to play	Normal game play	

There should be at least 24 hours (or longer) for each stage and if symptoms recur the athlete should rest until they resolve once again and then resume the program at the previous asymptomatic stage. Resistance training should only be added in the later stages.

If the athlete is symptomatic for more than 10 days, then consultation by a medical practitioner who is expert in the management of concussion, is recommended.

**Medical clearance should be given before return to play.**

## CONCUSSION INJURY ADVICE

(To be given to the **person monitoring** the concussed athlete)

This patient has received an injury to the head. A careful medical examination has been carried out and no sign of any serious complications has been found. Recovery time is variable across individuals and the patient will need monitoring for a further period by a responsible adult. Your treating physician will provide guidance as to this timeframe.

If you notice any change in behaviour, vomiting, dizziness, worsening headache, double vision or excessive drowsiness, please contact your doctor or the nearest hospital emergency department immediately.

Other important points:

- Rest (physically and mentally), including training or playing sports until symptoms resolve and you are medically cleared
- No alcohol
- No prescription or non-prescription drugs without medical supervision.  
Specifically:
  - No sleeping tablets
  - Do not use aspirin, anti-inflammatory medication or sedating pain killers
- Do not drive until medically cleared
- Do not train or play sport until medically cleared

Clinic phone number

### Scoring Summary:

Test Domain	Score		
	Date: <b>Oct/20/20</b>	Date: _____	Date: _____
	<b>17</b>		
Number of Symptoms of 22	<b>21</b>		
Symptom Severity Score of 132	<b>69</b>		
Orientation of 5	<b>1</b>		
Immediate Memory of 15	<b>9</b>		
Concentration of 5	<b>3</b>		
Delayed Recall of 5	<b>0</b>		
<b>SAC Total</b>	<b>13</b>		
BESS (total errors)	<b>12</b>		
Tandem Gait (seconds)	<b>1.112</b>		
Coordination of 1	<b>0</b>		

### Notes:

Patient's name \_\_\_\_\_

Date/time of injury \_\_\_\_\_

Date/time of medical review \_\_\_\_\_

Treating physician \_\_\_\_\_

Contact details or stamp

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## SCAT3

*Br J Sports Med* 2013 47: 259

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## SCAT5®

**SPORT CONCUSSION ASSESSMENT TOOL – 5TH EDITION**  
DEVELOPED BY THE CONCUSSION IN SPORT GROUP  
FOR USE BY MEDICAL PROFESSIONALS ONLY

supported by

Aaa Bbb



### Patient details

Name: John Doe

DOB: Oct/23/1980

Address: 1234

ID number: WRK93

Examiner: Aaa Bbb

Date of Injury: Dec/12/2016 Time: 07:45 PM

## WHAT IS THE SCAT5?

The SCAT5 is a standardized tool for evaluating concussions designed for use by physicians and licensed healthcare professionals<sup>1</sup>. The SCAT5 cannot be performed correctly in less than 10 minutes.

If you are not a physician or licensed healthcare professional, please use the Concussion Recognition Tool 5 (CRT5). The SCAT5 is to be used for evaluating athletes aged 13 years and older. For children aged 12 years or younger, please use the Child SCAT5.

Preseason SCAT5 baseline testing can be useful for interpreting post-injury test scores, but is not required for that purpose. Detailed instructions for use of the SCAT5 are provided on page 7. Please read through these instructions carefully before testing the athlete. Brief verbal instructions for each test are given in italics. The only equipment required for the tester is a watch or timer.

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## Recognise and Remove

A head impact by either a direct blow or indirect transmission of force can be associated with a serious and potentially fatal brain injury. If there are significant concerns, including any of the red flags listed in Box 1, then activation of emergency procedures and urgent transport to the nearest hospital should be arranged.

### Key points

- Any athlete with suspected concussion should be REMOVED FROM PLAY, medically assessed and monitored for deterioration. No athlete diagnosed with concussion should be returned to play on the day of injury.
- If an athlete is suspected of having a concussion and medical personnel are not immediately available, the athlete should be referred to a medical facility for urgent assessment.
- Athletes with suspected concussion should not drink alcohol, use recreational drugs and should not drive a motor vehicle until cleared to do so by a medical professional.
- Concussion signs and symptoms evolve over time and it is important to consider repeat evaluation in the assessment of concussion.
- The diagnosis of a concussion is a clinical judgment, made by a medical professional. The SCAT5 should NOT be used by itself to make, or exclude, the diagnosis of concussion. An athlete may have a concussion even if their SCAT5 is "normal".

### Remember:

- The basic principles of first aid (danger, response, airway, breathing, circulation) should be followed.
- Do not attempt to move the athlete (other than that required for airway management) unless trained to do so.
- Assessment for a spinal cord injury is a critical part of the initial on-field assessment.
- Do not remove a helmet or any other equipment unless trained to do so safely.

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1

## IMMEDIATE OR ON-FIELD ASSESSMENT

The following elements should be assessed for all athletes who are suspected of having a concussion prior to proceeding to the neurocognitive assessment and ideally should be done on-field after the first first aid / emergency care priorities are completed.

If any of the "Red Flags" or observable signs are noted after a direct or indirect blow to the head, the athlete should be immediately and safely removed from participation and evaluated by a physician or licensed healthcare professional.

Consideration of transportation to a medical facility should be at the discretion of the physician or licensed healthcare professional.

The GCS is important as a standard measure for all patients and can be done serially if necessary in the event of deterioration in conscious state. The Maddocks questions and cervical spine exam are critical steps of the immediate assessment; however, these do not need to be done serially.

## STEP 1: RED FLAGS

### RED FLAGS:

- Neck pain or tenderness
- Double vision
- Weakness or tingling/ burning in arms or legs
- Severe or increasing headache
- Seizure or convulsion
- Loss of consciousness
- Deteriorating conscious state
- Vomiting
- Increasingly restless, agitated or combative

## STEP 2: OBSERVABLE SIGNS

Witnessed ☐ Observed on Video ☒

Lying motionless on the playing surface	<input checked="" type="radio"/> Y	<input type="radio"/> N
Balance / gait difficulties / motor incoordination: stumbling, slow / laboured movements	<input type="radio"/> Y	<input checked="" type="radio"/> N
Disorientation or confusion, or an inability to respond appropriately to questions	<input type="radio"/> Y	<input checked="" type="radio"/> N
Blank or vacant look	<input type="radio"/> Y	<input checked="" type="radio"/> N
Facial injury after head trauma	<input type="radio"/> Y	<input checked="" type="radio"/> N

## STEP 3: MEMORY ASSESSMENT MADDOCKS QUESTIONS<sup>2</sup>

*"I am going to ask you a few questions, please listen carefully and give your best effort. First, tell me what happened?"*

### Description

Mark Y for correct answer / N for incorrect

What venue are we at today?	<input type="radio"/> Y	<input checked="" type="radio"/> N
Which half is it now?	<input type="radio"/> Y	<input checked="" type="radio"/> N
Who scored last in this match?	<input checked="" type="radio"/> Y	<input type="radio"/> N
What team did you play last week / game?	<input checked="" type="radio"/> Y	<input type="radio"/> N
Did your team win the last game?	<input checked="" type="radio"/> Y	<input type="radio"/> N

Note: Appropriate sport-specific questions may be substituted.

Name: John Doe

DOB: Oct/23/1980

Address: 1234

ID number: WRK93

Examiner: Aaa Bbb

Date: Oct/22/2017

## STEP 4: EXAMINATION

### GLASGOW COMA SCALE (GCS)<sup>3</sup>

Time of assessment	01:45 PM		
Date of assessment	Oct/22/2017		

#### Best eye response (E)

No eye opening	1	1	1
Eye opening in response to pain	<input checked="" type="radio"/> 2	2	2
Eye opening to speech	3	3	3
Eyes opening spontaneously	4	4	4

#### Best verbal response (V)

No verbal response	1	1	1
Incomprehensible sounds	2	2	2
Inappropriate words	<input checked="" type="radio"/> 3	3	3
Confused	4	4	4
Oriented	5	5	5

#### Best motor response (M)

No motor response	1	1	1
Extension to pain	2	2	2
Abnormal flexion to pain	3	3	3
Flexion / Withdrawal to pain	4	4	4
Localizes to pain	<input checked="" type="radio"/> 5	5	5
Obeys commands	6	6	6
Glasgow Coma score (E + V + M)	10		

## CERVICAL SPINE ASSESSMENT

Does the athlete report that their neck is pain free at rest?	<input type="radio"/> Y	<input checked="" type="radio"/> N
If there is NO neck pain at rest, does the athlete have a full range of ACTIVE pain free movement?	<input type="radio"/> Y	<input checked="" type="radio"/> N
Is the limb strength and sensation normal?	<input checked="" type="radio"/> Y	<input type="radio"/> N

**In a patient who is not lucid or fully conscious, a cervical spine injury should be assumed until proven otherwise.**

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## OFFICE OR OFF-FIELD ASSESSMENT

Please note that the neurocognitive assessment should be done in a distraction-free environment with the athlete in a resting state.

## STEP 1: ATHLETE BACKGROUND

Sport / team / school: team

Date / time of injury: Dec/12/2016 07:45 PM

Years of education completed: 6

Age: 36

Gender: ☒ M / ☐ F / Other

Dominant hand: ☒ left / ☐ neither / ☐ right

How many diagnosed concussions has the athlete had in the past?: 3

When was the most recent concussion?: 08/13/2008

How long was the recovery (time to being cleared to play) from the most recent concussion?: 3 (days)

### Has the athlete ever been:

Hospitalized for a head injury?	<input checked="" type="radio"/> Yes	<input type="radio"/> No
Diagnosed / treated for headache disorder or migraines?	<input checked="" type="radio"/> Yes	<input type="radio"/> No
Diagnosed with a learning disability / dyslexia?	<input checked="" type="radio"/> Yes	<input type="radio"/> No
Diagnosed with ADD / ADHD?	<input checked="" type="radio"/> Yes	<input type="radio"/> No
Diagnosed with depression, anxiety or other psychiatric disorder?	<input checked="" type="radio"/> Yes	<input type="radio"/> No

Current medications? If yes, please list:

medication

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

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## 2

## STEP 2: SYMPTOM EVALUATION

The athlete should be given the symptom form and asked to read this instruction paragraph out loud then complete the symptom scale. For the baseline assessment, the athlete should rate his/her symptoms based on how he/she typically feels and for the post injury assessment the athlete should rate their symptoms at this point in time.

Please Check: ☐ Baseline ☒ Post-Injury

Please hand the form to the athlete

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

Total number of symptoms: 22 of 22

Symptom severity score: 58 of 132

Do your symptoms get worse with physical activity? ☒ Y ☐ N

Do your symptoms get worse with mental activity? ☐ Y ☒ N

If 100% is feeling perfectly normal, what percent of normal do you feel? 30

If not 100%, why?

Reason

\_\_\_\_\_

\_\_\_\_\_

Please hand form back to examiner



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## STEP 3: COGNITIVE SCREENING

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

### ORIENTATION

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>5</b>	of 5

### IMMEDIATE MEMORY

The Immediate Memory component can be completed using the traditional 5-word per trial list or optionally using 10-words per trial to minimise any ceiling effect. All 3 trials must be administered irrespective of the number correct on the first trial. Administer at the rate of one word per second.

Please choose EITHER the 5 or 10 word list groups and circle the specific word list chosen for this test.

I am going to test your memory. I will read you a list of words and when I am done, repeat back as many words as you can remember, in any order. For Trials 2 & 3: I am going to repeat the same list again. Repeat back as many words as you can remember in any order, even if you said the word before.

List	Alternate 5 word lists					Score (of 5)		
	Trial 1	Trial 2	Trial 3					
A	Finger	Penny	Blanket	Lemon	Insect			
B	Candle	Paper	Sugar	Sandwich	Wagon			
C	Baby	Monkey	Perfume	Sunset	Iron			
D	Elbow	Apple	Carpet	Saddle	Bubble			
E	Jacket	Arrow	Pepper	Cotton	Movie			
F	Dollar	Honey	Mirror	Saddle	Anchor			
<b>Immediate Memory Score</b>						<b>of 15</b>		
<b>Time that last trial was completed</b>								

List	Alternate 10 word lists					Score (of 10)		
	Trial 1	Trial 2	Trial 3					
G	Finger	Penny	Blanket	Lemon	Insect			
	Candle	Paper	Sugar	Sandwich	Wagon			
H	Baby	Monkey	Perfume	Sunset	Iron	8	6	5
	Elbow	Apple	Carpet	Saddle	Bubble			
I	Jacket	Arrow	Pepper	Cotton	Movie			
	Dollar	Honey	Mirror	Saddle	Anchor			
<b>Immediate Memory Score</b>						<b>19</b> of 30		
<b>Time that last trial was completed</b>						<b>01:49</b>		

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DOB: Oct/23/1980  
Address: 764 s st  
ID number: WRK93  
Examiner: Aaa Bbb  
Date: Oct/22/2017

### CONCENTRATION

#### DIGITS BACKWARDS

Please circle the Digit list chosen (A, B, C, D, E, F). Administer at the rate of one digit per second reading DOWN the selected column.

I am going to read a string of numbers and when I am done, you repeat them back to me in reverse order of how I read them to you. For example, if I say 7-1-9, you would say 9-1-7.

Concentration Number Lists (circle one)					
List A	List B	List C			
4-9-3	5-2-6	1-4-2	Y	N	0
6-2-9	4-1-5	6-5-8	Y	N	1
3-8-1-4	1-7-9-5	6-8-3-1	Y	N	0
3-2-7-9	4-9-6-8	3-4-8-1	Y	N	1
6-2-9-7-1	4-8-5-2-7	4-9-1-5-3	Y	N	0
1-5-2-8-6	6-1-8-4-3	6-8-2-5-1	Y	N	0
7-1-8-4-6-2	8-3-1-9-6-4	3-7-6-5-1-9	Y	N	0
5-3-9-1-4-8	7-2-4-8-5-6	9-2-6-5-1-4	Y	N	0
List D	List E	List F			
7-8-2	3-8-2	2-7-1	Y	N	0
9-2-6	5-1-8	4-7-9	Y	N	1
4-1-8-3	2-7-9-3	1-6-8-3	Y	N	0
9-7-2-3	2-1-6-9	3-9-2-4	Y	N	1
1-7-9-2-6	4-1-8-6-9	2-4-7-5-8	Y	N	0
4-1-7-5-2	9-4-1-7-5	8-3-9-6-4	Y	N	1
2-6-4-8-1-7	6-9-7-3-8-2	5-8-6-2-4-9	Y	N	0
8-4-1-9-3-5	4-2-7-9-3-8	3-1-7-8-2-6	Y	N	1
<b>Digits Score:</b>					<b>2</b> of 4

### MONTHS IN REVERSE ORDER

Now tell me the months of the year in reverse order. Start with the last month and go backward. So you'll say December, November. Go ahead.

Dec - Nov - Oct - Sept - Aug - Jul - Jun - May - Apr - Mar - Feb - Jan	0
<b>Months Score</b>	<b>1</b> of 1
<b>Concentration Total Score (Digits + Months)</b>	
<b>3</b>	of 5

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## STEP 4: NEUROLOGICAL SCREEN

See the instruction sheet (page 7) for details of test administration and scoring of the tests.

Can the patient read aloud (e.g., symptom checklist) and follow instructions without difficulty?	<input checked="" type="radio"/> Y	<input type="radio"/> N
Does the patient have a full range of pain-free PASSIVE cervical spine movement?	<input checked="" type="radio"/> Y	<input type="radio"/> N
Without moving their head or neck, can the patient look side-to-side and up-and-down without double vision?	<input checked="" type="radio"/> Y	<input type="radio"/> N
Can the patient perform the finger nose coordination test normally?	<input checked="" type="radio"/> Y	<input type="radio"/> N
Can the patient perform tandem gait normally?	<input type="radio"/> Y	<input checked="" type="radio"/> N

## BALANCE EXAMINATION

### Modified Balance Error Scoring System (mBESS) testing<sup>5</sup>

Which foot was tested (i.e., which is the non-dominant foot)	<input type="checkbox"/> Left <input checked="" type="checkbox"/> Right
Testing surface (hard floor, field, etc.)	hard floor
Footwear (shoes, barefoot, braces, tape, etc.)	braces
Condition	Errors
Double leg stance	7 of 10
Single leg stance (non-dominant foot)	5 of 10
Tandem stance (non-dominant foot at the back)	4 of 10
Total Errors	16 of 30

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Examiner: Aaa Bbb

Date: Oct/22/2017

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## STEP 5: DELAYED RECALL:

The delayed recall should be performed after 5 minutes have elapsed since the end of the Immediate Recall section. Score 1 pt. for each correct response.

Do you remember that list of words I read a few times earlier? Tell me as many words from the list as you can remember in any order.

Time Started 01:51 PM

Please record each word correctly recalled. Total score equals number of words recalled.

Baby Monkey Perfume Bubble

Total number of words recalled accurately: 4 of 10

6

## STEP 6: DECISION

Domain	Date & time of assessment:		
	Oct/22/2017 01:52 PM		
Symptom number (of 22)	22		
Symptom severity score (of 132)	58		
Orientation (of 5)	5		
Immediate memory	19 of 15 of 30	of 15 of 30	of 15 of 30
Concentration (of 5)	3		
Neuro exam	Normal Abnormal	Normal Abnormal	Normal Abnormal
Balance errors (of 30)	16		
Delayed Recall	4 of 5 of 10	of 5 of 10	of 5 of 10

Date and time of injury: Dec/12/2016 07:45 PM

If the athlete is known to you prior to their injury, are they different from their usual self?

☐ Yes ☐ No ☐ Unsure ☒ Not Applicable

(If different, describe why in the clinical notes section)

Concussion Diagnosed?

☐ Yes ☐ No ☐ Unsure ☒ Not Applicable

If re-testing, has the athlete improved?

☒ Yes ☐ No ☐ Unsure ☐ Not Applicable

I am a physician or licensed healthcare professional and I have personally administered or supervised the administration of this SCAT5.

Signature: sig

Name: name

Title: title

Registration number (if applicable): 25689

Date: Oct/22/2017

**SCORING ON THE SCAT5 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.**

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## CLINICAL NOTES:

### Notes

Name: John Doe

DOB: Oct/23/1980

Address: 764 s st

ID number: WRK93

Examiner: Aaa Bbb

Date: Oct/22/2017



## CONCUSSION INJURY ADVICE

(To be given to the person monitoring the concussed athlete)

This patient has received an injury to the head. A careful medical examination has been carried out and no sign of any serious complications has been found. Recovery time is variable across individuals and the patient will need monitoring for a further period by a responsible adult. Your treating physician will provide guidance as to this timeframe.

**If you notice any change in behaviour, vomiting, worsening headache, double vision or excessive drowsiness, please telephone your doctor or the nearest hospital emergency department immediately.**

Other important points:

**Initial rest: Limit physical activity to routine daily activities (avoid exercise, training, sports) and limit activities such as school, work, and screen time to a level that does not worsen symptoms.**

- 1) Avoid alcohol
- 2) Avoid prescription or non-prescription drugs without medical supervision. Specifically:
  - a) Avoid sleeping tablets
  - b) Do not use aspirin, anti-inflammatory medication or stronger pain medications such as narcotics
- 3) Do not drive until cleared by a healthcare professional.
- 4) Return to play/sport requires clearance by a healthcare professional.

Clinic phone number: 3567425894

Patient's name: John Doe

Date / time of injury: Dec/12/2016 07:45 PM

Date / time of medical review: Oct/22/2017 01:52 PM

Healthcare Provider: provider

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details

Contact details or stamp

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## INSTRUCTIONS

Words in *italics* throughout the SCAT5 are the instructions given to the athlete by the clinician

### Symptom Scale

The time frame for symptoms should be based on the type of test being administered. At baseline it is advantageous to assess how an athlete "typically" feels whereas during the acute/post-acute stage it is best to ask how the athlete feels at the time of testing.

The symptom scale should be completed by the athlete, not by the examiner. In situations where the symptom scale is being completed after exercise, it should be done in a resting state, generally by approximating his/her resting heart rate.

For total number of symptoms, maximum possible is 22 except immediately post injury, if sleep item is omitted, which then creates a maximum of 21.

For Symptom severity score, add all scores in table, maximum possible is 22 x 6 = 132, except immediately post injury if sleep item is omitted, which then creates a maximum of 21x6=126.

### Immediate Memory

The Immediate Memory component can be completed using the traditional 5-word per trial list or, optionally, using 10-words per trial. The literature suggests that the immediate memory has a notable ceiling effect when a 5-word list is used. In settings where this ceiling is prominent, the examiner may wish to make the task more difficult by incorporating two 5-word groups for a total of 10 words per trial. In this case, the maximum score per trial is 10 with a total trial maximum of 30.

Choose one of the word lists (either 5 or 10). Then perform 3 trials of immediate memory using this list.

Complete all 3 trials regardless of score on previous trials.

*"I am going to test your memory. I will read you a list of words and when I am done, repeat back as many words as you can remember, in any order."* The words must be read at a rate of one word per second.

Trials 2 & 3 MUST be completed regardless of score on trial 1 & 2.

Trials 2 & 3:

*"I am going to repeat the same list again. Repeat back as many words as you can remember in any order, even if you said the word before."*

Score 1 pt. for each correct response. Total score equals sum across all 3 trials. Do NOT inform the athlete that delayed recall will be tested.

### Concentration

#### Digits backward

Choose one column of digits from lists A, B, C, D, E or F and administer those digits as follows:

*Say: "I am going to read a string of numbers and when I am done, you repeat them back to me in reverse order of how I read them to you. For example, if I say 7-1-9, you would say 9-1-7."*

Begin with first 3 digit string.

If correct, circle "Y" for correct and go to next string length. If incorrect, circle "N" for the first string length and read trial 2 in the same string length. One point possible for each string length. Stop after incorrect on both trials (2 N's) in a string length. The digits should be read at the rate of one per second.

#### Months in reverse order

*"Now tell me the months of the year in reverse order. Start with the last month and go backward. So you'll say December, November ... Go ahead"*

1 pt. for entire sequence correct

#### Delayed Recall

The delayed recall should be performed after 5 minutes have elapsed since the end of the Immediate Recall section.

*"Do you remember that list of words I read a few times earlier? Tell me as many words from the list as you can remember in any order."*

Score 1 pt. for each correct response

### Modified Balance Error Scoring System (mBESS)<sup>5</sup> testing

This balance testing is based on a modified version of the Balance Error Scoring System (BESS)<sup>6</sup>. A timing device is required for this testing.

Each of 20-second trial/stance is scored by counting the number of errors. The examiner will begin counting errors only after the athlete has assumed the proper start position. The modified BESS is calculated by adding one error point for each error during the three 20-second tests. The maximum number of errors for any single condition is 10. If the athlete commits multiple errors simultaneously, only

one error is recorded but the athlete should quickly return to the testing position, and counting should resume once the athlete is set. Athletes that are unable to maintain the testing procedure for a minimum of five seconds at the start are assigned the highest possible score, ten, for that testing condition.

OPTION: For further assessment, the same 3 stances can be performed on a surface of medium density foam (e.g., approximately 50cm x 40cm x 6cm).

#### Balance testing – types of errors

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

*"I am now going to test your balance. Please take your shoes off (if applicable), roll up your pant legs above ankle (if applicable), and remove any ankle taping (if applicable). This test will consist of three twenty second tests with different stances."*

(a) Double leg stance:

*"The first stance is standing with your feet together with your hands on your hips and with your eyes closed. You should try to maintain stability in that position for 20 seconds. I will be counting the number of times you move out of this position. I will start timing when you are set and have closed your eyes."*

(b) Single leg stance:

*"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. 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 hands on your hips and your eyes closed. I will be counting the number of times you move out of this position. If you stumble out of this position, open your eyes and return to the start position and continue balancing. I will start timing when you are set and have closed your eyes."*

(c) Tandem stance:

*"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 hands on your hips and your eyes closed. I will be counting the number of times you move out of this position. If you stumble out of this position, open your eyes and return to the start position and continue balancing. I will start timing when you are set and have closed your eyes."*

### Tandem Gait

Participants are instructed to stand with their feet together behind a starting line (the test is best done with footwear removed). Then, they walk in a forward direction as quickly and as accurately as possible along a 38mm wide (sports tape), 3 metre line with an alternate foot heel-to-toe gait ensuring that they approximate their heel and toe on each step. Once they cross the end of the 3m line, they turn 180 degrees and return to the starting point using the same gait. Athletes fail the test if they step off the line, have a separation between their heel and toe, or if they touch or grab the examiner or an object.

### Finger to Nose

*"I am going to test your coordination now. Please sit comfortably on the chair with your eyes open and your arm (either right or left) outstretched (shoulder flexed to 90 degrees and elbow and fingers extended), pointing in front of you. When I give a start signal, I would like you to perform five successive finger to nose repetitions using your index finger to touch the tip of the nose, and then return to the starting position, as quickly and as accurately as possible."*

### References

1. McCrory et al. Consensus Statement On Concussion in Sport – The 5th International Conference On Concussion in Sport Held in Berlin, October 2016. British Journal of Sports Medicine 2017 (available at [www.bjsm.bmj.com](http://www.bjsm.bmj.com))
2. Maddocks, DL; Dicker, GD; Saling, MM. The assessment of orientation following concussion in athletes. Clinical Journal of Sport Medicine 1995; 5: 32-33
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## CONCUSSION INFORMATION

**Any athlete suspected of having a concussion should be removed from play and seek medical evaluation.**

### Signs to watch for

Problems could arise over the first 24-48 hours. The athlete should not be left alone and must go to a hospital at once if they experience:

- Worsening headache
- Repeated vomiting
- Weakness or numbness in arms or legs
- Drowsiness or inability to be awakened
- Unusual behaviour or confusion or irritable
- Unsteadiness on their feet.
- Inability to recognize people or places
- Seizures (arms and legs jerk uncontrollably)
- Slurred speech

**Consult your physician or licensed healthcare professional after a suspected concussion. Remember, it is better to be safe.**

### Rest & Rehabilitation

After a concussion, the athlete should have physical rest and relative cognitive rest for a few days to allow their symptoms to improve. In most cases, after no more than a few days of rest, the athlete should gradually increase their daily activity level as long as their symptoms do not worsen. Once the athlete is able to complete their usual daily activities without concussion-related symptoms, the second step of the return to play/sport progression can be started. The athlete should not return to play/sport until their concussion-related symptoms have resolved and the athlete has successfully returned to full school/learning activities.

When returning to play/sport, the athlete should follow a stepwise, **medically managed exercise progression, with increasing amounts of exercise.** For example:

### Graduated Return to Sport Strategy

Exercise step	Functional exercise at each step	Goal of each step
1. Symptom-limited activity	Daily activities that do not provoke symptoms.	Gradual reintroduction of work/school activities.
2. Light aerobic exercise	Walking or stationary cycling at slow to medium pace. No resistance training.	Increase heart rate.
3. Sport-specific exercise	Running or skating drills. No head impact activities.	Add movement.
4. Non-contact training drills	Harder training drills, e.g., passing drills. May start progressive resistance training.	Exercise, coordination, and increased thinking.
5. Full contact practice	Following medical clearance, participate in normal training activities.	Restore confidence and assess functional skills by coaching staff.
6. Return to play/sport	Normal game play.	

In this example, it would be typical to have 24 hours (or longer) for each step of the progression. If any symptoms worsen while exercising, the athlete should go back to the previous step. Resistance training should be added only in the later stages (Stage 3 or 4 at the earliest).

**Written clearance should be provided by a healthcare professional before return to play/sport as directed by local laws and regulations.**

### Graduated Return to School Strategy

Concussion may affect the ability to learn at school. The athlete may need to miss a few days of school after a concussion. When going back to school, some athletes may need to go back gradually and may need to have some changes made to their schedule so that concussion symptoms do not get worse. If a particular activity makes symptoms worse, then the athlete should stop that activity and rest until symptoms get better. To make sure that the athlete can get back to school without problems, it is important that the healthcare provider, parents, caregivers and teachers talk to each other so that everyone knows what the plan is for the athlete to go back to school.

**Note: If mental activity does not cause any symptoms, the athlete may be able to skip step 2 and return to school part-time before doing school activities at home first.**

Mental Activity	Activity at each step	Goal of each step
1. Daily activities that do not give the athlete symptoms	Typical activities that the athlete does during the day as long as they do not increase symptoms (e.g. reading, texting, screen time). Start with 5-15 minutes at a time and gradually build up.	Gradual return to typical activities.
2. School activities	Homework, reading or other cognitive activities outside of the classroom.	Increase tolerance to cognitive work.
3. Return to school part-time	Gradual introduction of school-work. May need to start with a partial school day or with increased breaks during the day.	Increase academic activities.
4. Return to school full-time	Gradually progress school activities until a full day can be tolerated.	Return to full academic activities and catch up on missed work.

If the athlete continues to have symptoms with mental activity, some other accommodations that can help with return to school may include:

- Starting school later, only going for half days, or going only to certain classes
- Taking lots of breaks during class, homework, tests
- More time to finish assignments/tests
- No more than one exam/day
- Quiet room to finish assignments/tests
- Shorter assignments
- Not going to noisy areas like the cafeteria, assembly halls, sporting events, music class, shop class, etc.
- Repetition/memory cues
- Use of a student helper/tutor
- Reassurance from teachers that the child will be supported while getting better

**The athlete should not go back to sports until they are back to school/learning, without symptoms getting significantly worse and no longer needing any changes to their schedule.**

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Date and Time of Assessment: Oct/22/2017 01:45 PM, Patient ID: WRK93



## Sport concussion assessment tool - 5th edition

*Br J Sports Med* published online April 26, 2017

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Date and Time of Assessment: Oct/22/2017 01:43 PM, Patient ID: WRK93



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 John Doe Position Position Team Team Evaluator Aaa Bbb ATC / MD DO

Evaluation date Oct/22/2017 time 13:43 am / pm Injury date Dec/12/2016 time 19:45 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"):**

- |   |   |                                    |
|---|---|------------------------------------|
| 1) LOC or unresponsiveness? (for any period of time) If so, how long? _____   | <input type="checkbox"/> Y  | <input checked="" type="radio"/> N |
| 2) Confusion? (any disorientation or inability to respond appropriately to questions)   | <input checked="" type="checkbox"/> Y   | <input type="radio"/> N            |
| 3) Amnesia (retrograde / anterograde)? If so, how long? <u>4 days</u>   | <input checked="" type="checkbox"/> Y   | <input type="radio"/> N            |
| 4) New and/or persistent symptoms: see checklist? (e.g. headache, nausea, dizziness)  | <input checked="" type="checkbox"/> Y   | <input type="radio"/> N            |
| 5) Abnormal neurological finding? (any motor, sensory, cranial nerve, balance issues, seizures) or                                  | <input type="checkbox"/> Y  | <input checked="" type="radio"/> N |
| 6) Progressive, persistent or worsening symptoms? If so, consider cervical spine and/or a more serious brain injury (See box below) | <input type="checkbox"/> Y  | <input checked="" type="radio"/> N |
| Other _____   | Total Physical Signs Score: (total above <input type="checkbox"/> Yes scores) of 6 = <u>3</u> |                                    |

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

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

**ORIENTATION / SAC**

of 5 = 5

- |   |   |                                    |
|---|---|------------------------------------|
| What month is it?                           | 0 | <input checked="" type="radio"/> 1 |
| What is the date today?                     | 0 | <input checked="" type="radio"/> 1 |
| What is the day of the week?                | 0 | <input checked="" type="radio"/> 1 |
| What year is it?                            | 0 | <input checked="" type="radio"/> 1 |
| What time is it right now? (within an hour) | 0 | <input checked="" type="radio"/> 1 |

**ORIENTATION / Maddock's Questions**

of 5 = 4

- |   |                                    |                                    |
|---|------------------------------------|------------------------------------|
| Where are we?                           | 0                                  | <input checked="" type="radio"/> 1 |
| What quarter is it right now?           | 0                                  | <input checked="" type="radio"/> 1 |
| Who scored last in the practice / game? | 0                                  | <input checked="" type="radio"/> 1 |
| Who did we play last game?              | 0                                  | <input checked="" type="radio"/> 1 |
| Did we win the last game?               | <input checked="" type="radio"/> 0 | <input type="radio"/> 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	0	1	0	candle	1
apple	0	1	0	paper	1
carpet	0	1	0	sugar	0
saddle	0	0	1	sandwich	0
bubble	1	0	1	wagon	1
				baby	
				monkey	
				perfume	
				iron	

Total of all three immediate word recalls: out of 15 = 6

Total delayed recall: out of 5 = 3





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## 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:**      **Alternative digit lists**  
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

1 point for each sequence correct of 4 = 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

Total of SAC Concentration of 5 = 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 4

Single leg stance (non dominant foot) # errors 3

Tandem stance (non dominant foot at back) # errors 3

**BALANCE SCORE: (summed # of errors) = 10**

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) = 3 of 6

Maddock's score: = 4 of 5

All SAC scores: (summed orange boxes) = 19 of 30

Balance Score: (summed BESS Errors) = 10

Symptom Score: (# symptoms reported) = 24 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

Do symptoms worsen with mental activity? ☒ Y N

**Total # symptoms** = 24 of 24

**Symptom Severity (max 24 X max 6)** = 72 of 144

Date and Time of Assessment: Oct/22/2017 01:38 PM, Patient ID: WRK93

## STANDARDIZED ASSESSMENT OF CONCUSSION - SAC

**FORM C**

NAME: John Doe  
TEAM: team 2 EXAMINER: Aaa Bbb  
DATE OF EXAM: Oct/22/2017 TIME: 13:38  
EXAM (Circle One): BLINE INJURY **POST-GAME**  
FOLLOW-UP DAY: \_\_\_\_\_

### INTRODUCTION:

I am going to ask you some questions.  
Please listen carefully and give your best effort.

### ORIENTATION

What Month is it? \_\_\_\_\_ 0 ①  
What's the Date today? \_\_\_\_\_ 0 ①  
What's the Day of Week? \_\_\_\_\_ 0 ①  
What Year is it? \_\_\_\_\_ 0 1  
What Time is it right now? (within 1 hr.) \_\_\_\_\_ 0 1

Award 1 point for each correct answer.

ORIENTATION TOTAL SCORE ➡ 3

### IMMEDIATE MEMORY

I am going to test your memory. I will read you a list of words and when I am done, repeat back as many words as you can remember, in any order.

LIST	TRIAL 1	TRIAL 2	TRIAL 3
BABY	0 1	0 ①	0 1
MONKEY	0 1	0 ①	0 1
PERFUME	0 1	0 1	0 1
SUNSET	0 1	0 1	0 1
IRON	0 1	0 1	0 ①
TOTAL	0	2	1

Trials 2 & 3: I am going to repeat that list again.  
Repeat back as many words as you can remember in any order, even if you said the word before.

Complete all 3 trials regardless of score on trial 1 & 2. 1 pt. for each correct response. Total score equals sum across all 3 trials.

Do not inform the subject that delayed recall will be tested.

IMMEDIATE MEMORY TOTAL SCORE ➡ 3

### EXERTIONAL MANEUVERS:

If subject is not displaying or reporting symptoms, conduct the following maneuvers to create conditions under which symptoms likely to be elicited and detected. These measures need not be conducted if a subject is already displaying or reporting any symptoms. If not conducted, allow 2 minutes to keep time delay constant before testing Delayed Recall. These methods should be administered for baseline testing of normal subjects.

#### EXERTIONAL MANEUVERS

5 Jumping Jacks 5 Push-Ups  
5 Sit-ups 5 Knee Bends

### SEE REVERSE SIDE FOR IMPORTANT USER WARNINGS

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### NEUROLOGIC SCREENING

LOSS OF CONSCIOUSNESS/ WITNESSED UNRESPONSIVENESS	<input type="checkbox"/> No <input checked="" type="checkbox"/> Yes Length: 2
POST-TRAUMATIC AMNESIA? Poor recall of events after injury	<input type="checkbox"/> No <input checked="" type="checkbox"/> Yes Length: 3
RETROGRADE AMNESIA? Poor recall of events before injury	<input type="checkbox"/> No <input checked="" type="checkbox"/> Yes Length: 4
	NORMAL ABNORMAL
STRENGTH - Right Upper Extremity Left Upper Extremity Right Lower Extremity Left Lower Extremity	<input type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/>
SENSATION - examples: FINGER-TO-NOSE/ROMBERG	<input type="checkbox"/> <input checked="" type="checkbox"/>
COORDINATION - examples: TANDEM WALK/ FINGER-NOSE-FINGER	<input type="checkbox"/> <input checked="" type="checkbox"/>

### CONCENTRATION

**Digits Backward:** I am going to read you a string of numbers and when I am done, you repeat them back to me backwards, in reverse order of how I read them to you. For example, if I say 7-1-9, you would say 9-1-7.

If correct, go to next string length. If incorrect, read trial 2. 1 pt. possible for each string length. Stop after incorrect on both trials.

1-4-2 6-5-8 ① 1  
6-8-3-1 3-4-8-1 ① 1  
4-9-1-5-3 6-8-2-5-1 ① 1  
3-7-6-5-1-9 9-2-6-5-1-4 0 ①

**Months in Reverse Order:** Now tell me the months of the year in reverse order. Start with the last month and go backward. So you'll say December, November...Go ahead. 1 pt. for entire sequence correct.

Dec-Nov-Oct-Sept-Aug-Jul-Jun-May-Apr-Mar-Feb-Jan 0 ①

CONCENTRATION TOTAL SCORE ➡ 2

### DELAYED RECALL

Do you remember that list of words I read a few times earlier? Tell me as many words from the list as you can remember in any order. Circle each word correctly recalled. Total score equals number of words recalled.

BABY MONKEY PERFUME SUNSET IRON

DELAYED RECALL TOTAL SCORE ➡ 4

### SAC SCORING SUMMARY

Exertional Maneuvers & Neurologic Screening are important for examination, but not incorporated into SAC Total Score.

ORIENTATION	3 / 5
IMMEDIATE MEMORY	3 / 15
CONCENTRATION	2 / 5
DELAYED RECALL	4 / 5
SAC TOTAL SCORE ➡	12 / 30

### Important User Warnings

The Standardized Assessment of Concussion (SAC) is a complement to, not a substitute for, a clinical examination by a physician, athletic trainer or other qualified health provider. The SAC is not, however, intended as a stand-alone method of concussion assessment or return-to-play decision-making. The SAC is designed to provide a clinician with a standardized, objective measure for assessing the immediate neurocognitive and neurological effects of concussion. Information obtained from the SAC should not be considered complete, nor should it be solely relied on to suggest a course of treatment for a particular individual. SAC results should be complemented by all aspects of the injury evaluation (e.g., mental status examination, physical examination, symptom survey, witness accounts, neuropsychological testing, neuroimaging, etc.). All aspects of the injury evaluation must be equally considered in the assessment and management of concussion. The SAC is not intended as a substitute for formal neurologic or neuropsychological evaluation of an injured person.

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Date and Time of Assessment: Oct/22/2017 01:35 PM, Patient ID: WRK93



# MACE

## Military Acute Concussion Evaluation



Patient Name: John Doe  
 Service Member ID#: 35816 Unit: 479  
 Date of Injury: Dec/12/2016 Time of Injury: 19:45  
 Examiner: Aaa Bbb  
 Date of Evaluation: Oct/22/2017 Time of Evaluation: 13:35

## CONCUSSION SCREENING

Complete this section to determine if there was both an injury event  
AND an alteration of consciousness.

### 1. Description of Incident

#### A. Record the event as described by the service member or witness.

Use open-ended questions to get as much detail as possible.

Event \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

#### Key questions:

- Can you tell me what you remember?
- What happened?

#### B. Record the type of event.

Check all that apply:

- |   |  |  |
|---|--|--|
| <input checked="" type="checkbox"/> Explosion/Blast | <input type="checkbox"/> Fragment                      | <input type="checkbox"/> Motor Vehicle Crash |
| <input checked="" type="checkbox"/> Blunt Object    | <input type="checkbox"/> Sports Injury                 | <input type="checkbox"/> Gunshot Wound       |
| <input type="checkbox"/> Fall                       | <input checked="" type="checkbox"/> Other <u>Other</u> |  |

## MACE - Military Acute Concussion Evaluation

Date and Time of Assessment: Oct/22/2017 01:35 PM, Patient ID: WRK93

### CONCUSSION SCREENING – continued

#### 2. Alteration of Consciousness or Memory (AOC/LOC/PTA)

##### A. Was there Alteration of Consciousness (AOC)?

AOC is temporary confusion or "having your bell rung."

☐ YES ☒ NO

If yes, for how long? \_\_\_\_ minutes

##### Key question:

- Were you dazed, confused, or did you "see stars" immediately after the injury?

##### B. Was there Loss of Consciousness (LOC)?

LOC is temporarily passing out or blacking out.

☒ YES ☐ NO

If yes, for how long? 2 \_\_\_\_ minutes

##### Key question:

- Did you pass out or black out?

##### C. Was there any Post Traumatic Amnesia (PTA)?

PTA is a problem remembering part or all of the injury events.

☐ YES ☒ NO

If yes, for how long? \_\_\_\_ minutes

##### Key questions:

- What is the last thing you remember before the event?
- What is the first thing you remember after the event?

##### D. Was there a witness?

☒ YES ☐ NO

If yes, name of witness:  
Witness \_\_\_\_\_

##### Tips for assessment:

- Ask witness to verify AOC/LOC/PTA and estimate duration.

### CONCUSSION SCREENING RESULTS (Possible Concussion?)

YES to 1C  
**AND**  
YES to 2A, 2B or 2C



#### CONTINUE the MACE:

- Complete the Cognitive, Neurological and Symptoms portions of the MACE

NO to 1C  
**OR**  
NO to 2A, 2B and 2C



#### STOP the MACE:

- Evaluate and treat any other injuries or symptoms
- Enter negative screening result into electronic medical record (V80.01)
- Communicate results with provider and line commanders
- Check for history of previous concussions and refer to Concussion Management Algorithm for appropriate rest period

## MACE - Military Acute Concussion Evaluation

Date and Time of Assessment: Oct/22/2017 01:37 PM, Patient ID: WRK93

### COGNITIVE EXAM<sup>a</sup>

#### 3. Orientation

Score 1 point for each correct response.

Ask This Question	Incorrect	Correct
"What month is this?"	0	①
"What is the date or day of the month?"	①	1
"What day of the week is it?"	①	1
"What year is it?"	①	1
"What time do you think it is?"	①	1

*Correct response must be within 1 hour of actual time.*

#### ORIENTATION TOTAL SCORE

1 / 5

#### 4. Immediate Memory

Choose one list (A-F below) and use that list for the remainder of the MACE.

Read the script for each trial and then read all 5 words. Circle the response for each word for each trial. Repeat the trial 3 times, even if the service member scores perfectly on any of the trials.

##### Trial 1 Script:

- "I am going to test your memory. I will read you a list of words and when I am done, repeat back to me as many words as you can remember, in any order."

##### Trials 2 and 3 Script:

- "I am going to repeat that list again. Repeat back to me as many words as you can remember, in any order, even if you said them before."

	Trial 1		Trial 2		Trial 3	
List F	Incorrect	Correct	Incorrect	Correct	Incorrect	Correct
Dollar	①	1	①	1	0	①
Honey	①	1	①	1	0	①
Mirror	①	1	①	1	0	①
Saddle	0	①	0	①	①	1
Anchor	0	①	0	①	①	1

#### IMMEDIATE MEMORY TOTAL SCORE

7 / 15

##### Immediate Memory Alternate Word Lists

List E	List D	List C	List B	List A
Jacket	Finger	Baby	Candle	Elbow
Arrow	Penny	Monkey	Paper	Apple
Pepper	Blanket	Perfume	Sugar	Carpet
Cotton	Lemon	Sunset	Sandwich	Saddle
Movie	Insect	Iron	Wagon	Bubble

### MACE - Military Acute Concussion Evaluation

Date and Time of Assessment: Oct/22/2017 01:37 PM, Patient ID: WRK93

## NEUROLOGICAL EXAM

### 5. Eyes

Test pupil response  
to light, tracking

- ☐ Normal  
☒ Abnormal

#### Tips for assessment:

- Pupils should be round, equal in size and briskly constrict to a direct, bright light.
- Both eyes should smoothly track your finger side-to-side and up and down.

### 6. Speech

Test speech fluency  
and word finding

- ☐ Normal  
☒ Abnormal

#### Tips for assessment:

- Speech should be fluid and effortless – no pauses or unnatural breaks.
- Assess difficulties with word finding:
  - Does service member have trouble coming up with the name of a common object?

### 7. Motor

Test grip strength  
and pronator drift

- ☒ Normal  
☐ Abnormal

#### Tips for assessment:

- Assess grip strength.
- Assess for pronator drift for 5-10 seconds by directing patient to close eyes and extend arms forward, parallel to the ground with palms up:
  - Does either palm turn inward?
  - Does either arm drift down?

### 8. Balance

Tandem Romberg Test

- ☒ Normal  
☐ Abnormal

#### Tips for assessment:

- Have patient stand with eyes closed, one foot in front of the other heel-to-toe, arms extended forward, palms up. Observe for 5-10 seconds:
  - Does the service member stumble or shift feet?

## NEUROLOGICAL EXAM RESULTS



All Normal  
Green



Any Abnormal  
Red



**MACE - Military Acute Concussion Evaluation**

Date and Time of Assessment: Oct/22/2017 01:37 PM, Patient ID: WRK93

**COGNITIVE EXAM - Continued**

**9. Concentration**

**A. Reverse Digits**

Read the script and begin the trial by reading the first string of numbers in Trial 1.

Script:

- "I am going to read you a string of numbers. When I am finished, repeat them back to me backward. That is, in reverse order of how I read them to you. For example, if I said 7 - 1 - 9, then you would say 9 - 1 - 7."

Circle the response for each string.

- If correct on string length of Trial 1, proceed to the next longer string length in the same column.
- If incorrect on string length of Trial 1, move to the same string length of Trial 2.
- If incorrect on both string lengths in Trials 1 and 2, **STOP** and record score as zero for that string length. Record total score as sum of previous correct trials.

List F			
Trial 1	Trial 2 (if Trial 1 is incorrect)	Incorrect	Correct
2-7-1	4-7-9	0	1
1-6-8-3	3-9-2-4	0	1
2-4-7-5-8	8-3-9-6-4	0	1
5-8-6-2-4-9	3-1-7-8-2-6	0	1

**REVERSE DIGITS SCORE (9A)**

3 / 4

**Concentration Alternate Number Lists**

*Note: Use the same list (A-F) that was used in Question 4.*

List E	
Trial 1	Trial 2
3-8-2	5-1-8
2-7-9-3	2-1-6-9
4-1-8-6-9	9-4-1-7-5
6-9-7-3-8-2	4-2-7-9-3-8

List D	
Trial 1	Trial 2
7-8-2	9-2-6
4-1-8-3	9-7-2-3
1-7-9-2-6	4-1-7-5-2
2-6-4-8-1-7	8-4-1-9-3-5

List C	
Trial 1	Trial 2
1-4-2	6-5-8
6-8-3-1	3-4-8-1
4-9-1-5-3	6-8-2-5-1
3-7-6-5-1-9	9-2-6-5-1-4

List B	
Trial 1	Trial 2
5-2-6	4-1-5
1-7-9-5	4-9-6-8
4-8-5-2-7	6-1-8-4-3
8-3-1-9-6-4	7-2-7-8-5-6

List A	
Trial 1	Trial 2
4-9-3	6-2-9
3-8-1-4	3-2-7-9
6-2-9-7-1	1-5-2-8-5
7-1-8-4-6-3	5-3-9-1-4-8

## MACE - Military Acute Concussion Evaluation

Date and Time of Assessment: Oct/22/2017 01:37 PM, Patient ID: WRK93

### COGNITIVE EXAM<sup>a</sup> - Continued

#### 9. Concentration - Continued

##### B. Months in Reverse Order

###### Script:

- "Now tell me the months of the year in reverse order. Start with the last month and go backward. So you'll say: December, November...Go ahead."

Correct Response:

*Dec - Nov - Oct - Sep - Aug - Jul -  
Jun - May - Apr - Mar - Feb - Jan*

	Incorrect	Correct
ALL months in reverse order	0	①

##### MONTHS IN REVERSE ORDER (9B)

1	1
---	---

##### CONCENTRATION TOTAL SCORE

Sum of scores:

9A (0-4 points) and 9B (0 or 1 point)

4	5
---	---

#### 10. Delayed Recall

Read the script and circle the response for each word.  
Do NOT repeat the word list.

**Note: Use the same list (A-F) that was used in Question 4.**

###### Script:

- "Do you remember that list of words I read a few minutes earlier? I want you to tell me as many words from that list as you can remember. You can say them in any order."

List F	Incorrect	Correct
Dollar	0	①
Honey	0	①
Mirror	0	①
Saddle	0	①
Anchor	①	1

##### DELAYED RECALL TOTAL SCORE

4	5
---	---

##### Delayed Recall Alternate Word Lists

<b>List E</b> Jacket Arrow Pepper Cotton Movie	<b>List D</b> Finger Penny Blanket Lemon Insect	<b>List C</b> Baby Monkey Perfume Sunset Iron	<b>List B</b> Candle Paper Sugar Sandwich Wagon	<b>List A</b> Elbow Apple Carpet Saddle Bubble
---	--	--	--	---

## MACE - Military Acute Concussion Evaluation

Date and Time of Assessment: Oct/22/2017 01:37 PM, Patient ID: WRK93

### SYMPTOM SCREENING

#### 11. Symptoms — Check all that apply:

- |   |   |   |
|---|---|---|
| <input type="checkbox"/> Headache                   | <input type="checkbox"/> Balance Problems           | <input type="checkbox"/> Irritability                   |
| <input checked="" type="checkbox"/> Dizziness       | <input checked="" type="checkbox"/> Nausea/Vomiting | <input type="checkbox"/> Visual Disturbances            |
| <input checked="" type="checkbox"/> Memory Problems | <input type="checkbox"/> Difficulty Concentrating   | <input checked="" type="checkbox"/> Ringing in the Ears |
|   |   | <input type="checkbox"/> Other _____                    |

### SUMMARY

Record the data for correct MACE documentation.

#### Cognitive Summary

Orientation Total Score - Q3

1 / 5

Immediate Memory Total Score (all 3 trials) - Q4

7 / 15

Concentration Total Score (Sections A and B) - Q9

4 / 5

Delayed Recall Total Score - Q10

4 / 5

#### COGNITIVE RESULTS

16 / 30

#### NEUROLOGICAL RESULTS

(Page 4)



Normal  
(Green)



Abnormal  
(Red)

#### SYMPTOM RESULTS



No symptoms  
(A)



1 or more  
symptoms (B)

### MACE RESULTS (Report all 3 parts.) Example: 24/Red/B

Abnormality in any area should be discussed with provider.

**C** 16 / **N** Red / **S** B  
Cognitive / Neurological / Symptoms

#### CONCUSSION HISTORY IN PAST 12 MONTHS

12. During the past 12 months have you been diagnosed with a concussion, not counting this event?

☐ YES ☒ NO

If yes, how many? \_\_\_\_\_

Refer to Concussion Management Algorithm for clinical care guidance.

**MACE - Military Acute Concussion Evaluation**

Date and Time of Assessment: Oct/22/2017 01:37 PM, Patient ID: WRK93

**ADDITIONAL INFORMATION ABOUT MACE COGNITIVE SCORES**

Although cognitive is listed first in the summary of MACE results, this should not suggest that any one of the three screening categories is more or less important than the others. Each area (Cognitive, Neurological, Symptoms) must be evaluated carefully. The results of all three evaluations must be included in any MACE report for it to be considered complete.

Regarding cognitive scores, in studies of non-concussed subjects, the mean total cognitive score was 28. Therefore, a score of < 30 does not imply that a concussion has occurred. Definitive normative data for a cut-off score are not available. The Concussion Management Algorithm stipulates that a cognitive score of < 25 or the presence of symptoms requires consultation with a provider.

Repeating the MACE cognitive exam with a different version (A-F) may be used to evaluate acute concussion recovery; however, a physical exam and symptom assessment must accompany any repeated cognitive exam. Providers should be mindful of other factors affecting the MACE cognitive score such as sleep deprivation, medications or pain.

**Coding Tips for Concussion:**

1. Primary code (corpsmen/medics require co-sign)
  - 850.0 – Concussion without LOC
  - 850.11 – Concussion with LOC ≤ 30 min.
2. Personal history of TBI in Global War on Terror (GWOT)
  - V15.52\_2 – Injury related to GWOT, mild TBI
3. Symptom codes
  - As appropriate
4. Deployment status code
  - V70.5\_5 – During deployment encounter
5. Screening code
  - V80.01 – Special screening for TBI code
6. E-code (external cause of injury)
  - E979.2 (if applicable) – Terrorism involving explosions and fragments

**References**

- a. McCrea, M. Standardized Mental Status Testing on the Sideline After Sport-Related Concussion. J Athl Train. 2001 Sep;36(3):274-279.

**THIS TOOL MAY BE COPIED FOR CLINICAL USE.**For additional copies or information call 1.866.966.1020 or email [info@DVBIC.org](mailto:info@DVBIC.org)



Date and Time of Assessment: Oct/22/2017 01:34 PM, Patient ID: WRK93

Maddocks Assessment Summary

Patient Name: John Doe  
Team: Team  
Patient ID: WRK93  
Injury Date: Dec/12/2016  
Injury Time: 07:45 PM  
Assessment Date and Time: Oct/22/2017 01:34 PM

Maddocks Assessment

Maddocks Question:	Did Athlete Answer Correctly?
What venue are we at today?	CORRECT
Which half is it now?	INCORRECT
Who scored last in this match?	CORRECT
What team did you play last week/game?	INCORRECT
Did your team win the last game?	CORRECT
Maddocks Score:	3

Date and Time of Assessment: WRK93

## ACUTE CONCUSSION EVALUATION (ACE)

Emergency Department (ED) Version v1.4

Gerard Gioia, PhD<sup>1</sup> & Micky Collins, PhD<sup>2</sup>

<sup>1</sup>Children's National Medical Center

<sup>2</sup>University of Pittsburgh Medical Center

Patient Name John Doe

DOB: 10/23/1980 Age: 36

Date: Oct/22/2017 ID/MR# 124589

**A. Injury Characteristics** Date/Time of Injury Dec/12/2016 07:45 PM Reporter: ☒ Patient ☐ Parent ☐ Spouse ☐ Other

1. Injury Description description

1a. Is there evidence of a forcible blow to the head (direct or indirect)? ☐ Yes ☒ No ☐ Unknown

1b. Is there evidence of intracranial injury or skull fracture? ☒ Yes ☐ No ☐ Unknown

1c. Location of Impact: ☐ Frontal ☐ Lt Temporal ☐ Rt Temporal ☐ Lt Parietal ☐ Rt Parietal ☐ Occipital ☒ Neck ☐ Indirect Force

2. Cause: ☐ MVC ☐ Pedestrian-MVC ☐ Fall ☒ Assault ☐ Sports (specify) Other

3. **Amnesia Before (Retrograde)** Are there any events just BEFORE the injury that you/ person has no memory of (even brief)? ☐ Yes ☒ No Duration           

4. **Amnesia After (Anterograde)** Are there any events just AFTER the injury that you/ person has no memory of (even brief)? ☐ Yes ☒ No Duration           

5. **Loss of Consciousness:** Did you/ person lose consciousness? ☐ Yes ☒ No Duration           

6. **EARLY SIGNS:** ☐ Appears dazed or stunned ☐ Is confused about events ☐ Answers questions slowly ☒ Repeats Questions ☒ Forgetful (recent info)

7. **Seizures:** Were seizures observed? No ☐ Yes ☒ Detail details

**B. Symptom Check List\*** Since the injury, has the person experienced any of these symptoms any more than usual today or in the past day?

Indicate presence of each symptom (0=No, 1=Yes).

*\*Lovell & Collins, 1998 JHTR*

PHYSICAL (10)		COGNITIVE (4)		SLEEP (4)	
Headache	0 <input checked="" type="checkbox"/> 1	Feeling mentally foggy	0 <input checked="" type="checkbox"/> 1	Drowsiness	0 <input checked="" type="checkbox"/> 1
Nausea	0 <input checked="" type="checkbox"/> 1	Feeling slowed down	0 <input checked="" type="checkbox"/> 1	Sleeping less than usual	0 <input type="checkbox"/> 1 <input checked="" type="checkbox"/> N/A
Vomiting	0 <input checked="" type="checkbox"/> 1	Difficulty concentrating	0 <input checked="" type="checkbox"/> 1	Sleeping more than usual	0 <input type="checkbox"/> 1 <input checked="" type="checkbox"/> N/A
Balance problems	0 <input checked="" type="checkbox"/> 1	Difficulty remembering	0 <input checked="" type="checkbox"/> 1	Trouble falling asleep	0 <input checked="" type="checkbox"/> 1 <input checked="" type="checkbox"/> N/A
Dizziness	0 <input checked="" type="checkbox"/> 1	COGNITIVE Total (0-4) <u>2</u>		SLEEP Total (0-4) <u>0</u>	
Visual problems	0 <input checked="" type="checkbox"/> 1	EMOTIONAL (4)			
Fatigue	0 <input checked="" type="checkbox"/> 1	Irritability	0 <input checked="" type="checkbox"/> 1		
Sensitivity to light	0 <input checked="" type="checkbox"/> 1	Sadness	0 <input checked="" type="checkbox"/> 1		
Sensitivity to noise	0 <input checked="" type="checkbox"/> 1	More emotional	0 <input checked="" type="checkbox"/> 1		
Numbness/Tingling	0 <input checked="" type="checkbox"/> 1	Nervousness	0 <input checked="" type="checkbox"/> 1		
PHYSICAL Total (0-10) <u>10</u>		EMOTIONAL Total (0-4) <u>2</u>			
(Add Physical, Cognitive, Emotion, Sleep totals)					
Total Symptom Score (0-22)				<u>14</u>	

Other Observations  
observation

Patient Participation: Full ☐ Partial ☐ None ☒

Reason for Partial/None: Young Age ☐ Confused ☒ Inattentive ☐ Low arousal ☒ Emotional Upset ☐ In Pain ☐ Other           

**C. Concussion History:** Previous# 0 1 2 3 4 5 Date(s)           

Headache History: Prior treatment for headache N ☐ Y ☒ Details details

**D. Diagnosis (ICD):** ☐ Concussion w/o LOC 850.0 ☐ Concussion w/ LOC 850.1 ☒ Concussion (Unspecified) 850.9 ☐ Other (854)             
☐ No diagnosis

**E. Follow-Up Action Plan** ☒ Referral to PCP for Office Monitoring MD Name Name

☒ Neuropsychological Testing (recommended for Return to Sport decisions and academic/ behavioral management)

☒ Physician: Neurosurgery ☐ Neurology ☐ Sports Medicine ☒ Psychiatry ☐ Psychiatry ☐

☐ Other           

ACE-ED Completed by: RN MD (RN) NP DO

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Date and Time of Assessment: WRK93

**A concussion** is an injury to the brain as a result of a force or jolt applied directly or indirectly to the head, which produces a range of possible symptoms, and may or may not involve a loss of consciousness. It is a complex pathophysiologic process affecting the brain, induced by traumatic biomechanical forces secondary to direct or indirect forces to the head. Disturbance of brain function is related to neurometabolic dysfunction, rather than structural injury, and is typically associated with normal structural neuroimaging findings (i.e., CT scan, MRI). Concussion may or may not involve a loss of consciousness (LOC). Concussion results in a constellation of cognitive, somatic, emotional and sleep-related symptoms. Duration of symptoms are variable and may last for as short as several minutes and last as long as several days, weeks, months or even longer in some cases.

## ACE ED Instructions

### A. Injury Characteristics

1. **Injury Description:** Ask for description of events resulting in the injury; how the injury occurred, type of force, location on head.
2. **Cause:** Indicate the cause of injury or write in Other cause.
- 3/4. **Amnesia:** Determine whether child was not registering memories (amnesia) – before (retrograde) and after (anterograde) injury. Estimate length of time for each (Retrograde amnesia “What is the last thing you remember before your injury?”) Anterograde amnesia “What is the first thing you remember after your injury?”)
5. **Loss of consciousness (LOC)** - If occurs, determine length of LOC.
6. **Early signs observed by others.** Ask the individuals who know the patient (parent, spouse, friend, etc.) about signs of the concussion/ mTBI that they may have observed. Signs are typically observed early after the injury.
7. **Seizures:** Inquire whether seizures were observed or not.

### B. Symptom Check List:

- Ask patient (and/ or parent, if child) to report presence of the 4 categories of symptoms since injury. It is important to assess all listed symptoms as different parts of the brain control different functions. One or all symptoms may be present depending upon mechanisms of injury. If the symptom is not present, circle “0” on the scale. Circle “1” if present.
- Note: Most sleep symptoms are only applicable after a night has passed since the injury. If not applicable, circle N/A. Drowsiness may be present on the day of injury.
- Since symptoms can be present pre-morbidly/ at baseline (e.g., inattention, headaches, sleep, sadness), it is important to assess change from its typical presentation. For any symptom - if Patient/ Parent indicates “I/ He usually has that problem/symptom” – Ask “Are you/ they experiencing this symptom more than usual or in a different manner than usual?” If “Yes” circle “1”.
- Scoring:** Sum total number of symptoms present per area, and sum all 4 areas into Total Symptom Score. (Note: Most sleep symptoms are only applicable after a night has passed since the injury. Drowsiness may be present on the day of injury.) If symptoms are new and present, there is no lower limit symptom score. Any score > 0 indicates positive symptom history.
- **General Impression:** Ask how different the person is acting than usual. Circle 0 (No difference) to 6 (Major) to rate degree.
- **Patient Participation:** Indicate the extent to which the patient is able to participate in the evaluation and, if less than fully, give reason for Partial or No participation.

**C. Concussion history:** Assess the number and date(s) of prior concussions.<sup>4-8</sup> History of prior concussions, especially recent (within past several weeks or months) would suggest the need for more conservative decision-making regarding Return to Play, and general post-injury management.

**Headache history:** Assess personal history of diagnosis/treatment for headaches. Recent research indicates headache (migraine in particular) can result in protracted recovery from concussion.<sup>8-11</sup>

**D. Diagnosis:** Assign the most appropriate diagnosis given the following:

**850.0 (Concussion, with no loss of consciousness)** – Positive Injury Description (A1), i.e., forcible direct/ indirect blow to the head; plus evidence of active symptoms (B) of any type and number related to the trauma; no evidence of LOC (A5), skull fracture, or other intracranial injury.

**850.1 (Concussion, with brief loss of consciousness < 1 hour)** - Positive Injury Description (A1), i.e., forcible direct/ indirect blow to the head; plus evidence of active symptoms (B) of any type and number related to the trauma; positive evidence of LOC (A5); no skull fracture, or other intracranial injury.

**850.9 (Concussion, unspecified)** - Positive Injury Description (A1), i.e., forcible direct/ indirect blow to the head; plus evidence of active symptoms (B) of any type and number related to the trauma; unclear/unknown injury details; unclear evidence of LOC (A5), no skull fracture, or other intracranial injury.

**NOTE:** If there is evidence of skull fracture of structural intracranial injury to the brain, consider 854 (*Intracranial injury* of other and unspecified nature; 854.0 Without mention of open intracranial wound, 854.1 With open intracranial wound). Avoid using nonspecific *Head injury NOS (959.01)* whenever possible.

**E. Follow-Up Action:** Determine a plan of action for follow-up of symptomatic patients. Serial evaluation of the concussion is critical as symptoms may resolve, worsen, or ebb and flow depending upon a variety of factors (e.g., cognitive/ physical exertion, comorbidities). Referral to a specialist can be particularly valuable to help manage certain aspects of the patient's condition.

(a) Patient monitoring in the primary care physician office.

(b) Referral to a specialist: particularly valuable to help manage certain aspects of the patient's condition.

- **Neuropsychological Testing** is particularly relevant for cognitive and/or behavioral dysfunction affecting school, home or work activities, for purpose of treatment planning. Testing is also recommended when a patient may be returning to sports or other at-risk activities.
- **Physician Evaluation** is particularly relevant for medical evaluation and management of concussion. Also, critical for evaluation and management of focal neurologic, sensory, vestibular, and motor concerns. May be useful for medication management (e.g., headaches, sleep disturbance, depression) if post-concussive problems persist.





## ACUTE CONCUSSION EVALUATION (ACE)

### PHYSICIAN/CLINICIAN OFFICE VERSION

Gerard Gioia, PhD<sup>1</sup> & Micky Collins, PhD<sup>2</sup>

<sup>1</sup>Children's National Medical Center

<sup>2</sup>University of Pittsburgh Medical Center

Date and Time of Assessment: Oct/22/2017 01:31 PM, Patient ID: WRK93

Patient Name: John Doe  
DOB: 10/23/1980 Age: 36  
Date: Oct/22/2017 ID/MR#: 658709

**A. Injury Characteristics** Date/Time of Injury Dec/12/2016 19:45 Reporter: Patient Parent ☒ Spouse Other

**1. Injury Description** description

1a. Is there evidence of a forcible blow to the head (direct or indirect)? Yes ☒ No ☐ Unknown

1b. Is there evidence of intracranial injury or skull fracture? Yes ☒ No ☐ Unknown

1c. Location of Impact: ☒ Frontal ☐ Lft Temporal ☐ Rt Temporal ☐ Lft Parietal ☐ Rt Parietal ☐ Occipital ☐ Neck ☐ Indirect Force

2. Cause: MVC Pedestrian-MVC Fall Assault ☒ Sports (specify) soccer Other

3. Amnesia Before (Retrograde) Are there any events just BEFORE the injury that you/ person has no memory of (even brief)? Yes ☒ No ☐ Duration 5

4. Amnesia After (Anterograde) Are there any events just AFTER the injury that you/ person has no memory of (even brief)? Yes ☒ No ☐ Duration 4

5. Loss of Consciousness: Did you/ person lose consciousness? Yes ☒ No ☐ Duration

6. EARLY SIGNS: Appears dazed or stunned Is confused about events ☒ Answers questions slowly Repeats Questions ☒ Forgetful (recent info)

7. Seizures: Were seizures observed? No Yes ☒ Detail observed

**B. Symptom Check List\*** Since the injury, has the person experienced any of these symptoms any more than usual today or in the past day?

Indicate presence of each symptom (0=No, 1=Yes).

\*Lovell & Collins, 1998 JHTR

PHYSICAL (10)		COGNITIVE (4)		SLEEP (4)	
Headache	0 1	Feeling mentally foggy	0 1	Drowsiness	0 1
Nausea	0 1	Feeling slowed down	0 1	Sleeping less than usual	0 1 N/A
Vomiting	0 1	Difficulty concentrating	0 1	Sleeping more than usual	0 1 N/A
Balance problems	0 1	Difficulty remembering	0 1	Trouble falling asleep	0 1 N/A
Dizziness	0 1	COGNITIVE Total (0-4)	4	SLEEP Total (0-4)	2
Visual problems	0 1	EMOTIONAL (4)			
Fatigue	0 1	Irritability	0 1		
Sensitivity to light	0 1	Sadness	0 1		
Sensitivity to noise	0 1	More emotional	0 1		
Numbness/Tingling	0 1	Nervousness	0 1		
PHYSICAL Total (0-10)	1	EMOTIONAL Total (0-4)	1		
(Add Physical, Cognitive, Emotion, Sleep totals)		Total Symptom Score (0-22)		8	

**Exertion:** Do these symptoms worsen with:

Physical Activity Yes ☒ No ☐ N/A

Cognitive Activity ☒ Yes ☐ No ☐ N/A

**Overall Rating:** How different is the person acting compared to his/her usual self? (circle)

Normal 0 1 2 3 4 5 6 Very Different

**C. Risk Factors for Prolonged Recovery** (check all that apply)

Concussion History? Y <input checked="" type="checkbox"/> N <input type="checkbox"/>	Headache History? Y <input checked="" type="checkbox"/> N <input type="checkbox"/>	Developmental History	Psychiatric History
Previous # 1 2 3 4 5 6+	Prior treatment for headache	Learning disabilities	Anxiety
Longest symptom duration Days Weeks Months Years	History of migraine headache Personal Family	Attention-Deficit/ Hyperactivity Disorder	Depression
If multiple concussions, less force caused reinjury? Yes No		Other developmental disorder	Sleep disorder
			Other psychiatric disorder

List other comorbid medical disorders or medication usage (e.g., hypothyroid, seizures) seizures

**D. RED FLAGS for acute emergency management:** Refer to the emergency department with sudden onset of any of the following:

* Headaches that worsen	* Looks very drowsy/ can't be awakened	* Can't recognize people or places	* Neck pain
* Seizures	* Repeated vomiting	* Increasing confusion or irritability	* Unusual behavioral change
* Focal neurologic signs	* Slurred speech	* Weakness or numbness in arms/legs	* Change in state of consciousness

**E. Diagnosis (ICD):** Concussion w/o LOC 850.0 Concussion w/ LOC 850.1 Concussion (Unspecified) 850.9 Other (854)

☒ No diagnosis

**F. Follow-Up Action Plan** Complete ACE Care Plan and provide copy to patient/family.

No Follow-Up Needed

Physician/Clinician Office Monitoring: Date of next follow-up Oct/29/2017

Referral:

☒ Neuropsychological Testing

☒ Physician: Neurosurgery Neurology Sports Medicine Psychiatrist ☒ Psychiatrist Other Other

☒ Emergency Department

ACE Completed by: physician

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This form is part of the "Heads Up: Brain Injury in Your Practice" tool kit developed by the Centers for Disease Control and Prevention (CDC).

Date and Time of Assessment: Oct/22/2017 01:31 PM, Patient ID: WRK93

**A concussion (or mild traumatic brain injury (MTBI))** is a complex pathophysiologic process affecting the brain, induced by traumatic biomechanical forces secondary to direct or indirect forces to the head. Disturbance of brain function is related to neurometabolic dysfunction, rather than structural injury, and is typically associated with normal structural neuroimaging findings (i.e., CT scan, MRI). Concussion may or may not involve a loss of consciousness (LOC). Concussion results in a constellation of physical, cognitive, emotional, and sleep-related symptoms. Symptoms may last from several minutes to days, weeks, months or even longer in some cases.

#### ACE Instructions

The ACE is intended to provide an evidence-based clinical protocol to conduct an initial evaluation and diagnosis of patients (both children and adults) with known or suspected MTBI. The research evidence documenting the importance of these components in the evaluation of an MTBI is provided in the reference list.

#### A. Injury Characteristics:

1. Obtain **description of the injury** – how injury occurred, type of force, location on the head or body (if force transmitted to head). Different biomechanics of injury may result in differential symptom patterns (e.g., occipital blow may result in visual changes, balance difficulties).
2. Indicate the **cause of injury**. Greater forces associated with the trauma are likely to result in more severe presentation of symptoms.
- 3/4. **Amnesia**: Amnesia is defined as the failure to form new memories. Determine whether amnesia has occurred and attempt to determine length of time of memory dysfunction – before (retrograde) and after (anterograde) injury. Even seconds to minutes of memory loss can be predictive of outcome. Recent research has indicated that amnesia may be up to 4-10 times more predictive of symptoms and cognitive deficits following concussion than is LOC (less than 1 minute).<sup>1</sup>
5. **Loss of consciousness (LOC)** – If occurs, determine length of LOC.
6. **Early signs**. If present, ask the individuals who know the patient (parent, spouse, friend, etc) about specific signs of the concussion that may have been observed. These signs are typically observed early after the injury.
7. Inquire whether **seizures** were observed or not.

#### B. Symptom Checklist: <sup>2</sup>

1. Ask patient (and/or parent, if child) to report presence of the four categories of symptoms since injury. It is important to assess all listed symptoms as different parts of the brain control different functions. One or all symptoms may be present depending upon mechanisms of injury.<sup>3</sup> Record "1" for Yes or "0" for No for their presence or absence, respectively.
2. For all symptoms, indicate presence of symptoms as experienced within the past 24 hours. Since symptoms can be present pre-morbidly/at baseline (e.g., inattention, headaches, sleep, sadness), it is important to assess change from their usual presentation.
3. **Scoring**: Sum total number of symptoms present per area, and sum all four areas into Total Symptom Score (score range 0-22). (Note: most sleep symptoms are only applicable after a night has passed since the injury. Drowsiness may be present on the day of injury.) If symptoms are new and present, there is no lower limit symptom score. Any score > 0 indicates positive symptom history.
4. **Exertion**: Inquire whether any symptoms worsen with physical (e.g., running, climbing stairs, bike riding) and/or cognitive (e.g., academic studies, multi-tasking at work, reading or other tasks requiring focused concentration) exertion. Clinicians should be aware that symptoms will typically worsen or re-emerge with exertion, indicating incomplete recovery. Over-exertion may protract recovery.
5. **Overall Rating**: Determine how different the person is acting from their usual self. Circle "0" (Normal) to "6" (Very Different).

#### C. Risk Factors for Protracted Recovery: Assess the following risk factors as possible complicating factors in the recovery process.

1. **Concussion history**: Assess the number and date(s) of prior concussions, the duration of symptoms for each injury, and whether less biomechanical force resulted in re-injury. Research indicates that cognitive and symptom effects of concussion may be cumulative, especially if there is minimal duration of time between injuries and less biomechanical force results in subsequent concussion (which may indicate incomplete recovery from initial trauma).<sup>4-6</sup>
2. **Headache history**: Assess personal and/or family history of diagnosis/treatment for headaches. Research indicates headache (migraine in particular) can result in protracted recovery from concussion.<sup>8-11</sup>
3. **Developmental history**: Assess history of learning disabilities, Attention-Deficit/Hyperactivity Disorder or other developmental disorders. Research indicates that there is the possibility of a longer period of recovery with these conditions.<sup>12</sup>
4. **Psychiatric history**: Assess for history of depression/mood disorder, anxiety, and/or sleep disorder.<sup>13-16</sup>

#### D. Red Flags: The patient should be carefully observed over the first 24-48 hours for these serious signs. Red flags are to be assessed as possible signs of deteriorating neurological functioning. Any positive report should prompt strong consideration of referral for emergency medical evaluation (e.g. CT Scan to rule out intracranial bleed or other structural pathology).<sup>17</sup>

#### E. Diagnosis: The following ICD diagnostic codes may be applicable.

- 850.0 (Concussion, with no loss of consciousness)** – Positive injury description with evidence of forcible direct/ indirect blow to the head (A1a); plus evidence of active symptoms (B) of any type and number related to the trauma (Total Symptom Score >0); no evidence of LOC (A5), skull fracture or intracranial injury (A1b).
- 850.1 (Concussion, with brief loss of consciousness < 1 hour)** – Positive injury description with evidence of forcible direct/ indirect blow to the head (A1a); plus evidence of active symptoms (B) of any type and number related to the trauma (Total Symptom Score >0); positive evidence of LOC (A5), skull fracture or intracranial injury (A1b).
- 850.9 (Concussion, unspecified)** – Positive injury description with evidence of forcible direct/ indirect blow to the head (A1a); plus evidence of active symptoms (B) of any type and number related to the trauma (Total Symptom Score >0); unclear/unknown injury details; unclear evidence of LOC (A5), no skull fracture or intracranial injury.
- Other Diagnoses** – If the patient presents with a positive injury description and associated symptoms, but additional evidence of intracranial injury (A 1b) such as from neuroimaging, a moderate TBI and the diagnostic category of 854 (Intracranial injury) should be considered.

#### F. Follow-Up Action Plan: Develop a follow-up plan of action for symptomatic patients. The physician/clinician may decide to (1) monitor the patient in the office or (2) refer them to a specialist. Serial evaluation of the concussion is critical as symptoms may resolve, worsen, or ebb and flow depending upon many factors (e.g., cognitive/physical exertion, comorbidities). Referral to a specialist can be particularly valuable to help manage certain aspects of the patient's condition. (Physician/Clinician should also complete the ACE Care Plan included in this tool kit.)

1. **Physician/Clinician serial monitoring** – Particularly appropriate if number and severity of symptoms are steadily decreasing over time and/or fully resolve within 3-5 days. If steady reduction is not evident, referral to a specialist is warranted.
2. **Referral to a specialist** – Appropriate if symptom reduction is not evident in 3-5 days, or sooner if symptom profile is concerning in type/severity.
  - **Neuropsychological Testing** can provide valuable information to help assess a patient's brain function and impairment and assist with treatment planning, such as return to play decisions.
  - **Physician Evaluation** is particularly relevant for medical evaluation and management of concussion. It is also critical for evaluating and managing focal neurologic, sensory, vestibular, and motor concerns. It may be useful for medication management (e.g., headaches, sleep disturbance, depression) if post-concussive problems persist.



Date and Time of Assessment: Oct/22/2017 01:25 PM, Patient ID: WRK93

## ACE Sports

Patient Name:	John Doe
Patient Date of Birth:	Oct/23/1980
Patient ID:	WRK93
Assessment Date and Time:	Oct/22/2017 01:25 PM

### Concussion Signs and Symptoms

Signs Observed by Medical Staff:	Appears dazed or stunned
	Is confused about assignment
	Moves clumsily
	Shows behavior or personality changes
Symptoms Reported By Athlete:	Can't recall events after hit or fall (anterograde amnesia)
	Nausea
	Balance problems or dizziness
	Sensitivity to noise
	Does not "feel right"

### Signs of Deteriorating Neurological Function

Signs and Symptoms Present:	Seizures
	Focal neurologic signs
	Looks very drowsy or can't be awakened
	Unusual behavior change
	Significant irritability
	Any loss of consciousness greater than 30 seconds or longer.

### Orientation

Orientation Question:	Did Athlete Answer Correctly?
What period/quarter/half are we in?	No
What stadium/field is this?	No
What city is this?	No
Who is the opposing team?	No
Who scored last?	No
What team did we play last?	Yes



Date and Time of Assessment: Oct/22/2017 01:25 PM, Patient ID: WRK93

## ACE Sports

### Anterograde Amnesia

Question:	Did Athlete Answer Correctly?
-----------	-------------------------------

Ask the athlete to repeat the following words: Yes  
Girl, Dog, Green

### Retrograde Amnesia

Question:	Did Athlete Answer Correctly?
-----------	-------------------------------

Do you remember the hit?	Yes
--------------------------	-----

What happened in the play prior to the hit?	Yes
---	-----

What happened in the quarter/period prior to the hit?	Yes
---	-----

What was the score of the game prior to the hit?	No
--	----

### Concentration

Question:	Did Athlete Answer Correctly?
-----------	-------------------------------

Repeat the days of the week backwards (starting with today)	No
---	----

Repeat the months of the year backward (starting with December)	No
---	----

Repeat these numbers backward 63 (36), 419 (914), 6294 (4926)	No
---	----

### Word List Memory

Question:	Did Athlete Answer Correctly?
-----------	-------------------------------

Ask the athlete to repeat the words from earlier: Girl, Dog, Green	No
--	----

Date and Time of Assessment: Oct/22/2017 01:25 PM, Patient ID: WRK93

## Rivermead Post Concussion Symptoms Questionnaire

Modified (Rpq-3 And Rpq-13)<sup>42</sup> Printed With Permission: Modified Scoring System From Eyres 2005<sup>28</sup>

Name: **John Doe**

Date: **Oct/22/2017**

After a head injury or accident some people experience symptoms that can cause worry or nuisance. We would like to know if you now suffer any of the symptoms given below. Because many of these symptoms occur normally, we would like you to compare yourself now with before the accident. For each symptom listed below please circle the number that most closely represents your answer.

0 = not experienced at all  
1 = no more of a problem  
2 = a mild problem  
3 = a moderate problem  
4 = a severe problem

Compared with **before** the accident, do you **now** (i.e., over the last 24 hours) suffer from:

	not experienced	no more of a problem	mild problem	moderate problem	severe problem
Headaches	①	1	2	3	4
Feelings of dizziness	①	1	2	3	4
Nausea and/or vomiting	①	1	2	3	4
Noise sensitivity (easily upset by loud noise)	0	①	2	3	4
Sleep disturbance	0	①	2	3	4
Fatigue, tiring more easily	0	①	2	3	4
Being irritable, easily angered	①	1	2	3	4
Feeling depressed or tearful	①	1	2	3	4
Feeling frustrated or impatient	①	1	2	3	4
Forgetfulness, poor memory	0	①	2	3	4
Poor concentration	0	①	2	3	4
Taking longer to think	0	①	2	3	4
Blurred vision	0	1	②	3	4
Light sensitivity (easily upset by bright light)	0	1	②	3	4
Double vision	0	1	②	3	4
Restlessness	0	1	2	③	4

Are you experiencing any other difficulties? Please specify, and rate as above.

1. Symptom	0	1	2	3	④
2.	0	1	2	3	4

Administration only:

<b>RPQ-3</b> (total for first three items)	0
<b>RPQ-13</b> (total for next 13 items)	15

<http://www.mc.man.ac.uk/default.asp?MenuID=149>

Date and Time of Assessment: Oct/22/2017 01:25 PM, Patient ID: WRK93

**Rivermead Post Concussion Symptoms Questionnaire (cont.)**Modified (Rpq-3 And Rpq-13)<sup>42</sup> Printed With Permission: Modified Scoring System From Eyres 2005 <sup>28</sup>**Administration only**

Individual item scores reflect the presence and severity of post concussive symptoms. Post concussive symptoms, as measured by the RPQ, may arise for different reasons subsequent to (although not necessarily directly because of) a traumatic brain injury. The symptoms overlap with broader conditions, such as pain, fatigue and mental health conditions such as depression<sup>72</sup>.

The questionnaire can be repeated to monitor a patient's progress over time. There may be changes in the severity of symptoms, or the range of symptoms. Typical recovery is reflected in a reduction of symptoms and their severity within three months.

**Scoring**

The scoring system has been modified from Eyres, 2005<sup>24</sup>.

The items are scored in two groups. The first group (RPQ-3) consists of the first three items (headaches, feelings of dizziness and nausea) and the second group (RPQ-13) comprises the next 13 items. The total score for RPQ-3 items is potentially 0–12 and is associated with early symptom clusters of post concussive symptoms. If there is a higher score on the RPQ-3, earlier reassessment and closer monitoring is recommended.

The RPQ-13 score is potentially 0–52, where higher scores reflect greater severity of post concussive symptoms. The RPQ-13 items are associated with a later cluster of symptoms, although the RPQ-3 symptoms of headaches, dizziness and nausea may also be present. The later cluster of symptoms is associated with having a greater impact on participation, psychosocial functioning and lifestyle. Symptoms are likely to resolve within three months. A gradual resumption of usual activities is recommended during this period, appropriate to symptoms. If the symptoms do not resolve within three months, consideration of referral for specialist assessment or treatment services is recommended.

**References:**

- Eyres, S., Carey, A., Gilworth, G., Neumann, V., Tennant, A. (2005). Construct validity and reliability of the Rivermead Post Concussion Symptoms Questionnaire. *Clinical Rehabilitation*, 19, 878-887.
- King, N. S., Crawford, S., Wenden, F.J., Moss, N.E.G. Wade, D.T. (1995). The Rivermead Post Concussion Symptoms Questionnaire: a measure of symptoms commonly experienced after head injury and its reliability *Journal of Neurology*, 242, 587-592.
- Potter, S., Leigh, E., Wade, D., Fleminger, S. (2006). The Rivermead Post Concussion Symptoms Questionnaire *Journal of Neurology*, October 1-12.

<http://www.maa.nsw.gov.au/default.aspx?MenuID=148>





Date and Time of Assessment: Oct/22/2017 01:24 PM, Patient ID: WRK93

## Primary Care PTSD Assessment

Patient Name: John Doe  
Date of Birth: 10/23/1980  
Patient ID: WRK93  
Assessment Date and Time: Oct/22/2017 01:24 PM

1. Have had nightmares about it or thought about it when you did not want to?	YES
2. Tried hard not to think about it or went out of your way to avoid situations that reminded you of it?	YES
3. Were constantly on guard, watchful, or easily startled?	YES
4. Felt numb or detached from others, activities, or your surroundings?	YES

a. Whether the patient has had a traumatic experience  
Experience

b. Whether endorsed screen items are really trauma-related symptoms  
Symptoms

c. Whether endorsed screen items are disruptive to the patient's life  
Event

Discern whether traumatic events are ongoing in a patient's life  
Event

The result is: **Positive**

Current research suggests that the results of the PC-PTSD should be considered "positive" if a patient answers "yes" to any three items. A positive response to the screen does not necessarily indicate that a patient has Posttraumatic Stress Disorder. However, a positive response does indicate that a patient may have PTSD or trauma-related problems and further investigation of trauma symptoms by a mental-health professional may be warranted.



Australian Centre for  
**Posttraumatic Mental Health**

## The Posttraumatic Stress Disorder Checklist (PCL)

The PCL (Weathers et al, 1993) is an easily administered self-report rating scale for assessing the 17 DSM-IV symptoms of PTSD. It has excellent test-retest reliability over a 2-3 day period. Internal consistency is very high for each of the three groups of items corresponding to the DSM-IV symptom clusters as well as for the full 17-item scale. The PCL correlates strongly with other measures of PTSD, such as the Mississippi Scale, the PK scale of the MMPI-2, and the Impact of Events Scale, and also correlates moderately with level of combat exposure.

Three versions of the PCL are available, although the differences are very small. The PCL-M is a military version and questions refer to “a stressful military experience”. The PCL-S is a non-military version that can be referenced to any specific traumatic event; the questions refer to “the stressful experience”. The PCL-C is a general civilian version that is not linked to a specific event; the questions refer to “a stressful experience from the past”. The scoring is the same for all three versions.

A total score is computed by adding the 17 items, so that possible scores range from 17 to 85. Used as a continuous measure, the PCL has good diagnostic utility. In Vietnam combat veterans a cut-off of 50 on the PCL is a good predictor of a PTSD diagnosis based on the SCID PTSD module. Principal components analysis revealed one large factor, consisting primarily of re-experiencing and hyperarousal items, and one much small factor, consisting primarily of emotional numbing items.

### References:

- Blanchard, E.B., Jones-Alexander, J., Buckley, T.C., & Forneris, C.A. (1996). Psychometric properties of the PTSD Checklist (PCL). *Behaviour Research and Therapy*, 34, 669-673.
- Cardove, M.J., Andrykowski, M.A., Redd, W.H., Kenady, D.E., McGrath, P.C., & Sloan, D.A. (1995). Frequency and correlates of posttraumatic stress disorder like symptoms after treatment for breast cancer. *Journal of Consulting and Clinical Psychology*, 63, 981-986.
- Forbes, D., Creamer, M., and Biddle, D. (2001). The validity of the PTSD checklist as a measure of symptomatic change in combat-related PTSD. *Behavior Therapy and Research*, 39, 977-986.
- Weathers, F.W., Litz, B.T., Herman, D.S., Huska, J.A. & Keane, T.M. (1993) The PTSD Checklist (PCL): Reliability, validity, and diagnostic utility. Paper presented at the 9th Annual Conference of the ISTSS, San Antonio.

Common assessment measures: PTSD Checklist

Date and Time of Assessment: Oct/22/2017 01:23 PM, Patient ID: WRK93

## PTSD Checklist – Civilian Version (PCL-C)

Patient's Name: John Doe

Instructions: Below is a list of problems and complaints that people sometimes have in response to stressful life experiences. Please read each one carefully, put an "X" in the box to indicate how much you have been bothered by that problem *in the past month*.

No.	Response:	Not at all (1)	A little bit (2)	Moderately (3)	Quite a bit (4)	Extremely (5)
1.	Repeated, disturbing <i>memories, thoughts</i> , or <i>images</i> of a stressful experience from the past?					X
2.	Repeated, disturbing <i>dreams</i> of a stressful experience from the past?					X
3.	Suddenly <i>acting or feeling</i> as if a stressful experience <i>were happening again</i> (as if you were reliving it)?					X
4.	Feeling <i>very upset</i> when <i>something reminded</i> you of a stressful experience from the past?					X
5.	Having <i>physical reactions</i> (e.g., heart pounding, trouble breathing, or sweating) when <i>something reminded</i> you of a stressful experience from the past?					X
6.	Avoid <i>thinking about</i> or <i>talking about</i> a stressful experience from the past or avoid <i>having feelings</i> related to it?					X
7.	Avoid <i>activities</i> or <i>situations</i> because <i>they remind</i> you of a stressful experience from the past?					X
8.	Trouble <i>remembering important parts</i> of a stressful experience from the past?					X
9.	Loss of interest in things that you used to enjoy?					X
10.	Feeling <i>distant</i> or <i>cut off</i> from other people?					X
11.	Feeling <i>emotionally numb</i> or being unable to have loving feelings for those close to you?					X
12.	Feeling as if your <i>future</i> will somehow be <i>cut short</i> ?					X
13.	Trouble falling or staying asleep?					X
14.	Feeling irritable or having angry outbursts?					X
15.	Having difficulty concentrating?					X
16.	Being " <i>super alert</i> " or watchful on guard?					X
17.	Feeling <i>jumpy</i> or easily startled?					X

Weathers, F.W., Huska, J.A., Keane, T.M. *PCL-C for DSM-IV*. Boston: National Center for PTSD – Behavioral Science Division, 1991.

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A total score is computed by adding the 17 items, so that possible scores range from 17 to 85. Used as a continuous measure, the PCL has good diagnostic utility. In Vietnam combat veterans a cut-off of 50 on the PCL is a good predictor of a PTSD diagnosis based on the SCID PTSD module. Principal components analysis revealed one large factor, consisting primarily of re-experiencing and hyperarousal items, and one much small factor, consisting primarily of emotional numbing items.

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Common assessment measures: PTSD Checklist

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Date and Time of Assessment: Oct/22/2017 01:22 PM, Patient ID: WRK93

## PTSD Checklist – Civilian Version (PCL-S)

Patient's Name: John Doe

Instructions: Below is a list of problems and complaints that people sometimes have in response to stressful life experiences. Please read each one carefully, put an "X" in the box to indicate how much you have been bothered by that problem *in the past month*.

The event you experienced was Description on Dec/12/2016 (date)

No.	Response:	Not at all (1)	A little bit (2)	Moderately (3)	Quite a bit (4)	Extremely (5)
1.	Repeated, disturbing <i>memories, thoughts, or images</i> of a stressful experience from the past?	X				
2.	Repeated, disturbing <i>dreams</i> of a stressful experience from the past?	X				
3.	Suddenly <i>acting or feeling</i> as if a stressful experience <i>were happening again</i> (as if you were reliving it)?	X				
4.	Feeling <i>very upset</i> when <i>something reminded</i> you of a stressful experience from the past?	X				
5.	Having <i>physical reactions</i> (e.g., heart pounding, trouble breathing, or sweating) when <i>something reminded</i> you of a stressful experience from the past?	X				
6.	Avoid <i>thinking about</i> or <i>talking about</i> a stressful experience from the past or avoid <i>having feelings</i> related to it?	X				
7.	Avoid <i>activities</i> or <i>situations</i> because <i>they remind you</i> of a stressful experience from the past?	X				
8.	Trouble <i>remembering important parts</i> of a stressful experience from the past?	X				
9.	Loss of interest in things that you used to enjoy?	X				
10.	Feeling <i>distant</i> or <i>cut off</i> from other people?	X				
11.	Feeling <i>emotionally numb</i> or being unable to have loving feelings for those close to you?	X				
12.	Feeling as if your <i>future</i> will somehow be <i>cut short</i> ?	X				
13.	Trouble falling or staying asleep?	X				
14.	Feeling irritable or having angry outbursts?	X				
15.	Having difficulty concentrating?	X				
16.	Being " <i>super alert</i> " or watchful on guard?	X				
17.	Feeling <i>jumpy</i> or easily startled?	X				

Weathers, F.W., Huska, J.A., Keane, T.M. *PCL-S for DSM-IV*. Boston: National Center for PTSD – Behavioral Science Division, 1991.

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Common assessment measures: PTSD Checklist

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- Forbes, D., Creamer, M., and Biddle, D. (2001). The validity of the PTSD checklist as a measure of symptomatic change in combat-related PTSD. *Behavior Therapy and Research*, 39, 977-986.
- Weathers, F.W., Litz, B.T., Herman, D.S., Huska, J.A. & Keane, T.M. (1993) The PTSD Checklist (PCL): Reliability, validity, and diagnostic utility. Paper presented at the 9th Annual Conference of the ISTSS, San Antonio.

Common assessment measures: PTSD Checklist

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Date and Time of Assessment: Oct/22/2017 01:21 PM, Patient ID: WRK93

## PTSD CheckList – Military Version (PCL-M)

Patient's Name: John Doe

Instructions: Below is a list of problems and complaints that people sometimes have in response to stressful military experiences. Please read each one carefully, put an "X" in the box to indicate how much you have been bothered by that problem *in the past month*.

No.	Response:	Not at all (1)	A little bit (2)	Moderately (3)	Quite a bit (4)	Extremely (5)
1.	Repeated, disturbing <i>memories, thoughts</i> , or <i>images</i> of a stressful experience from the past?			X		
2.	Repeated, disturbing <i>dreams</i> of a stressful experience from the past?			X		
3.	Suddenly <i>acting</i> or <i>feeling</i> as if a stressful experience <i>were happening again</i> (as if you were reliving it)?			X		
4.	Feeling <i>very upset</i> when <i>something reminded</i> you of a stressful experience from the past?			X		
5.	Having <i>physical reactions</i> (e.g., heart pounding, trouble breathing, or sweating) when <i>something reminded</i> you of a stressful experience from the past?			X		
6.	Avoid <i>thinking about</i> or <i>talking about</i> a stressful experience from the past or avoid <i>having feelings</i> related to it?			X		
7.	Avoid <i>activities</i> or <i>situations</i> because <i>they remind you</i> of a stressful experience from the past?			X		
8.	Trouble <i>remembering important parts</i> of a stressful experience from the past?			X		
9.	Loss of interest in things that you used to enjoy?			X		
10.	Feeling <i>distant</i> or <i>cut off</i> from other people?			X		
11.	Feeling <i>emotionally numb</i> or being unable to have loving feelings for those close to you?			X		
12.	Feeling as if your <i>future</i> will somehow be <i>cut short</i> ?			X		
13.	Trouble falling or staying asleep?			X		
14.	Feeling irritable or having angry outbursts?			X		
15.	Having difficulty concentrating?			X		
16.	Being " <i>super alert</i> " or watchful on guard?			X		
17.	Feeling <i>jumpy</i> or easily startled?			X		

Weathers, F.W., Huska, J.A., Keane, T.M. *PCL-C for DSM-IV*. Boston: National Center for PTSD – Behavioral Science Division, 1991.

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Common assessment measures: PTSD Checklist

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Date and Time of Assessment: Oct04/2017 01:25 PM, Patient ID: W1K22

## PTSD Checklist – Military Version (PCL-M)

Patient's Name: John Doe

Instructions: Below is a list of problems and complaints that people sometimes have in response to stressful military experiences. Please read each one carefully, put an "X" in the box to indicate how much you have been bothered by that problem *in the past month*.

No.	Response:	Not at all (1)	A little bit (2)	Moderately (3)	Quite a bit (4)	Extremely (5)
1.	Repeated, disturbing memories, thoughts, or images of a stressful experience from the past?					X
2.	Repeated, disturbing dreams of a stressful experience from the past?					X
3.	Suddenly acting or feeling as if a stressful experience were happening again (as if you were reliving it)?					X
4.	Feeling very upset when something reminded you of a stressful experience from the past?					X
5.	Having physical reactions (e.g., heart pounding, trouble breathing, or sweating) when something reminded you of a stressful experience from the past?					X
6.	Avoid thinking about or talking about a stressful experience from the past or avoid having feelings related to it?					X
7.	Avoid activities or situations because they remind you of a stressful experience from the past?					X
8.	Trouble remembering important parts of a stressful experience from the past?					X
9.	Loss of interest in things that you used to enjoy?					X
10.	Feeling distant or cut off from other people?					X
11.	Feeling emotionally numb or being unable to have loving feelings for those close to you?					X
12.	Feeling as if your future will somehow be cut short?					X
13.	Trouble falling or staying asleep?					X
14.	Feeling irritable or having angry outbursts?					X
15.	Having difficulty concentrating?					X
16.	Being "super alert" or watchful on guard?					X
17.	Feeling jumpy or easily startled?					X

Weathers, F.W., Huska, J.A., Keane, T.M. *PCL-C for DSM-IV*. Boston: National Center for PTSD Behavioral Science Division, 1991.

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Common assessment measures: PTSD Checklist

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## Appendix 3: Vestibular/Balance

Balance testing is considered by the 4th Consensus Statement on Concussion in Sport to be a "useful tool for objectively assessing" neurological functioning and a "reliable and valid addition to the assessment of athletes suffering from concussion, particularly where symptoms or signs indicate a balance component."<sup>1</sup> An accompanying review of the peer-reviewed medical literature<sup>2</sup> found that "studies show that balance is an important component of the sideline assessment."

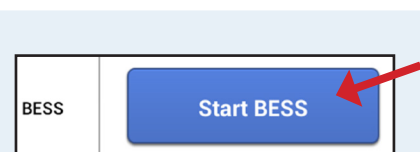
### Balance Error Scoring System (BESS)

The Balance Error Scoring System (BESS) is a balance test used for assessing static postural stability. The BESS consists of 3 stance tests lasting 20 seconds each, performed first on a firm surface (grass, turf, court) and then on a piece of medium-density foam (foam not provided by BrainScope), all with the eyes closed, and scored based on the number of errors across trials. The three stances are: double leg stance (hands on the hips and feet together), single leg stance (standing on the non-dominant leg with hands on hips), and a tandem stance (non-dominant foot behind the dominant foot) in a heel-to-toe fashion.

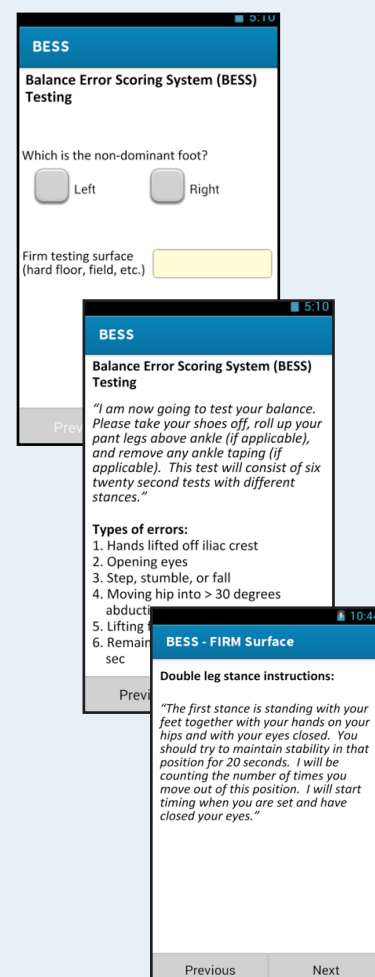
To begin the BESS assessment from the **Information Hub**, press the **START** button (Figure A3-1) and the handheld will navigate to a screen to select which foot is being tested and testing surface. (Figure A3-2).



**NOTE:** The BESS assessment is set up to begin testing on a firm surface first followed by testing on a foam surface. The testing sequence will run through all three stances on firm surface and then run through all three stances on foam surface before displaying results. Results for both sets of test sequences will be displayed together on the **BESS Summary**.



**Figure A3-1:**  
Start BESS Test



**Figure A3-2:**  
BESS Test Start Instructions

<sup>1</sup> McCrory P, et al. Concussion Statement on concussion in sport: the 4th International Conference on Concussion in Sport held in Zurich, November 2012. Br J Sports Med 2013;47:250-258

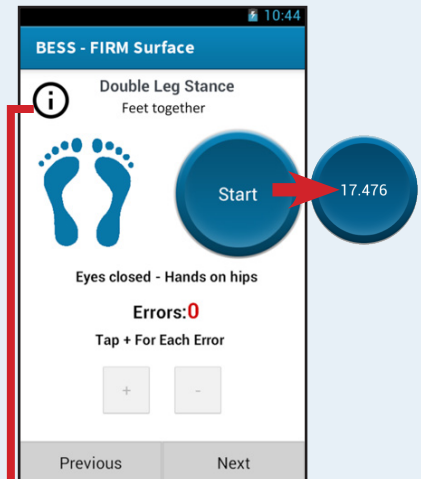
<sup>2</sup> McCrea M, Iverson G, Echmendia R, et al. Day of injury assessment of sport-related concussion. Br J Sports Med 2013;47:272-284



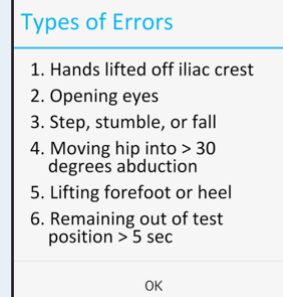
**NOTE:** The **INFORMATION** button will display the Type of Errors that should be counted by the Operator during testing.

For all BESS Tests the following apply:

- Once **START** has been selected a timer will replace "Start" and count down from 20 seconds to 0 seconds (Figure A3-3)
- Once the timer has reached 0 seconds **START** will reappear and the test is complete.
- During the test press the **PLUS** and **MINUS** to increase or decrease the number of errors that occur during the 20 second testing period. Errors recorded will appear in red above the **PLUS** and **MINUS**.
- Once a test is complete press **NEXT** to proceed to the next stance test.
- At any time, press **PREVIOUS** to navigate to the previous screen.



**Figure A3-3:  
Start Button**



Prior to testing, the Operator will provide the following instructions 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 three twenty second tests with different stances on firm and foam surfaces."**



**NOTE:** Each of the 20-second trials is scored by counting the errors, or deviations from the proper stance, accumulated by the athlete. The examiner will begin counting errors only after the individual has assumed the proper start position. **The BESS is calculated by adding one error point for each error during the three 20-second tests. The maximum total number of errors for any single condition is 10.** If an athlete commits multiple errors simultaneously, only one error is recorded but the athlete should quickly return to the testing position, and counting should resume once subject is set. Subjects that are unable to maintain the testing procedure for a minimum of **five seconds** at the start are assigned the highest possible score, ten, for that testing condition.

#### **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

### Double Leg Stance (Firm)

The following instructions will appear on the screen and must be read to the subject prior to starting the Firm Double Leg Stance testing.

**“The first stance is standing with your feet together with your hands on your hips and with your eyes closed. You should try to maintain stability in that position for 20 seconds. I will be counting the number of times you move out of this position. I will start timing when you are set and have closed your eyes.”**

Confirm with the subject that they understand the instructions and press **START** to begin.

### Single Leg Stance (Firm)

The following instructions will appear on the screen and must be read to the subject prior to starting the Single Leg Stance testing.

**“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. 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 hands on your hips and your eyes closed. I will be counting the number of times you move out of this position. If you stumble out of this position, open your eyes and return to the start position and continue balancing. I will start timing when you are set and have closed your eyes.”**

Confirm with the subject that they understand the instructions.

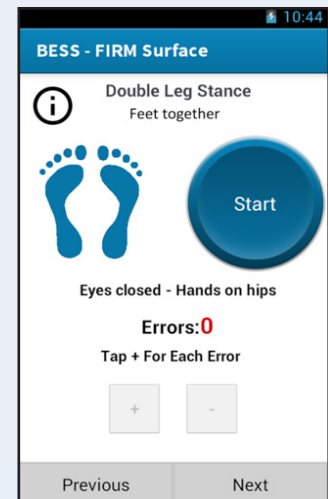
Press the left or right **FOOT** that the subject will be using for the test. Once the subject is in place, press **START**.

### Tandem Stance (Firm)

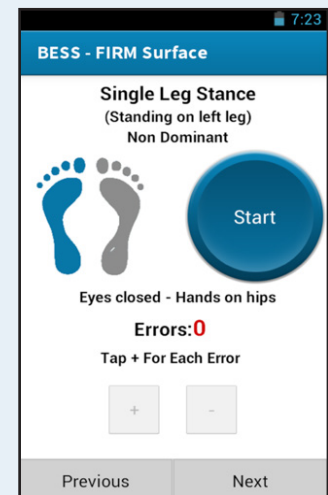
The following instructions will appear on the screen and must be read to the subject prior to starting the Tandem Stance testing.

**“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 hands on your hips and your eyes closed. I will be counting the number of times you move out of this position. If you stumble out of this position, open your eyes and return to the start position and continue balancing. I will start timing when you are set and have closed your eyes.”**

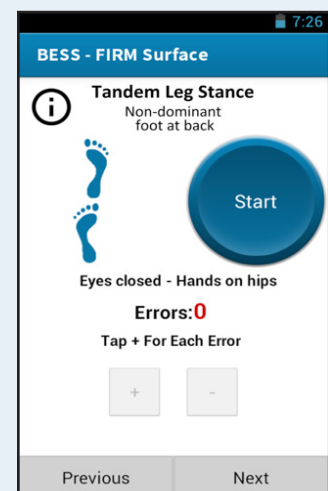
Confirm with the subject that they understand the instructions and press **START** to begin.



**Figure A3-4:**  
**Double Leg Stance (Firm)**



**Figure A3-5:**  
**Single Leg Stance (Firm)**



**Figure A3-6:**  
**Tandem Leg Stance (Firm)**

## Double Leg Stance (Foam)

The following instructions will appear on the screen and must be read to the subject prior to starting the Double Leg Stance testing.

**“Standing on the foam, put your feet together with your hands on your hips and with your eyes closed. You should try to maintain stability in that position for 20 seconds. I will be counting the number of times you move out of this position. I will start timing when you are set and have closed your eyes.”**

Confirm with the subject that they understand the instructions and press **START** to begin.

## Single Leg Stance (Foam)

The following instructions will appear on the screen and must be read to the subject prior to starting the Single Leg Stance testing.

**“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 on the foam. 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 hands on your hips and your eyes closed. I will be counting the number of times you move out of this position. If you stumble out of this position, open your eyes and return to the start position and continue balancing. I will start timing when you are set and have closed your eyes.”**

Confirm with the subject that they understand the instructions.

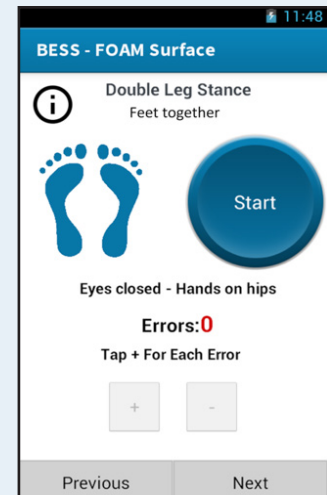
Press the left or right **FOOT** that the subject will be using for the test. Once the subject is in place, press **START**.

## Tandem Stance (Foam)

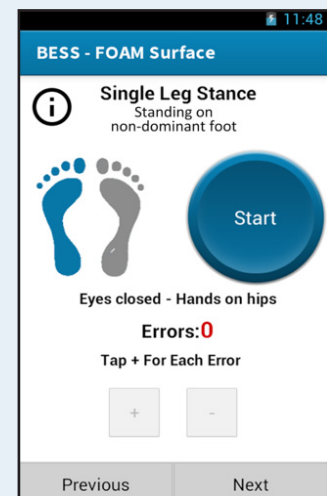
The Operator will provide the following instructions that appear on the screen to begin the Foam Tandem Stance testing.

**“On the foam, 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 hands on your hips and your eyes closed. I will be counting the number of times you move out of this position. If you stumble out of this position, open your eyes and return to the start position and continue balancing. I will start timing when you are set and have closed your eyes.”**

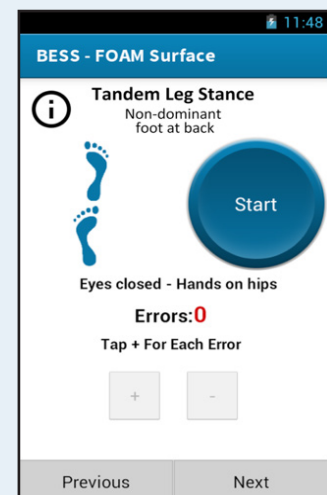
Confirm with the subject that they understand the instructions and press **START** to begin.



**Figure A3-7:**  
Double Leg Stance (Foam)



**Figure A3-8:**  
Single Leg Stance (Foam)



**Figure A3-9:**  
Tandem Leg Stance (Foam)

Upon completion of the Tandem Leg Stance testing BESS results can be viewed on the **BESS Summary** (Figure A3-10), press **NEXT** to proceed to the **BESS Summary**.

The **BESS Summary** displays the score for all tests and the BESS total score.

Press the **CONFIRM** button to return to the **Information Hub** or press **PREVIOUS** to navigate back to the previous screen.

## BESS Detailed Results

Detailed results on current and previous BESS tests are stored in the database and can be accessed from the **Information Hub** screen.

Once a BESS test session has been completed the BESS total score will replace the **START** button next to the BESS test on the **Information Hub** (Figure A3-11).



**NOTE:** The **BESS Detailed Results** will default to view the **CURRENT TEST** tab.

## Current Test Tab

The **BESS Current Test Detailed Results** (Figure A3-12) contains two options to select from:

- Review – access results of all three stances
- New Test – start a new test



**NOTE:** While reviewing patient information the screen header will contain "Review" to inform the operator that they are currently in review mode.

BESS Summary	
<b>BESS - Review</b>	
Patient ID: 123456	
<b>BESS - FIRM Surface</b>	
Double Leg Stance Score:	1
Single Leg Stance Score:	4
Tandem Leg Stance Score:	3
<b>Total Score:</b>	<b>8</b>
<b>BESS - FOAM Surface</b>	
Double Leg Stance Score:	2
Single Leg Stance Score:	5
Tandem Leg Stance Score:	6
<b>Total Score:</b>	<b>13</b>
<b>BESS Total Score:</b>	<b>21</b>
Previous	Confirm

**Figure A3-10:**  
**BESS Summary of Results**

BESS	Firm+Foam	10 Errors
------	-----------	-----------

**Figure A3-11:**  
**BESS results area from the Information Hub**

BESS Summary	
CURRENT TEST	PREVIOUS TESTS
<b>BESS Assessment Summary</b>	
Patient ID: 123456	Review New Test
<b>BESS - FIRM Surface</b>	
Double Leg Stance Score:	1
Single Leg Stance Score:	4
Tandem Leg Stance Score:	3
<b>Total Score:</b>	<b>8</b>
<b>BESS - FOAM Surface</b>	
Double Leg Stance Score:	2
Single Leg Stance Score:	5
Tandem Leg Stance Score:	6
<b>Total Score:</b>	<b>13</b>
<b>BESS Total Score:</b>	<b>21</b>
Close	

**Figure A3-12:**  
**Current Test Detailed Results**

The **BESS Review** screens will appear in exact order of the testing sequence. Press **REVIEW** to begin the review sequence. An example of a **BESS Review** screen is shown in Figure A3-13.

From the **BESS Results Review** (Figure A3-14) press **CONFIRM** to return to the **BESS Current Test Detailed Results** (Figure A3-12).

From **BESS Current Test Detailed Results** (Figure A3-12) a new test can be started.

Press **NEW TEST** to begin the BESS test sequence beginning with the **BESS Firm Double Leg**.

For instructions on completing a new BESS test refer to the sections above.

**Figure A3-13:**  
Example of a BESS Review screen

BESS - FIRM Surface	
Double Leg Stance Score:	1
Single Leg Stance Score:	4
Tandem Leg Stance Score:	3
Total Score:	8

BESS - FOAM Surface	
Double Leg Stance Score:	2
Single Leg Stance Score:	5
Tandem Leg Stance Score:	6
Total Score:	13

<b>BESS Total Score:</b>	<b>21</b>
--------------------------	-----------

**Figure A3-14:**  
Example of a BESS Results screen



## Previous Test Tab

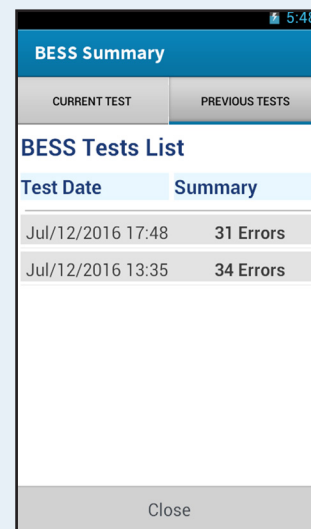
Results from previous BESS testing dates and times can be reviewed from the **BESS Previous Tests Detailed Results** (Figure A3-15) by pressing the **PREVIOUS TESTS** tab.

The **BESS Previous Tests Detailed Results** lists all tests recorded by test date, time and summary of errors (BESS Total Score).

To view the **BESS Assessment Summary** for all stances press the desired test from the "BESS Tests List" .

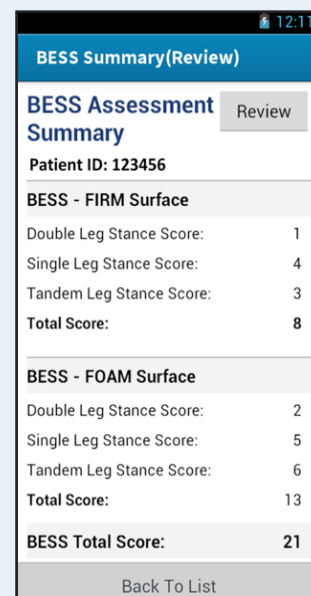
Once the test has been selected the **BESS Previous Test Review** (Figure A3-16) will appear displaying the test results from each of the stances along with the BESS Total Score.

For instructions on reviewing-and starting a new test refer to the sections above.



BESS Summary	
CURRENT TEST	PREVIOUS TESTS
<b>BESS Tests List</b>	
Test Date	Summary
Jul/12/2016 17:48	31 Errors
Jul/12/2016 13:35	34 Errors
Close	

**Figure A3-15:**  
**BESS Tests List**



BESS Summary(Review)	
<b>BESS Assessment Summary</b>	Review
Patient ID: 123456	
<b>BESS - FIRM Surface</b>	
Double Leg Stance Score:	1
Single Leg Stance Score:	4
Tandem Leg Stance Score:	3
<b>Total Score:</b>	<b>8</b>
<b>BESS - FOAM Surface</b>	
Double Leg Stance Score:	2
Single Leg Stance Score:	5
Tandem Leg Stance Score:	6
<b>Total Score:</b>	<b>13</b>
<b>BESS Total Score:</b>	<b>21</b>
Back To List	

**Figure A3-16:**  
**BESS Previous Test Review**



## Modified Balance Error Scoring System (mBESS)

The Modified Balance Error Scoring System (mBESS) is a modified version of the Balance Error Scoring System (BESS). The mBESS consists of testing the three stances included in the BESS on a firm surface only. The mBESS is included as part of the updated Sports Concussion Assessment Tool (SCAT3) issued in conjunction with the Zurich Consensus Statement.

To begin the mBESS assessment from the **Information Hub**, press **START** button (Figure A3-17) and the handheld will navigate to a screen to select which foot is being tested and testing surface. (Figure A3-18).

Prior to testing the Operator will provide the following instructions to the subject:

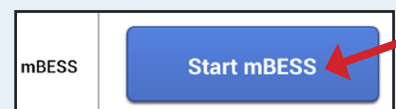
**"I am now going to test your balance. Please take your shoes off, roll up your pant legs above ankle (if applicable), and remove any ankle taping (if applicable). This test will consist of three twenty second tests with different stances"**



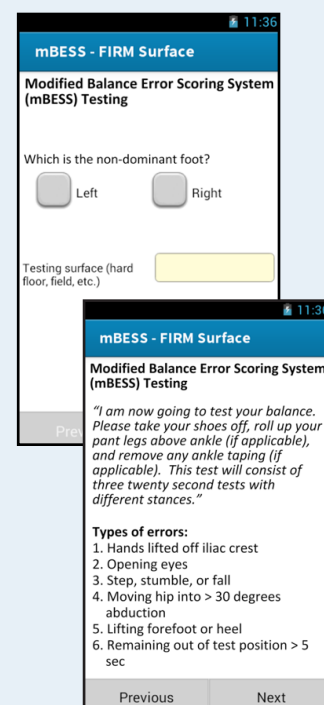
**NOTE:** Each of the 20-second trials is scored by counting the errors, or deviations from the proper stance, accumulated by the athlete. The examiner will begin counting errors only after the individual has assumed the proper start position. **The mBESS is calculated by adding one error point for each error during the three 20-second tests. The maximum total number of errors for any single condition is 10.** If an athlete commits multiple errors simultaneously, only one error is recorded but the athlete should quickly return to the testing position, and counting should resume once subject is set. Subjects that are unable to maintain the testing procedure for a minimum of **five seconds** at the start are assigned the highest possible score, ten, for that testing condition.

### 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



**Figure A3-17:**  
**Start mBESS Test**



**Figure A3-18:**  
**mBESS Test Start Instructions**



**NOTE:** For all mBESS Tests the following apply:

- Once **START** has been selected a timer will replace "Start" and count down from 20 seconds to 0 seconds (Figure A3-19)
- Once the timer has reached 0 seconds **START** will reappear and the test is complete.
- During the test press the **PLUS** and **MINUS** to increase or decrease the number of errors that occur during the 20 second testing period. Errors recorded will appear in red above the **PLUS** and **MINUS**.
- Once a test is complete press **NEXT** to proceed to the next stance test.
- At any time, press **PREVIOUS** to navigate to the previous screen.

## Double Leg Stance

The following instructions will appear on the screen and must be read to the subject prior to starting:

**"The first stance is standing with your feet together with your hands on your hips and with your eyes closed. You should try to maintain stability in that position for 20 seconds. I will be counting the number of times you move out of this position. I will start timing when you are set and have closed your eyes."**

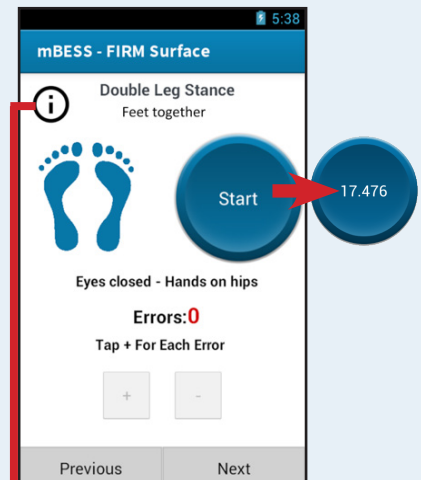
Confirm with the subject that they understand the instructions and press **START** to begin.

## Single Leg Stance

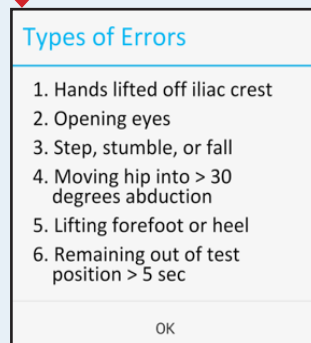
The following instructions will appear on the screen and must be read to the subject prior to starting:

**"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. 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 hands on your hips and your eyes closed. I will be counting the number of times you move out of this position. If you stumble out of this position, open your eyes and return to the start position and continue balancing. I will start timing when you are set and have closed your eyes."**

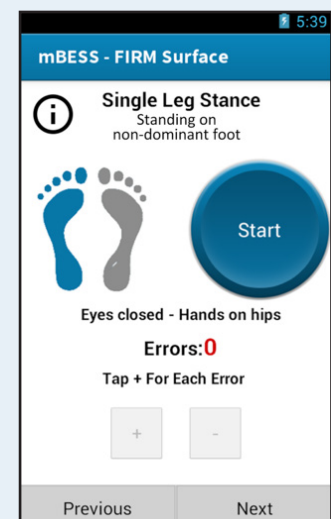
Confirm with the subject that they understand the instructions. Once the subject is in place, press **START**.



**Figure A3-19:**  
**Start Button**



**Figure A3-20:**  
**Information - Type of Errors**



**Figure A3-21:**  
**Single Leg Stance**

## Tandem Leg Stance

The following instructions will appear on the screen and must be read to the subject prior to starting:

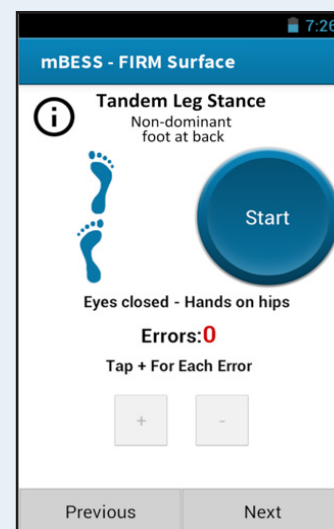
**"Now stand heel-to-toe with your non-dominant foot in back. Your weight should be evenly distributed across both feet. Again, you should try to maintain stability for 20 seconds with your hands on your hips and your eyes closed. I will be counting the number of times you move out of this position. If you stumble out of this position, open your eyes and return to the start position and continue balancing. I will start timing when you are set and have closed your eyes."**

Confirm with the subject that they understand the instructions and press **START** to begin.

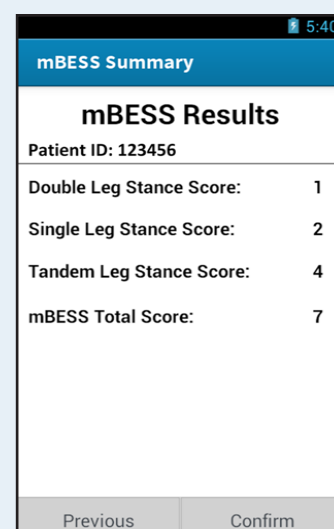
Upon completion of the Tandem Leg Stance testing mBESS results can be viewed on the **mBESS Summary** (Figure A3-23).

The **mBESS Summary** displays the score for all tests and the mBESS total score.

Press the **CONFIRM** button to return to the **Information Hub** or press **PREVIOUS** to navigate back to the previous screen.



**Figure A3-22:**  
**Tandem Leg Stance**



**Figure A3-23:**  
**mBESS Summary of Results**

## mBESS Detailed Results

Detailed results on current and previous mBESS tests are stored in the database and can be accessed from the **Information Hub** screen.

Once a mBESS test session has been completed the mBESS total score will replace the **START** button next to the mBESS test on the **Information Hub** (Figure A3-24).



**NOTE:** The **mBESS Detailed Results** will default to view the **CURRENT TEST** tab.

### Current Test Tab

The **mBESS Current Test Detailed Results** (Figure A3-25) contains two options to select from:

- Review – access results of all three stances
- New Test – start a new test

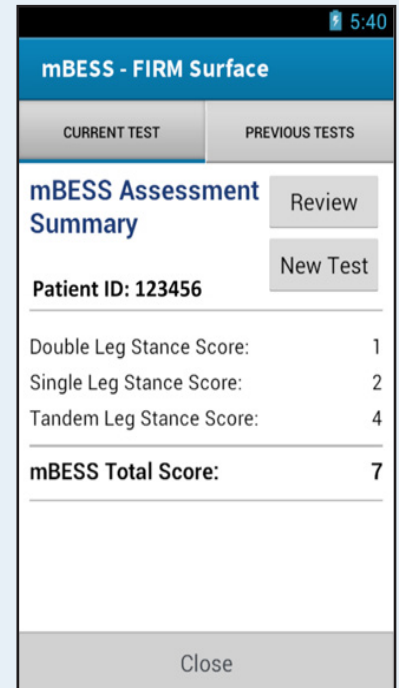


**NOTE:** While reviewing patient information the screen header will contain "Review" to inform the operator that they are currently in review mode.

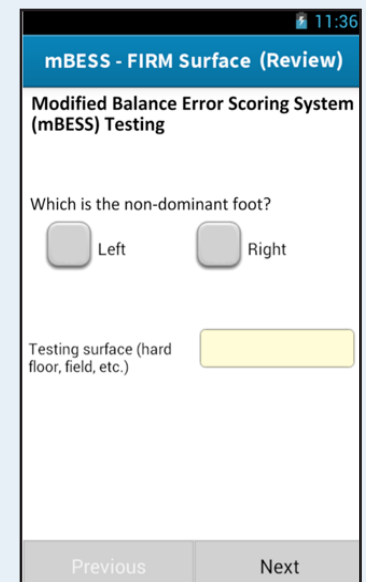
The **mBESS Review** screens will appear in exact order of the testing sequence. Press **REVIEW** to begin the review sequence. An example of a **mBESS Review** screen is shown in Figure A3-26.



**Figure A3-24:**  
mBESS results area from the  
Information Hub



**Figure A3-25:**  
Current Test Detailed Results



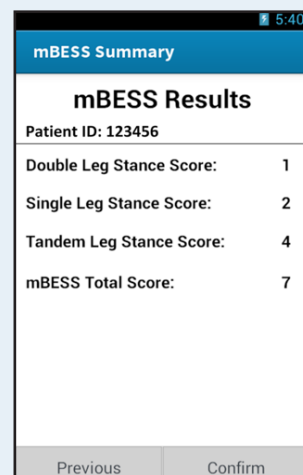
**Figure A3-26:**  
Example of a mBESS Review screen

From the **mBESS Results Review** (Figure A3-27) press **CONFIRM** to return to the **mBESS Current Test Detailed Results** (Figure A3-25).

From **mBESS Current Test Detailed Results** (Figure A3-25) a new test can be started.

Press **NEW TEST** to begin the mBESS test sequence beginning with the **mBESS Firm Double Leg**.

For instructions on completing a new mBESS test refer to the sections above.



mBESS Summary	
<b>mBESS Results</b>	
Patient ID: 123456	
Double Leg Stance Score:	1
Single Leg Stance Score:	2
Tandem Leg Stance Score:	4
mBESS Total Score:	7
Previous	Confirm

**Figure A3-27:**  
Example of a mBESS Results screen

## Previous Test Tab

Results from previous mBESS testing dates and times can be reviewed from the **mBESS Previous Tests Detailed Results** by pressing the **PREVIOUS TESTS** tab (Figure A3-28).

The **mBESS Previous Tests Detailed Results** lists all tests recorded by test date, time and summary of errors (mBESS Total Score).

To view the **mBESS Assessment Summary** for all stances press the desired test from the "mBESS Tests List".

Once the test has been selected the **mBESS Previous Test Review** (Figure A3-29) will appear displaying the test results from each of the stances along with the mBESS Total Score.

For instructions on reviewing and starting a new test refer to the sections above.

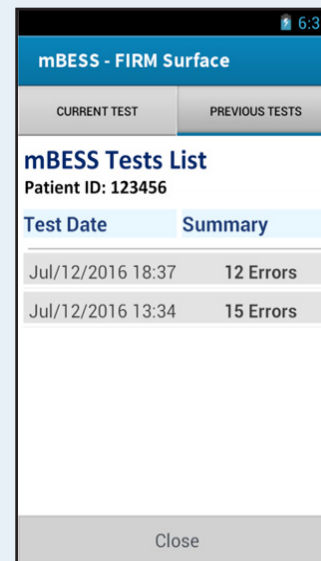


Figure A3-28:  
mBESS Tests List

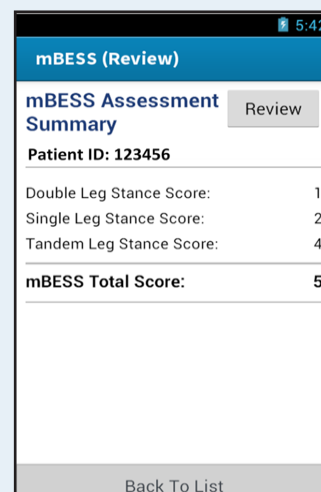


Figure A3-29:  
Example of a mBESS Results screen

## Appendix 4: Concussion Symptom Inventory (CSI)

The Concussion Symptom Inventory (CSI) is a derived symptom scale designed specifically for tracking recovery. Randolph<sup>3</sup> and colleagues analyzed a large set of data from existing scales obtained from three separate case-control studies. Through a series of analyses they eliminated overlapping items that were found to be insensitive to concussion. They collected baseline data from symptom checklists, including a total of 27 symptom variables from a total of 16,350 high school and college athletes. Follow-up data were obtained from 641 athletes who subsequently incurred a concussion. Symptom checklists were administered at baseline (pre-season), immediately post-concussion, postgame, and at 1, 3, and 5 days following injury. Effect-size analyses resulted in the retention of only 12 of the 27 variables. Receiver-operating characteristic analyses (non-parametric approach) were used to confirm that the reduction in items did not reduce sensitivity or specificity (area under the curve at day 1 post injury=0.867). Because the inventory has a limited set of symptoms, Randolph and colleagues note the need for a complete symptom inventory for other problems associated with concussion.

To begin the CSI from the **Information Hub**, press **START** (Figure A4-1) and the handheld will navigate to the **CSI Start** screen (Figure A4-2).

The date fields on the **CSI Start** screen will be pre-populated with the date of injury entered in the **Patient Information** screens and the current date.

The Name field on the **CSI Start** screen will be pre-populated with the patient name for the current session.

Press **START** to begin the assessment.

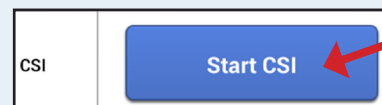


Figure A4-1:  
Start CSI Test

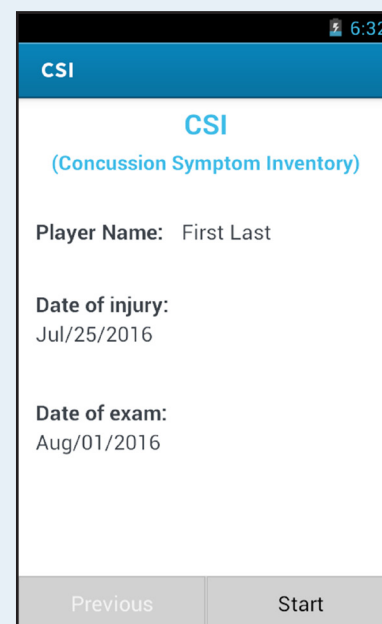


Figure A4-2:  
CSI Test Start Screen

<sup>3</sup>Randolph C, Millis S, Barr WB, McCrea M, Guskiewicz KM, Hammeke TA, Kelly JP. Concussion Symptom Inventory: An empirically-derived scale for monitoring resolution of symptoms following sports-related concussion. Archives of Clinical Neuropsychology. 2009;24(3):219-229



The **CSI Symptoms 1 through 4** screens (Figures A4-3 through A4-6) will run through a series of symptoms, rating each symptom by severity on a scale of 0-6 with the following labels:

- 0 – “Absent”
- 1, 2 – “Mild”
- 3, 4 – “Moderate”
- 5, 6 – “Severe”

The **CSI Symptoms 1 through 4** screens will provide the following instructions to be read to the subject:

**“Specify the symptoms listed below using the provided scale.”**

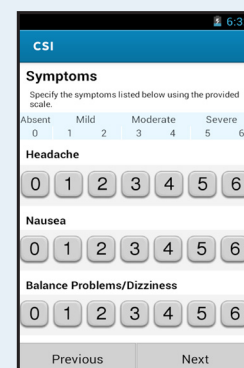
To record the subject's response, press the response number and move on to the next symptom. Repeat these steps for all of the symptoms on **CSI Symptoms 1 through 4** screens.



**NOTE:** If a button is inadvertently selected, select the button again to unselect.

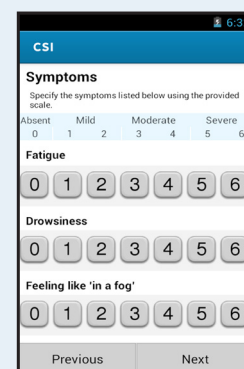
Press **NEXT** to navigate through the **CSI Symptoms** screens.

At any time, press **PREVIOUS** to navigate to the previous screen.



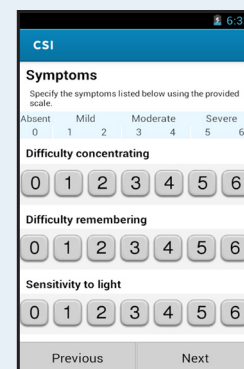
The screen displays the 'CSI Symptoms' title and a scale from 0 to 6. The symptoms listed are Headache, Nausea, and Balance Problems/Dizziness. Each symptom has a row of buttons labeled 0 through 6.

Figure A4-3



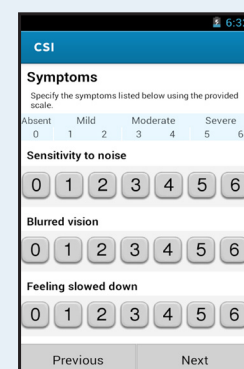
The screen displays the 'CSI Symptoms' title and a scale from 0 to 6. The symptoms listed are Fatigue, Drowsiness, and Feeling like 'in a fog'. Each symptom has a row of buttons labeled 0 through 6.

Figure A4-4



The screen displays the 'CSI Symptoms' title and a scale from 0 to 6. The symptoms listed are Difficulty concentrating, Difficulty remembering, and Sensitivity to light. Each symptom has a row of buttons labeled 0 through 6.

Figure A4-5



The screen displays the 'CSI Symptoms' title and a scale from 0 to 6. The symptoms listed are Sensitivity to noise, Blurred vision, and Feeling slowed down. Each symptom has a row of buttons labeled 0 through 6.

Figure A4-6

Once the last response has been recorded, press **NEXT** to advance to the **CSI Results** (Figure A4-7) to view the results.

The CSI results are displayed next to “Total Symptoms”. The results are calculated by adding up the recorded numbers for each symptom.

In the **CSI Results** screen, the operator can record additional symptoms if the subject may have experienced any that are not listed in the previous screens.

## CSI Detailed Results

Detailed results on current and previous CSI tests are stored in the database and can be accessed from the **Information Hub** screen.

Once a CSI test session has been completed the CSI total score will replace the **START** button next to the CSI test on the **Information Hub** (Figure A4-8).



**NOTE:** The **CSI Detailed Results** will default to view the **CURRENT TEST** tab.

## Current Test Tab

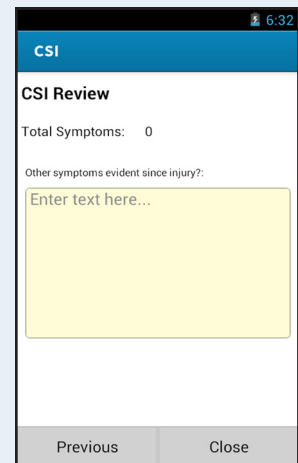
The **CSI Current Test Detailed Results** (Figure A4-9) contains two options to select from:

- Review – access all entered symptom scores
- New Test – start a new test

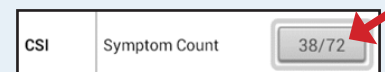


**NOTE:** While reviewing patient information the screen header will contain “Review” to inform the operator that they are currently in review mode.

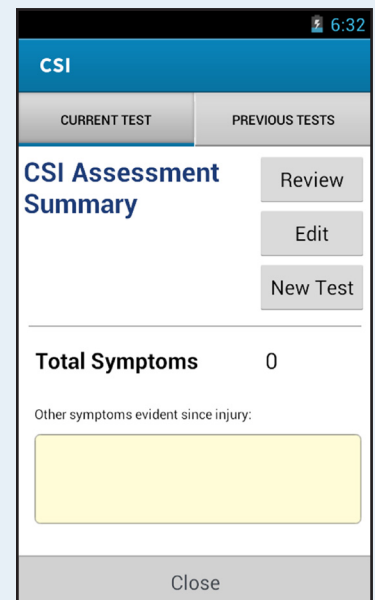
The **CSI Review** screens will appear in exact order of the testing sequence.



**Figure A4-7:**  
**CSI Summary of Results**



**Figure A4-8:**  
**CSI results area from the Information Hub**



**Figure A4-9:**  
**Current Test Detailed Results**

Press the **REVIEW** button to enter **CSI Review**. An example of a **CSI Review** screen is shown in Figure A4-10.

From the **CSI Results Review** (Figure A4-11) press **CONFIRM** to return to the **CSI Current Test Detailed Results** (Figure A4-9).

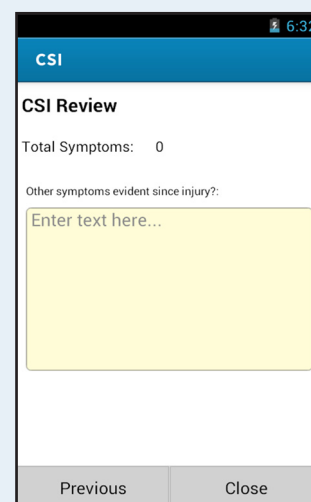
From the **CSI Current Test Detailed Results** (Figure A4-9) a new test can be started.

Press **NEW TEST** to begin the CSI test.

For instructions on completing a new CSI test refer to the sections above.



**Figure A4-10:**  
Example of a CSI Review screen



**Figure A4-11:**  
Example of a CSI Results screen

## Previous Test Tab

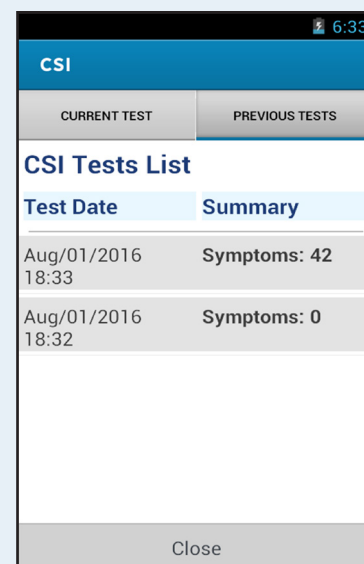
Results from previous CSI test can be reviewed from the **CSI Previous Tests Detailed Results** (Figure A4-12) by pressing the **PREVIOUS TESTS** tab.

The **CSI Previous Tests Detailed Results** lists all tests recorded by test date, time and summary of symptoms.

To view the CSI Assessment Summaries, press the desired test from the "CSI Tests List".

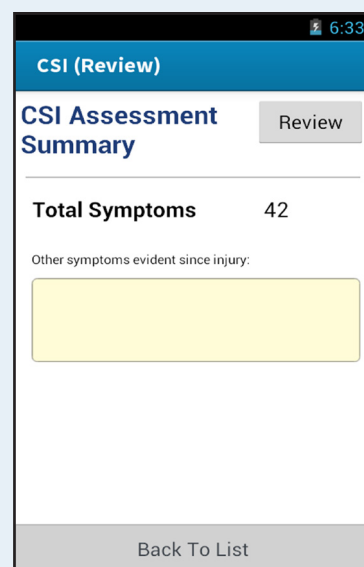
Once the test has been selected the **CSI Previous Test Review** (Figure A4-13) will appear displaying the test results.

For instructions on reviewing and starting a new test refer to the sections above.



CSI	
CURRENT TEST	
PREVIOUS TESTS	
<b>CSI Tests List</b>	
Test Date	Summary
Aug/01/2016 18:33	Symptoms: 42
Aug/01/2016 18:32	Symptoms: 0
Close	

**Figure A4-12:**  
**CSI Tests List**



CSI (Review)	
CSI Assessment Summary	
Review	
Total Symptoms	42
Other symptoms evident since injury:	
Back To List	

**Figure A4-13:**  
**CSI Previous Test Review**

## Appendix 5: Graded Symptom Checklist (GSC)

The Graded Symptom Checklist (GSC) is a self-report measure of concussion symptoms derived from the longer Head Injury Scale<sup>4</sup>. The symptoms are rated on their severity. The evidence is much stronger to support the use of such self-report symptom measures in youth ages 13 and older. Test-retest reliability has not been reported, but a three factor solution (cognitive, somatic, neurobehavioral) has been reported, although a better solution contained only nine items<sup>5</sup>. Evidence of convergent validity includes parallel recovery on the GSC and measures of balance and neurocognitive function and correlation with the presence of posttraumatic headaches<sup>6,7</sup>, and discriminant validity between higher and lower impact force<sup>8</sup>.

To begin the GSC from the **Information Hub**, press **START** (Figure A5-1) and the handheld will navigate to the **GSC Start** screen (Figure A5-2).

The Date fields on the **GSC Start** screen will be pre-populated with the date of injury entered in the **Patient Information** screens and the current date.

The Name field on the **GSC Start** screen will be pre-populated with the patient name for the current session.

Press **START** to advance to the **GSC Note**.

Prior to starting the GSC test, the operator should review the **GSC Note**. The **GSC Note** will contain the following information for the operator:

**Evaluate all signs and symptoms, ranking each on a scale of 0-6.**  
**Establish baseline score prior to the start of the athletic season.**  
**After a concussive injury, re-assess the athlete for each symptom.**  
**Add columns and compare to baseline score. Only consider return to activity if scores are comparable to baseline score.**  
**Continue testing every 2-3 days if symptoms do not resolve. Use with SAC and/or BESS to determine appropriate time for return to play.**

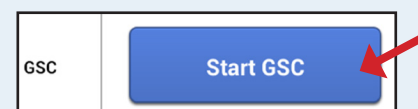


Figure A5-1:  
Start GSC Test

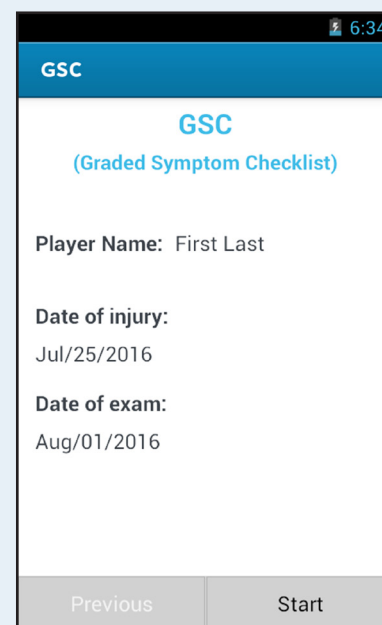


Figure A5-2:  
GSC Test Start Screen

<sup>4</sup> Janusz JA, Sady MD, Gioia GA. Postconcussion symptom assessment. In: Kirkwood MW, Yeates KO, editors. In Mild Traumatic Brain Injury in Children and Adolescents: From Basic Science to Clinical Management. New York: Guilford Press;2012. pp. 241-263.

<sup>5</sup> Piland SG, Motl RW, Guskiewicz KM, McCrea M, Ferrara MS. Structural validity of a self-report concussion-related symptom scale. Medicine and Science in Sports and Exercise. 2006;38(1):27-32.

<sup>6</sup> McCrea M, et al. Acute effects and recovery time following concussion in collegiate football players: The NCAA Concussion Study. JAMA. 2003;290(19):2556-2563.

<sup>7</sup> Register-Mihalik J, et al. The effects of headache on clinical measures of neurocognitive function. Clinical Journal of Sport Medicine. 2007;17(4):282-288.

<sup>8</sup> McCaffrey MA, et al. Measurement of head impacts in collegiate football players: Clinical measures of concussion after high- and low-magnitude impacts. Neurosurgery. 2007;61(6):1236-1243.

From the **GSC Note** press **NEXT** to begin the **GSC Exam** (Figure A5-3)  
On the **GSC Exam** screen select the type of exam for the current session. The following options are available to choose from:

- Preseason Baseline
- Time of Injury
- 24 Hours Post-Injury
- Day 3 Post-Injury
- Day 4 Post-Injury
- Day 5 Post-Injury

Press **NEXT** to begin recording the GSC symptoms.

The **GSC Symptoms 1 through 9** screens (an example of the GSC Symptoms screen is shown in Figure A5-4) will provide the following instructions to be read to the subject after each symptom:

**"Score according to severity"**

For each symptom the severity of the symptom is based on a scale of 0 to 6 following the below labels:

- 0, 1 – "None"
- 2, 3, 4 – "Moderate"
- 5, 6 – "Severe"

To record the subject's response, press the number they provided and move on to the next symptom.

Repeat these steps for all of the symptoms on **GSC Symptoms 1 through 9** screens.



**NOTE:** If a button is inadvertently selected, select the button again to unselect.

Press **NEXT** to navigate through the **GSC Symptoms** screens.

At any time, press **PREVIOUS** to navigate to the previous screen.

The screenshot shows the 'GSC' screen with a list of exam types and buttons to select them. The status bar at the top shows the time as 6:34.

Exam Type	Button
Preseason Baseline	[Button]
Time of injury	[Button]
24 Hours Post-Injury	[Button]
Day 3 Post-Injury	[Button]
Day 4 Post-Injury	[Button]
Day 5 Post-Injury	[Button]

At the bottom, there are 'Previous' and 'Next' buttons.

**Figure A5-3:**  
**Selecting the Type of Exam**

The screenshot shows the 'GSC Symptoms' screen. It includes a table for 'Score According to Severity' and input fields for 'Blurred Vision', 'Dizziness', and 'Drowsiness'. The status bar at the top shows the time as 6:34.

None		Moderate			Severe	
0	1	2	3	4	5	6
Blurred Vision						
[0]	[1]	[2]	[3]	[4]	[5]	[6]
Dizziness						
[0]	[1]	[2]	[3]	[4]	[5]	[6]
Drowsiness						
[0]	[1]	[2]	[3]	[4]	[5]	[6]

At the bottom, there are 'Previous' and 'Next' buttons.

**Figure A5-4:**  
**Example of the GSC Symptoms screens**

Once the last response has been recorded press **NEXT** to advance to the **GSC Results** screen to review how many symptoms were recorded.

## GSC Detailed Results

Detailed results on current and previous GSC tests are stored in the database and can be accessed from the **Information Hub**. In the detailed results screens the operator can review all GSC tests recorded and start a new test.

To access the **GSC Detailed Results**, press the GSC score (Figure A5-6) from the **Information Hub**.



**NOTE:** The **GSC Detailed Results** will default to view the **CURRENT TEST** tab.

### Current Test Tab

The **GSC Current Test Detailed Results** (Figure A5-7) contains two options to select from:

- Review – access all entered symptom severity scores
- New Test – start a new test



**NOTE:** While reviewing patient information the screen header will contain “Review” to inform the operator that they are currently in review mode.

The **GSC Review** screens will appear in the exact order of the testing sequence.

**Figure A5-5:**  
**GSC Summary of Results**

**Figure A5-6:**  
**GSC results area from the**  
**Information Hub**

**Figure A5-7:**  
**Current Test Detailed Results**



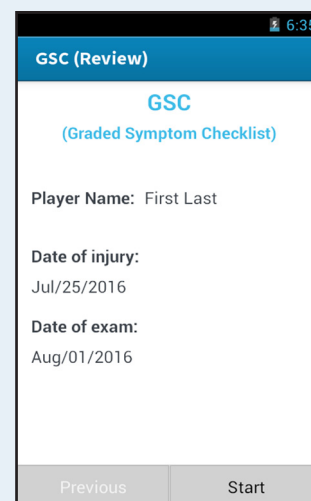
Press the **REVIEW** button to enter **GSC Review**. An example of a **GSC Review** screen is shown in Figure A5-8.

From the **GSC Results Review** (Figure A5-9) press **CONFIRM** to return to the **GSC Current Test Detailed Results** (Figure A5-7).

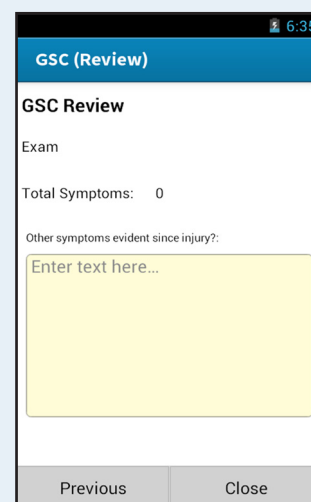
From the **GSC Current Test Detailed Results** (Figure A5-7) a new test can be started.

Press **NEW TEST** to begin the GSC test.

For instructions on completing a new GSC test refer to the sections above.



**Figure A5-8:**  
Example of a GSC Review screen



**Figure A5-9:**  
Example of a GSC Results screen

## Previous Test Tab

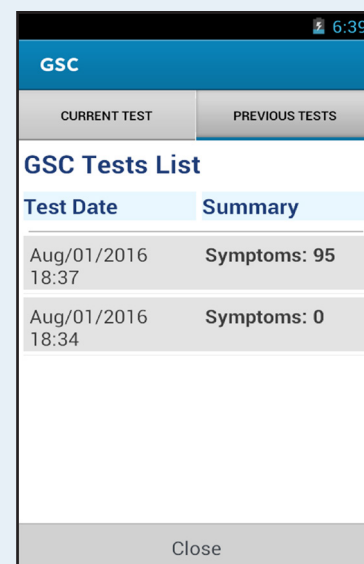
Results from previous GSC tests can be reviewed from the **GSC Previous Tests Detailed Results** (Figure A5-10) by pressing **PREVIOUS TESTS** tab.

The **GSC Previous Tests Detailed Results** lists all tests recorded by test date, time and summary of symptoms.

To view the GSC Assessment Summaries, press the desired test from the "GSC Tests List".

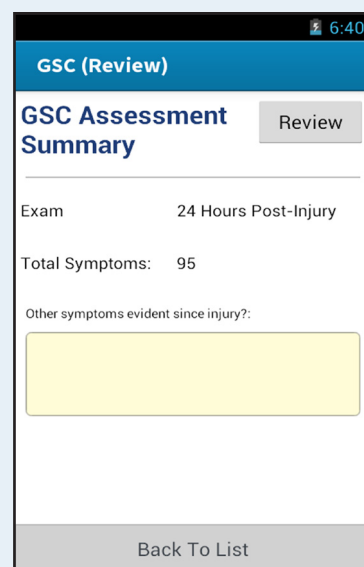
Once the test has been selected the **GSC Previous Test Review** (Figure A5-11) will appear displaying the test results.

For instructions on reviewing, editing and starting a new test refer to the sections above.



Test Date	Summary
Aug/01/2016 18:37	Symptoms: 95
Aug/01/2016 18:34	Symptoms: 0

**Figure A5-10:**  
**GSC Tests List**



Exam 24 Hours Post-Injury

Total Symptoms: 95

Other symptoms evident since injury?:

Back To List

**Figure A5-11:**  
**GSC Previous Test Review**

## Appendix 6: Sports Concussion Assessment Tool – 3rd Edition (SCAT3)

The Sport Concussion Assessment Tool 3 (SCAT3) is a concussion evaluation tool designed for individuals 13 years and older. Due to its demonstrated utility, the SAC has been incorporated into this tool, which also includes the GCS, modified SCAT3 questions<sup>9</sup>, a neck evaluation and balance assessment, and a yes/no symptom checklist as well as information on the mechanism of injury and background information, including learning disabilities, attention deficit hyperactivity disorder, and history of concussion, headaches, migraines, depression, and anxiety.<sup>10</sup> The precursor SCAT2 had been standardized as an easy-to-use tool with adequate psychometric properties for identifying concussions within the first 7 days.<sup>11</sup> The SCAT3 was developed from the original SCAT to help in making return-to-play decisions.<sup>12,13</sup> This concussion evaluation tool can be used on the sideline or in the health care provider's office. The SCAT3 takes approximately 15 to 20 minutes to complete.

Because the SCAT3 was recently published<sup>14</sup>, normative data and concussion cutoff scores are not yet available. However, a recent study to determine baseline values of the SCAT2 in normal male and female high school athletes found a high error rate on the concentration portion of the assessment in non-concussed athletes, suggesting the need for baseline testing in order to understand post-injury results<sup>15</sup>. The study also showed significant sex differences, with females scoring higher on the balance, immediate memory, and concentration components of the assessment.

Findings similar to those of Jinguji and colleagues<sup>16</sup> were reported in a study of youth ice hockey players who demonstrated an average total score of 86.9 out of 100 points.<sup>17</sup> In the largest assessment of the SAC/SCAT2, Valovich McLeod and colleagues (2012) assessed 1,134 high school students. Male high school athletes and male and female ninth graders were found to have significantly lower SAC and total SCAT2 scores than did female athletes and upperclassmen, respectively (Valovich McLeod et al., 2012). A self-reported history of previous concussion did not have a significant effect on SAC scores, but it did affect the symptom and total SCAT2 scores. The authors recommended baseline assessments in order to understand post-injury results for individual athletes. Schneider and colleagues<sup>18</sup> tested more than 4,000 youth hockey players with the original SCAT and reported baseline scores showing absolute differences with age and sex. However, because no parametric statistics were provided, the significance of the observed differences is not known.

<sup>9</sup> SCAT3 DL, Dicker GD, Saling MM. The assessment of orientation following concussion in athletes. *Clinical Journal of Sport Medicine*. 1995;5(1):32–33.

<sup>10</sup> McCrory P, et al. SCAT3. *British Journal of Sports Medicine*. 2013c;47(5):259–262.

<sup>11</sup> Barr WB, McCrea M. Sensitivity and specificity of standardized neurocognitive testing immediately following sports concussion. *Journal of the International Neuropsychological Society*. 2001;7(6):693–702.

<sup>12</sup> McCrory P, et al. Consensus statement on concussion in sport: The 3rd International Conference on Concussion in Sport held in Zurich, November 2008. *British Journal of Sports Medicine*. 2009;43(Suppl 1):i76–i84.

<sup>13</sup> McCrory P, et al. Consensus statement on concussion in sport: The 4th International Conference on Concussion in Sport held in Zurich, November 2012. *British Journal of Sports Medicine*. 2013b;47(5):250–258.

<sup>14</sup> McCrory P, et al. Child-SCAT3. *British Journal of Sports Medicine*. 2013a;47(5):263–266.

<sup>15</sup> Jinguji TM, et al. Sport Concussion Assessment Tool-2: Baseline values for high school athletes. *British Journal of Sports Medicine*. 2012;46(5):365–370.

<sup>16</sup> Valovich McLeod TC, et al. Representative baseline values on the Sport Concussion Assessment Tool 2 (SCAT2) in adolescent athletes vary by gender, grade, and concussion history. *American Journal of Sports Medicine*. 2012;40(4):927–933.

<sup>17</sup> Blake TA, et al. Sport Concussion Assessment Tool, Version 2, normative values and test-retest reliability in elite youth ice hockey. [Abstract.] *Clinical Journal of Sport Medicine*. 2012;22(3):307.

<sup>18</sup> Schneider KJ, et al. Examining Sport Concussion Assessment Tool ratings for male and female youth hockey players with and without a history of concussion. *British Journal of Sports Medicine*. 2010;44(15):1112–1117.

## INSTRUCTIONS

Words in *italics* throughout the SCAT3 are the instructions given to the athlete by the tester.

### Symptom Scale

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

To be completed by the athlete. In situations where the symptom scale is being completed after exercise, it should still be done in a resting state, at least 10 minutes post exercise.

For total number of symptoms, maximum possible is 22.

For Symptom severity score, add all scores in table, maximum possible is 22x6=132.

### SAC<sup>4</sup>

#### Immediate Memory

*"I am going to test your memory. I will read you a list of words and when I am done, repeat back as many words as you can remember, in any order."*

#### Trials 2 & 3:

*"I am going to repeat the same list again. Repeat back as many words as you can remember in any order, even if you said the word before."*

Complete all 3 trials regardless of score on trial 1 & 2. Read the words at a rate of one per second. **Score 1 pt. for each correct response.** Total score equals sum across all 3 trials. Do not inform the athlete that delayed recall will be tested.

#### Concentration

##### Digits backward

*"I am going to read you a string of numbers and when I am done, you repeat them back to me backwards, in reverse order of how I read them to you. For example, if I say 7-1-9, you would say 9-1-7."*

If correct, go to next string length. If incorrect, read trial 2. **One point possible for each string length.** Stop after incorrect on both trials. The digits should be read at the rate of one per second.

#### Months in reverse order

*"Now tell me the months of the year in reverse order. Start with the last month and go backward. So you'll say December, November ... Go ahead"*

**1 pt. for entire sequence correct**

#### Delayed Recall

The delayed recall should be performed after completion of the Balance and Coordination Examination.

*"Do you remember that list of words I read a few times earlier? Tell me as many words from the list as you can remember in any order."*

**Score 1 pt. for each correct response**

## Balance Examination

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

This balance testing is based on a modified version of the Balance Error Scoring System (BESS)<sup>6</sup>. A stopwatch or watch with a second hand is required for this testing.

*"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 three twenty second tests with different stances."*

#### (a) Double leg stance:

*"The first stance is standing with your feet together with your hands on your hips and with your eyes closed. You should try to maintain stability in that position for 20 seconds. I will be counting the number of times you move out of this position. I will start timing when you are set and have closed your eyes."*

#### (b) Single leg stance:

*"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. 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 hands on your hips and your eyes closed. I will be counting the number of times you move out of this position. If you stumble out of this position, open your eyes and return to the start position and continue balancing. I will start timing when you are set and have closed your eyes."*

#### (c) Tandem stance:

*"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 hands on your hips and your eyes closed. I will be counting the number of times you move out of this position. If you stumble out of this position, open your eyes and return to the start position and continue balancing. I will start timing when you are set and have closed your eyes."*

### 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

Each of the 20-second trials is scored by counting the errors, or deviations from the proper stance, accumulated by the athlete. The examiner will begin counting errors only after the individual has assumed the proper start position. **The modified BESS is calculated by adding one error point for each error during the three 20-second tests. The maximum total number of errors for any single condition is 10.** If a athlete commits multiple errors simultaneously, only one error is recorded but the athlete should quickly return to the testing position, and counting should resume once subject is set. Subjects that are unable to maintain the testing procedure for a minimum of **five seconds** at the start are assigned the highest possible score, ten, for that testing condition.

**OPTION:** For further assessment, the same 3 stances can be performed on a surface of medium density foam (e.g., approximately 50cm x 40cm x 6cm).

### Tandem Gait<sup>5,7</sup>

*Participants are instructed to stand with their feet together behind a starting line (the test is best done with footwear removed). Then, they walk in a forward direction as quickly and as accurately as possible along a 38mm wide (sports tape), 3 meter line with an alternate foot heel-to-toe gait ensuring that they approximate their heel and toe on each step. Once they cross the end of the 3m line, they turn 180 degrees and return to the starting point using the same gait. A total of 4 trials are done and the best time is retained. Athletes should complete the test in 14 seconds. Athletes fail the test if they step off the line, have a separation between their heel and toe, or if they touch or grab the examiner or an object. In this case, the time is not recorded and the trial repeated, if appropriate.*

## Coordination Examination

### Upper limb coordination

Finger-to-nose (FTN) task:

*"I am going to test your coordination now. Please sit comfortably on the chair with your eyes open and your arm (either right or left) outstretched (shoulder flexed to 90 degrees and elbow and fingers extended), pointing in front of you. When I give a start signal, I would like you to perform five successive finger to nose repetitions using your index finger to touch the tip of the nose, and then return to the starting position, as quickly and as accurately as possible."*

**Scoring: 5 correct repetitions in < 4 seconds = 1**

**Note for testers:** Athletes fail the test if they do not touch their nose, do not fully extend their elbow or do not perform five repetitions. **Failure should be scored as 0.**

## References & Footnotes

1. This tool has been developed by a group of international experts at the 4th International Consensus meeting on Concussion in Sport held in Zurich, Switzerland in November 2012. The full details of the conference outcomes and the authors of the tool are published in The BJSM Injury Prevention and Health Protection, 2013, Volume 47, Issue 5. The outcome paper will also be simultaneously co-published in other leading biomedical journals with the copyright held by the Concussion in Sport Group, to allow unrestricted distribution, providing no alterations are made.
2. McCrory P et al., Consensus Statement on Concussion in Sport – the 3rd International Conference on Concussion in Sport held in Zurich, November 2008. British Journal of Sports Medicine 2009; 43: i76-89.
3. Maddocks, DL; Dicker, GD; Saling, MM. The assessment of orientation following concussion in athletes. Clinical Journal of Sport Medicine. 1995; 5(1): 32–3.
4. McCrea M. Standardized mental status testing of acute concussion. Clinical Journal of Sport Medicine. 2001; 11: 176–181.
5. Guskiewicz KM. Assessment of postural stability following sport-related concussion. Current Sports Medicine Reports. 2003; 2: 24–30.
6. Schneiders, A.G., Sullivan, S.J., Gray, A., Hammond-Tooke, G. & McCrory, P. Normative values for 16-37 year old subjects for three clinical measures of motor performance used in the assessment of sports concussions. Journal of Science and Medicine in Sport. 2010; 13(2): 196–201.
7. Schneiders, A.G., Sullivan, S.J., Kvarnstrom, J.K., Olsson, M., Yden, T. & Marshall, S.W. The effect of footwear and sports-surface on dynamic neurological screening in sport-related concussion. Journal of Science and Medicine in Sport. 2010; 13(4): 382–386



## ATHLETE INFORMATION

Any athlete suspected of having a concussion should be removed from play, and then seek medical evaluation.

### Signs to watch for

Problems could arise over the first 24–48 hours. The athlete should not be left alone and must go to a hospital at once if they:

- Have a headache that gets worse
- Are very drowsy or can't be awakened
- Can't recognize people or places
- Have repeated vomiting
- Behave unusually or seem confused; are very irritable
- Have seizures (arms and legs jerk uncontrollably)
- Have weak or numb arms or legs
- Are unsteady on their feet; have slurred speech

Remember, it is better to be safe.

**Consult your doctor after a suspected concussion.**

[Return to play](#)

Athletes should not be returned to play the same day of injury.

When returning athletes to play, they should be **medically cleared and then follow a stepwise supervised program**, with stages of progression.

For example:

Rehabilitation stage	Functional exercise at each stage of rehabilitation	Objective of each stage
No activity	Physical and cognitive rest	Recovery
Light aerobic exercise	Walking, swimming or stationary cycling keeping intensity 70% maximum predicted heart rate. No resistance training	Increase heart rate
Sport-specific exercise	Skating drills in ice hockey, running drills in soccer. No head impact activities	Add movement
Non-contact training drills	Progression to more complex training drills, eg passing drills in football and ice hockey. May start progressive resistance training	Exercise, coordination, and cognitive load
Full contact practice	Following medical clearance participate in normal training activities	Restore confidence and assess functional skills by coaching staff
Return to play	Normal game play	

There should be at least 24 hours (or longer) for each stage and if symptoms recur the athlete should rest until they resolve once again and then resume the program at the previous asymptomatic stage. Resistance training should only be added in the later stages.

If the athlete is symptomatic for more than 10 days, then consultation by a medical practitioner who is expert in the management of concussion, is recommended.

**Medical clearance should be given before return to play.**

## CONCUSSION INJURY ADVICE

(To be given to the **person monitoring** the concussed athlete)

This patient has received an injury to the head. A careful medical examination has been carried out and no sign of any serious complications has been found. Recovery time is variable across individuals and the patient will need monitoring for a further period by a responsible adult. Your treating physician will provide guidance as to this timeframe.

If you notice any change in behaviour, vomiting, dizziness, worsening headache, double vision or excessive drowsiness, please contact your doctor or the nearest hospital emergency department immediately.

Other important points:

- Rest (physically and mentally), including training or playing sports until symptoms resolve and you are medically cleared
  - No alcohol
  - No prescription or non-prescription drugs without medical supervision.
- Specifically:
- No sleeping tablets
  - Do not use aspirin, anti-inflammatory medication or sedating pain killers
- Do not drive until medically cleared
  - Do not train or play sport until medically cleared

Clinic phone number

### Scoring Summary:

Test Domain	Score		
	Date: _____	Date: _____	Date: _____
Number of Symptoms of 22			
Symptom Severity Score of 132			
Orientation of 5			
Immediate Memory of 15			
Concentration of 5			
Delayed Recall of 5			
<b>SAC Total</b>			
BESS (total errors)			
Tandem Gait (seconds)			
Coordination of 1			

**Notes:**

Patient's name \_\_\_\_\_

Date/time of injury

Date/time of medical review \_\_\_\_\_

Treating physician \_\_\_\_\_

Contact details or stamp

There are two versions of the SCAT3 available with the BrainScope One:

- SCAT3 Sideline Assessment
- SCAT3 Full Assessment

The SCAT3 Full Assessment test sequence will be available after the SCAT3 Sideline Assessment test sequence.

The version in Figure A6-2 appears when the operator has completed the sideline assessment.

To begin the SCAT3 from the **Information Hub**, determine which version of the SCAT3 is available.

Press **START** (Figure A6-1 or A6-2) next to the appropriate assessment and the handheld will navigate to **SCAT3 Start** (Figure A6-3 or A6-4).

Figure A6-3 is **SCAT3 Start** when **START** has been selected before the Sideline Assessment has been completed.

Figure A6-4 is **SCAT3 Start** when **START** has been selected after the Sideline Assessment has been completed.

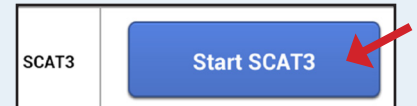


**NOTE:** Scoring on the SCAT3 should not be used as a stand-alone method to diagnose concussion, measure recovery or make decisions about an athlete's readiness to return to competition after concussion. Since signs and symptoms may evolve over time, it is important to consider repeat evaluation in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

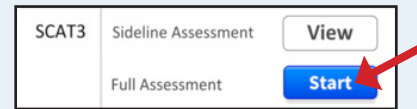
The "Date" fields on **SCAT3 Start** will be pre-populated with the date of injury entered in **Patient Information** and the current date.

The "Examiner" and "Name" on **SCAT3 Start** will be pre-populated with the operator name and patient name for the current session.

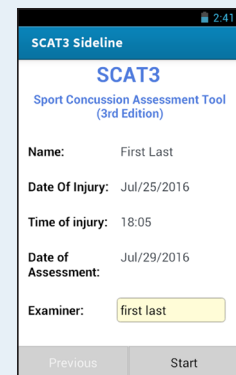
Press **START** on Figure A6-3 to navigate to the **SCAT3 Sideline Assessment Introduction**.



**Figure A6-1:**  
**SCAT3 Start**



**Figure A6-2:**  
**Start SCAT3 -Sideline and Full Assessment (Sideline completed, Full Assessment ready to start)**



**Figure A6-3:**  
**Start SCAT3 - Sideline Assessment**



**Figure A6-4:**  
**Start SCAT3 - Sideline Assessment Completed**

The **SCAT3 Sideline Assessment Introduction** provides the following note:

**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

Press **NEXT** to navigate to **SCAT3 Signs of Concussion 1 of 7**.

The **SCAT3 Signs of Concussion 1 through 7** screens contain a series of questions to identify the potential signs of a concussion. The questions will cover the following signs:

- Loss of consciousness and the duration of the loss of consciousness
- Balance or motor incoordination
- Disorientation or confusion
- Loss of memory
- Blank or vacant look
- Visible facial injury in combination with any of the above

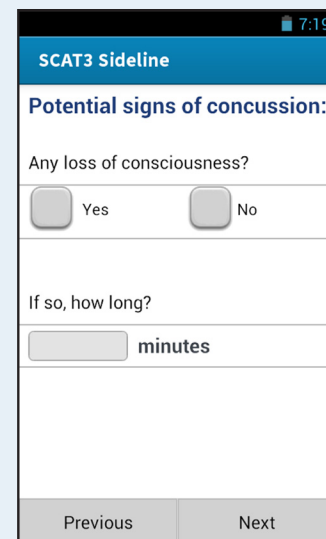
An example of a **SCAT3 Signs of Concussion Screen** is shown in Figure A6-5.

Prior to beginning the SCAT3 Signs of Concussion questions the **SCAT3 Signs of Concussion 1** will display the following information for the operator to consider as they go through the questions:

**If any one 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.**

Press **NEXT** to navigate through the **SCAT3 Signs of Concussion** screens.

At any time press **PREVIOUS** to navigate to the previous screen.



**Figure A6-5:**  
**Example of a SCAT3 Signs of Concussion screen**



On the **SCAT3 Signs of Concussion 7** press **NEXT** to navigate to the Glasgow Coma Scale (GCS) series of questions (Figure A6-6).

**SCAT3 GCS** (Figure A6-6) contains three drop-down menus to record responses for the following:

- Best eye response (E)
- Best verbal response (V)
- Best motor response (M)

For Best eye response (E) the following options are available to select from in the drop-down menu:

- 1 – No eye opening
- 2 – Eye opening in response to pain
- 3 – Eye opening to speech
- 4 – Eye opening spontaneously

For Best verbal response (V) the following options are available to select from in the drop-down menu:

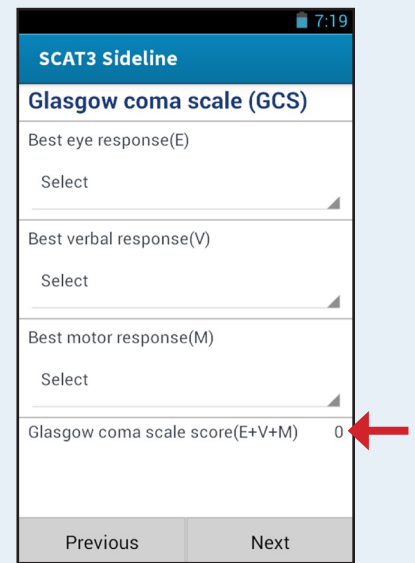
- 1 – No verbal response
- 2 – Incomprehensible sounds
- 3 – Inappropriate words
- 4 – Confused
- 5 – Oriented

For Best motor response (M) the following options are available to select from in the drop-down menu:

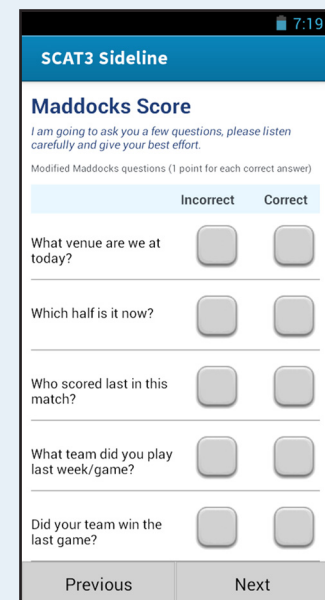
- 1 – No motor response
- 2 – Extension to pain
- 3 – Abnormal flexion to pain
- 4 – Flexion/Withdrawal to pain
- 5 – Localizes to pain
- 6 – Obeys commands

Once the options for each response have been recorded the **SCAT3 GCS** will display the Glasgow Coma Scale score (E+V+M) at the bottom of the screen (Figure A6-6).

Press **NEXT** to navigate to the **Maddocks Score** (Figure A6-7).



**Figure A6-6:**  
**SCAT3 GCS Questions**



**Figure A6-7:**  
**Maddocks Score**

The **SCAT3 Maddocks Score** screen (Figure A6-7) will provide the following instructions to be read to the subject:

**I am going to ask you a few questions, please listen carefully and give your best effort.**



**NOTE:** SCAT3 Maddocks Score (1 point for each correct answer)

To record the subject's response press either **INCORRECT** or **CORRECT** to the answer they provided and move on to the next question. Repeat these steps for all questions on the **SCAT3 Maddocks Score**.

Press **NEXT** to navigate to the **SCAT3 Notes** (Figure A6-8).

The **SCAT3 Notes** contains a text entry field to record the mechanism of the injury as reported by the subject.

Press **NEXT** to navigate to the **SCAT3 Sideline Assessment Summary**.

The **SCAT3 Sideline Assessment Summary** (Figure A6-9) contains a summary of the responses recorded from the Signs of Concussion, GCS and Maddocks Score.

Press **CONFIRM** to navigate to the **Information Hub** screen. If the SCAT3 Sideline Assessment was completed previously, the **Information Hub** will display Figure A6-2. Select **START** to advance to the **SCAT3 Full Start** (Figure A6-4).

**Figure A6-8:**  
**SCAT3 Notes**

**Figure A6-9:**  
**SCAT3 Sideline Assessment Summary**

**SCAT3 Background 1 and 2** screens (Figure A6-10 shows example of one of the screens) will allow the operator to record background on previous concussions, headaches, learning disabilities, psychiatric disorders and medications.

After completing the background section of the SCAT3 press **NEXT** to navigate to the **SCAT3 Symptoms** screens.

The **SCAT3 Symptoms 1 through 7** screens (Figure A6-11 shows an example of one of the screens) will run through a series of symptoms comparing the symptoms to before the accident and rating each symptom by severity on a scale of 0-6 with the following labels:

- 0 – Absent
- 1, 2 – Mild
- 3, 4 – Moderate
- 5, 6 – Severe

**SCAT3 Symptoms 1 through 7** screens will contain the following instructions for the operator to read to the subject:

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

Once the last response has been recorded press **NEXT** to advance to the **SCAT3 Symptoms Summary** (Figure A6-12).

The **SCAT3 Symptoms Summary** will display the total number of symptoms recorded and the symptom severity score.

The **SCAT3 Symptom Summary** allows for the operator to answer two questions to record whether the symptoms get worse with physical or mental activity.

The **SCAT3 Symptom Summary** allows for the operator to identify how the symptoms were observed:

- self rated
- self rated and clinician monitored
- clinician interview
- self rated with parent input

Press **NEXT** to navigate to the **SCAT3 Overall Rating** screen.

**Figure A6-10:**  
**SCAT3 Background**

**Figure A6-11:**  
**SCAT3 Symptoms**

**Figure A6-12:**  
**SCAT3 Symptoms Summary**

The **SCAT3 Overall Rating** (Figure A6-13) allows the operator to record an overall rating of the subject by asking the following question:

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

Press **NEXT** to navigate to the SCAT3 Cognitive and Physical Evaluation sections.

The first part of the SCAT3 Cognitive and Physical Evaluation includes a cognitive assessment of the following areas:

- Orientation
- Immediate Memory
- Concentration

The **SCAT3 Orientation** (Figure A6-14) consists of a series of questions to determine the subject’s ability to identify time accurately.

The **SCAT3 Immediate Memory 1** will contain the following instructions for the operator to read to the subject:

**“I am going to test your memory. I will read you a list of words and when I am done, repeat back as many words as you can remember, in any order.**

**Trials 2 & 3: I am going to repeat that list again. Repeat back as many words as you can remember in any order, even if you said the word before.”**



**NOTE:** Complete all 3 trials regardless of score on trial 1 & 2. 1 pt. for each correct response. Total score equals sum across all 3 trials. Do not inform the subject that delayed recall will be tested.

Press **NEXT** to navigate to the **SCAT3 Immediate Memory 2** (Figure A6-15). The **SCAT3 Immediate Memory 2** will navigate to Trial 1 of 3.

**Figure A6-13:**  
**SCAT3 Overall Rating**

**Figure A6-14:**  
**SCAT3 Orientation**

The **SCAT3 Immediate Memory 2** (Figure A6-15) contains five pairs (ten total) of checkboxes, with each pair displayed next to a test word defined by the selected list.

On the **SCAT3 Immediate Memory 2**, press **SWAP** to switch to a different list. The current list will be displayed next to the **SWAP** button; e.g. "List A", "List B" or "List C". Each time **SWAP** is selected, the display for the List column title shall cycle from "List A" through "List D", and then back to "List A".

The **SCAT3 Immediate Memory 2** shall use the test words for each list as defined in the table below:

List Name	Ordered Test Words
List A	Elbow, Apple, Carpet, Saddle, Bubble
List B	Candle, Paper, Sugar, Sandwich, Wagon
List C	Baby, Monkey, Perfume, Sunset, Iron
List D	Finger, Penny, Blanket, Lemon, Insect

The **SCAT3 Immediate Memory 3** navigates to Trial 2 of 3 and **SCAT3 Immediate Memory 4** navigates to Trial 3 of 3.

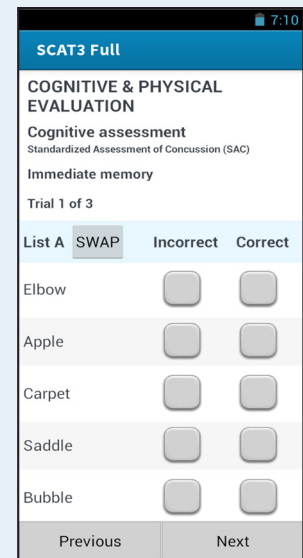
Once the Trials have been completed press **NEXT** to navigate to the **SCAT3 Concentration**.

The **SCAT3 Concentration 1** will contain the following instructions for the operator to read to the subject.

**"Digits Backward: I am going to read you a string of numbers and when I am done, you repeat them back to me backwards, in reverse order of how I read them to you. For example, if I say 7-1-9, you would say 9-1-7"**



**NOTE:** If subject answers correctly, go to next string length. If incorrect, read trial 2. 1 pt. possible for each string length. Stop after incorrect on both trials. The digits should be read at the rate of one per second.



**Figure A6-15:**  
**SCAT3 Immediate Memory**  
**Trial 1 of 3**

The **SCAT3 Concentration 2** (Figure A6-16) will contain columns for "Trial 1," "Trial 2" and the answer ("Incorrect" or "Correct").

The **SCAT3 Concentration 2** shall use the test numbers for each list as defined in the table below:

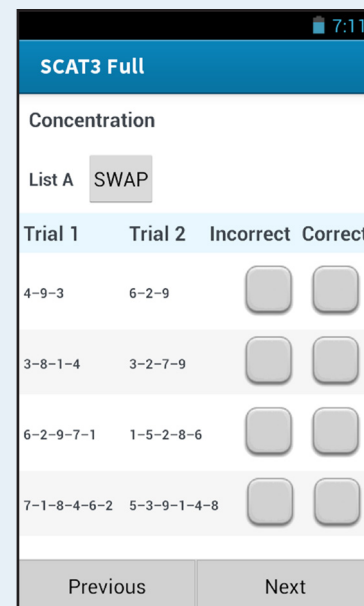
List	Trial 1	Trial 2
List A	4-9-3, 3-8-1-4, 6-2-9-7-1, 7-1-8-4-6-2	6-2-9, 3-2-7-9, 1-5-2-8-6, 5-3-9-1-4-8
List B	5-2-6, 1-7-9-5, 3-8-5-2-7, 8-3-1-9-6-4	4-1-5, 4-9-6-8, 6-1-8-4-3, 7-2-7-8-5-6

Press **NEXT** to navigate to **SCAT3 Concentration 3**.

**SCAT3 Concentration 3** (Figure A6-17) contains the following information to be read by the operator to the subject:

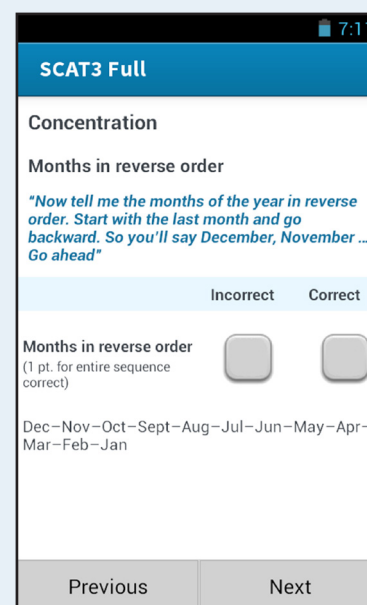
**"Months in Reverse Order: Now tell me the months of the year in reverse order. Start with the last month and go backward. So you'll say December, November...Go ahead."**

Press **NEXT** to navigate to the **SCAT3 Neck** assessment.



Trial 1	Trial 2	Incorrect	Correct
4-9-3	6-2-9	<input type="button" value="Incorrect"/>	<input type="button" value="Correct"/>
3-8-1-4	3-2-7-9	<input type="button" value="Incorrect"/>	<input type="button" value="Correct"/>
6-2-9-7-1	1-5-2-8-6	<input type="button" value="Incorrect"/>	<input type="button" value="Correct"/>
7-1-8-4-6-2	5-3-9-1-4-8	<input type="button" value="Incorrect"/>	<input type="button" value="Correct"/>

**Figure A6-16:**  
**SCAT3 Concentration Number Testing**



Months in reverse order (1 pt. for entire sequence correct)	Incorrect	Correct
Dec-Nov-Oct-Sept-Aug-Jul-Jun-May-Apr-Mar-Feb-Jan	<input type="button" value="Incorrect"/>	<input type="button" value="Correct"/>

**Figure A6-17:**  
**SCAT3 Concentration Months Testing**

The **SCAT3 Neck** (Figure A6-18) allows the operator to record findings from a neck examination. Range of motion, tenderness and upper and lower limb sensation and strength can be recorded on the **SCAT3 Neck**.

Press **NEXT** to navigate to **SCAT3 Balance 1**.

The **SCAT3 Balance 1** (Figure A6-20) instructs the operator to perform a balance examination by doing one or both of the following tests:

1. mBESS
2. Tandem Gait

On the **SCAT3 Balance 1** record what type of footwear was used during the test(s).

Press **NEXT** to navigate to **SCAT3 Balance 2**.

**SCAT3 Balance 2** begins the testing sequence for the mBESS balance examination.

**SCAT3 Balance 2** allows the operator to record what foot is being tested and the testing surface of the mBESS.

Press **NEXT** to navigate to **SCAT3 Balance 3**.

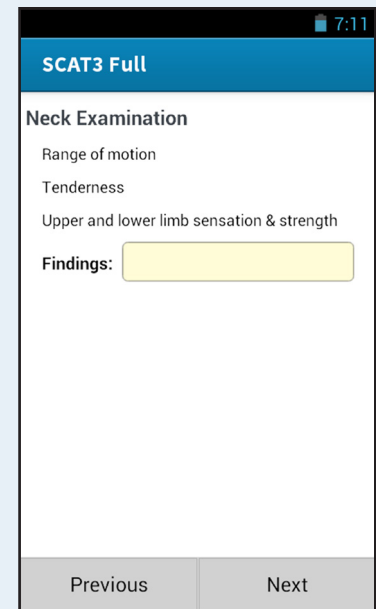
At any time press **PREVIOUS** to navigate to the previous screen.

Prior to starting the test on **SCAT3 Balance 3**, the Operator will provide the following instructions to the subject:

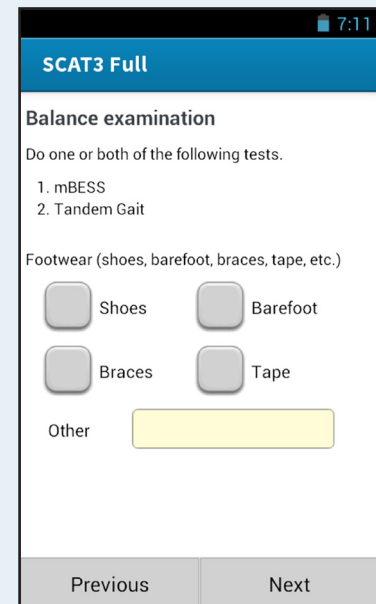
**I am now going to test your balance. Please take your shoes off, roll up your pant legs above ankle (if applicable), and remove any ankle taping (if applicable). This test will consist of three twenty second tests with different stances**



**NOTE:** Each of the 20-second trials is scored by counting the errors, or deviations from the proper stance, accumulated by the athlete. The examiner will begin counting errors only after the individual has assumed the proper start position. **The mBESS is calculated by adding one error point for each error during the three 20-second tests. The maximum total number of errors for any single condition is 10.** If an athlete commits multiple errors simultaneously, only one error is recorded but the athlete should quickly return to the testing position, and counting should resume once subject is set. Subjects that are unable to maintain the testing procedure for a minimum of **five seconds** at the start are assigned the highest possible score, ten, for that testing condition.



**Figure A6-18:**  
**SCAT3 Neck**



**Figure A6-19:**  
**SCAT3 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

**NOTE:** For all SCAT3 Balance Tests the following apply:



- Once **START** has been selected a timer will replace "Start" and count down from 20 seconds to 0 seconds (Figure A6-20)
- Once the timer has reached 0 seconds **START** will reappear and the test is complete.
- During the test press the **PLUS** and **MINUS** to increase or decrease the number of errors that occur during the 20 second testing period. Errors recorded will appear in red above the **PLUS** and **MINUS**.
- Once a test is complete press **NEXT** to proceed to the next stance test.
- At any time, press **PREVIOUS** to navigate to the previous screen.

## Double Leg Stance

The following instructions will appear on the screen and must be read to the subject prior to starting:

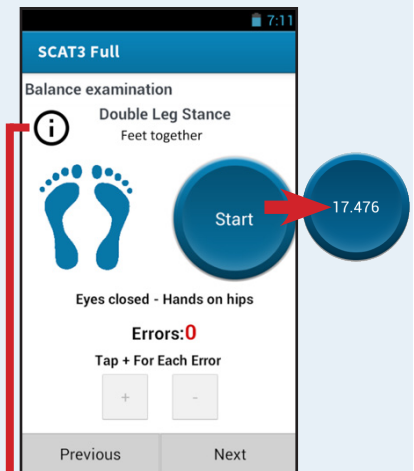
**"The first stance is standing with your feet together with your hands on your hips and with your eyes closed. You should try to maintain stability in that position for 20 seconds. I will be counting the number of times you move out of this position. I will start timing when you are set and have closed your eyes."**

Confirm with the subject that they understand the instructions and press **START** to begin.

## Single Leg Stance

The following instructions will appear on the screen and must be read to the subject prior to starting:

**"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."**



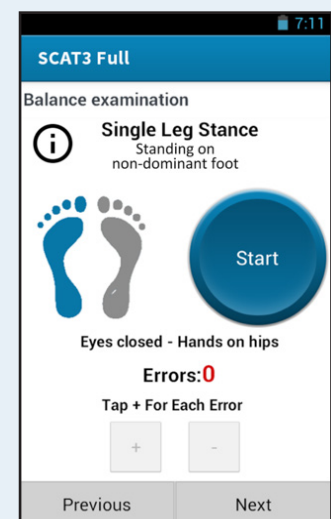
**Figure A6-20:**  
**Start Button**

### 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

OK

**Figure A6-21:**  
**Information - Type of Errors**



**Figure A6-22:**  
**Single Leg Stance**

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 hands on your hips and your eyes closed. I will be counting the number of times you move out of this position. If you stumble out of this position, open your eyes and return to the start position and continue balancing. I will start timing when you are set and have closed your eyes."

Confirm with the subject that they understand the instructions. Press the left or right **FOOT** that the subject will be using for the test. Once the subject is in place, press **START**.

### Tandem Leg Stance

The following instructions will appear on the screen and must be read to the subject prior to starting:

**"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 hands on your hips and your eyes closed. I will be counting the number of times you move out of this position. If you stumble out of this position, open your eyes and return to the start position and continue balancing. I will start timing when you are set and have closed your eyes."**

Confirm with the subject that they understand the instructions and press **START** to begin.

Once the subject is in place, press **START**.

Once the test is complete press **NEXT** to proceed to the **SCAT3 Balance 6**.

### Tandem Gait

Participants are instructed to stand with their feet together behind a starting line (the test is best done with footwear removed). Then, they walk in a forward direction as quickly and as accurately as possible along a 38mm wide (sports tape), 3 meter line with an alternate foot heel-to-toe gait ensuring that they approximate their heel and toe on each step. Once they cross the end of the 3m line, they turn 180 degrees and return to the starting point using the same gait. A total of 4 trials are done and the best time is retained. Athletes should complete the test in 14 seconds. Athletes fail the test if they step off the line, have a separation between their heel and toe, or if they touch or grab the examiner or an object. In this case, the time is not recorded and the trial repeated, if appropriate.

The **SCAT3 Balance 6** (Figure A6-24) allows the operator to perform the Tandem gait test if desired.

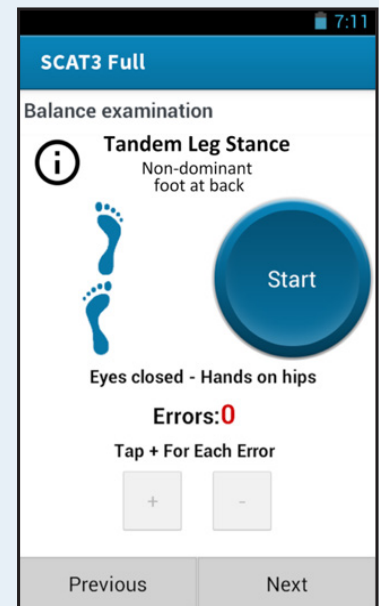


Figure A6-23:  
Tandem Leg Stance

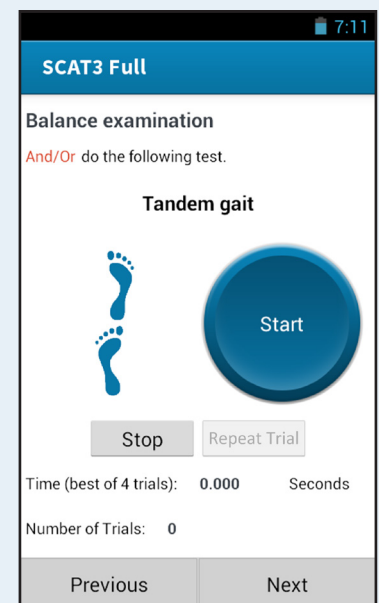


Figure A6-24:  
Tandem Gait

## Coordination Examination

During the coordination examination section of the SCAT3 the upper limb coordination will be tested by doing a Finger-to-nose (FTN) task.

The operator will provide the following instructions to the subject:

**I am going to test your coordination now. Please sit comfortably on the chair with your eyes open and your arm (either right or left) outstretched (shoulder flexed to 90 degrees and elbow and fingers extended), pointing in front of you. When I give a start signal, I would like you to perform five successive finger to nose repetitions using your index finger to touch the tip of the nose, and then return to the starting position, as quickly and as accurately as possible.**

**Scoring: 5 correct repetitions in < 4 seconds = 1**



**NOTE:** Athletes fail the test if they do not touch their nose, do not fully extend their elbow or do not perform five repetitions. Failure should be scored as 0.

Once the test is complete press **NEXT** to proceed to the SCAT3 delayed recall testing.

## SAC Delayed Recall

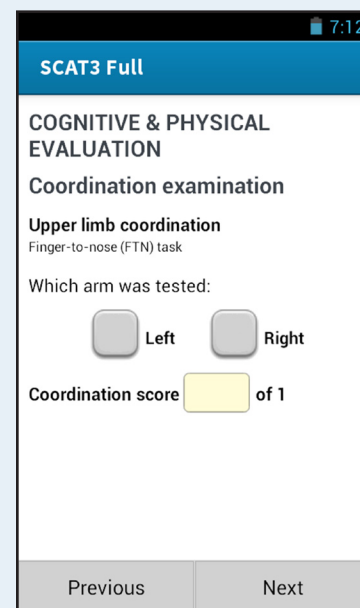
The delayed recall should be performed after completion of the Balance and Coordination examination.

The operator will provide the following instructions to the subject prior to starting the delayed recall test:

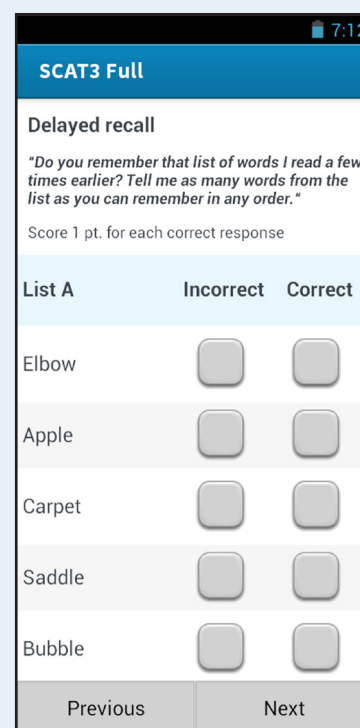
**Do you remember that list of words I read a few times earlier? Tell me as many words from the list as you can remember in any order.**

**Score 1 pt. for each correct response**

Once the test is complete press **NEXT** to proceed to the **SCAT3 Summary** screen (Figure A6-27).



**Figure A6-25:**  
**Coordination Exam**



List A	Incorrect	Correct
Elbow	<input type="button" value="Incorrect"/>	<input type="button" value="Correct"/>
Apple	<input type="button" value="Incorrect"/>	<input type="button" value="Correct"/>
Carpet	<input type="button" value="Incorrect"/>	<input type="button" value="Correct"/>
Saddle	<input type="button" value="Incorrect"/>	<input type="button" value="Correct"/>
Bubble	<input type="button" value="Incorrect"/>	<input type="button" value="Correct"/>

**Figure A6-26:**  
**SAC Delayed Recall**

The **SCAT3 Summary** screen (Figure A6-27) will display results from each of the testing sections from the SCAT3.

Press **CONFIRM** to navigate to the **Information Hub** screen.

At any time, press **PREVIOUS** to navigate to the previous screen.

## SCAT3 Detailed Results

Detailed results on current and previous SCAT3 tests are stored in the database and can be accessed from the **Information Hub** screen.

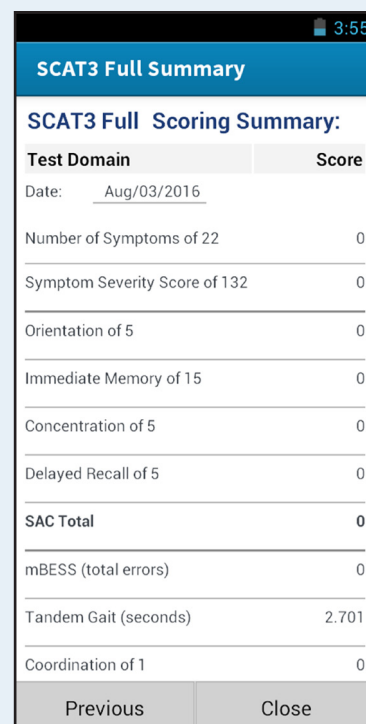
Once a SCAT3 test session has been completed the SCAT3 scores will replace the **START** button next to the SCAT3 test on the **Information Hub**.

To access the **SCAT3 Detailed Results** screen do either of the following depending on what options are available:

- 1) Press **VIEW** next to Sideline Assessment (Figure A6-28) from the **Information Hub** screen to view the detailed results of the Sideline Assessment testing.
- 2) Press the score (Figure A6-28) from the **Information Hub** screen to view the detailed results of the Full Assessment testing.

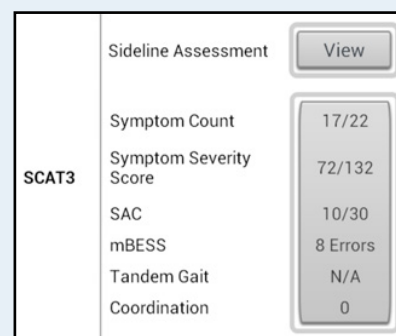


**NOTE:** The **SCAT3 Detailed Results** will default to view the **CURRENT TEST** tab.



SCAT3 Full Summary	
SCAT3 Full Scoring Summary:	
Test Domain	Score
Date: Aug/03/2016	
Number of Symptoms of 22	0
Symptom Severity Score of 132	0
Orientation of 5	0
Immediate Memory of 15	0
Concentration of 5	0
Delayed Recall of 5	0
<b>SAC Total</b>	<b>0</b>
mBESS (total errors)	0
Tandem Gait (seconds)	2.701
Coordination of 1	0
Previous	Close

**Figure A6-27:**  
**SCAT3 Summary**



	Sideline Assessment	View
SCAT3	Symptom Count	17/22
	Symptom Severity Score	72/132
	SAC	10/30
	mBESS	8 Errors
	Tandem Gait	N/A
	Coordination	0

**Figure A6-28**  
**SCAT3 Results on the**  
**Information Hub**

## Current Test Tab

The **SCAT3 Current Test Detailed Results** (Figure A6-29 and Figure A6-30) contains two options to select from:

- Review – access responses and results from the entire SCAT3 assessment
- New Test – start a new test



**NOTE:** While reviewing patient information the screen header will contain “Review” to inform the operator that they are currently in review mode.

The **SCAT3 Review** screens will appear in the exact order of the testing sequence.

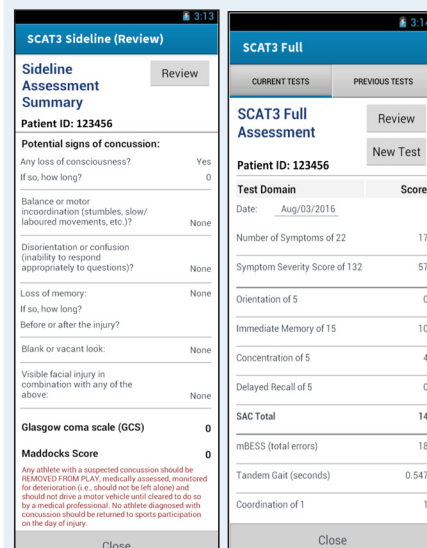
Press the **REVIEW** button to enter **SCAT3 Review**. An example of a **SCAT3 Review** screen is shown in Figure A6-31.

From the **SCAT3 Summary Review** (Figure A6-32) press **CONFIRM** to return to the **SCAT3 Current Test Detailed Results** (Figure A6-29 or A-30).

From **SCAT3 Current Test Detailed Results** (Figure A6-29 or A-30) a new test can be started.

Press **NEW TEST** to begin the SCAT3 test.

For instructions on completing a new SCAT3 test refer to the sections above.



**SCAT3 Sideline (Review)**

**Sideline Assessment Summary**

Patient ID: 123456

Potential signs of concussion:

Any loss of consciousness? Yes

If so, how long? 0

Balance or motor incoordination (stumbles, slow/ laboured movements, etc.)? None

Disorientation or confusion (inability to respond appropriately to questions)? None

Loss of memory: None

If so, how long? None

Before or after the injury? None

Blank or vacant look: None

Visible facial injury in combination with any of the above: None

Glasgow coma scale (GCS) 0

Maddocks Score 0

Any athlete with a suspected concussion should be REMOVED 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.

Close

**SCAT3 Full**

**SCAT3 Full Assessment**

Patient ID: 123456

Date: Aug/03/2016

Test Domain	Score
Number of Symptoms of 22	17
Symptom Severity Score of 132	57
Orientation of 5	0
Immediate Memory of 15	10
Concentration of 5	4
Delayed Recall of 5	0
SAC Total	14
mBESS (total errors)	18
Tandem Gait (seconds)	0.547
Coordination of 1	1

Close

**Figure A6-29 and A6-30:**  
**Current Test Detailed Results for**  
**Sideline Assessment only and Full**  
**SCAT3 Assessment**



**SCAT3 Full (Review)**

**SCAT3**

Sport Concussion Assessment Tool (3rd Edition)

Name: John Doe

Date: Aug/03/2016

Examiner: Examiner 2

Sport/Team/School: Team 2

Date of Injury: Jul/31/2016

Time of Injury: 15:48

Age: 18

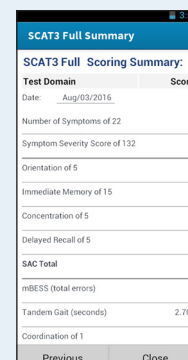
Gender: Male

Years of education completed: 4

Dominant hand: Right Left Neither

Previous Start

**Figure A6-31:**  
**Example of a SCAT3 Review**



**SCAT3 Full Summary**

**SCAT3 Full Scoring Summary:**

Test Domain Score

Date: Aug/03/2016

Number of Symptoms of 22	0
Symptom Severity Score of 132	0
Orientation of 5	0
Immediate Memory of 15	0
Concentration of 5	0
Delayed Recall of 5	0
SAC Total	0
mBESS (total errors)	0
Tandem Gait (seconds)	2.701
Coordination of 1	0

Previous Close

**Figure A6-32:**  
**Example of a SCAT3 Summary**

## Previous Test Tab

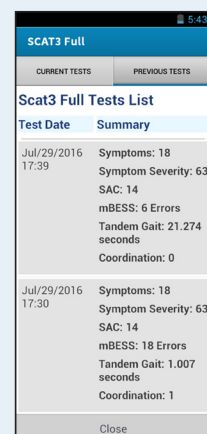
Results from previous SCAT3 tests can be reviewed from the **SCAT3 Previous Tests Detailed Results** (Figure A6-33) by pressing **PREVIOUS TESTS** tab.

The **SCAT3 Previous Tests Detailed Results** lists all tests recorded by test date, time and summary of symptoms.

To view the SCAT3 Assessment Summaries, press the desired test from the "SCAT3 Tests List".

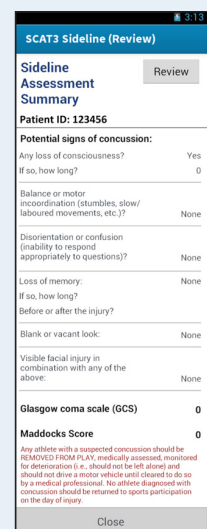
Once the test has been selected the **SCAT3 Previous Test Review** (Figure A6-34) will appear displaying the test results.

For instructions on reviewing and starting a new test refer to the sections above.



SCAT3 Full	
CURRENT TESTS    PREVIOUS TESTS	
Scat3 Full Tests List	
Test Date	Summary
Jul/29/2016 17:39	Symptoms: 18 Symptom Severity: 63 SAC: 14 mBESS: 6 Errors Tandem Gait: 21.274 seconds Coordination: 0
Jul/29/2016 17:30	Symptoms: 18 Symptom Severity: 63 SAC: 14 mBESS: 18 Errors Tandem Gait: 1.007 seconds Coordination: 1

Figure A6-33:  
SCAT3 Tests List



SCAT3 Sideline (Review)	
Sideline Assessment Summary	Review
Patient ID: 123456	
Potential signs of concussion:	
Any loss of consciousness? If so, how long?	Yes 0
Balance or motor incoordination (stumbles, slow/ laboured movements, etc.)?	None
Disorientation or confusion (inability to respond appropriately to questions)?	None
Loss of memory: If so, how long? Before or after the injury?	None
Blank or vacant look:	None
Visible facial injury in combination with any of the above:	None
Glasgow coma scale (GCS)	0
Maddocks Score	0
<small>Any athlete with a suspected concussion should be REMOVED 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.</small>	
Close	

Figure A6-34:  
Example of a SCAT3 Previous Test Review



## Appendix 7: National Football League Sports Concussion Assessment Tool (NFL SCAT)

To begin the NFL SCAT from the **Information Hub**, press **START** (Figure A7-1) and the handheld will navigate to the **NFL SCAT Start** screen (Figure A7-2).

The **NFL SCAT Start** screen (Figure A7-2) will provide the following information for the operator to consider prior to testing:

**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) (McCorry, et al. BJSM '09) and represents a standardized method of evaluating NFL players for concussion consistent with the reasonable, objective practice of the healthcare professional. 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.**



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

Press **START** to navigate to the **NFL SCAT Test Information screens** (an example of a test information screen is shown in Figure A7-3).

The **NFL SCAT Test Information 1 and 2** screens will be pre-populated with the following:

- athlete and evaluator information
- evaluation date and time
- injury date and time

When all information has been entered press **NEXT** to navigate to the **NFL SCAT Mechanism of Injury**.

The next series of screens provide the option to record the following:

- mechanism of injury (to record, select the correct checkbox from the list provided)
- whether or not a penalty was called during the time of injury.

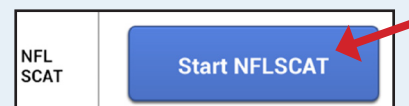


Figure A7-1:  
Start NFL SCAT

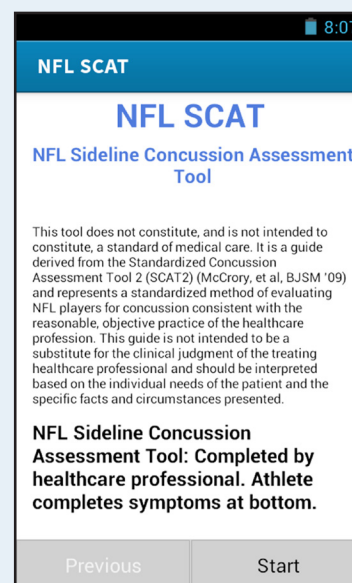


Figure A7-2:  
NFL SCAT Start Screen

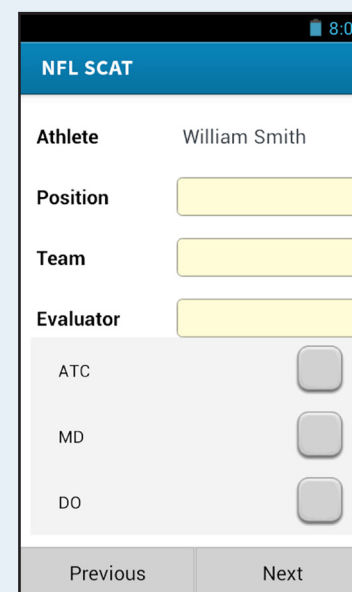


Figure A7-3:  
NFL SCAT Test Information Screen



When all answers have been recorded press **NEXT** to navigate to the **NFL SCAT Note**:

**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.**

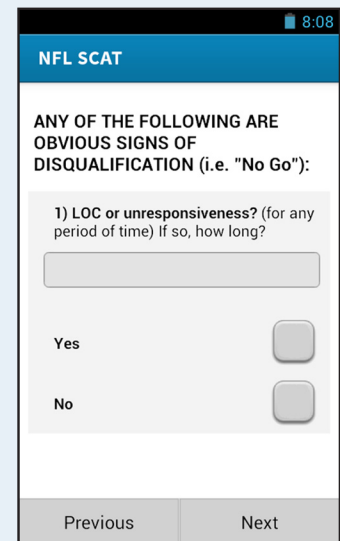
After reading the note, press **NEXT** to navigate to the **NFL SCAT Disqualification** screens.

The **NFL SCAT Disqualification 1 through 6** screens (an example is shown in Figure A7-4) contains a series of questions to identify the potential signs of a concussion that could lead to disqualification of the player from the game. To record the answer, press the appropriate checkbox to the right of the response.

The questions will cover the following:

- Loss of consciousness and the duration of the loss of consciousness
- Confusion
- Amnesia (retrograde/ anterograde)
- New and/or persistent symptoms
- Abnormal neurological findings
- Progressive, persistent or worsening of symptoms

On the **NFL Disqualification 6** screen press **NEXT** to navigate to the neurological screening section of the NFL SCAT.



The screenshot shows a mobile application interface for the NFL SCAT. At the top, there's a status bar with the time 8:08. Below it is a blue header with the text "NFL SCAT". The main content area has a white background with the text "ANY OF THE FOLLOWING ARE OBVIOUS SIGNS OF DISQUALIFICATION (i.e. 'No Go'):". Below this is a question: "1) LOC or unresponsiveness? (for any period of time) If so, how long?". There is a text input field for the duration. Below the input field are two radio button options: "Yes" and "No". At the bottom of the screen are two buttons: "Previous" and "Next".

**Figure A7-4:**  
Example of the Disqualification screens

The **NFL SCAT Neurological Screening** screen (Figure A7-5) provides a series of questions to screen for cervical spine and/or more serious brain trauma. To record the answer, press the appropriate checkbox to the right of the question.

Press **NEXT** to navigate to the **NFL SCAT Orientation** screens.

The **NFL SCAT Orientation 1 and 2** screens (an example of one is shown in Figure A7-6) consist of a series of questions to determine the subject's ability to identify time and place accurately.

On the **NFL SCAT Orientation 2** screen press **NEXT** to navigate to the **NFL SCAT Word Recall** screens.

The **NFL SCAT Word Recall 1** screen will provide the following instructions:

**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.**

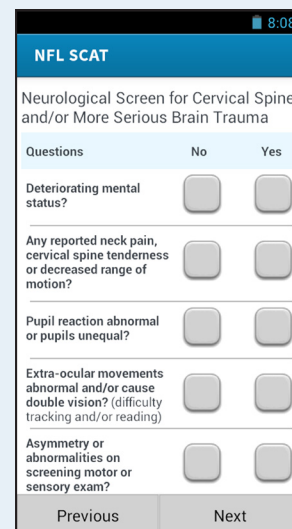


**NOTE:** Do not tell athlete that delayed recall will be tested.

Press **NEXT** to navigate to the **NFL SCAT Word Recall 2** screen (Figure A7-7). The **NFL SCAT Word Recall 2** screen will navigate to Trial 1 of 3.

The **NFL SCAT Word Recall 2** screen contains five pairs (ten total) of checkboxes, with each pair displayed next to a test word defined by the selected list.

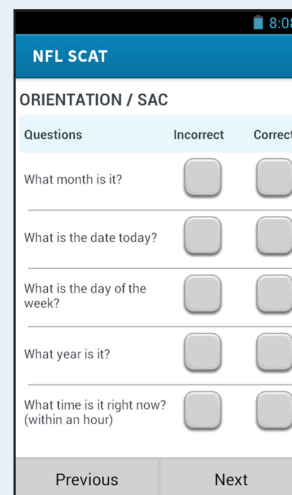
On the **NFL SCAT Word Recall 2** screen, press **SWAP** to switch to a different list. The current list will be displayed next to the **SWAP** button; e.g. "List A", "List B", "List C". Each time **SWAP** is selected, the display for the List column title shall cycle from "List A" through "List C", and then back to "List A".



Questions	No	Yes
Deteriorating mental status?	<input type="checkbox"/>	<input type="checkbox"/>
Any reported neck pain, cervical spine tenderness or decreased range of motion?	<input type="checkbox"/>	<input type="checkbox"/>
Pupil reaction abnormal or pupils unequal?	<input type="checkbox"/>	<input type="checkbox"/>
Extra-ocular movements abnormal and/or cause double vision? (difficulty tracking and/or reading)	<input type="checkbox"/>	<input type="checkbox"/>
Asymmetry or abnormalities on screening motor or sensory exam?	<input type="checkbox"/>	<input type="checkbox"/>

Previous Next

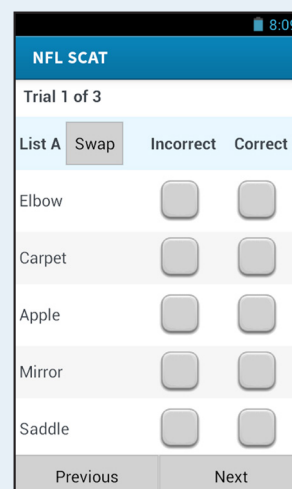
**Figure A7-5:**  
**NFL SCAT Neurological Screening**



Questions	Incorrect	Correct
What month is it?	<input type="checkbox"/>	<input type="checkbox"/>
What is the date today?	<input type="checkbox"/>	<input type="checkbox"/>
What is the day of the week?	<input type="checkbox"/>	<input type="checkbox"/>
What year is it?	<input type="checkbox"/>	<input type="checkbox"/>
What time is it right now? (within an hour)	<input type="checkbox"/>	<input type="checkbox"/>

Previous Next

**Figure A7-6:**  
**NFL SCAT Orientation**



List A	Swap	Incorrect	Correct
Elbow		<input type="checkbox"/>	<input type="checkbox"/>
Carpet		<input type="checkbox"/>	<input type="checkbox"/>
Apple		<input type="checkbox"/>	<input type="checkbox"/>
Mirror		<input type="checkbox"/>	<input type="checkbox"/>
Saddle		<input type="checkbox"/>	<input type="checkbox"/>

Previous Next

**Figure A7-7:**  
**NFL SCAT Word Recall**

The **NFL SCAT Word Recall** screens shall use the test words for each list as defined in the table below:

List Name	Ordered Test Words
List A	Elbow, Apple, Carpet, Mirror, Saddle
List B	Candle, Sugar, Paper, Sandwich, Wagon
List C	Baby, Perfume, Monkey, Sunset, Iron

Press **NEXT** to navigate to Trial 2 of 3, **NFL SCAT Word Recall 3**, and Trial 3 of 3, **NFL SCAT Word Recall 4**.

Once complete, press **NEXT** to navigate to the **NFL SCAT Overall Rating**.

The **NFL SCAT Overall Rating** screen (Figure A7-8) allows the operator to record an overall rating of the subject by asking the following question:

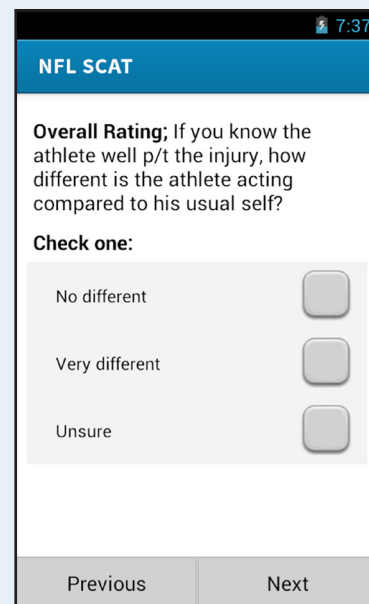
**If you know the athlete well prior to the injury, how different is the athlete acting compared to his/her usual self?**

Press **NEXT** to navigate to the **NFL SCAT Concentration** screens.

The **NFL SCAT Concentration 1** screen will contain the following instruction:

**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.**

After you have read the instructions press **NEXT** to navigate to **NFL SCAT Concentration 2**.



**Figure A7-8:**  
**NFL SCAT Overall Rating**

The **NFL SCAT Concentration 2** screen (Figure A7-9) will contain columns for "Trial 1", "Trial 2" and the answer ("Incorrect" or "Correct").

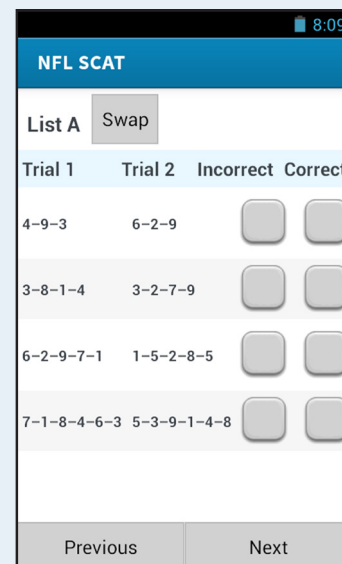
List	Trial 1	Trial 2
List A	4-9-3, 3-8-1-4, 6-2-9-7-1, 7-1-8-4-6-3	6-2-9, 3-2-7-9, 1-5-2-8-5, 5-3-9-1-4-8
List B	5-2-6, 1-7-9-5, 4-8-5-2-7, 8-3-1-9-6-4	4-1-5, 4-9-6-8, 6-1-8-4-3, 7-2-7-8-5-6
List C	1-4-2, 6-8-3-1, 4-9-1-5-3, 3-7-6-5-1-9	6-5-8, 3-4-8-1, 6-8-2-5-1, 9-2-6-5-1-4

Press **SWAP** to switch to a different list. The current list will be displayed next to the **SWAP** button; e.g. "List A", "List B", "List C". Each time **SWAP** is selected, the display for the List column title shall cycle from "List A" through "List C", and then back to "List A".

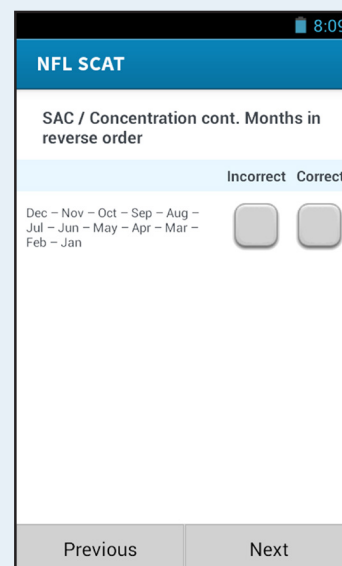
Press **NEXT** to navigate to **NFL SCAT Concentration 3**.

The **NFL SCAT Concentration 3** (Figure A7-10) will record the subject's response to saying the months in reverse order.

Press **NEXT** to navigate to **NFL SCAT mBESS**.



**Figure A7-9:**  
**NFL SCAT Concentration 2**



**Figure A7-10:**  
**NFL SCAT Concentration 3**

## Balance Examination

Prior to starting the mBESS, the following information will be provided to the operator:

**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

In addition to the information provided above, the **NFL SCAT mBESS 1** screen (Figure A7-11) allows recording of the foot being tested.

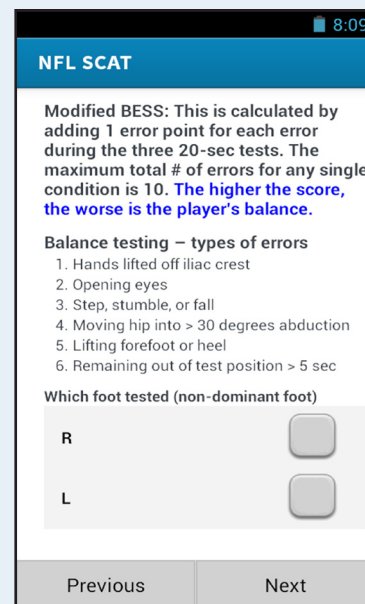
Press **NEXT** to navigate to the **NFL SCAT mBESS 2** screen. The **NFL SCAT mBESS 2** screen begins the testing sequence for the mBESS balance examination.

Prior to starting the test on **NFL SCAT mBESS 2** screen, the Operator will provide the following instructions 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 three twenty second tests with different stances**



**NOTE:** Each of the 20-second trials is scored by counting the errors, or deviations from the proper stance, accumulated by the athlete. The examiner will begin counting errors only after the individual has assumed the proper start position. **The mBESS is calculated by adding one error point for each error during the three 20-second tests. The maximum total number of errors for any single condition is 10.** If an athlete commits multiple errors simultaneously, only one error is recorded but the athlete should quickly return to the testing position, and counting should resume once subject is set. Subjects that are unable to maintain the testing procedure for a minimum of **five seconds** at the start are assigned the highest possible score, ten, for that testing condition.



8:09

**NFL SCAT**

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)

R

L

Previous Next

**Figure A7-11:**  
**mBESS information screen**



**NOTE:** For all NFL SCAT Balance Tests the following apply:

- Once **START** has been selected a timer will replace "Start" and count down from 20 seconds to 0 seconds (Figure A5-12)
- Once the timer has reached 0 seconds **START** will reappear and the test is complete.
- During the test press the **PLUS** and **MINUS** to increase or decrease the number of errors that occur during the 20 second testing period. Errors recorded will appear in red above the **PLUS** and **MINUS**.
- Once a test is complete press **NEXT** to proceed to the next stance test.
- At any time, press **PREVIOUS** to navigate to the previous screen.

The following instructions must be read to the subject prior to starting:

**The first stance is standing with your feet together with your hands on your hips and with your eyes closed. You should try to maintain stability in that position for 20 seconds. I will be counting the number of times you move out of this position. I will start timing when you are set and have closed your eyes.**

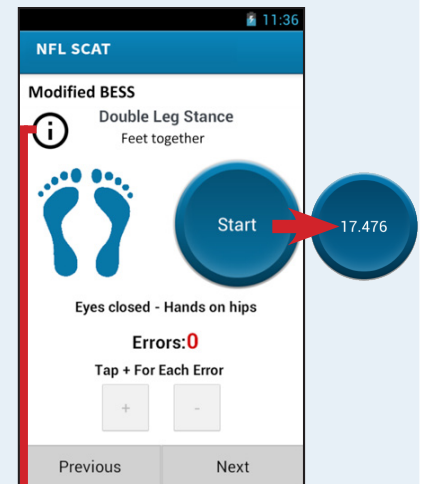
Confirm with the subject that they understand the instructions and press **START** to begin.

## Single Leg Stance

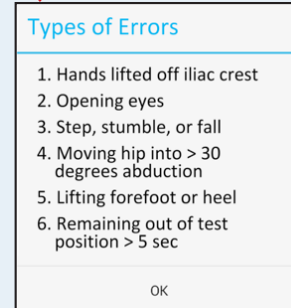
The following instructions will appear on the screen and must be read to the subject prior to starting:

**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. 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 hands on your hips and your eyes closed. I will be counting the number of times you move out of this position. If you stumble out of this position, open your eyes and return to the start position and continue balancing. I will start timing when you are set and have closed your eyes.**

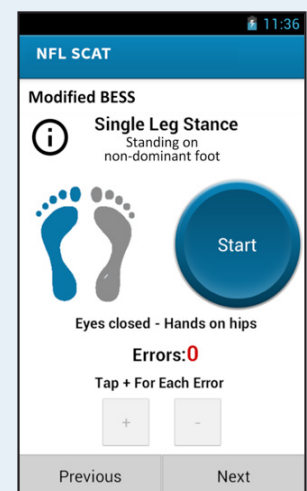
Confirm with the subject that they understand the instructions. Once the subject is in place, press **START**.



**Figure A7-12:**  
**Start Button**



**Figure A7-13:**  
**Information - Type of Errors**



**Figure A7-14:**  
**Single Leg Stance**

## Tandem Leg Stance

The following instructions will appear on the screen and must be read to the subject prior to starting:

**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 hands on your hips and your eyes closed. I will be counting the number of times you move out of this position. If you stumble out of this position, open your eyes and return to the start position and continue balancing. I will start timing when you are set and have closed your eyes.**

Confirm with the subject that they understand the instructions and press **START** to begin.

Once the subject is in place, press **START**.

Once the test is complete press **NEXT** to proceed to the **NFL SCAT Note 2**.

The **NFL SCAT Note 2** screen will provide the following information:

**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"**

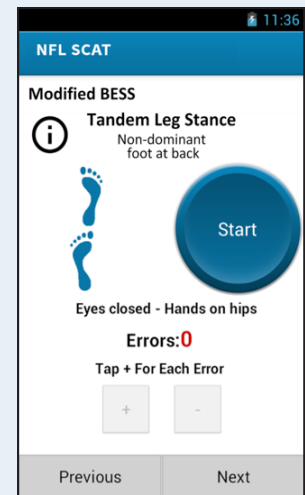
Press **NEXT** to proceed to the **NFL SCAT Symptoms 1** screen which provides the following instructions to the operator:

**The following symptoms checklist should be completed by the athlete.**

Press **NEXT** to proceed to the **NFL SCAT Symptoms 2 through 9** screens.

The **NFL SCAT Symptoms 2 through 9** screens (an example of one is shown in Figure A7-16) will run through a series of symptoms which will be scored by severity on a scale of 0-6 with the following labels:

- 0 – Absent
- 1, 2 – Mild
- 3, 4 – Moderate
- 5, 6 – Severe



**Figure A7-15:**  
**Tandem Leg Stance**



**Figure A7-16:**  
**Example of a NFL SCAT**  
**Symptoms screen**



**NFL SCAT Symptoms 2 through 9** screens will contain the following instructions:

**The athlete should score themselves on the following symptoms, as applicable, based on how they feel at the time.**

Press **NEXT** to navigate through the **NFL SCAT Symptoms** screen.

Once the last response has been recorded press **NEXT** to advance to the **NFL SCAT Symptoms Summary** (Figure A7-17).

The **NFL SCAT Symptoms Summary** will display the total number of symptoms recorded and the symptom severity score and allows for the operator to answer two questions to record whether the symptoms get worse with physical or mental activity.

Press **NEXT** to navigate to the **NFL SCAT Delayed Recall**.

The **NFL SCAT Delayed Recall** (Figure A7-18) will ask the subject to review words that were provided earlier in the assessment.

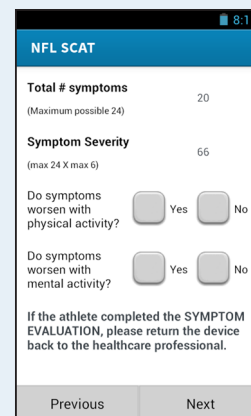
The operator will provide the following instructions to the subject prior to starting the delayed recall test:

**Do you remember that list of words I read a few times earlier? Tell me as many words from the list as you can remember in any order.**

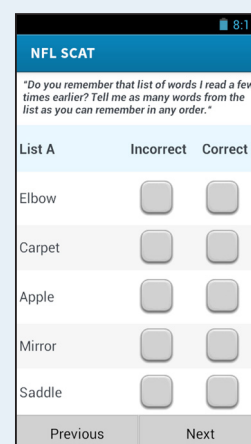
**Score 1 pt. for each correct response**

Once the test is complete press **NEXT** to proceed to the **NFL SCAT Summary** (Figure A7-19).

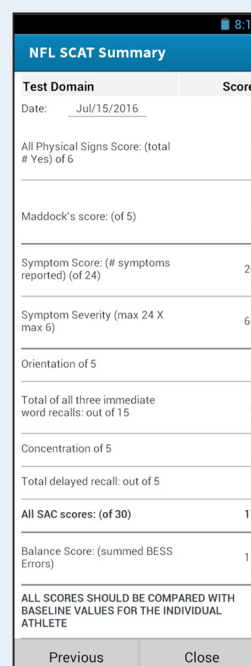
Press **CONFIRM** to navigate to the **Information Hub**.



**Figure A7-17:**  
**Symptoms Summary**



**Figure A7-18:**  
**Delayed Recall**



**Figure A7-19:**  
**NFL SCAT Summary**

## NFL SCAT Detailed Results

Detailed results on current and previous NFL SCAT tests are stored in the database and can be accessed from the **Information Hub** screen.

Once a NFL SCAT test session has been completed the NFL SCAT total score will replace the **START** button next to the NFL SCAT test on the **Information Hub** (Figure A7-20).



**NOTE:** The **NFL SCAT Detailed Results** will default to view the **CURRENT TEST** tab.

### Current Test Tab

The **NFL SCAT Current Test Detailed Results** (Figure A7-21) contains two options to select from:

- Review – access responses and results from the entire NFL SCAT assessment
- New Test – start a new test



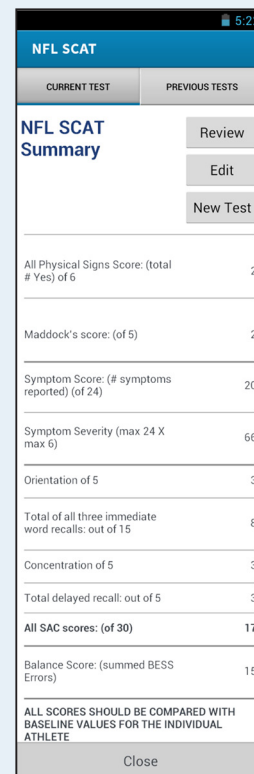
**NOTE:** While reviewing patient information the screen header will contain “Review” to inform the operator that they are currently in review mode.

The **NFL SCAT Review** screens will appear in the exact order of the testing sequence.

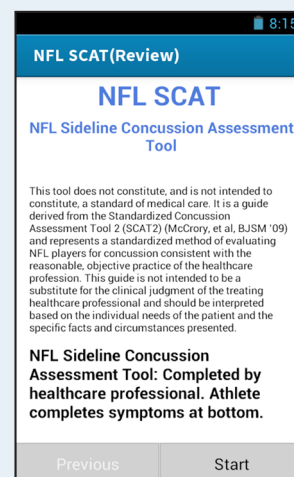
Press the **REVIEW** button to enter **NFL SCAT Review**. An example of a **NFL SCAT Review** screen is shown in Figure A7-22.

NFL SCAT	Physical Signs	5/6
	Maddocks Score	1/5
	SAC	4/30
	mBESS	0 Errors
	Symptom Count	16/24

**Figure A7-20:**  
NFL SCAT results area from the **Information Hub**



**Figure A7-21:**  
Current Test Detailed Results



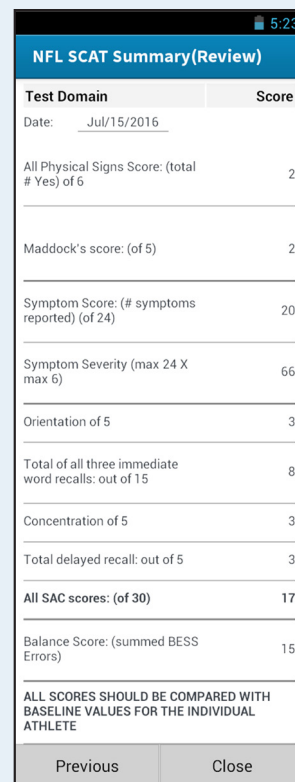
**Figure A7-22:**  
Example of a NFL SCAT Review

From the **NFL SCAT Summary Review** (Figure A7-23) press **CONFIRM** to return to the **NFL SCAT Current Test Detailed Results** (Figure A7-21).

From **NFL SCAT Current Test Detailed Results** (Figure A7-21) a new test can be started.

Press **NEW TEST** to begin the NFL SCAT test.

For instructions on completing a new NFL SCAT test refer to the sections above.



Test Domain	Score
Date: Jul/15/2016	
All Physical Signs Score: (total # Yes) of 6	2
Maddock's score: (of 5)	2
Symptom Score: (# symptoms reported) (of 24)	20
Symptom Severity (max 24 X max 6)	66
Orientation of 5	3
Total of all three immediate word recalls: out of 15	8
Concentration of 5	3
Total delayed recall: out of 5	3
All SAC scores: (of 30)	17
Balance Score: (summed BESS Errors)	15
ALL SCORES SHOULD BE COMPARED WITH BASELINE VALUES FOR THE INDIVIDUAL ATHLETE	
Previous	Close

**Figure A7-23:**  
**Example of a NFL SCAT Summary**

## Previous Test Tab

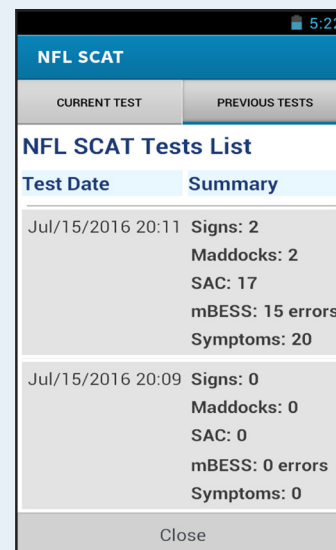
Results from previous NFL SCAT tests can be reviewed from the **NFL SCAT Previous Tests Detailed Results** (Figure A7-24) by pressing **PREVIOUS TESTS** tab.

The **NFL SCAT Previous Tests Detailed Results** lists all tests recorded by test date, time and summary of symptoms.

To view the NFL SCAT Assessment Summaries, press the desired test from the "NFL SCAT Tests List".

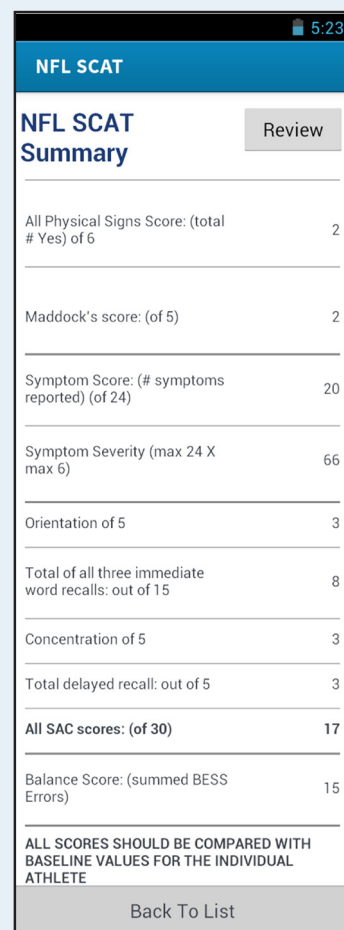
Once the test has been selected the **NFL SCAT Previous Test Review** (Figure A7-25) will appear displaying the test results.

For instructions on reviewing and starting a new test refer to the sections above.



NFL SCAT	
CURRENT TEST	PREVIOUS TESTS
<b>NFL SCAT Tests List</b>	
Test Date	Summary
Jul/15/2016 20:11	Signs: 2 Maddocks: 2 SAC: 17 mBESS: 15 errors Symptoms: 20
Jul/15/2016 20:09	Signs: 0 Maddocks: 0 SAC: 0 mBESS: 0 errors Symptoms: 0
Close	

**Figure A7-24:**  
**NFL SCAT Tests List**



NFL SCAT	
<b>NFL SCAT Summary</b>	Review
All Physical Signs Score: (total # Yes) of 6	2
Maddock's score: (of 5)	2
Symptom Score: (# symptoms reported) (of 24)	20
Symptom Severity (max 24 X max 6)	66
Orientation of 5	3
Total of all three immediate word recalls: out of 15	8
Concentration of 5	3
Total delayed recall: out of 5	3
All SAC scores: (of 30)	17
Balance Score: (summed BESS Errors)	15
ALL SCORES SHOULD BE COMPARED WITH BASELINE VALUES FOR THE INDIVIDUAL ATHLETE	
Back To List	

**Figure A7-25:**  
**Example of a NFL SCAT Previous Test Review**

## Appendix 8: Standardized Assessment of Concussion (SAC)

The Standardized Assessment of Concussion (SAC) was developed in response to and accordance with the recommendations of the Colorado and AAN Guidelines. The SAC provides immediate sideline mental status assessment of athletes who may have incurred a concussion.<sup>19,20,21</sup> The test contains questions designed to assess athletes' orientation, immediate memory, concentration, and delayed memory. It also includes an exertion test and brief neurological evaluation. The SAC takes approximately 5 minutes to administer and does not require a neuropsychologist to evaluate test scores. The test is scored out of 30 with a mean score of 26.6.<sup>22</sup>

Studies have found the SAC to have good sensitivity and specificity<sup>23,24</sup> making it a useful tool for identifying the presence of concussion.<sup>25</sup> Significant differences in scores have been reported for males and females in healthy young athletes (9 to 14 years of age), suggesting the need for separate norms for males and females in this age group<sup>26</sup> as well as in high school athletes.<sup>27</sup>

<sup>19</sup> Barr WB, McCrea M. Sensitivity and specificity of standardized neurocognitive testing immediately following sports concussion. *Journal of the International Neuropsychological Society*. 2001;7(6):693–702

<sup>20</sup> McCrea M, et al. Standardized Assessment of Concussion (SAC): On-site mental status evaluation of the athlete. *Journal of Head Trauma Rehabilitation*. 1998;13(2):27–35.

<sup>21</sup> McCrea M, Kelly JP, Randolph C. Standardized Assessment of Concussion (SAC): Manual for Administration, Scoring and Interpretation. 2nd. Waukesha, WI: CNS Inc; 2000.

<sup>22</sup> McCrea M, Kelly J, Randolph C. Standardized Assessment of Concussion (SAC): Manual for Administration, Scoring and Interpretation. Waukesha, WI: CNS Inc; 1996.

<sup>23</sup> McCrea M. Standardized mental status testing on the sideline after sport-related concussion. *Journal of Athletic Training*. 2001;36(3):274–279.

<sup>24</sup> McCrea M, et al. Acute effects and recovery time following concussion in collegiate football players: The NCAA Concussion Study. *JAMA*. 2003;290(19):2556–2563.

<sup>25</sup> Giza CC, et al. Evidence-Based Guideline Update: Evaluation and Management of Concussion in Sports. Report of the Guideline Development Subcommittee of the American Academy of Neurology. *American Academy of Neurology*; 2013.

<sup>26</sup> Valovich McLeod TC, et al. Psychometric and measurement properties of concussion assessment tools in youth sports. *Journal of Athletic Training*. 2006;41(4):399–408.

<sup>27</sup> Barr WB. Neuropsychological testing of high school athletes: Preliminary norms and test-retest indices. *Archives of Clinical Neuropsychology*. 2003;18:91–101.

To begin the SAC from the **Information Hub**, press **START** (Figure A8-1) and the handheld will navigate to the **SAC Start** screen (Figure A8-2).

The “Date of Exam” and “Time” on the **SAC Start** will be pre-populated with the current date and time. The Name field on the **SAC Start** will be pre-populated with the patient name for the current session.

The Examiner field on the **SAC Start** will be pre-populated with the operator name for the current session.

The operator can select the type of exam by pressing the checkbox in the exam area. The following exams can be selected:

- Bline
- Injury
- Postgame
- Follow up day

If Follow up day is selected, a text entry field will be enabled allowing for entry of the text below the follow up day.

Press **START** to navigate to the **SAC Introduction**.

On the **SAC Introduction** screen the following instructions will be provided for the operator to read to the subject:

**I am going to ask you some questions. Please listen carefully and give your best effort.**

Press **NEXT** to navigate to the **SAC Orientation**.

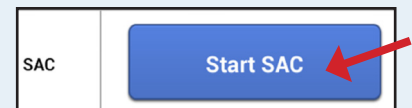
At any time press **PREVIOUS** to navigate to the previous screen.

The **SAC Orientation** (Figure A8-3) contains five questions to ask the subject. Next to the questions are 5 pairs of checkboxes for the answer provided. Select the correct box based on the answer the subject provided.

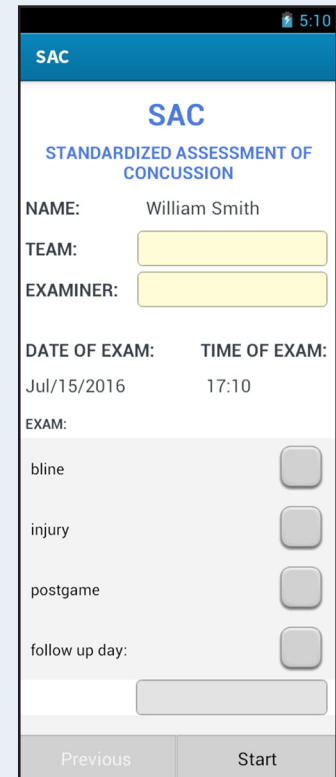


**NOTE:** If a button is inadvertently selected, select the button again to unselect.

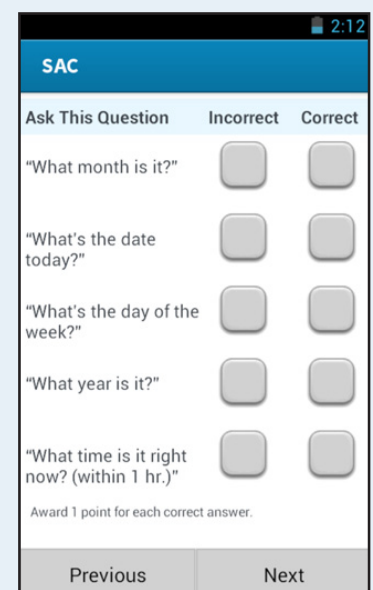
Press **NEXT** to navigate to the **SAC Immediate Memory 1** screen.



**Figure A8-1:**  
**Start SAC**



**Figure A8-2:**  
**SAC Start**



**Figure A8-3:**  
**SAC Orientation**

The **SAC Immediate Memory 1** screen will contain the following instructions for the operator to read to the subject:

*"I am going to test your memory. I will read you a list of words and when I am done, repeat back as many words as you can remember, in any order."*

**Trials 2 & 3:** *"I am going to repeat that list again. Repeat back as many words as you can remember in any order, even if you said the word before."*



**NOTE:** Complete all 3 trials regardless of score on trials 1 & 2. 1 pt. for each correct response. Total score equals sum across all 3 trials. Do not inform the subject that delayed recall will be tested.

Press **NEXT** to navigate to the **SAC Immediate Memory 2** (Figure A8-4) screen.

The **SAC Immediate Memory 2** contains five pairs (ten total) of checkboxes, with each pair displayed next to a test word defined by the selected list.

The **SAC Immediate Memory 2** screen will navigate to Trial 1 of 3.

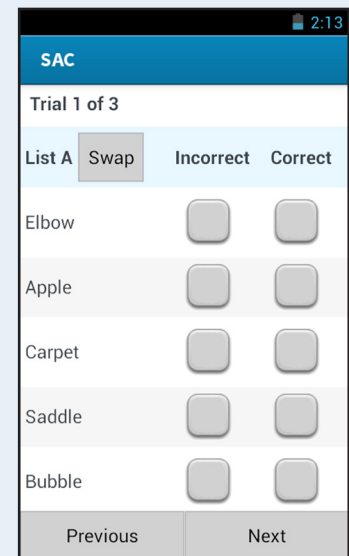
Read the list of words on the screen and record the appropriate response by checking the box next to the word.

On the **SAC Immediate Memory 2** screen, press **SWAP** to switch to a different list. The current list will be displayed next to the **SWAP** button; e.g. "List A", "List B" or "List C". Each time **SWAP** is selected, the display for the List column title shall cycle from "List A" through "List C", and then back to "List A".

The **SAC Immediate Memory 2** screen will use the test words for each list as defined in the table below:

List Name	Ordered Test Words
List A	Elbow, Apple, Carpet, Saddle, Bubble
List B	Candle, Paper, Sugar, Sandwich, Wagon
List C	Baby, Monkey Perfume, Sunset, Iron

Press **NEXT** to navigate through the **SAC Immediate Memory** screens. Once complete press **NEXT** on the last screen to navigate to **SAC Exertional Maneuvers**.



**Figure A8-4:**  
**SAC Immediate Memory**



The **SAC Exertional Maneuvers** screen (Figure A8-45) contains the following instructions for the operator to consider prior to proceeding:

*If subject is not displaying or reporting symptoms, conduct the following maneuvers to create conditions under which symptoms likely to be elicited and detected. These measures need not be conducted if a subject is already displaying or reporting any symptoms. If not conducted, allow 2 minutes to keep time delay constant before testing Delayed Recall. These methods should be administered for baseline testing of normal subjects.*

#### EXERTIONAL MANEUVERS

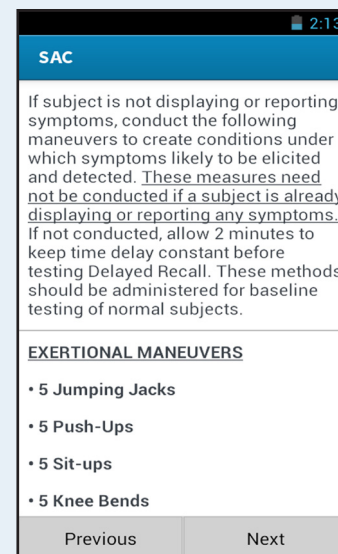
- 5 Jumping Jacks
- 5 Push-Ups
- 5 Sit-Ups
- 5 Knee Bends

Press **NEXT** to navigate to the **SAC Neurological Screening** screens (an example is provided in Figure A8-6).

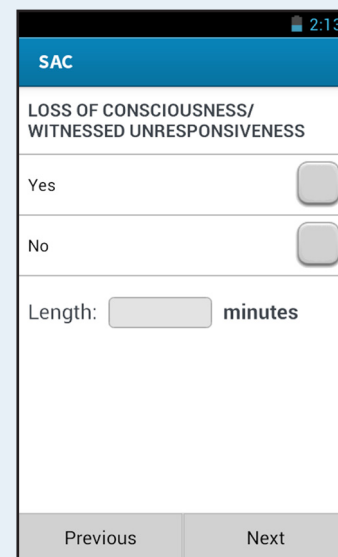
The SAC Neurological Screening consists of the following:

- If the subject experienced any loss of consciousness and the duration of the loss of consciousness (if "Yes" is recorded).
- If the subject experienced any post-traumatic amnesia and the duration of the post-traumatic amnesia (if "Yes" is recorded).
- If the subject experienced any retrograde amnesia and the duration of the retrograde amnesia (if "Yes" is recorded).
- If the subject is experiencing any deficits in strength in the upper extremities.
- If the subject is experiencing any deficits in sensation, e.g. finger-to-nose. Perform the test and record the finding as "Normal" or "Abnormal".
- If the subject is experiencing any deficits in coordination, e.g. tandem walk. Perform the test and record the finding as "Normal" or "Abnormal".

Once complete press **NEXT** to navigate to the **SAC Concentration** screens.



**Figure A8-5:**  
**SAC Exertional Maneuvers**



**Figure A8-6:**  
**SAC Neurological Screening**

The **SAC Concentration 1** (Figure A8-7) will contain the following instructions for the operator to read to the subject.

**Digits Backward:** I am going to read you a string of numbers and when I am done, you repeat them back to me backwards, in reverse order of how I read them to you. For example, if I say 7-1-9, you would say 9-1-7.



**NOTE:** If subject answers correctly, go to next string length. If incorrect, read trial 2. 1 pt. possible for each string length. Stop after incorrect on both trials.

The **SAC Concentration 2** (Figure A8-8) will contain columns for "Trial 1", "Trial 2" and the answer ("Incorrect" or "Correct").

The **SAC Concentration 2** shall use the test numbers for each list as defined in the table below:

List	Trial 1	Trial 2
List A	4-9-3, 3-8-1-4, 6-2-9-7-1, 7-1-8-4-6-2	6-2-9, 3-2-7-9, 1-5-2-8-6, 5-3-9-1-4-8
List B	5-2-6, 1-7-9-5, 4-8-5-2-7, 8-3-1-9-6-4	4-1-5, 4-9-6-8, 6-1-8-4-3, 7-2-4-8-5-6
List C	1-4-2, 6-8-3-1, 4-9-1-5-3, 3-7-6-5-1-9,	6-5-8, 3-4-8-1, 6-8-2-5-1, 9-2-6-5-1-4

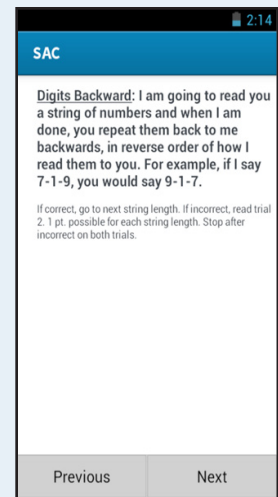
Read the list of numbers on the screen and record the appropriate response by checking the "Incorrect" or "Correct" box next to the number list.

Press **NEXT** to navigate to the **SAC Concentration 3** screen.

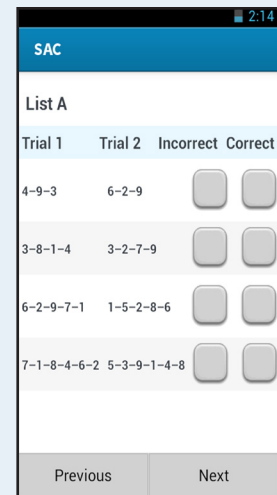
The **SAC Concentration 3** screen (Figure A8-9) contains the following information to be read by the operator to the subject:

**Months in Reverse Order:** Now tell me the months of the year in reverse order. Start with the last month and go backward. So you'll say December, November...Go ahead.

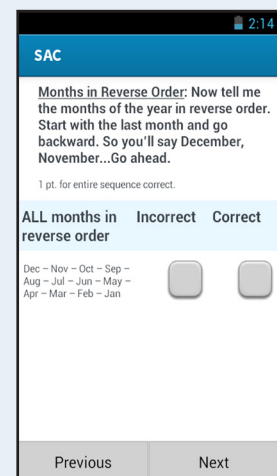
Press **NEXT** to navigate to the **SAC Delayed Recall** screen.



**Figure A8-7:**  
**SAC Concentration (Digits Backwards)**



**Figure A8-8:**  
**SAC Concentration (Trials)**



**Figure A8-9:**  
**SAC Concentration (Months)**

The **SAC Delayed Recall** screen (Figure A8-10) contains the following information to be read by the operator to the subject:

**Do you remember that list of words I read a few times earlier? Tell me as many words from the list as you can remember in any order.**

Record all the words reported by the subject by checking the **INCORRECT** or **CORRECT** box next to the word.

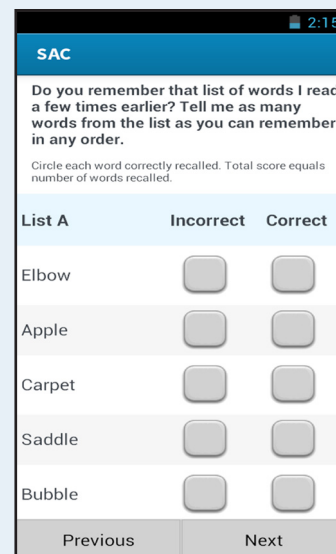
Press **NEXT** to navigate to the **SAC Summary** screen.

The **SAC Summary** screen (Figure A8-11) displays the results of each section of the SAC test.



**NOTE:** Exertional Maneuvers & Neurologic Screening are important for examination, but not incorporated into the SAC Total Score.

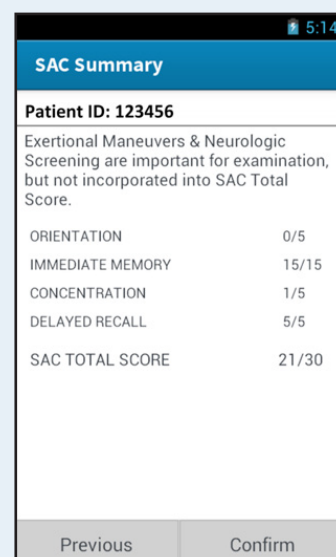
Press **CONFIRM** to return to the **Information Hub**.



List A	Incorrect	Correct
Elbow	<input type="checkbox"/>	<input type="checkbox"/>
Apple	<input type="checkbox"/>	<input type="checkbox"/>
Carpet	<input type="checkbox"/>	<input type="checkbox"/>
Saddle	<input type="checkbox"/>	<input type="checkbox"/>
Bubble	<input type="checkbox"/>	<input type="checkbox"/>

Previous Next

**Figure A8-10:**  
**SAC Delayed Recall**



**SAC Summary**

**Patient ID: 123456**

Exertional Maneuvers & Neurologic Screening are important for examination, but not incorporated into SAC Total Score.

ORIENTATION	0/5
IMMEDIATE MEMORY	15/15
CONCENTRATION	1/5
DELAYED RECALL	5/5
SAC TOTAL SCORE	21/30

Previous Confirm

**Figure A8-11:**  
**SAC Summary**

## SAC Detailed Results

Detailed results on current and previous SAC tests are stored in the database and can be accessed from the **Information Hub** screen.

Once a SAC test session has been completed the SAC total score will replace the **START** button next to the SAC test on the **Information Hub** (Figure A8-12).



**NOTE:** The **SAC Detailed Results** will default to view the **CURRENT TEST** tab.

### Current Test Tab

The **SAC Current Test Detailed Results** (Figure A8-13) contains two options to select from:

- Review – access responses and results from the entire SAC assessment
- New Test – start a new test



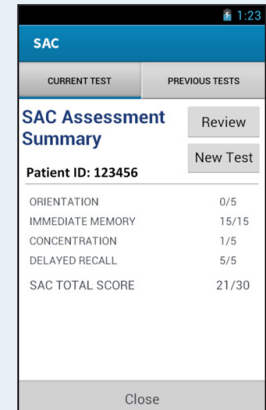
**NOTE:** While reviewing patient information the screen header will contain “Review” to inform the operator that they are currently in review mode.

The **SAC Review** screens will appear in the exact order of the testing sequence.

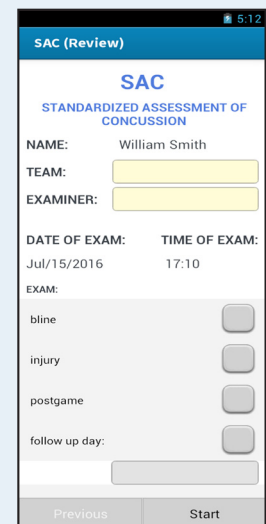
Press the **REVIEW** button to enter **SAC Review**. An example of a **SAC Review** screen is shown in Figure A8-14.



**Figure A8-12:**  
**SAC results area from the**  
**Information Hub**



**Figure A8-13:**  
**Current Test Detailed Results**



**Figure A8-14:**  
**Example of a SAC Review**

From the **SAC Summary Review** (Figure A8-15) press **CONFIRM** to return to the **SAC Current Test Detailed Results** (Figure A8-113).

From **SAC Current Test Detailed Results** (Figure A8-13) a new test can be started.

Press **NEW TEST** to begin the SAC test.

For instructions on completing a new SAC test refer to the sections above.

### Previous Test Tab

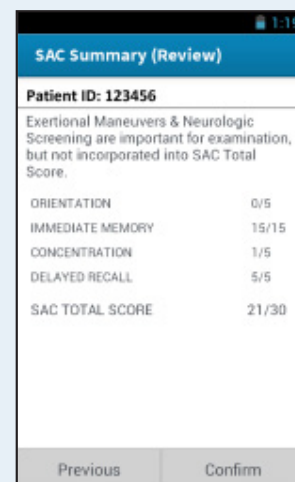
Results from previous SAC tests can be reviewed from the **SAC Previous Tests Detailed Results** (Figure A8-16) by pressing the **PREVIOUS TESTS** tab.

The **SAC Previous Tests Detailed Results** lists all tests recorded by test date, time and summary of symptoms.

To view the SAC Assessment Summaries, press the desired test from the "SAC Tests List".

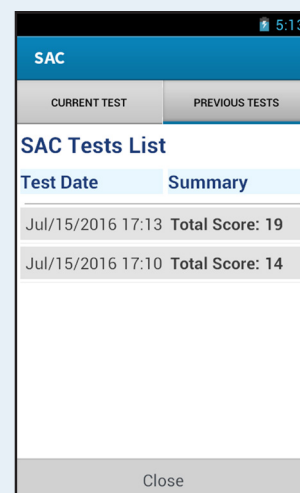
Once the test has been selected the **SAC Previous Test Review** (Figure A8-17) will appear displaying the test results.

For instructions on reviewing and starting a new test refer to the sections above.



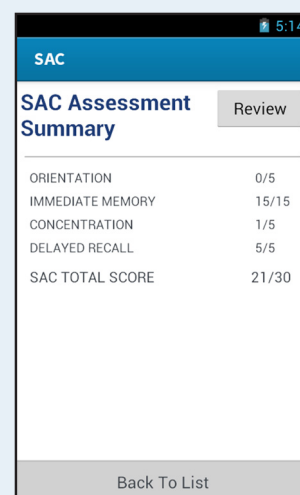
SAC Summary (Review)	
Patient ID: 123456	
Exertional Maneuvers & Neurologic Screening are important for examination, but not incorporated into SAC Total Score.	
ORIENTATION	0/5
IMMEDIATE MEMORY	15/15
CONCENTRATION	1/5
DELAYED RECALL	5/5
SAC TOTAL SCORE	21/30

**Figure A8-15:**  
Example of a SAC Summary



SAC	
CURRENT TEST	PREVIOUS TESTS
SAC Tests List	
Test Date	Summary
Jul/15/2016 17:13	Total Score: 19
Jul/15/2016 17:10	Total Score: 14

**Figure A8-16:**  
SAC Tests List



SAC	
SAC Assessment Summary	
Review	
ORIENTATION	0/5
IMMEDIATE MEMORY	15/15
CONCENTRATION	1/5
DELAYED RECALL	5/5
SAC TOTAL SCORE	21/30

**Figure A8-17:**  
Example of a SAC Previous Test Review

## Appendix 9: Military Acute Concussion Evaluation (MACE) Data Collection

The Military Acute Concussion Evaluation (MACE) is a screening test designed for the acute evaluation of concussion developed by the Defense and Veterans Brain Injury Center (DVBIC). The test is currently the only standardized and most widely used method for evaluation of acute mild TBI (also referred to as concussion) in military operational settings.

The MACE consists of 2 sections – History of Head Injury (Concussion Screening) and computerized version of the Standardized Assessment of Concussion (SAC) (Full Assessment). The sections consist of the following:

- A. Description of the incident
- B. Alteration of Consciousness or Memory
- C. Cognitive Exam – Standardized Assessment of Concussion (SAC)
  - a. Orientation
  - b. Immediate Memory
  - c. Neurological Screen
  - d. Concentration
  - e. Delayed Recall

There are two versions of the MACE available with the BrainScope One:

- MACE Concussion Screening
- Full MACE Exam

The Full MACE Exam test sequence will be available after the MACE Concussion Screening test sequence.

To begin a MACE assessment from the **Information Hub**, press **START** (Figure A9-1 or A9-2) next to the appropriate assessment and the handheld will navigate to **MACE Start** (Figure A9-3).

The Full Mace Exam sequence, will be available after the MACE Concussion Screening test sequence.

For Concussion Screening see Figure A9-1; for Full Exam see Figure A9-2.

Figure A9-1 appears when the operator has not completed the Concussion Screening and Figure A9-2 appears when the operator has completed the Concussion Screening.

### Concussion Screening

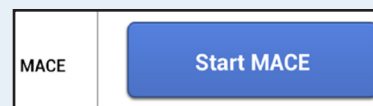
Press **START** (Figure A9-1) and the handheld will navigate to the **MACE Start** (Figure A9-3).

The Date and Time of Injury, Date and Time of Evaluation will be pre-populated from the entry in the **Patient Information** screens. Text entry fields are available for Service Member ID, Unit and Examiner.

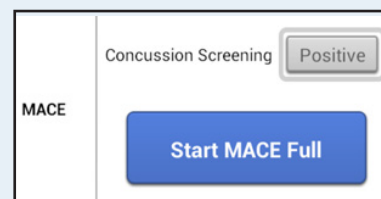
Press **START** to navigate to the **MACE Note** screen.

The **MACE Note** provides the following instructions:

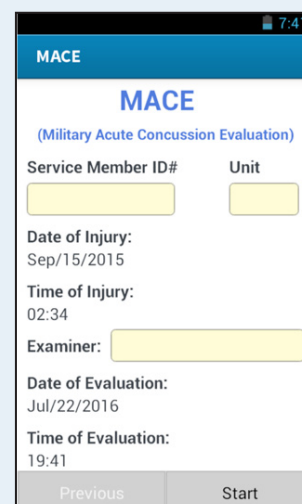
**Complete this section to determine if there was both an injury event AND an alteration of consciousness.**



**Figure A9-1:**  
**MACE Start from the**  
**Information Hub**



**Figure A9-2:**  
**MACE Full Assessment when**  
**Concussion Screening is completed**



**Figure A9-3:**  
**MACE Start**



The first section of the Concussion Screening begins with description of the incident (an example of a screen in this section is provided in Figure A9-4).

Ask the patient to describe memories of the incident and enter the text using the on-screen keyboard. Press **DONE** on the on-screen keyboard when complete. Press **NEXT** button to proceed to the next section.

Record the type of event using a pre-populated list of possible causes. Select one or as many as applies. If you select OTHER enter a cause of injury not listed.

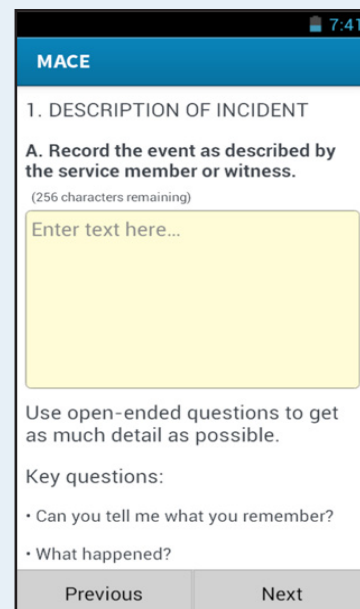
Press **NEXT** to proceed to the next section.



**NOTE:** If a button is inadvertently selected, select the button again to unselect.

The next sections enable data collection of any amnesia, loss of consciousness, previous concussions and symptoms associated with the incident (an example of a screen in this section is provided in Figure A9-5).

Upon completion of the history of head injury section, press **NEXT** to proceed with the viewing the Concussion Screening results.



**MACE**

1. DESCRIPTION OF INCIDENT

A. Record the event as described by the service member or witness.  
(256 characters remaining)

Enter text here...

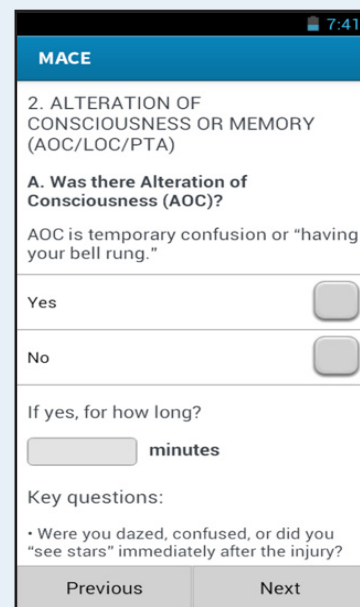
Use open-ended questions to get as much detail as possible.

Key questions:

- Can you tell me what you remember?
- What happened?

Previous Next

**Figure A9-4:**  
**MACE Description of Incident**



**MACE**

2. ALTERATION OF CONSCIOUSNESS OR MEMORY (AOC/LOC/PTA)

A. Was there Alteration of Consciousness (AOC)?

AOC is temporary confusion or "having your bell rung."

Yes ☐

No ☐

If yes, for how long?

minutes

Key questions:

- Were you dazed, confused, or did you "see stars" immediately after the injury?

Previous Next

**Figure A9-5:**  
**MACE Alteration of Consciousness or Memory (AOC/LOC/PTA)**

There are three options for the MACE Concussion Screening Results.

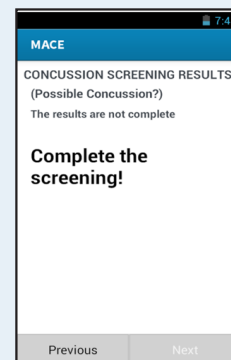
1. Complete the Screening – The results are not complete
2. Continue with MACE – MACE results indicate need for further assessment
3. Stop MACE – MACE results indicate there is not a need for further assessment

If the **Complete the Screening MACE Results** screen is displayed (Figure A9-6) press **PREVIOUS** to return to the previous pages and complete the screening. The results of the Concussion Screening have been found to be incomplete and will need to be completed prior to moving on with the full MACE exam, if available. The **NEXT** button will be grayed out.

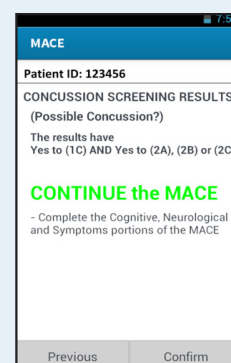
Press **CONFIRM** (Figure A9-7) to return to the **Information Hub**. The Full MACE Exam can then be started to complete the Cognitive, Neurological and Symptoms portions of the MACE. (Figure A9-2)

If the patient is not found to have an injury event and an alteration of consciousness based on the data entered by the operator, the **Stop MACE Results** screen will appear (Figure A9-8).

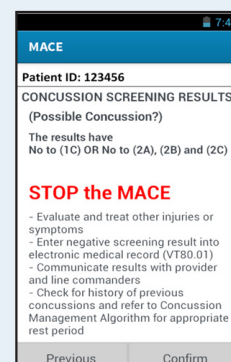
If the **Stop MACE Results** screen appears, press **CONFIRM** to navigate back to the **Information Hub**.



**Figure A9-6:**  
**Complete the Screening**



**Figure A9-7:**  
**Continue the MACE**  
**(continue with full assessment)**



**Figure A9-8:**  
**Stop the MACE**

## Cognitive Assessment

The **MACE - Orientation** provides information related to the current time of assessment. Ask the patient about the month, date, day of week, year and time and record each correct answer by selecting the corresponding button. (an example of a screen in this section is provided in Figure A9-9).

The Immediate Memory test assesses how well a list of five pre-populated words can be memorized.

From the **MACE - Immediate Memory**, read the list of words and select the corresponding button when repeated back. After each exercise, press **NEXT** to advance to the next trial. This exercise must be repeated three times to proceed (Trial 1 of 3, Trial 2 of 3, etc.) (an example of a screen in this section is provided in Figure A9-10)

Multiple lists of words exist (A-F) for subsequent testing at a later time. Press **SWAP** to generate a new list of words if the patient was recently administered the A list, for example.

Complete a standard neurological screening examination and select **NORMAL** or **ABNORMAL** (an example of a screen in this section is provided in Figure A9-11).

The Concentration test consists of numeric exercises (an example of a screen in this section is provided in Figure A9-12).

For the numeric exercise, read the list of numbers and ask the patient to repeat it **in reverse order**. If the patient correctly recalls the numbers in the correct sequence, select **CORRECT**; otherwise select **INCORRECT**. Selecting **CORRECT** will enable a new list with longer strings of numbers until the evaluation is complete. Selecting **INCORRECT** will enable a new list of numbers with the same degree of difficulty. If two consecutive evaluations are incorrect, the evaluation for this exercise is complete.

Press **SWAP** to generate a new list of numbers if the patient was recently administered the A list, for example.

For this verbal exercise, ask the patient to recite the months of the year **in reverse order**. If this is completed accurately, select **CORRECT**; otherwise select **INCORRECT**. Press **NEXT**.

Last, on the **Delayed Recall** screen (Figure A9-13), ask the patient to recall the list of five words, introduced earlier during the test.

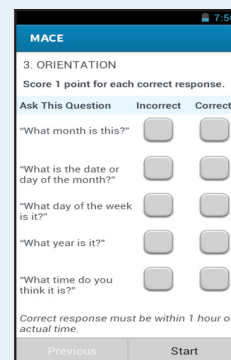


Figure A9-9:  
MACE Orientation

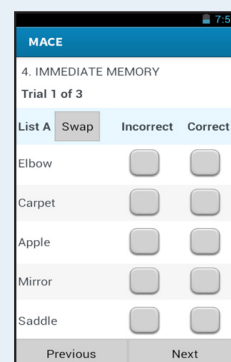


Figure A9-10:  
MACE Immediate Memory

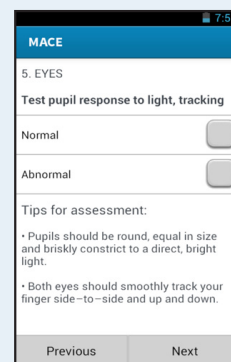


Figure A9-11:  
MACE Standard Neurological  
Screening

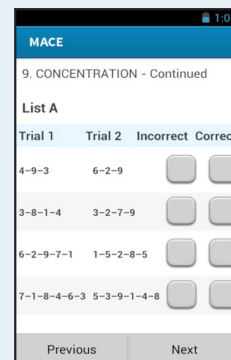


Figure A9-12:  
MACE Concentration



**NOTE:** Do not provide the list.

Select the word(s) that are repeated by selecting the corresponding button. Press **NEXT** to proceed to the Symptom Screening.

## Symptom Screening

The **MACE - Symptom Screening** (Figure A9-14) provides information related to the patient's symptoms. Record the symptoms using a pre-populated list of possible symptoms. Select one or as many as applies. If you select **OTHER** enter a cause of injury not listed. Press **NEXT** to proceed to the next section.

The **MACE - Concussion History** (Figure A9-15) asks the patient about their concussion history in the past 12 months. Read the question to the patient and mark **YES** or **NO**. If the patient answers **YES**, record the number of concussions.

**MACE**

10. DELAYED RECALL

Read the script and circle the response for each word. Do NOT repeat the word list.

Note: Use the same list (A-F) that was used in Question 4.

Script:

• "Do you remember that list of words I read a few minutes earlier? I want you to tell me as many words from that list as you can remember. You can say them in any order."

List A	Incorrect	Correct
Elbow	<input type="button" value="Incorrect"/>	<input type="button" value="Correct"/>
Carpet	<input type="button" value="Incorrect"/>	<input type="button" value="Correct"/>
Apple	<input type="button" value="Incorrect"/>	<input type="button" value="Correct"/>
Mirror	<input type="button" value="Incorrect"/>	<input type="button" value="Correct"/>
Saddle	<input type="button" value="Incorrect"/>	<input type="button" value="Correct"/>

Previous Next

**Figure A9-13:**  
**MACE Delayed Recall**

**MACE**

11. SYMPTOMS

Check all that apply

☐ Headache ☐ Balance Problems

☐ Irritability ☐ Dizziness

☐ Nausea/Vomiting

☐ Visual Disturbances

☐ Memory Problems

☐ Difficulty Concentrating

☐ Ringing in the Ears ☐ Other

If other, explain...

Previous Next

**Figure A9-14:**  
**MACE Symptom Screening**

**MACE**

12. CONCUSSION HISTORY

During the past 12 months have you been diagnosed with a concussion, not counting this event?

Yes

No

If yes, how many?

Refer to Concussion Management Algorithm for clinical care guidance.

Previous Next

**Figure A9-15:**  
**MACE Concussion History**

## MACE Summary Screen

Upon completion of all sections of the MACE, the results will appear (Figure A9-16).

The MACE score, composed from the answers in the SAC section, ranges from 0 to 30. The maximum total score for orientation, concentration and delayed recall is 5 each and immediate memory is 15.

The Neurological Screening indicates Normal results in green and Abnormal results in red.

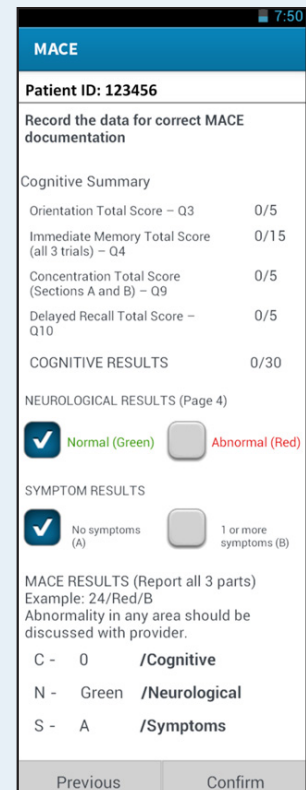
The Symptoms are rated "A" – no symptoms associated with injury, or "B" – symptoms associated with injury.

The MACE Results located at the bottom of the screen is a summary of the Cognitive, Neurological and Symptoms sections of the test.



**NOTE:** Although cognitive is listed first in the summary of MACE results, this should not suggest that any one of the three screening categories is more or less important than the others. Each area (Cognitive, Neurological, Symptoms) must be evaluated carefully. The results of all three evaluations must be included in any MACE report for it to be considered complete. Regarding cognitive scores, in studies of non-concussed subjects, the mean total cognitive score was 28. Therefore, a score of < 30 does not imply that a concussion has occurred. Definitive normative data for a cut-off score are not available. The Concussion Management Algorithm stipulates that a cognitive score of < 25 or the presence of symptoms requires consultation with a provider.

For MACE score interpretation, refer to the latest DVBIC mTBI/ Concussion Clinical Guidance, available at DVBIC website, <http://www.dvbic.org/>



**MACE**

Patient ID: 123456

Record the data for correct MACE documentation

Cognitive Summary

Orientation Total Score – Q3	0/5
Immediate Memory Total Score (all 3 trials) – Q4	0/15
Concentration Total Score (Sections A and B) – Q9	0/5
Delayed Recall Total Score – Q10	0/5
<b>COGNITIVE RESULTS</b>	<b>0/30</b>

NEUROLOGICAL RESULTS (Page 4)

☒ Normal (Green) ☐ Abnormal (Red)

SYMPTOM RESULTS

☒ No symptoms (A) ☐ 1 or more symptoms (B)

MACE RESULTS (Report all 3 parts)  
Example: 24/Red/B  
Abnormality in any area should be discussed with provider.

C - 0 /Cognitive  
N - Green /Neurological  
S - A /Symptoms

Previous Confirm

**Figure A9-16:**  
**MACE Summary**

## MACE Detailed Results

Detailed results on current and previous MACE tests are stored in the database and can be accessed from the **Information Hub**. In the detailed results screens the operator can review all MACE tests recorded, edit results and start a new test.

To access the **MACE Detailed Results**, press the MACE score (Figure A9-17 or Figure A9-18) from the **Information Hub**.



**NOTE:** The **MACE Full Assessment Detailed Results** will default to view the **CURRENT TEST** tab. The **MACE Concussion Screening Detailed Results** (Figure A9-19) only display the current test. The MACE Concussion Screening can only be executed once whereas the MACE Full Assessment can be executed several times.

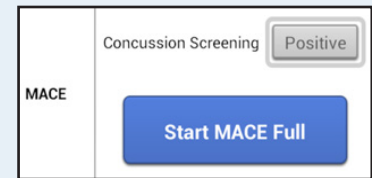
## Current Test Tab

The **MACE Full Assessment Current Test Detailed Results** (Figure A9-20) contains two options to select from:

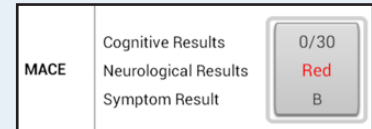
- Review – access responses and results for the entire MACE assessment
- New Test – start a new test



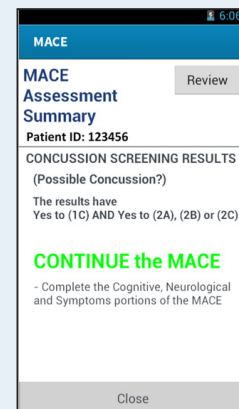
**NOTE:** While reviewing patient information the screen header will contain “Review” to inform the operator that they are currently in review mode.



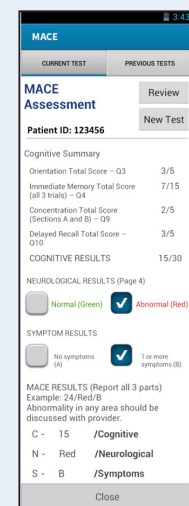
**Figure A9-17:**  
MACE results area from the Information Hub when Concussion Screening Only has been completed



**Figure A9-18:**  
MACE results area from the Information Hub when Full MACE Assessment has been completed



**Figure A9-19:**  
Current Test Detailed Results (concussion screening only)



**Figure A9-20:**  
Current Test Detailed Results (full assessment)

The **MACE Review** screens will appear in exact order of the testing sequence.

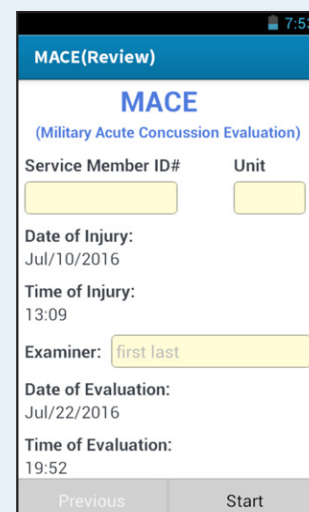
Press the **REVIEW** button to enter **MACE Review**. An example of a **MACE Review** screen is shown in Figure A9-21.

From the **MACE Results Review** (Figure A9-22) press **CONFIRM** to return to the **MACE Current Test Detailed Results**.

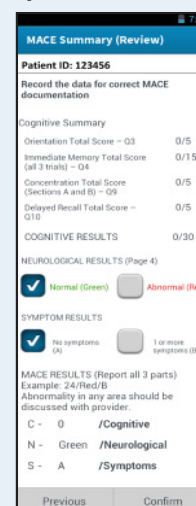
From **MACE Full Assessment Current Test Detailed Results** (Figure A9-20) a new test can be started.

Press **NEW TEST** to begin the MACE test.

For instructions on completing a new MACE test refer to the sections above.



**Figure A9-21:**  
Example of a MACE Review



**Figure A9-22:**  
Example of a MACE Results



## Previous Test Tab

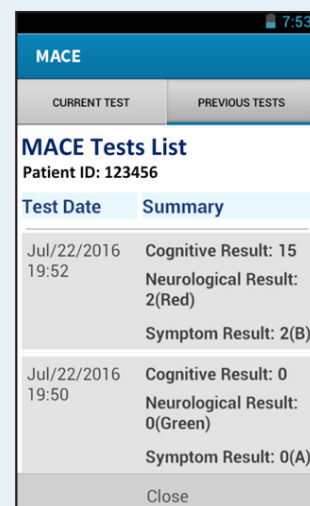
Results from previous MACE testing dates and times can be reviewed from the **MACE Full Assessment Tests Detailed Results** (Figure A9-23) by pressing **PREVIOUS TESTS** tab.

The **MACE Full Assessment Previous Tests Detailed Results** lists all tests recorded by test date, time and summary of symptoms.

To view the MACE Assessment Summaries, press the desired test from the "MACE Tests List".

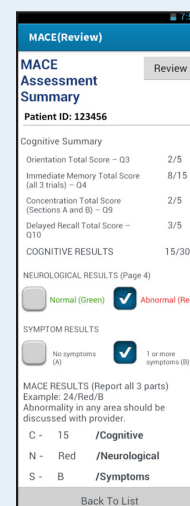
Once the test has been selected the **MACE Full Assessment Previous Test Review** (Figure A9-24) will appear displaying the test results.

For instructions on reviewing, editing and starting a new test refer to the sections above.



MACE	
CURRENT TEST	PREVIOUS TESTS
<b>MACE Tests List</b> Patient ID: 123456	
Test Date	Summary
Jul/22/2016 19:52	Cognitive Result: 15 Neurological Result: 2(Red) Symptom Result: 2(B)
Jul/22/2016 19:50	Cognitive Result: 0 Neurological Result: 0(Green) Symptom Result: 0(A)
Close	

**Figure A9-23:**  
**MACE Tests List**



**MACE (Review)**

**MACE Assessment Summary** Review

Patient ID: 123456

**Cognitive Summary**

Orientation Total Score - Q3 2/5

Immediate Memory Total Score (all 3 trials) - Q4 8/15

Concentration Total Score (Sections A and B) - Q5 2/5

Delayed Recall Total Score - Q10 3/5

COGNITIVE RESULTS 15/30

NEUROLOGICAL RESULTS (Page 4)

☐ Normal (Green) ☒ Abnormal (Red)

SYMPTOM RESULTS

☐ No symptoms (A) ☒ 1 or more symptoms (B)

**MACE RESULTS (Report all 3 parts)**  
Example: 24/Red/B  
Abnormality in any area should be discussed with provider.

C - 15 /Cognitive

N - Red /Neurological

S - B /Symptoms

Back To List

**Figure A9-24:**  
**MACE Previous Test Review**

## Appendix 10: Acute Concussion Evaluation (ACE) – Sports

Acute Concussion Evaluation (ACE) — is an assessment tool that can be used for the initial evaluation and diagnosis of people who have a known or suspected concussion or mild TBI.

To begin the ACE – Sports from the **Information Hub**, press the **START** button (Figure A10-1) and the handheld will navigate to the **ACE-Sports Concussion Signs 1** (Figure A10-2).

The **ACE-Sports Concussion Signs 1 and 2** screens each contain ten checkboxes to record signs that have been observed by medical staff. Press the checkbox to record if that sign has been observed and repeat for all ten signs.

Press **NEXT** to advance to the **ACE-Sports Concussion Symptoms** screens.

At any time, press **PREVIOUS** to navigate to the previous screen.

The **ACE-Sports Concussion Symptoms 1 and 2** screens each contain nine checkboxes to record symptoms that have been reported by the subject. Press the checkbox to record if that symptom has been observed and repeat for all nine symptoms.

Press **NEXT** to advance to the **ACE-Sports Neurological** screens.

The **ACE-Sports Neurological 1 and 2** screens each contain 13 checkboxes to record signs of deteriorating neurological function. Press the checkbox to record if that sign has been observed and repeat for all nine signs.



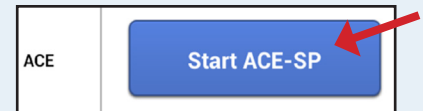
**NOTE:** Any athlete should be taken to the emergency department if any of the following signs and/or symptoms are present.

Press **NEXT** to advance to the **ACE-Sports Mental Status** screens.

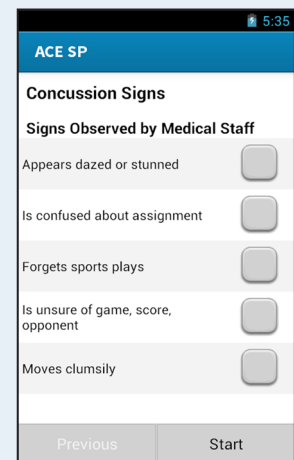
The **ACE-Sports Mental Status 1 through 3** screens each contain symptoms of Orientation, Anterograde Amnesia, Retrograde Amnesia and Concentration.

Read the question to the subject and then press **INCORRECT** or **CORRECT** to record the answer provided.

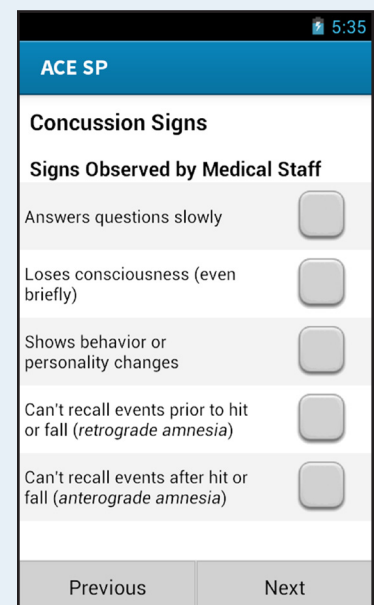
Once all information has been recorded press **NEXT** to advance to the **ACE-Sports Summary** screen (Figure A10-3).



**Figure A10-1:**  
**ACE-Sports Start from**  
**Information Hub**



**Figure A10-2:**  
**ACE-Sports Concussion Signs**  
**Screens**



**Figure A10-3:**  
**ACE-Sports Summary Screen**

## ACE-Sports Detailed Results

Detailed results on current and previous ACE-Sports tests are stored in the database and can be accessed from the **Information Hub**. In the detailed results screens the operator can review all ACE-Sports tests recorded, edit results and start a new test.

To access the **ACE-Sports Detailed Results**, press the **VIEW** (Figure A10-4) from the **Information Hub**.



**NOTE:** The **ACE-Sports Detailed Results** will default to view the **CURRENT TEST** tab.

### Current Test Tab

The **ACE-Sports Current Test Detailed Results** (Figure A10-5) contains two options to select from:

- Review – access responses and results for the entire ACE-Sports assessment
- New Test – start a new test



**NOTE:** While reviewing patient information the screen header will contain “Review” to inform the operator that they are currently in review mode.

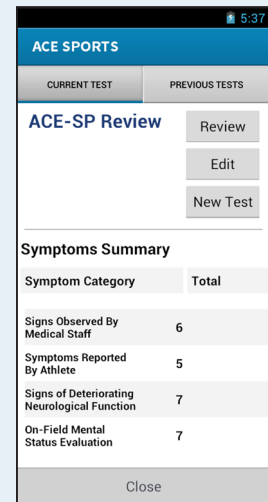
The **ACE-Sports Review** screens will appear in exact order of the testing sequence.

Press the **REVIEW** button to enter **ACE-Sports Review**. An example of a **ACE-Sports Review** screen is shown in Figure A10-6.

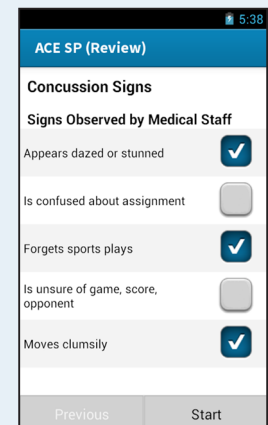
From the **ACE-Sports Results Review** (Figure A10-7) press **CONFIRM** to return to the **ACE-Sports Current Test Detailed Results** (Figure A10-5).



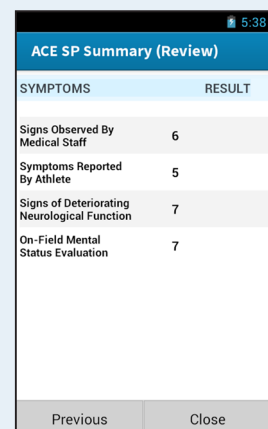
**Figure A10-4:**  
**ACE-Sports results area from the Information Hub**



**Figure A10-5:**  
**Current Test Detailed Results**



**Figure A10-6**  
**Example of a ACE-Sports Review**



**Figure A10-7:**  
**Example of a ACE-Sports Results**

From **ACE-Sports Current Test Detailed Results** (Figure A10-5) a new test can be started.

Press **NEW TEST** to begin the ACE-Sports test.

For instructions on completing a new ACE-Sports test refer to the sections above.

### Previous Test Tab

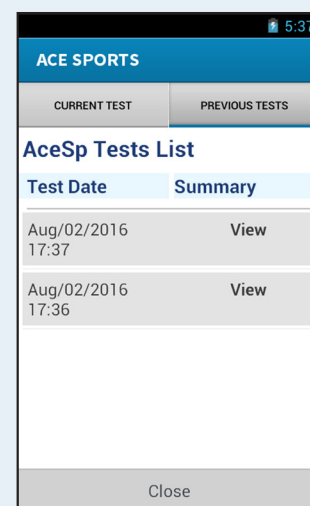
Results from previous ACE-Sports testing dates and times can be reviewed from the **ACE-Sports Previous Tests Detailed Results** (Figure A10-8) by pressing **PREVIOUS TESTS** tab.

The **ACE-Sports Previous Tests Detailed Results** lists all tests recorded by test date, time and summary of symptoms.

To view the ACE-Sports Assessment Summaries, press the desired test from the "ACE-Sports Tests List".

Once the test has been selected the **ACE-Sports Previous Test Review** (Figure A10-9) will appear displaying the test results.

For instructions on reviewing, editing and starting a new test refer to the sections above.



ACE SPORTS	
CURRENT TEST	PREVIOUS TESTS
<b>AceSp Tests List</b>	
Test Date	Summary
Aug/02/2016 17:37	View
Aug/02/2016 17:36	View
Close	

**Figure A10-8:**  
**ACE-Sports Tests List**



ACE SPORTS	
ACE-SP Review	Review
<b>Symptoms Summary</b>	
Symptom Category	Total
Signs Observed By Medical Staff	6
Symptoms Reported By Athlete	5
Signs of Deteriorating Neurological Function	7
On-Field Mental Status Evaluation	7
Back To List	

**Figure A10-9:**  
**ACE-Sports Previous Test Review**

## Appendix 11: Acute Concussion Evaluation (ACE) – Emergency Department (Version v1.4)

The Acute Concussion Evaluation (ACE) tool is a physician/clinician form used to evaluate individuals for a concussion.<sup>28,29</sup> The form consists of questions about the presence of concussion characteristics (i.e., loss of consciousness, amnesia), 22 concussion symptoms, and risk factors that might predict prolonged recovery (i.e., a history of concussion). The ACE can be used serially to track symptom recovery over time to help inform clinical management decisions.

To begin the ACE – Emergency Department from the **Information Hub**, press **START** (Figure A11-1) and the handheld will navigate to the **ACE-ED Start** screen (Figure A11-2).

The Date fields on the **ACE-ED Start** screen will be pre-populated with the Date of Injury entered on the **Patient Information 1** screen and the current date.

The Name and Age field on the **ACE-ED Start** screen will be pre-populated with the patient name and age for the current session.

An ID/MR# field is available to enter the patient hospital identification or medical record number.

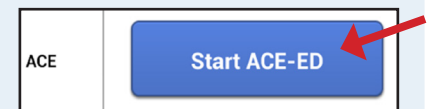
Press **START** to navigate to the **ACE-ED Injury Characteristics** screen.

The **ACE-ED Injury Characteristics** screen (Figure A11-3) allows for the operator to record when the injury occurred and who is reporting the injury.

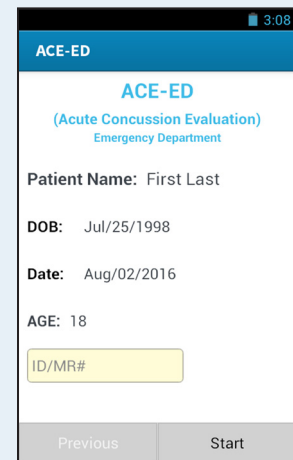
The following options are available to record who is reporting the injury characteristics: (Press the checkbox next to the selection to record)

- Patient
- Parent
- Spouse
- Other (If other, a text entry field is available to enter text.)

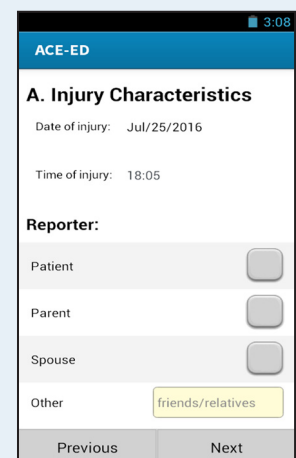
Press **NEXT** to navigate to the **ACE-ED Injury Description** screen.



**Figure A11-1:**  
**ACE-ED Start from**  
**Information Hub**



**Figure A11-2:**  
**ACE-ED Start**



**Figure A11-3:**  
**ACE-ED Injury Characteristics**

<sup>28</sup> Gioia G, Collins M. Acute Concussion Evaluation (ACE): Physician/Clinician Office Version. 2006.

<sup>29</sup> Gioia G, Collins M, Isquith PK. Improving identification and diagnosis of mild traumatic brain injury with evidence: Psychometric support for the Acute Concussion Evaluation. Journal of Head Trauma Rehabilitation. 2008a;23(4):230–242

The **ACE-ED Injury Description** screen (Figure A11-4) allows for entry of the events resulting in the injury; how the injury occurred, type of force, and evidence of intracranial injury or skull fracture.

The next sequence of screens allows for entry of the following information: (an example of one of the screens is provided in Figure A11-5)

- Location of Impact
- Cause
- Amnesia Before
- Amnesia After
- Loss of Consciousness
- Early Signs
- Seizures

The **ACE-ED Symptoms** screen provides instructions for completing the **ACE-ED Symptoms 2 through 5** screens.

The ACE-ED Symptom Check List is provided on the **ACE-ED Symptoms 2 through 5** screens (an example of one of the screens is provided in Figure A11-6).

The following information can be used as a guide while completing the symptoms check list:

- Ask patient (and/or parent, if child) to report presence of the 4 categories of symptoms (Physical, Cognitive, Emotional, and Sleep) since injury. It is important to assess all listed symptoms as different parts of the brain control different functions. One or all symptoms may be present depending upon mechanisms of injury. If the symptom is not present, press "NO" (No = 0) on the scale, press "YES" (Yes = 1) if present.



**NOTE:** Most sleep symptoms are only applicable after a night has passed since the injury. If not applicable, press N/A. Drowsiness may be present on the day of injury.

- Since symptoms can be present premorbidly/ at baseline (e.g., inattention, headaches, sleep, sadness), it is important to assess change from its typical presentation. For any symptom – if Patient/Parent indicates "I/He usually has that problem/ symptom" – Ask "Are you/they experiencing this symptom more than usual or in a different manner than usual?" If the symptom is not present, press "NO" on the scale, press "YES" if present.

**Figure A11-4:**  
**ACE-ED Injury Description**

**Figure A11-5:**  
**ACE-ED Injury Description Details**

**Figure A11-6:**  
**ACE-ED Symptoms**

**Scoring:** Sum total number of symptoms present per area, and sum all 4 areas into Total Symptom Score.

If symptoms are new and present, there is no lower limit symptom score.

Any score > 0 indicates positive symptom history.

On the **ACE-ED Symptoms 5** screen press **NEXT** to navigate to the **ACE-ED Symptoms Summary** screen.

The **ACE-ED Symptoms Summary** screen (Figure A11-7) will provide a summary of the results recorded during the ACE-ED Symptoms Check List.

Press **NEXT** to navigate to the **ACE-ED Participation** screen.

The **ACE-ED Participation** screen (Figure A11-8) allows for entry of the extent to which the patient is able to participate in the evaluation and, if less than fully, give reason for Partial or No participation.

Press the checkbox next to the option to record the results. A text field is available for to record details if "Other" is selected.

Press **NEXT** to navigate to the **ACE-ED History** screen.

The **ACE-ED History** screen (Figure A11-9) allows for entry of concussion and headache history for the patient.

For concussion history, assess the number and date(s) of prior concussions.



**NOTE:** History of prior concussions, especially recent (within past several weeks or months) would suggest the need for more conservative decision-making regarding Return to Play, and general post-injury management.

For headache history, assess personal history of diagnosis/treatment for headaches.

Press **NEXT** to navigate to the **ACE-ED Diagnosis** screen.

Symptom Category	Total
Physical	0
Cognitive	0
Emotional Upset	0
Sleep	0
Other Observations	
<b>Total Symptoms</b>	<b>0</b>

**Figure A11-7:**  
**ACE-ED Symptoms Summary**

**Figure A11-8:**  
**ACE-ED Participation**

**Figure A11-9:**  
**ACE-ED History**



The **ACE-ED Diagnosis** screen (Figure A11-10) allows for entry of the appropriate ICD diagnostic code.

The following can be used as a guide in determining which options to select.

**Diagnosis:** Assign the most appropriate diagnosis given the following:

**850.0 (Concussion, with no loss of consciousness)** – Positive Injury Description (A1), i.e., forcible direct/indirect blow to the head; plus evidence of active symptoms (B) of any type and number related to the trauma; no evidence of LOC (A5), skull fracture, or other intracranial injury.

**850.1 (Concussion, with brief loss of consciousness < 1 hour)** – Positive Injury Description (A1), i.e., forcible direct/indirect blow to the head; plus evidence of active symptoms (B) of any type and number related to the trauma; positive evidence of LOC (A5); no skull fracture, or other intracranial injury.

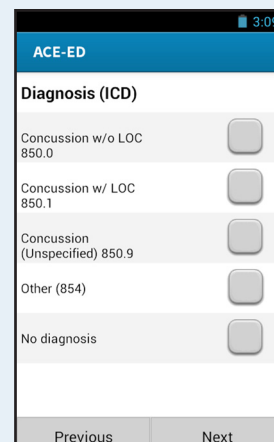
**850.9 (Concussion, unspecified)** – Positive Injury Description (A1), i.e., forcible direct/indirect blow to the head; plus evidence of active symptoms (B) of any type and number related to the trauma; unclear/unknown injury details; unclear evidence of LOC (A5), no skull fracture, or other intracranial injury.



**NOTE: If there is evidence of skull fracture of structural intracranial injury to the brain, consider 854 (Intracranial injury of other and unspecified nature; 854.0 Without mention of open intracranial wound, 854.1 With open intracranial wound). Avoid using nonspecific Head injury NOS (959.01) whenever possible.**

Press the checkbox next to the option to record the results.

Press **NEXT** to navigate to the **ACE-ED Follow-up** screen.



**Figure A11-10:**  
**ACE-ED Diagnosis**

The **ACE-ED Follow-up** screen (Figure A11-11) allows for entry of the follow-up action plan. The following can be used as a guide in determining the best options:

**Follow-Up Action:** Determine a plan of action for follow-up of symptomatic patients. Serial evaluation of the concussion is critical as symptoms may resolve, worsen, or ebb and flow depending upon a variety of factors (e.g., cognitive/physical exertion, comorbidities). Referral to a specialist can be particularly valuable to help manage certain aspects of the patient's condition.

(a) Patient monitoring in the primary care physician office.

(b) Referral to a specialist: particularly valuable to help manage certain aspects of the patient's condition.

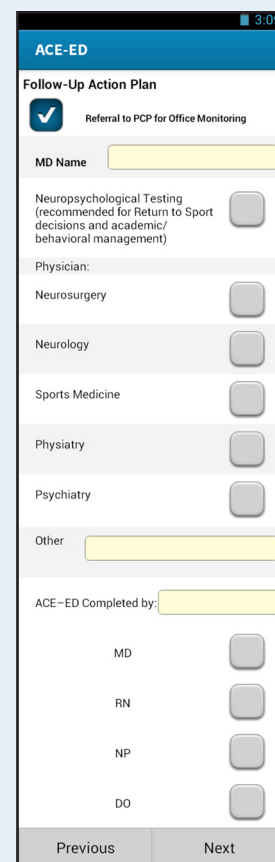
- Neuropsychological Testing is particularly relevant for cognitive and/or behavioral dysfunction affecting school, home or work activities, for purpose of treatment planning. Testing is also recommended when a patient may be returning to ED or other at-risk activities.
- Physician Evaluation is particularly relevant for medical evaluation and management of concussion. Also, critical for evaluation and management of focal neurologic, sensory, vestibular, and motor concerns. May be useful for medication management (e.g., headaches, sleep disturbance, depression) if post-concussive problems persist.

Press the checkbox next to the option to record the results. Text entry fields are available to record the physician the patient is being referred to and the ACE-ED test administrator.

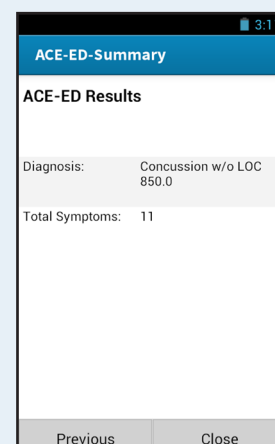
Press **NEXT** to navigate to the **ACE-ED Summary** screen.

The **ACE-ED Summary** screen (Figure A11-12) provides the diagnosis code as entered by the operator and the total number of symptoms recorded during the Symptoms Check List.

Press **CONFIRM** to return to the **Information Hub** screen.



**Figure A11-11:**  
**ACE-ED Follow-up**



**Figure A11-12:**  
**ACE-ED Summary**

## ACE-ED Detailed Results

Detailed results on current and previous ACE-ED tests are stored in the database and can be accessed from the **Information Hub**. In the detailed results screens the operator can review all ACE-ED tests recorded, edit results and start a new test.

To access the **ACE-ED Detailed Results**, press the ACE-ED score (Figure A11-13) from the **Information Hub**.



**NOTE:** The **ACE-ED Detailed Results** will default to view the **CURRENT TEST** tab.

## Current Test Tab

The **ACE-ED Current Test Detailed Results** (Figure A11-14) contains two options to select from:

- Review – access responses and results for the entire ACE-ED assessment
- New Test – start a new test

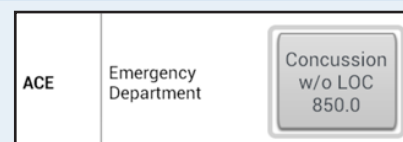


**NOTE:** While reviewing patient information the screen header will contain “Review” to inform the operator that they are currently in review mode.

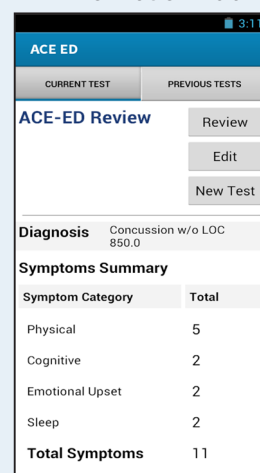
The **ACE-ED Review** screens will appear in exact order of the testing sequence.

Press the **REVIEW** button to enter **ACE-ED Review**. An example of a **ACE-ED Review** screen is shown in Figure A11-15.

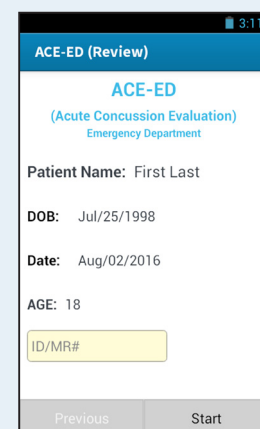
From the **ACE-ED Results Review** (Figure A11-16) press **CONFIRM** to return to the **ACE-ED Current Test Detailed Results** (Figure A11-14).



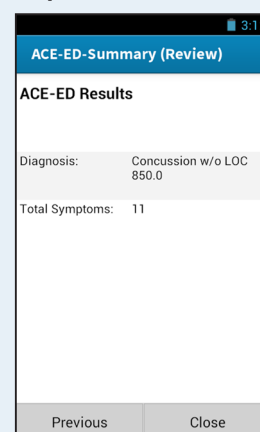
**Figure A11-13:**  
**ACE-ED results area from the Information Hub**



**Figure A11-14:**  
**Current Test Detailed Results**



**Figure A11-15**  
**Example of a ACE-ED Review**



**Figure A11-16:**  
**Example of a ACE-ED Results**

From **ACE-ED Current Test Detailed Results** (Figure A11-14) a new test can be started.

Press **NEW TEST** to begin the ACE-ED test.

For instructions on completing a new ACE-ED test refer to the sections above.

### Previous Test Tab

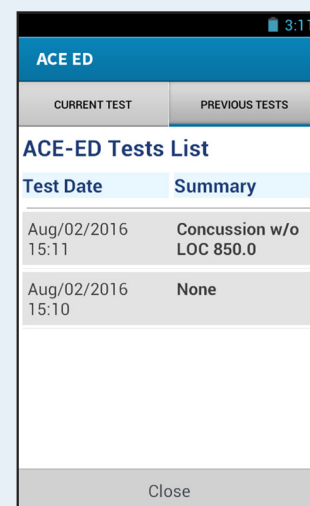
Results from previous ACE-ED testing dates and times can be reviewed from the **ACE-ED Previous Tests Detailed Results** (Figure A11-17) by pressing **PREVIOUS TESTS** tab.

The **ACE-ED Previous Tests Detailed Results** lists all tests recorded by test date, time and summary of symptoms.

To view the ACE-ED Assessment Summaries, press the desired test from the "ACE-ED Tests List"

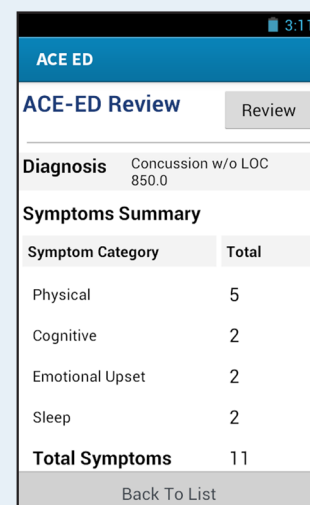
Once the test has been selected the **ACE-ED Previous Test Review** (Figure A11-18) will appear displaying the test results.

For instructions on reviewing, editing and starting a new test refer to the sections above.



ACE ED	
CURRENT TEST	PREVIOUS TESTS
<b>ACE-ED Tests List</b>	
Test Date	Summary
Aug/02/2016 15:11	Concussion w/o LOC 850.0
Aug/02/2016 15:10	None
Close	

**Figure A11-17:**  
**ACE-ED Tests List**



ACE ED	
<b>ACE-ED Review</b> <span>Review</span>	
<b>Diagnosis</b>	Concussion w/o LOC 850.0
<b>Symptoms Summary</b>	
Symptom Category	Total
Physical	5
Cognitive	2
Emotional Upset	2
Sleep	2
<b>Total Symptoms</b>	<b>11</b>
Back To List	

**Figure A4-18:**  
**ACE-ED Previous Test Review**

## Appendix 12: Acute Concussion Evaluation (ACE) – Physician/Clinician Office Version

The Acute Concussion Evaluation (ACE) tool is a physician/clinician form used to evaluate individuals for a concussion.<sup>30,31</sup> The form consists of questions about the presence of concussion characteristics (i.e., loss of consciousness, amnesia), 22 concussion symptoms, and risk factors that might predict prolonged recovery (i.e., a history of concussion). The ACE can be used serially to track symptom recovery over time to help inform clinical management decisions.

To begin the ACE – Physician/Clinician Office from the **Information Hub** screen, press the START button (Figure A12-1) and the handheld will navigate to the **ACE-PH Start** screen (Figure A12-2).

The Date fields on the **ACE-PH Start** screen will be pre-populated with the Date of Injury entered on the **Patient Information 1** screen and the current date.

The Name and Age field on the **ACE-PH Start** screen will be pre-populated with the patient name and age for the current session.

An ID/MR# field is available to enter the patient hospital identification or medical record number.

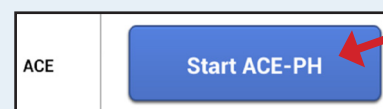
Press **START** to navigate to the **ACE-PH Injury Characteristics** screen.

The **ACE-PH Injury Characteristics** screen (Figure A12-3) allows for the operator to record when the injury occurred and who is reporting the injury.

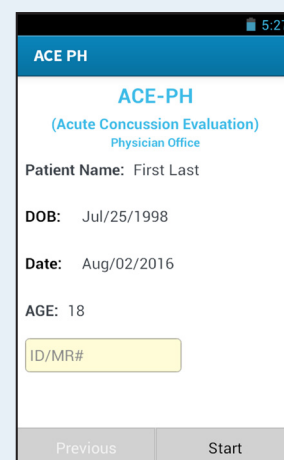
The following options are available to record who is reporting the injury characteristics: (Press the checkbox next to the selection to record)

- Patient
- Parent
- Spouse
- Other (If other, a text entry field is available to enter text.)

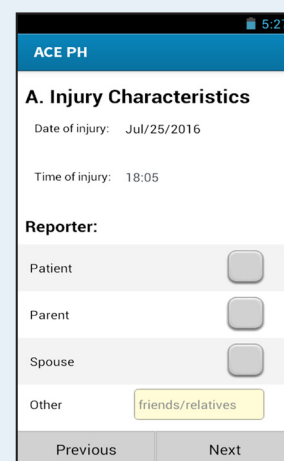
Press **NEXT** to navigate to the **ACE-PH Injury Description** screen.



**Figure A12-1:**  
**ACE-PH Start from**  
**Information Hub**



**Figure A12-2:**  
**ACE-PH Start**



**Figure A12-3:**  
**ACE-PH Injury Characteristics**

<sup>30</sup> Gioia G, Collins M. Acute Concussion Evaluation (ACE): Physician/Clinician Office Version. 2006.

<sup>31</sup> Gioia G, Collins M, Isquith PK. Improving identification and diagnosis of mild traumatic brain injury with evidence: Psychometric support for the Acute Concussion Evaluation. Journal of Head Trauma Rehabilitation. 2008a;23(4):230-242

The **ACE-PH Injury Description** screen (Figure A12-4) allows for entry of the events resulting in the injury; how the injury occurred, type of force, and evidence of intracranial injury or skull fracture.

The next sequence of screens allows for entry of the following information: (an example of one of the screens is provided in Figure A12-5)

- Location of Impact
- Cause
- Amnesia Before
- Amnesia After
- Loss of Consciousness
- Early Signs
- Seizures

The **ACE-PH Symptoms** screen provides instructions for completing the **ACE-PH Symptoms 2 through 5** screens.

The ACE-PH Symptom Check List is provided on the **ACE-PH Symptoms 2 through 5** screens (an example of one of the screens is provided in Figure A12-6).

The following information can be used as a guide while completing the symptoms check list:

- Ask patient (and/or parent, if child) to report presence of the 4 categories of symptoms (Physical, Cognitive, Emotional, and Sleep) since injury. It is important to assess all listed symptoms as different parts of the brain control different functions. One or all symptoms may be present depending upon mechanisms of injury. If the symptom is not present, press "NO" (No = 0) on the scale, press "YES" (Yes = 1) if present.



**NOTE:** Most sleep symptoms are only applicable after a night has passed since the injury. If not applicable, press N/A. Drowsiness may be present on the day of injury.

- Since symptoms can be present premorbidly/ at baseline (e.g., inattention, headaches, sleep, sadness), it is important to assess change from its typical presentation. For any symptom – if Patient/Parent indicates "I/He usually has that problem/ symptom" – Ask "Are you/they experiencing this symptom more than usual or in a different manner than usual?" If the symptom is not present, press "NO" on the scale, press "YES" if present.

**Figure A12-4:**  
**ACE-PH Injury Description**

**Figure A12-5:**  
**ACE-PH Injury Description Details**

**Figure A12-6:**  
**ACE-PH Injury Description Details**

**Scoring:** Sum total number of symptoms present per area, and sum all 4 areas into Total Symptom Score.

If symptoms are new and present, there is no lower limit symptom score.

Any score > 0 indicates positive symptom history.

On the **ACE-PH Symptoms 5** screen press **NEXT** to navigate to the **ACE-PH Symptoms Summary** screen.

The **ACE-PH Symptoms Summary** screen (Figure A12-7) will provide a summary of the results recorded during the ACE-PH Symptoms Check List.

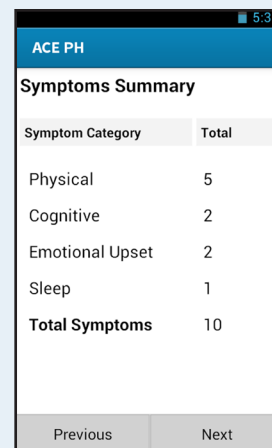
Press **NEXT** to navigate to the **ACE-PH Exertion** screen.

The **ACE-PH Exertion** screen (Figure A12-8) allows for entry of signs of exertion and overall rating of the patient. The following can be used as a guide in completing these questions:

**Exertion:** Inquire whether any symptoms worsen with physical (e.g., running, climbing stairs, bike riding) and/or cognitive (e.g., academic studies, multi-tasking at work, reading or other tasks requiring focused concentration) exertion. Clinicians should be aware that symptoms will typically worsen or re-emerge with exertion, indicating incomplete recovery. Over-exertion may protract recovery.

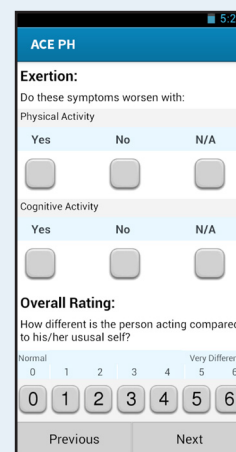
**Overall Rating:** Determine how different the person is acting from their usual self. Press "0" (Normal) to "6" (Very Different).

Press **NEXT** to navigate to the Risk Factors for Protracted Recovery section of the ACE-PH assessment.



ACE PH	
Symptoms Summary	
Symptom Category	Total
Physical	5
Cognitive	2
Emotional Upset	2
Sleep	1
<b>Total Symptoms</b>	<b>10</b>
Previous	Next

**Figure A12-7:**  
**ACE-PH Symptoms Summary**



**ACE PH**

**Exertion:**  
Do these symptoms worsen with:

Physical Activity  
Yes No N/A  
☐ ☐ ☐

Cognitive Activity  
Yes No N/A  
☐ ☐ ☐

**Overall Rating:**  
How different is the person acting compared to his/her usual self?

Normal Very Different  
0 1 2 3 4 5 6  
☐ ☐ ☐ ☐ ☐ ☐ ☐

Previous Next

**Figure A12-8:**  
**ACE-PH Exertion**



The following risks are evaluated during the next sequence of screens:  
(an example of one of the screens is provided in Figure A12-9)

- **Concussion history:** Assess the number and date(s) of prior concussions, the duration of symptoms for each injury, and whether less biomechanical force resulted in re-injury. Research indicates that cognitive and symptom effects of concussion may be cumulative, especially if there is minimal duration of time between injuries and less biomechanical force results in subsequent concussion (which may indicate incomplete recovery from initial trauma).
- Headache History
- Developmental History
- Psychiatric History
- Other Comorbid Medical Disorders or Medication Usage

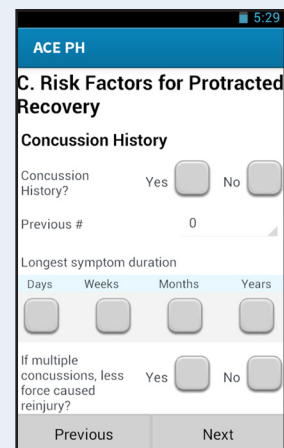
Press the checkboxes for the appropriate response or provide details in text entry fields.

On the last ACE-PH Risk Factors for Protracted Recovery screens press **NEXT** to navigate to the **Red Flags** screens.

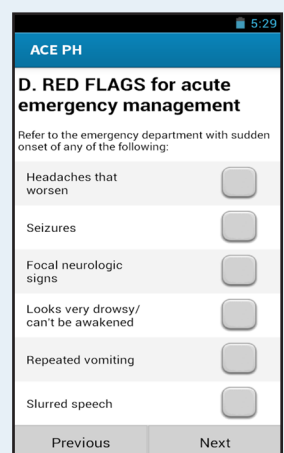
The **ACE-PH Red Flags 1 and 2** screens (Figures A12-10 and A12-11) allow for entry of the possibility of red flag symptoms that may be present. The following can be used as a guide to completing the red flags section of the ACE-PH.

**Red Flags:** The patient should be carefully observed over the first 24-48 hours for these serious signs. Red flags are to be assessed as possible signs of deteriorating neurological functioning. Any positive report should prompt strong consideration of referral for emergency medical evaluation (e.g. CT Scan to rule out intracranial bleed or other structural pathology).

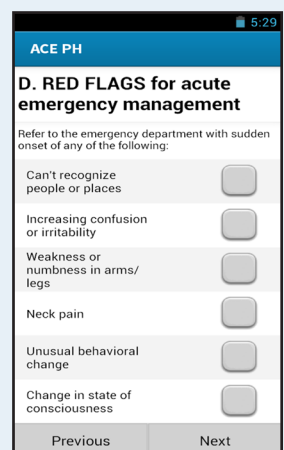
Press **NEXT** to navigate to the **ACE-PH Diagnosis** screen.



**Figure A12-9:**  
**ACE-PH Concussion History**



**Figure A12-10:**  
**ACE-PH Red Flags 1**



**Figure A12-11:**  
**ACE-PH Red Flags 2**

The **ACE-PH Diagnosis** screen (Figure A12-12) allows for entry of the appropriate ICD diagnostic code.

The following can be used as a guide in determining which options to select.

**Diagnosis:** Assign the most appropriate diagnosis given the following:

**850.0 (Concussion, with no loss of consciousness)** – Positive Injury Description (A1), i.e., forcible direct/indirect blow to the head; plus evidence of active symptoms (B) of any type and number related to the trauma; no evidence of LOC (A5), skull fracture, or other intracranial injury.

**850.1 (Concussion, with brief loss of consciousness < 1 hour)** – Positive Injury Description (A1), i.e., forcible direct/indirect blow to the head; plus evidence of active symptoms (B) of any type and number related to the trauma; positive evidence of LOC (A5); no skull fracture, or other intracranial injury.

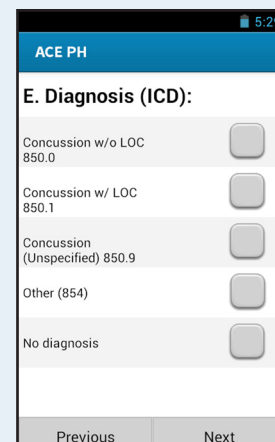
**850.9 (Concussion, unspecified)** – Positive Injury Description (A1), i.e., forcible direct/indirect blow to the head; plus evidence of active symptoms (B) of any type and number related to the trauma; unclear/unknown injury details; unclear evidence of LOC (A5), no skull fracture, or other intracranial injury.



**NOTE: If there is evidence of skull fracture of structural intracranial injury to the brain, consider 854 (Intracranial injury of other and unspecified nature; 854.0 Without mention of open intracranial wound, 854.1 With open intracranial wound). Avoid using nonspecific Head injury NOS (959.01) whenever possible.**

Press the checkbox next to the option to record the results.

Press **NEXT** to navigate to the **ACE-PH Follow-up** screen.



ACE PH	
<b>E. Diagnosis (ICD):</b>	
Concussion w/o LOC 850.0	<input type="checkbox"/>
Concussion w/ LOC 850.1	<input type="checkbox"/>
Concussion (Unspecified) 850.9	<input type="checkbox"/>
Other (854)	<input type="checkbox"/>
No diagnosis	<input type="checkbox"/>
<div>Previous Next</div>	

**Figure A12-12:**  
**ACE-PH Diagnosis**

The **ACE-PH Follow-up** screen (Figure A12-13) allows for entry of the follow-up action plan. The following can be used as a guide in determining the best options:

**Follow-Up Action Plan:** Develop a follow-up plan of action for symptomatic patients. The physician/clinician may decide to (1) monitor the patient in the office or (2) refer them to a specialist. Serial evaluation of the concussion is critical as symptoms may resolve, worsen, or ebb and flow depending upon many factors (e.g., cognitive/physical exertion, comorbidities). Referral to a specialist can be particularly valuable to help manage certain aspects of the patient's condition. (Physician/Clinician should also complete the ACE Care Plan included in this tool kit.)

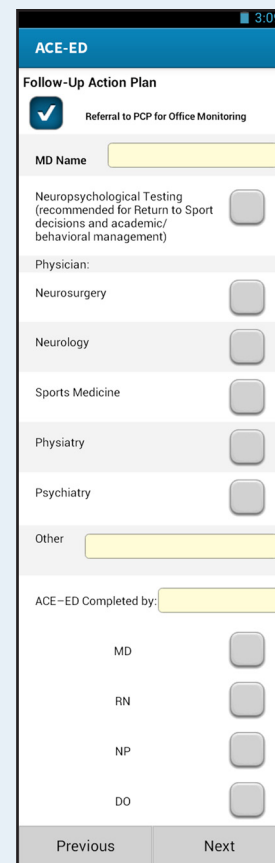
1. **Physician/Clinician serial monitoring** – Particularly appropriate if number and severity of symptoms are steadily decreasing over time and/or fully resolve within 3-5 days. If steady reduction is not evident, referral to a specialist is warranted.
2. **Referral to a specialist** – Appropriate if symptom reduction is not evident in 3-5 days, or sooner if symptom profile is concerning in type/severity.
  - Neuropsychological Testing can provide valuable information to help assess a patient's brain function and impairment and assist with treatment planning, such as return to play decisions.
  - Physician Evaluation is particularly relevant for medical evaluation and management of concussion. It is also critical for evaluating and managing focal neurologic, sensory, vestibular, and motor concerns. It may be useful for medication management (e.g., headaches, sleep disturbance, depression) if post-concussive problems persist.

Press the checkbox next to the option to record the results. Text entry fields are available to record the physician the patient is being referred to, if other, and the ACE-PH test administrator.

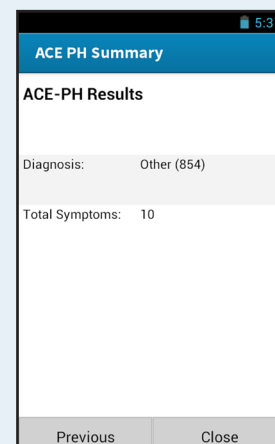
Press **NEXT** to navigate to the **ACE-PH Summary** screen.

The **ACE-PH Summary** screen (Figure A12-14) provides the diagnosis code as entered by the operator and the total number of symptoms.

Press **CONFIRM** to return to the **Information Hub** screen.



**Figure A12-13:**  
**ACE-PH Follow-up**



**Figure A12-14:**  
**ACE-PH Summary**

## ACE-PH Detailed Results

Detailed results on current and previous ACE-PH tests are stored in the database and can be accessed from the **Information Hub**. In the detailed results screens the operator can review all ACE-PH tests recorded, edit results and start a new test.

To access the **ACE-PH Detailed Results**, press the ACE-PH score (Figure A12-15) from the **Information Hub**.



**NOTE:** The **ACE-PH Detailed Results** will default to view the **CURRENT TEST** tab.

## Current Test Tab

The **ACE-PH Current Test Detailed Results** (Figure A12-16) contains two options to select from:

- Review – access responses and results for the entire ACE-PH assessment
- New Test – start a new test

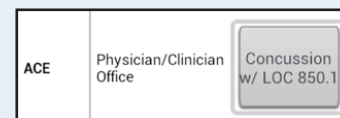


**NOTE:** While reviewing patient information the screen header will contain “Review” to inform the operator that they are currently in review mode.

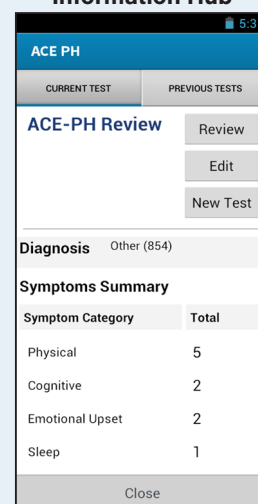
The **ACE-PH Review** screens will appear in exact order of the testing sequence.

Press the **REVIEW** button to enter **ACE-PH Review**. An example of a **ACE-PH Review** screen is shown in Figure A12-17.

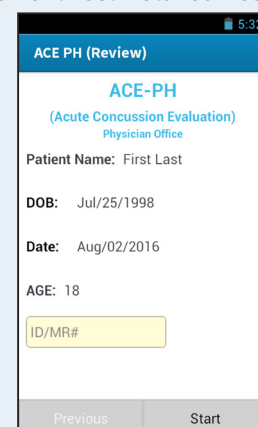
From the **ACE-PH Results Review** (Figure A12-18) press **CONFIRM** to return to the **ACE-PH Current Test Detailed Results** (Figure A12-16).



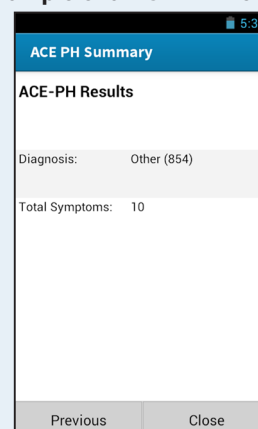
**Figure A12-15:**  
**ACE-PH results area from the Information Hub**



**Figure A12-16:**  
**Current Test Detailed Results**



**Figure A12-17:**  
**Example of a ACE-PH Review**



**Figure A12-18:**  
**Example of a ACE-PH Results**

From **ACE-PH Current Test Detailed Results** (Figure A12-16) a new test can be started.

Press **NEW TEST** to begin the ACE-PH test.

For instructions on completing a new ACE-PH test refer to the sections above.

### Previous Test Tab

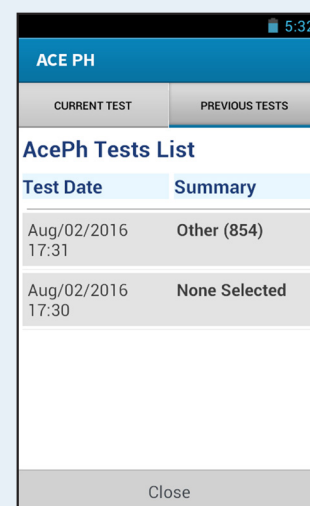
Results from previous ACE-PH testing dates and times can be reviewed from the **ACE-PH Previous Tests Detailed Results** (Figure A12-19) by pressing **PREVIOUS TESTS** tab.

The **ACE-PH Previous Tests Detailed Results** lists all tests recorded by test date, time and summary of symptoms.

To view the ACE-PH Assessment Summaries, press the desired test from the "ACE-PH Tests List"

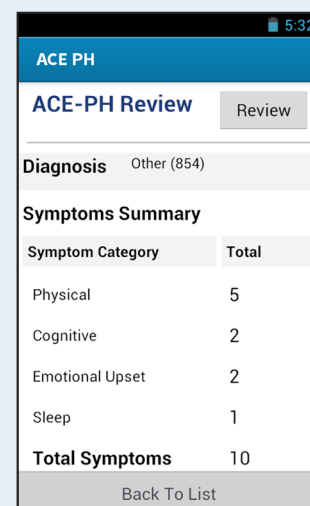
Once the test has been selected the **ACE-PH Previous Test Review** (Figure A12-20) will appear displaying the test results.

For instructions on reviewing, editing and starting a new test refer to the sections above.



ACE PH	
CURRENT TEST	PREVIOUS TESTS
<b>AcePh Tests List</b>	
Test Date	Summary
Aug/02/2016 17:31	Other (854)
Aug/02/2016 17:30	None Selected
Close	

**Figure A12-19:**  
**ACE-PH Tests List**



ACE PH	
<b>ACE-PH Review</b> <span>Review</span>	
<b>Diagnosis</b>	Other (854)
<b>Symptoms Summary</b>	
Symptom Category	Total
Physical	5
Cognitive	2
Emotional Upset	2
Sleep	1
<b>Total Symptoms</b>	<b>10</b>
Back To List	

**Figure A12-20:**  
**ACE-PH Previous Test Review**

## Appendix 13: Maddocks Score

The Maddocks Score combine scientific validity with a quick simple and practical tool which can be administered either on-field or on the sidelines. Maddocks Score is a qualitative measure (questions) for the screening of mental status abnormalities and is a useful starting point in the initial screening for sport concussion. An athlete's inability to answer Maddocks questions correctly should raise suspicion for the presence of a concussive injury and indicates the need for a more thorough assessment.

To begin the Maddocks questions from the Information Hub screen, press the **START** button (Figure A13-1) and the handheld will navigate to the **Maddocks Start** screen (Figure A13-2).

The Date fields on the **Maddocks Start** screen will be pre-populated with the date of injury entered in the **Patient Information** screens and the current date.

The Name field on the **Maddocks Start** screen will be pre-populated with the patient name for the current session.

Press **START** to advance to the **Maddocks Score** screen.

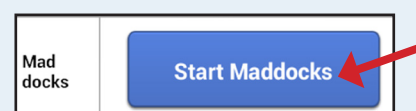
The **Maddocks Score** screen will provide the following instructions to be read to the patient:

**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)**

To record the patients response press either **INCORRECT** or **CORRECT** to the answer they provide and move on to the next question. Repeat these steps for all questions on the **Maddocks Score** screen.

Press **NEXT** to advance to the **Maddocks Results**.



**Figure A13-1:**  
**Start Maddocks Test**

**Figure A13-2:**  
**Maddocks Test Start Screen**

**Figure A13-3:**  
**Maddocks Score Screen**

The **Maddocks Results** screen (Figure A13-4) will provide the Maddocks Score as a summary of the incorrect answers.



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

## Maddocks Detailed Results

Detailed results on current and previous Maddocks tests are stored in the database and can be accessed from the **Information Hub** screen.

Once a Maddocks test session has been completed the Maddocks total score will replace the **START** button next to the Maddocks test on the **Information Hub** (Figure A13-5).



**NOTE:** The **Maddocks Detailed Results** will default to view the **CURRENT TEST** tab.

## Current Test Tab

The **Maddocks Current Test Detailed Results** (Figure A13-6) contains two options to select from:

- Review – access responses and results from the entire Maddocks assessment
- New Test – start a new test

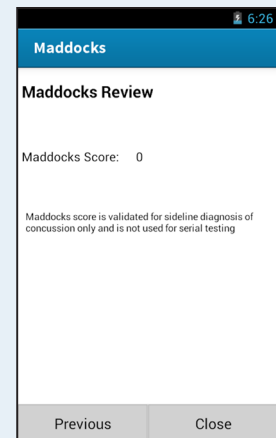


**NOTE:** While reviewing patient information the screen header will contain "Review" to inform the operator that they are currently in review mode.

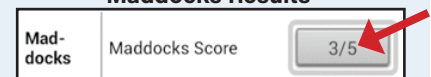
The **Maddocks Review** screens will appear in exact order of the testing sequence.

Press the **REVIEW** button to enter **Maddocks Review**. An example of a **Maddocks Review** screen is shown in Figure A13-7.

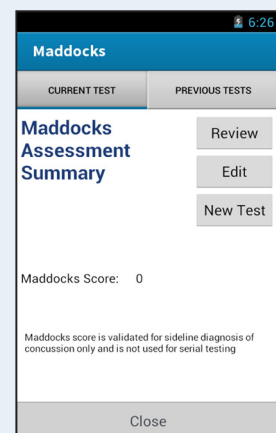
From the **Maddocks Summary Review** (Figure A13-8) press **CONFIRM** to return to the **Maddocks Current Test Detailed Results** (Figure A13-6).



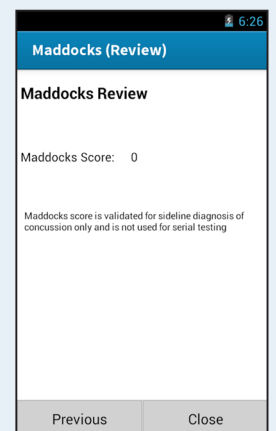
**Figure A13-4:**  
**Maddocks Results**



**Figure A13-5:**  
**Maddocks results area from the Information Hub**



**Figure A13-6:**  
**Current Test Detailed Results**



**Figure A13-7:**  
**Example of a Maddocks Review screen**



From **Maddocks Current Test Detailed Results** (Figure A13-6) a new test can be started.

Press **NEW TEST** to begin the Maddocks test.

For instructions on completing a new Maddocks test refer to the sections above.

## Previous Test Tab

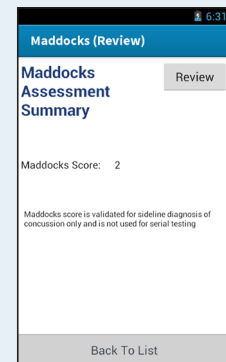
Results from previous Maddocks testing dates and times can be reviewed from the **Maddocks Previous Tests Detailed Results** (Figure A13-9) by pressing **PREVIOUS TESTS** tab.

The **Maddocks Previous Tests Detailed Results** lists all tests recorded by test date, time and summary of symptoms.

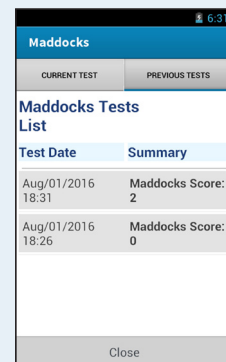
To view the Maddocks Assessment Summaries, press the desired test from the "Maddocks Tests List".

Once the test has been selected the **Maddocks Previous Test Review** (Figure A13-10) will appear displaying the test results.

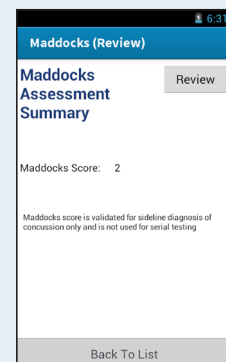
For instructions on reviewing, editing and starting a new test refer to the sections above.



**Figure A13-8:**  
Example of a Maddocks Summary screen



**Figure A13-9:**  
Maddocks Tests List



**Figure A13-10:**  
Maddocks Previous Test Review

## Appendix 14: Rivermead Post Concussion Symptoms Questionnaire

The Rivermead Post-Concussion Symptoms Questionnaire (RPCSQ) is a 16-item self-report measure of symptom severity that asks individuals to compare the presence and severity of symptoms they have experienced within the past 24 hours relative to their experience of the same symptoms prior to the injury.

To begin the Rivermead from the **Information Hub** screen, press **START** (Figure A14-1) and the handheld will navigate to the **Rivermead Start** screen (Figure A14-2).

The Date fields on the **Rivermead Start** screen will be pre-populated with the date of injury entered in the **Patient Information** screens and the current date.

The Name field on the **Rivermead Start** screen will be pre-populated with the patient name for the current session.

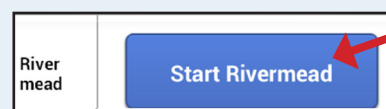
Press **START** to advance to the **Rivermead Instructions** screen.

The **Rivermead Instructions** screen will provide the following instructions to be read to the subject:

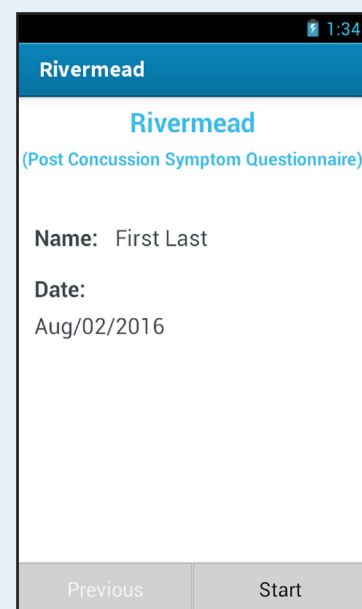
**After a head injury or accident some people experience symptoms that can cause worry or nuisance. We would like to know if you now suffer any of the symptoms given below. Because many of these symptoms occur normally, we would like you to compare yourself now with before the accident. For each symptom listed below, please select the number that most closely represents your answer.**

- 0 = not experienced at all**
- 1 = no more of a problem**
- 2 = a mild problem**
- 3 = a moderate problem**
- 4 = a severe problem**

Press **NEXT** to advance to the **Rivermead Symptoms 1** screen.



**Figure A14-1:**  
**Start Rivermead Test**



**Figure A14-2:**  
**Rivermead Test Start Screen**

The **Rivermead Symptoms 1 through 6** screens (an example of these is shown in Figures A14-3) will run through a series of symptoms comparing the symptoms to before the accident and rating each symptom by severity on a scale of 0-4 with the following labels:

- 0 – “not experienced”
- 1 – “no more of a problem”
- 2 – “mild problem”
- 3 – “moderate problem”
- 4 – “severe problem”

The **Rivermead Symptoms 1 through 6** screens will provide the following instructions to be read to the subject:

**Compared with before the accident, do you now (i.e., over the last 24 hours) suffer from:**

After the last symptom is scored, ask the subject the following question:

**Are you experiencing any other difficulties?**

If the subject has additional symptoms to report, press the yellow box and record the symptom. Ask the subject to rate these additional symptoms using the same scale. The questionnaire allows the operator to enter 2 additional symptoms.

On the last screen press **NEXT** to advance to the **Rivermead Summary** screen (Figure A14-4)



**NOTE:** Individual item scores reflect the presence and severity of post concussive symptoms. Post concussive symptoms, as measured by the RPQ, may arise for different reasons subsequent to (although not necessarily directly because of) a traumatic brain injury. The symptoms overlap with broader conditions, such as pain, fatigue and mental health conditions such as depression.

The questionnaire can be repeated to monitor a patient’s progress over time. There may be changes in the severity of symptoms, or the range of symptoms. Typical recovery is reflected in a reduction of symptoms and their severity within three months.

## Scoring

The scoring system has been modified from Eyres, 2005.

The items are scored in two groups. The first group (RPQ-3) consists of the first three items (headaches, feelings of dizziness and nausea) and the second group (RPQ-13) comprises the next 13 items. The total

**Figure A14-3:**  
Example of a Rivermead Symptoms screen

**Figure A14-4:**  
Rivermead Summary

score for RPQ-3 items is potentially 0–12 and is associated with early symptom clusters of post concussive symptoms. If there is a higher score on the RPQ-3, earlier reassessment and closer monitoring is recommended.

The RPQ-13 score is potentially 0–52, where higher scores reflect greater severity of post concussive symptoms. The RPQ-13 items are associated with a later cluster of symptoms, although the RPQ-3 symptoms of headaches, dizziness and nausea may also be present. The later cluster of symptoms is associated with having a greater impact on participation, psychosocial functioning and lifestyle. Symptoms are likely to resolve within three months. A gradual resumption of usual activities is recommended during this period, appropriate to symptoms. If the symptoms do not resolve within three months, consideration of referral for specialist assessment or treatment services is recommended.

## Rivermead Detailed Results

Detailed results on current and previous Rivermead tests are stored in the database and can be accessed from the **Information Hub** screen.

Once a Rivermead test session has been completed the Rivermead total score will replace the **START** button next to the Rivermead test on the **Information Hub** (Figure A14-5).



**NOTE:** The **Rivermead Detailed Results** will default to view the **CURRENT TEST** tab.

### Current Test Tab

The **Rivermead Current Test Detailed Results** (Figure A14-6) contains two options to select from:

- Review – access responses and results from the entire Rivermead assessment
- New Test – start a new test



**NOTE:** While reviewing and editing patient information the screen header will contain “Review” and “Edit” to inform the

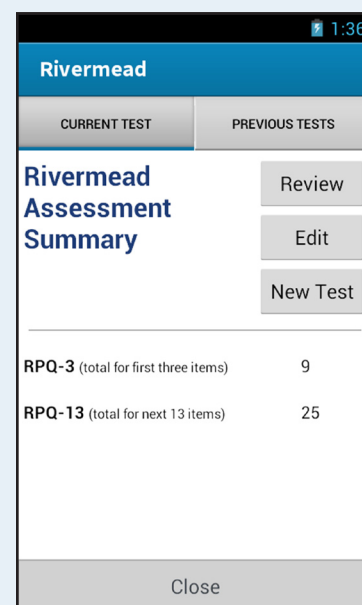
<sup>32</sup> Eyres, S., Carey, A., Gilworth, G., Neumann, V., Tennant, A. (2005). Construct validity and reliability of the Rivermead Post Concussion Symptoms Questionnaire. *Clinical Rehabilitation*, 19, 878-887.

<sup>33</sup> King, N. S., Crawford, S., Wenden, F.J., Moss, N.E.G. Wade, D.T. (1995). The Rivermead Post Concussion Symptoms Questionnaire: a measure of symptoms commonly experienced after head injury and its reliability *Journal of Neurology*, 242, 587-592.

<sup>34</sup> Potter, S., Leigh, E., Wade, D., Fleminger, S. (2006). The Rivermead Post Concussion Symptoms Questionnaire *Journal of Neurology*, October 1-12.



**Figure A14-5:**  
**Rivermead results area from the**  
**Information Hub**



**Figure A14-6:**  
**Current Test Detailed Results**

operator that they are currently in review or edit mode.

The **Rivermead Review** screens will appear in exact order of the testing sequence.

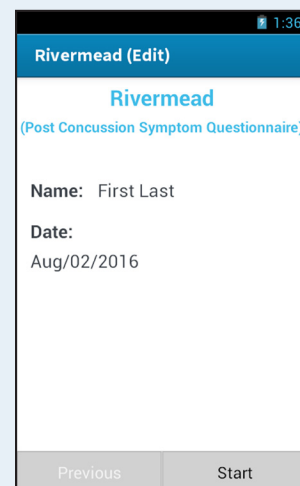
Press the **REVIEW** button to enter **Rivermead Review**. An example of a **Rivermead Review** screen is shown in Figure A14-7.

From the **Rivermead Summary Review** (Figure A14-8) press **CONFIRM** to return to the **Rivermead Current Test Detailed Results** (Figure A14-6).

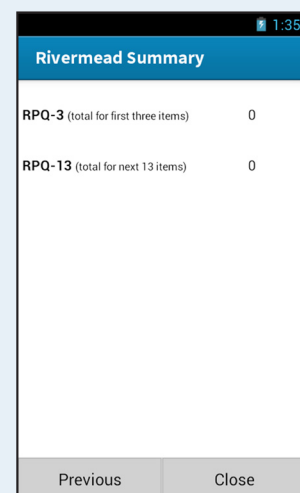
From **Rivermead Current Test Detailed Results** (Figure A14-6) a new test can be started.

Press **NEW TEST** to begin the Rivermead test.

For instructions on completing a new Rivermead test refer to the sections above.



**Figure A14-7:**  
Example of a Rivermead Review screen



**Figure A14-8:**  
Example of a Rivermead Summary screen

## Previous Test Tab

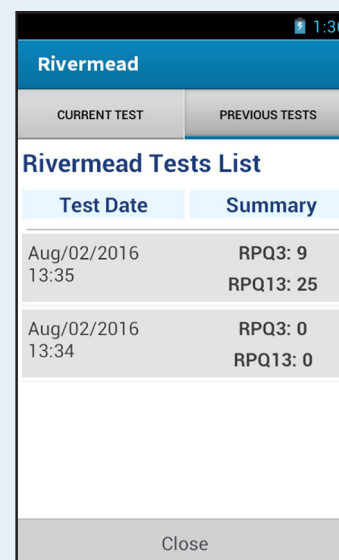
Results from previous Rivermead testing dates and times can be reviewed from the ***Rivermead Previous Tests Detailed Results*** (Figure A14-9) by pressing **PREVIOUS TESTS** tab.

The ***Rivermead Previous Tests Detailed Results*** lists all tests recorded by test date, time and summary of symptoms.

To view the Rivermead Assessment Summaries, press the desired test from the "Rivermead Tests List".

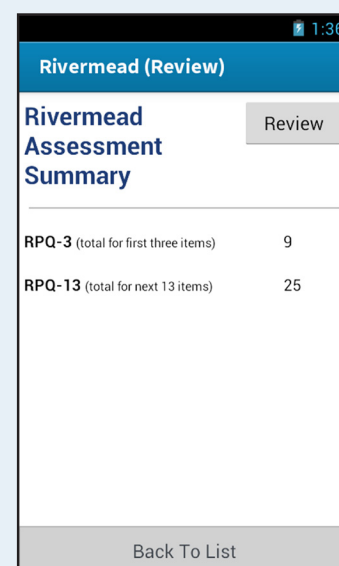
Once the test has been selected the ***Rivermead Previous Test Review*** (Figure A14-10) will appear displaying the test results.

For instructions on reviewing and starting a new test refer to the sections above.



Test Date	Summary
Aug/02/2016 13:35	RPQ3: 9 RPQ13: 25
Aug/02/2016 13:34	RPQ3: 0 RPQ13: 0

**Figure A14-9:**  
**Rivermead Tests List**



RPQ-3 (total for first three items)	9
RPQ-13 (total for next 13 items)	25

**Figure A14-10:**  
**Rivermead Previous Test Review**

## Appendix 15: Primary Care PTSD Screen (PC-PTSD)

The Primary Care Post-Traumatic Stress Disorder (PC-PTSD) screening tool is a 4-item screen that was designed for use in primary care and other medical settings and is currently used to screen for Post-Traumatic Stress Disorder (PTSD) in military veterans using the Veteran's Health Administration medical system. The screen includes an introductory sentence to cue respondents to traumatic events. The screen does not include a list of potentially traumatic events.

To begin the PC-PTSD from the **Information Hub**, press **START** (Figure A15-1) and the handheld will navigate to the **PC-PTSD Start** screen (Figure A15-2).

The **PC-PTSD Question** screens will guide you through a series of questions that must be read to the patient. The questions provided during the PC-PTSD exam are provided below:

**In your life, have you ever had any experience that was so frightening, horrible, or upsetting that, in the past month, you:**

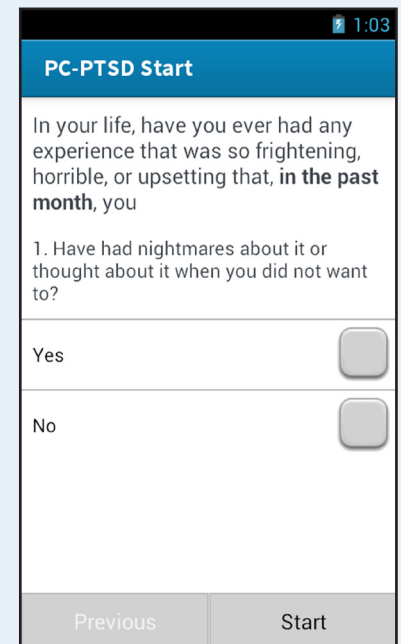
- 1. Have had nightmares about it or thought about it when you did not want to?**
- 2. Tried hard not to think about it or went out of your way to avoid situations that reminded you of it?**
- 3. Were constantly on guard, watchful, or easily startled?**
- 4. Felt numb or detached from others, activities, or your surroundings?**

Press **YES** or **NO** to record the subject's response.

Press **START** to advance to **PC-PTSD Question 2** and **NEXT** to advance through the question 2 through 4.



**Figure A15-1:**  
**Start PC-PTSD Test**



**Figure A15-2:**  
**PC-PTSD Test Start**



## Follow-Up Questions

If the PC-PTSD screening instrument is utilized, the operator should clarify responses to determine the following:



**NOTE:** To record the subject's response, enter text into the yellow text field box. The text box will alert the operator as to how many characters remain as the operator adds text.

- a. Whether the patient has had a traumatic experience by asking the following:

**I notice from your answers to our questionnaire that you experience some symptoms of stress. At some point in their lives, many people have experienced extremely distressing events such as combat, physical or sexual assault, or a bad accident, and sometimes those events lead to the kinds of symptoms you have. Have you ever had any experiences like that?**

- b. Whether endorsed screen items are really trauma-related symptoms by asking the following:

**I see that you have said you have nightmares about or have thought about an upsetting experience when you did not want to. Can you give me an example of a nightmare or thinking about an upsetting experience when you didn't want to?**



**NOTE:** If a patient gives an example of a symptom that does not appear to be in response to a traumatic event (e.g., a response to a divorce rather than to a traumatic event), it may be that he or she is ruminating about a negative life event rather than experiencing intrusive thoughts about a traumatic stressor.

- c. Whether endorsed screen items are disruptive to the patient's life by asking the following:

**How have these thoughts, memories, or feelings affected your life? Have they interfered with your relationships? Your work? How about with recreation or your enjoyment of activities?**



**NOTE:** Positive responses to these questions in addition to endorsement of symptom items on the **PC-PTSD** screen indicate an increased likelihood that the patient has PTSD and needs further evaluation.



**NOTE:** If ongoing traumatic events are a part of the patient's life, it is critical that the primary care practitioner discern whether the patient needs an immediate referral for social work or mental-health services. The practitioner might ask:

**Are any of these dangerous or life-threatening experiences still continuing in your life now?**

If ongoing family violence is suspected, it is imperative that the patient be told the limits of confidentiality for medical professionals, who are mandated to report suspected ongoing abuse of children and dependent adults. Discussion of possible abuse should take place in the absence of the suspected perpetrator; if the abuser is present, victims may deny abuse for fear of retaliation.

If ongoing family threats to safety are present:

- Acknowledge the difficulty in seeking help when the trauma has not stopped
- Determine if reporting is legally mandated. If it is, develop a plan with the patient to file the report in a way that increases rather than decreases the safety of the patient and his or her loved ones.

If reporting is not appropriate, provide written information (or oral if written might stimulate violent behavior in the perpetrator) about local resources that might help the situation. Establish a plan that the patient will agree to in order to move toward increased safety.

**The National Domestic Violence Hotline is available to guide callers to local resources: 1-800-799-SAFE or TTY: 1-800-787-3224.**

To record the subject's response, enter text into the yellow text field box. The text box will alert the operator as to how many characters remain as the operator adds text.

Press **NEXT** to advance to the **PC-PTSD Summary**.

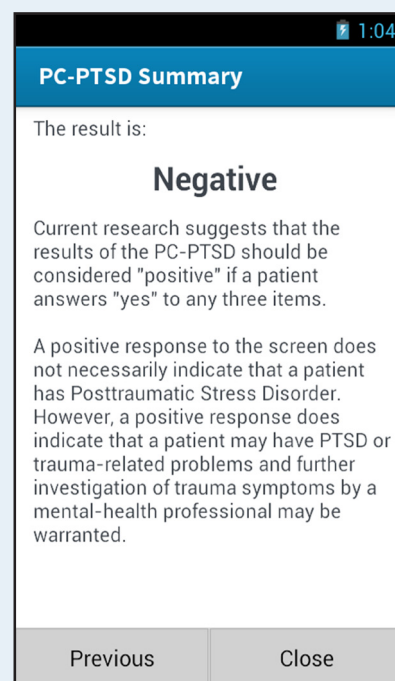
At any time, press **PREVIOUS** to navigate to the previous screen.

The **PC-PTSD Summary** (Figure A15-3) will display results as either Positive or Negative.



**NOTE:** Current research suggests that the results of the PC-PTSD should be considered "positive" if a patient answers "yes" to any three items.

A positive response to the screen does not necessary indicate that a patient has Post Traumatic Stress Disorder. However, a positive response does indicate that a patient may have PTSD or trauma-related problems and further investigation of trauma symptoms by a mental-health professional may be warranted.



**Figure A15-3:**  
**PC-PTSD Summary of results**

## PC-PTSD Detailed Results

Detailed results on current and previous PC-PTSD tests are stored in the database and can be accessed from the **Information Hub** screen.

Once a PC-PTSD test session has been completed the PC-PTSD total score will replace the **START** button next to the PC-PTSD test on the **Information Hub** (Figure A15-4).



**NOTE:** The **PC-PTSD Detailed Results** will default to view the **CURRENT TEST** tab.

### Current Test Tab

The **PC-PTSD Current Test Detailed Results** (Figure A15-5) contains two options to select from:

- Review – access responses and results for the entire PC-PTSD assessment
- New Test – start a new test



**NOTE:** While reviewing patient information the screen header will contain “Review” to inform the operator that they are currently in review mode.

The **PC-PTSD Review** screens will appear in exact order of the testing sequence.

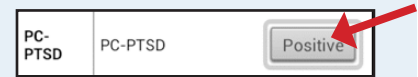
Press the **REVIEW** button to enter **PC-PTSD Review**. An example of a **PC-PTSD Review** screen is shown in Figure A15-6.

From the **PC-PTSD Summary Review** (Figure A15-7) press **CONFIRM** to return to the **PC-PTSD Current Test Detailed Results** (Figure A15-5).

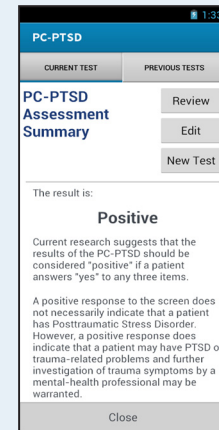
From **PC-PTSD Current Test Detailed Results** (Figure A15-5) a new test can be started.

Press **NEW TEST** to begin the PC-PTSD test.

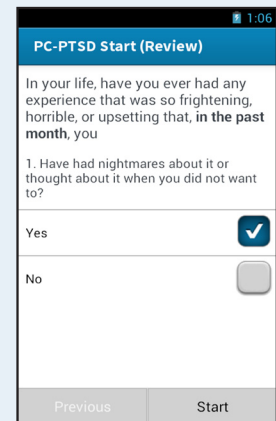
For instructions on completing a new PC-PTSD test refer to the sections above.



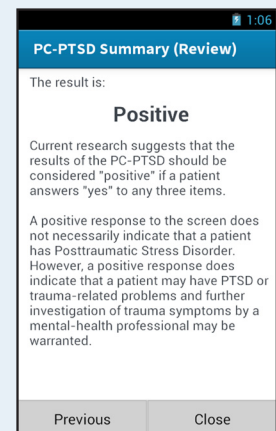
**Figure A15-4**  
PC-PTSD results area from the Information Hub



**Figure A15-5:**  
Current Test Detailed Results



**Figure A15-6:**  
Example of a PC-PTSD Review



**Figure A15-7:**  
Example of a PC-PTSD Summary

## Previous Test Tab

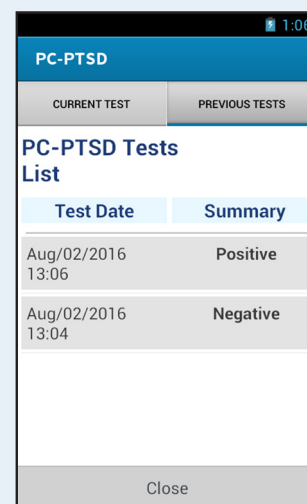
Results from previous PC-PTSD testing dates and times can be reviewed from the **PC-PTSD Previous Tests Detailed Results** (Figure A15-8) by pressing **PREVIOUS TESTS** tab.

The **PC-PTSD Previous Tests Detailed Results** lists all tests recorded by test date, time and summary of symptoms.

To view the PC-PTSD Assessment Summaries, press the desired test from the "PC-PTSD Tests List".

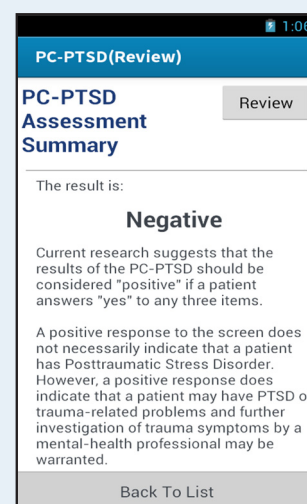
Once the test has been selected the **PC-PTSD Previous Test Review** (Figure A15-9) will appear displaying the test results.

For instructions on reviewing, editing and starting a new test refer to the sections above.



PC-PTSD	
CURRENT TEST	PREVIOUS TESTS
<b>PC-PTSD Tests List</b>	
Test Date	Summary
Aug/02/2016 13:06	Positive
Aug/02/2016 13:04	Negative
Close	

**Figure A15-8:**  
**PC-PTSD Tests List**



PC-PTSD(Review)	
<b>PC-PTSD Assessment Summary</b>	Review
The result is:	
<b>Negative</b>	
Current research suggests that the results of the PC-PTSD should be considered "positive" if a patient answers "yes" to any three items.	
A positive response to the screen does not necessarily indicate that a patient has Posttraumatic Stress Disorder. However, a positive response does indicate that a patient may have PTSD or trauma-related problems and further investigation of trauma symptoms by a mental-health professional may be warranted.	
Back To List	

**Figure A15-9:**  
**PC-PTSD Previous Test Review**

## Appendix 16: PTSD Checklist - Civilian (PCL-C)

The PCL is a standardized self-report rating scale for PTSD comprising 17 items that correspond to the key symptoms of PTSD. Two versions of the PCL exist: 1) PCL-M is specific to PTSD caused by military experiences and 2) PCL-C is applied generally to any traumatic event.

The PCL can be easily modified to fit specific time frames or events. For example, instead of asking about "the past month," questions may ask about "the past week" or be modified to focus on events specific to a deployment.

### How is the PCL completed?

- The PCL is self-administered
- Respondents indicate how much they have been bothered by a symptom over the past month using a 5-point (1-5) scale, circling their responses. Responses range from 1 Not at All – 5 Extremely

### How is the PCL Scored?

1. Add up all items for a total severity score, or
2. Treat response categories 3-5 (Moderately or above) as symptomatic and responses 1-2 (below Moderately) as non-symptomatic, then use the following DSM criteria for a diagnosis:
  - Symptomatic response to at least 1 "B" item (Questions 1-5),
  - Symptomatic response to at least 3 "C" items (Questions 6-12), and
  - Symptomatic response to at least 2 "D" items (Questions 13-17)

### Are Results Valid and Reliable?

Two studies of both Vietnam and Persian Gulf theater veterans show that the PCL is both valid and reliable (Additional references are available from the DHCC)

### What Additional Follow-up is Available?

- All military health system beneficiaries with health concerns they believe are deployment-related are encouraged to seek medical care
- Patients should be asked, "Is your health concern today related to a deployment?" during all primary care visits.
- If the patient replies "yes," the provider should follow the Post-Deployment Health Clinical Practice

Guideline (PDH-CPG) and supporting guidelines available through the DHCC and [www.PDHealth.mil](http://www.PDHealth.mil).

To begin the PCL-C from the **Information Hub**, press **START** (Figure A16-1) and the handheld will navigate to the **PCL-C Start** screen (Figure A16-2).

The **PCL-C Question Start** will be pre-populated with the patient name and provide the following note:

**NOTE: Please answer the questions in severity range from 1 to 5 to indicate how much you have been bothered by that problem in the past month.**

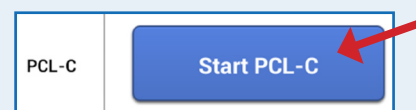
1. Not at all
2. A little bit
3. Moderately
4. Quite a bit
5. Extremely

Press **START** to advance to **the PCL-C Symptom** screens.

The PCL-C Symptom screens will navigate you through a series of the following questions to determine the following:

- Any repeated memories and dreams
- Acting or feelings of reliving stressful events
- Feelings of being upset when reminded of a past stressful experiences
- Any physical reactions when reminded of past stressful experiences
- Avoidance of activities or situations because of past stressful experiences
- Trouble remembering important parts of past stressful experiences
- Losing of interest in things
- Feelings of being distant or cut off
- Feelings of numbness or being able to have loving feelings for people
- Feelings of being cut short of the future
- Sleep disturbances
- Feelings of anger and irritability
- Difficulties concentrating
- Needing to be watchful or more alert
- Easily startled or jumpy

Press **NEXT** to advance through the **PCL-C Symptom** screens. After all symptoms have been recorded press **NEXT** on the last symptom screen to navigate to the **PCL-C Summary**.



**Figure A16-1:**  
**Start PCL-C Test**

**Figure A16-2:**  
**PCL-C Test Start Screen**

**Figure A16-3:**  
**PCL-C Symptoms**

**Figure A16-4:**  
**PCL-C Test Summary**

## PCL-C Detailed Results

Detailed results on current and previous PCL-C tests are stored in the database and can be accessed from the **Information Hub** screen.

Once a PCL-C test session has been completed the PCL-C total score will replace the **START** button next to the PCL-C test on the **Information Hub** (Figure A16-5).



**NOTE:** The **PCL-C Detailed Results** will default to view the **CURRENT TEST** tab.

### Current Test Tab

The **PCL-C Current Test Detailed Results** (Figure A16-6) contains two options to select from:

- Review – access responses and results for the entire PCL-C assessment
- New Test – start a new test



**NOTE:** While reviewing patient information the screen header will contain "Review" to inform the operator that they are currently in review mode.

The **PCL-C Review** screens will appear in exact order of the testing sequence.

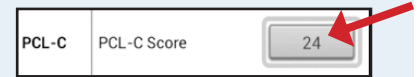
Press the **REVIEW** button to enter **PCL-C Review**. An example of a **PCL-C Review** screen is shown in Figure A16-7.

From the **PCL-C Summary Review** (Figure A16-8) press **CONFIRM** to return to the **PCL-C Current Test Detailed Results** (Figure A16-6).

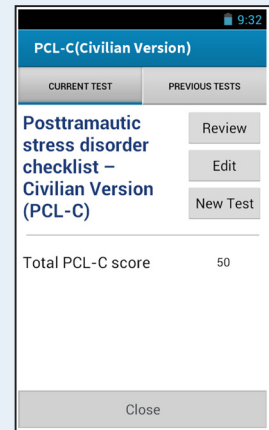
From **PCL-C Current Test Detailed Results** (Figure A16-6) a new test can be started.

Press **NEW TEST** to begin the PCL-C test.

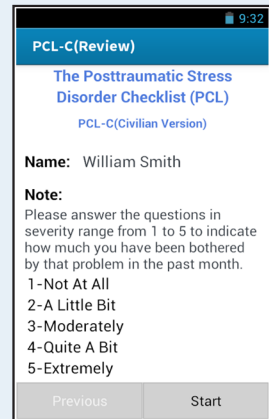
For instructions on completing a new PCL-C test refer to the sections above.



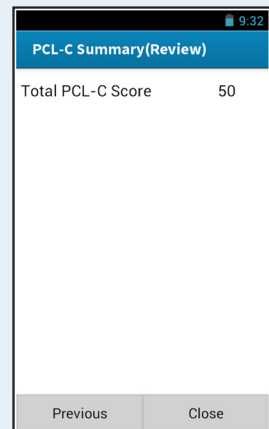
**Figure A16-5**  
**PCL-C results area from the Information Hub**



**Figure A16-6:**  
**Current Test Detailed Results**



**Figure A16-7:**  
**Example of a PCL-C Review**



**Figure A16-8:**  
**Example of a PCL-C Summary**



## Previous Test Tab

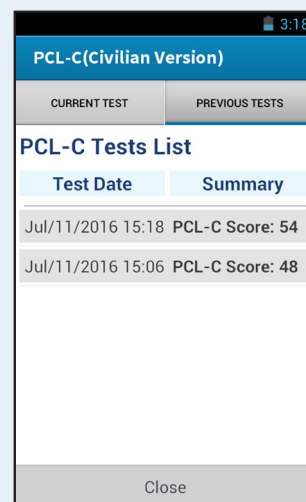
Results from previous PCL-C testing dates and times can be reviewed from the **PCL-C Previous Tests Detailed Results** (Figure A16-9) by pressing **PREVIOUS TESTS** tab.

The **PCL-C Previous Tests Detailed Results** lists all tests recorded by test date, time and summary of symptoms.

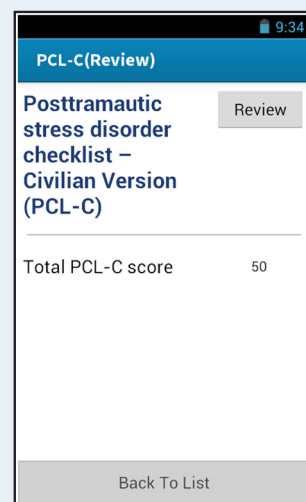
To view the PCL-C Assessment Summaries, press the desired test from the "PCL-C Tests List"

Once the test has been selected the **PCL-C Previous Test Review** (Figure A16-10) will appear displaying the test results.

For instructions on reviewing, editing and starting a new test refer to the sections above.



**Figure A16-9:**  
**PCL-C Tests List**



**Figure A16-10:**  
**PCL-C Previous Test Review**

## Appendix 17: PTSD Checklist - Specific (PCL-S)

The PCL is a standardized self-report rating scale for PTSD comprising 17 items that correspond to the key symptoms of PTSD.

The PCL-S is a general civilian version that is not linked to a specific event; the questions refer to “a stressful experience from the past”. The scoring is the same PCL-C, PCL M and PCL-S.

To begin the PCL-S from the **Information Hub**, press **START** (Figure A17-1) and the handheld will navigate to the **PCL-S Start** screen (Figure A17-2).

The **PCL-S Question Start** will be pre-populated with the patient name, date of event and a text entry field for event description.

Press next to navigate to the instructions.

The **Instructions** (Figure A17-3) provide the following note:

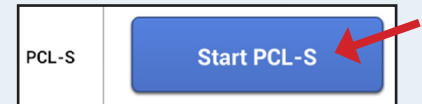
**NOTE: Please answer the questions in severity range from 1 to 5 to indicate how much you have been bothered by that problem in the past month.**

1. Not at all
2. A little bit
3. Moderately
4. Quite a bit
5. Extremely

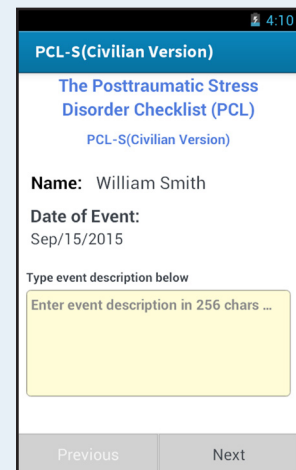
Press **START** to advance to **the PCL-S Symptom** screens (an example is provided in Figure A17-4).

The PCL-S Symptom screens will navigate you through a series of the following questions to determine the following:

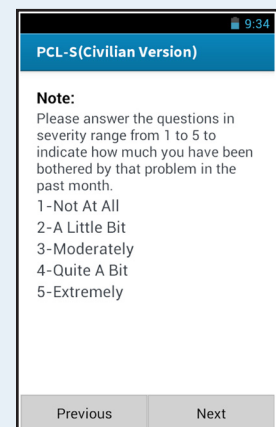
- Any repeated memories and dreams
- Acting or feelings of reliving stressful events
- Feelings of being upset when reminded of a past stressful experiences
- Any physical reactions when reminded of past stressful experiences
- Avoidance of activities or situations because of past stressful experiences
- Trouble remembering important parts of past stressful experiences
- Losing of interest in things



**Figure A17-1:**  
Start PCL-S Test



**Figure A17-2:**  
PCL-S Test Start Screen

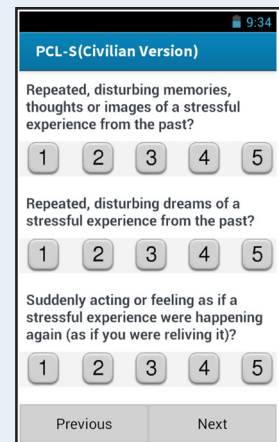


**Figure A17-3:**  
PCL-S Instructions

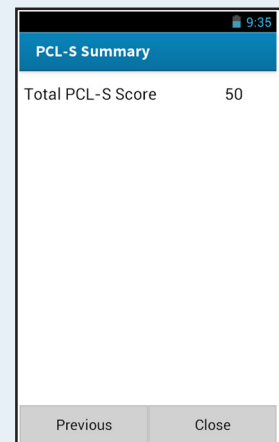
- Feelings of being distant or cut off
- Feelings of numbness or being able to have loving feelings for people
- Feelings of being cut short of the future
- Sleep disturbances
- Feelings of anger and irritability
- Difficulties concentrating
- Needing to be watchful or more alert
- Easily startled or jumpy
- 

Press **NEXT** to advance through the **PCL-S Symptom** screens.

After all symptoms have been recorded press **NEXT** on the last symptom screen to navigate to the **PCL-S Summary** (Figure A17-5).



**Figure A17-4:**  
**PCL-S Symptoms**



**Figure A17-5:**  
**PCL-S Test Summary**

## PCL-S Detailed Results

Detailed results on current and previous PCL-S tests are stored in the database and can be accessed from the **Information Hub** screen.

Once a PCL-S test session has been completed the PCL-S total score will replace the **START** button next to the PCL-S test on the **Information Hub** (Figure A17-6).



**NOTE:** The **PCL-S Detailed Results** will default to view the **CURRENT TEST** tab.

### Current Test Tab

The **PCL-S Current Test Detailed Results** (Figure A17-7) contains three options to select from:

- Review – access responses and results for the entire PCL-S assessment
- New Test – start a new test



**NOTE:** While reviewing patient information the screen header will contain "Review" to inform the operator that they are currently in review mode.

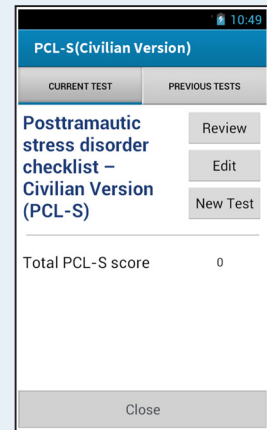
The **PCL-S Review** screens will appear in exact order of the testing sequence.

Press the **REVIEW** button to enter **PCL-S Review**. An example of a **PCL-S Review** screen is shown in Figure A17-8.

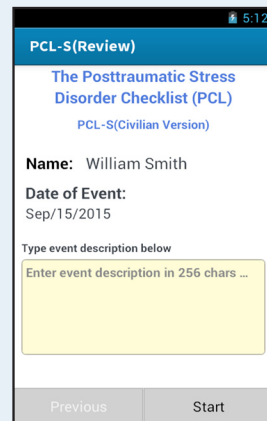
From the **PCL-S Summary Review** (Figure A17-9) press **CONFIRM** to return to the **PCL-S Current Test Detailed Results** (Figure A17-7).



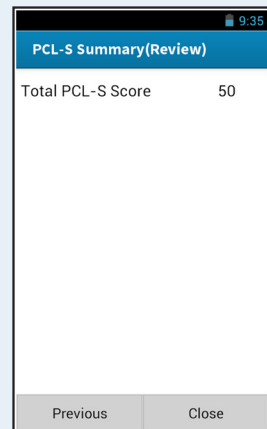
**Figure A17-6**  
PCL-S results area from the  
**Information Hub**



**Figure A17-7:**  
Current Test Detailed Results



**Figure A17-8:**  
Example of a PCL-S Review



**Figure A17-9:**  
Example of a PCL-S Summary

From **PCL-S Current Test Detailed Results** (Figure A17-7) a new test can be started.

Press **NEW TEST** to begin the PCL-S test.

For instructions on completing a new PCL-S test refer to the sections above.

## Previous Test Tab

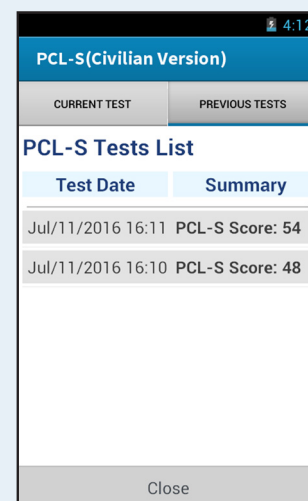
Results from previous PCL-S testing dates and times can be reviewed from the **PCL-S Previous Tests Detailed Results** (Figure A17-10) by pressing **PREVIOUS TESTS** tab.

The **PCL-S Previous Tests Detailed Results** lists all tests recorded by test date, time and summary of symptoms.

To view the PCL-S Assessment Summaries, press the desired test from the "PCL-S Tests List".

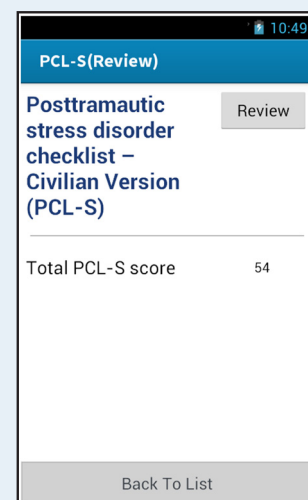
Once the test has been selected the **PCL-S Previous Test Review** (Figure A17-11) will appear displaying the test results.

For instructions on reviewing, editing and starting a new test refer to the sections above.



PCL-S(Civilian Version)	
CURRENT TEST	PREVIOUS TESTS
<b>PCL-S Tests List</b>	
Test Date	Summary
Jul/11/2016 16:11	PCL-S Score: 54
Jul/11/2016 16:10	PCL-S Score: 48
Close	

**Figure A17-10:**  
**PCL-S Tests List**



PCL-S(Review)	
Posttraumatic stress disorder checklist – Civilian Version (PCL-S)	Review
Total PCL-S score	54
Back To List	

**Figure A17-11:**  
**PCL-S Previous Test Review**

## **Appendix 18: PTSD Checklist - Military (PCL-M)**

The PCL is a standardized self-report rating scale for PTSD comprising 17 items that correspond to the key symptoms of PTSD. Two versions of the PCL exist: 1) PCL-M is specific to PTSD caused by military experiences and 2) PCL-C is applied generally to any traumatic event.

The PCL can be easily modified to fit specific time frames or events. For example, instead of asking about "the past month," questions may ask about "the past week" or be modified to focus on events specific to a deployment.

### **How is the PCL completed?**

- The PCL is self-administered
- Respondents indicate how much they have been bothered by a symptom over the past month using a 5-point (1-5) scale, circling their responses. Responses range from 1 Not at All – 5 Extremely

### **How is the PCL Scored?**

1. Add up all items for a total severity score, or
2. Treat response categories 3-5 (Moderately or above) as symptomatic and responses 1-2 (below Moderately) as non-symptomatic, then use the following DSM criteria for a diagnosis:
  - Symptomatic response to at least 1 "B" item (Questions 1-5),
  - Symptomatic response to at least 3 "C" items (Questions 6-12), and
  - Symptomatic response to at least 2 "D" items (Questions 13-17)

### **Are Results Valid and Reliable?**

Two studies of both Vietnam and Persian Gulf theater veterans show that the PCL is both valid and reliable (Additional references are available from the DHCC)

### **What Additional Follow-up is Available?**

- All military health system beneficiaries with health concerns they believe are deployment-related are encouraged to seek medical care
- Patients should be asked, "Is your health concern today related to a deployment?" during all primary care visits.
- If the patient replies "yes," the provider should follow the Post-Deployment Health Clinical Practice

Guideline (PDH-CPG) and supporting guidelines available through the DHCC and [www.PDHealth.mil](http://www.PDHealth.mil).

To begin the PCL-M from the **Information Hub**, press **START** (Figure A18-1) and the handheld will navigate to the **PCL-M Start** screen (Figure A18-2).

The **PCL-M Question Start** will be pre-populated with the patient name and provide the following note:

**NOTE: Please answer the questions pertaining to military stressful experiences in severity range from 1 to 5 to indicate how much you have been bothered by that problem in the past month.**

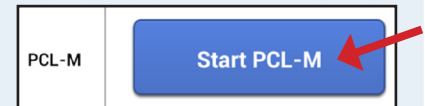
1. Not at all
2. A little bit
3. Moderately
4. Quite a bit
5. Extremely

Press **START** to advance to **the PCL-M Symptom** screens.

The PCL-M Symptom screens will navigate you through a series of the following questions to determine the following:

- Any repeated memories and dreams
- Acting or feelings of reliving stressful events
- Feelings of being upset when reminded of a past stressful experiences
- Any physical reactions when reminded of past stressful experiences
- Avoidance of activities or situations because of past stressful experiences
- Trouble remembering important parts of past stressful experiences
- Losing of interest in things
- Feelings of being distant or cut off
- Feelings of numbness or being able to have loving feelings for people
- Feelings of being cut short of the future
- Sleep disturbances
- Feelings of anger and irritability
- Difficulties concentrating
- Needing to be watchful or more alert
- Easily startled or jumpy

Press **NEXT** to advance through the **PCL-M Symptom** screens. After all symptoms have been recorded press **NEXT** on the last symptom screen to navigate to the **PCL-M Summary**.



**Figure A18-1:  
Start PCL-M Test**

**Figure A18-2:  
PCL-M Test Start Screen**

**Figure A18-3:  
PCL-M Symptoms**

**Figure A18-4:  
PCL-M Test Summary**



## PCL-M Detailed Results

Detailed results on current and previous PCL-M tests are stored in the database and can be accessed from the **Information Hub** screen.

Once a PCL-M test session has been completed the PCL-M total score will replace the **START** button next to the PCL-M test on the **Information Hub** (Figure A18-5).



**NOTE:** The **PCL-M Detailed Results** will default to view the **CURRENT TEST** tab.

### Current Test Tab

The **PCL-M Current Test Detailed Results** (Figure A18-6) contains two options to select from:

- Review – access responses and results for the entire PCL-M assessment
- New Test – start a new test

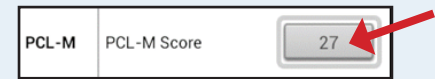


**NOTE:** While reviewing patient information the screen header will contain "Review" to inform the operator that they are currently in review mode.

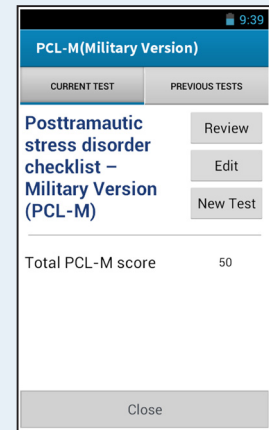
The **PCL-M Review** screens will appear in exact order of the testing sequence.

Press the **REVIEW** button to enter **PCL-M Review**. An example of a **PCL-M Review** screen is shown in Figure A18-7.

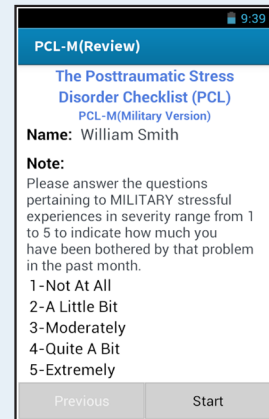
From the **PCL-M Summary Review** (Figure A18-8) press **CONFIRM** to return to the **PCL-M Current Test Detailed Results** (Figure A18-6).



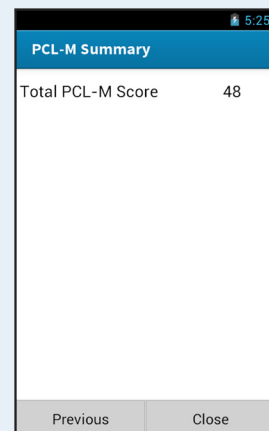
**Figure A18-5**  
**PCL-M results area from the Information Hub**



**Figure A18-6:**  
**Current Test Detailed Results**



**Figure A18-7:**  
**Example of a PCL-M Review**



**Figure A18-8:**  
**Example of a PCL-M Summary**

From **PCL-M Current Test Detailed Results** (Figure A18-6) a new test can be started.

Press **NEW TEST** to begin the PCL-M test.

For instructions on completing a new PCL-M test refer to the sections above.

## Previous Test Tab

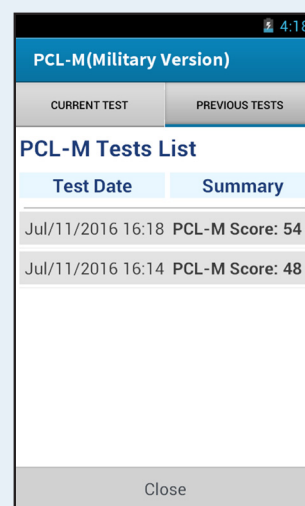
Results from previous PCL-M testing dates and times can be reviewed from the **PCL-M Previous Tests Detailed Results** (Figure A18-9) by pressing **PREVIOUS TESTS** tab.

The **PCL-M Previous Tests Detailed Results** lists all tests recorded by test date, time and summary of symptoms.

To view the PCL-M Assessment Summaries, press the desired test from the "PCL-M Tests List".

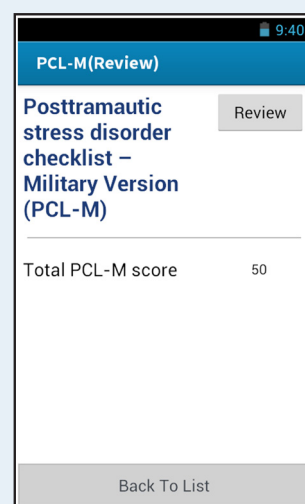
Once the test has been selected the **PCL-M Previous Test Review** (Figure A18-10) will appear displaying the test results.

For instructions on reviewing, editing and starting a new test refer to the sections above.



PCL-M(Military Version)	
CURRENT TEST	PREVIOUS TESTS
<b>PCL-M Tests List</b>	
Test Date	Summary
Jul/11/2016 16:18	PCL-M Score: 54
Jul/11/2016 16:14	PCL-M Score: 48
Close	

**Figure A18-9:**  
**PCL-M Tests List**



PCL-M(Review)	
Posttraumatic stress disorder checklist – Military Version (PCL-M)	Review
Total PCL-M score	50
Back To List	

**Figure A18-10:**  
**PCL-M Previous Test Review**

## Appendix 19: Vestibular/Ocular Function

### Vestibular/Ocular Motor Screening (VOMS)

**Interpretation:** This test is designed for use with subjects ages 9-40. When used with patients outside this age range, interpretation may vary. Abnormal findings or provocation of symptoms with any test may indicate dysfunction – and should trigger a referral to the appropriate health care professional for more detailed assessment and management.

**Equipment:** Tape measure (cm); Metronome; Target with 14 point font print.

To begin the VOMS assessment from the **Information Hub**, press **START** (Figure A19-1) and the handheld will navigate to the **VOMS Start** screen (Figure A19-2). Press **START** to begin the assessment.

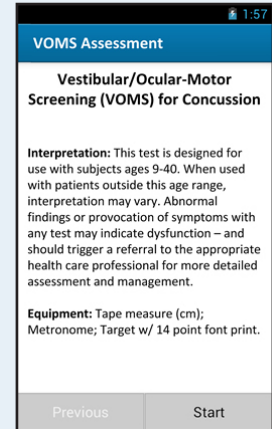
**Baseline Symptoms** – Record all symptoms on a 0-10 scale prior to beginning screening: Headache, Dizziness, Nausea & Foggiess (Figure A19-3).

**Smooth Pursuits** - Test the ability to follow a slowly moving target. The patient and the examiner are seated. The examiner holds a fingertip at a distance of 3 ft. from the patient. The patient is instructed to maintain focus on the target as the examiner moves the target smoothly in the horizontal direction 1.5 ft. to the right and 1.5 ft. to the left of midline. One repetition is complete when the target moves back and forth to the starting position, and 2 repetitions are performed. The target should be moved at a rate requiring approximately 2 seconds to go fully from left to right and 2 seconds to go fully from right to left. The test is repeated with the examiner moving the target smoothly and slowly in the vertical direction 1.5 ft. above and 1.5 ft. below midline for 2 complete repetitions up and down. Again, the target should be moved at a rate requiring approximately 2 seconds to move the eyes fully upward and 2 seconds to move fully downward. Record: Headache, Dizziness, Nausea & Foggiess ratings after the test (Figure A19-4).

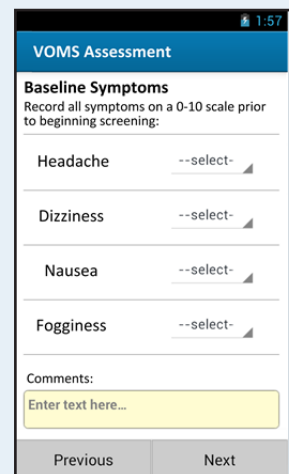
**Saccades** - Test the ability of the eyes to move quickly between targets. The patient and the examiner are seated.



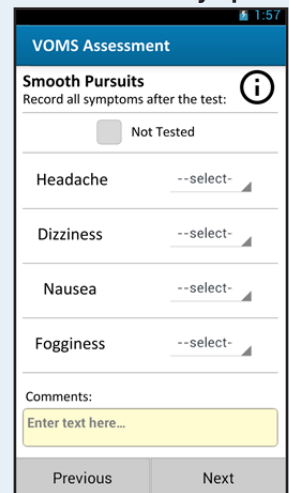
**Figure A19-1:**  
**Start VOMS Test**



**Figure A19-2:**  
**VOMS Test Start Screen**



**Figure A19-3:**  
**VOMS Baseline Symptoms**

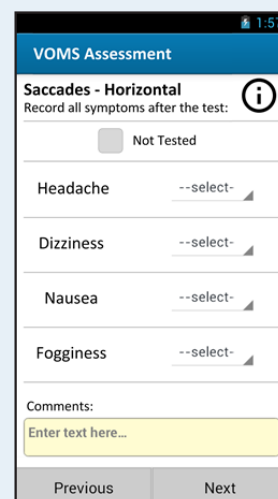


**Figure A19-4:**  
**VOMS Smooth Pursuits**

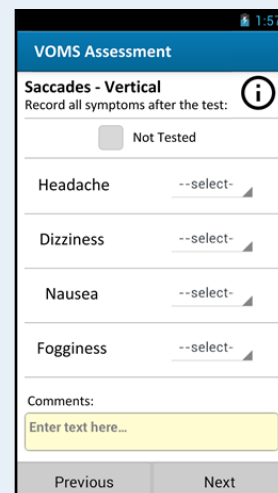
**Horizontal Saccades:** The examiner holds two single points (fingertips) horizontally at a distance of 3 ft. from the patient, and 1.5 ft. to the right and 1.5 ft. to the left of midline so that the patient must gaze 30 degrees to left and 30 degrees to the right. Instruct the patient to move their eyes as quickly as possible from point to point. One repetition is complete when the eyes move back and forth to the starting position, and 10 repetitions are performed. Record: Headache, Dizziness, Nausea & Foggiess ratings after the test (Figure A19-5).

**Vertical Saccades:** Repeat the test with 2 points held vertically at a distance of 3 ft. from the patient, and 1.5 feet above and 1.5 feet below midline so that the patient must gaze 30 degrees upward and 30 degrees downward. Instruct the patient to move their eyes as quickly as possible from point to point. One repetition is complete when the eyes move up and down to the starting position, and 10 repetitions are performed. Record: Headache, Dizziness, Nausea & Foggiess ratings after the test (Figure A19-6).

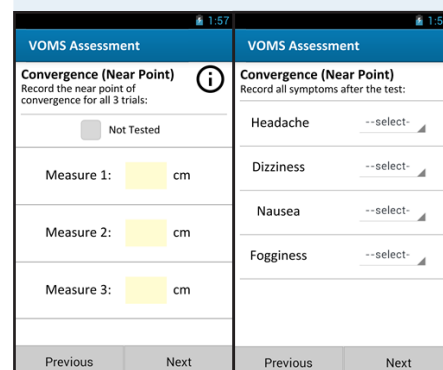
**Convergence (Near Point)** – Measure the ability to view a near target without double vision. The patient is seated and wearing corrective lenses (if needed). The examiner is seated in front of the patient and observes their eye movement during this test. The patient focuses on a small target (approximately 14 point font size) at arm's length and slowly brings it toward the tip of their nose. The patient is instructed to stop moving the target when they see two distinct images or when the examiner observes an outward deviation of one eye. Blurring of the image is ignored. The distance in centimeters (cm). between target and the tip of nose is measured and recorded. This is repeated a total of 3 times with measures recorded each time. Record: Headache, Dizziness, Nausea & Foggiess ratings after the test. Abnormal: Near Point of convergence  $\geq 6$  centimeters (cm) from the tip of the nose (Figure A19-7).



**Figure A19-5:**  
Horizontal Saccades



**Figure A19-6:**  
Vertical Saccades



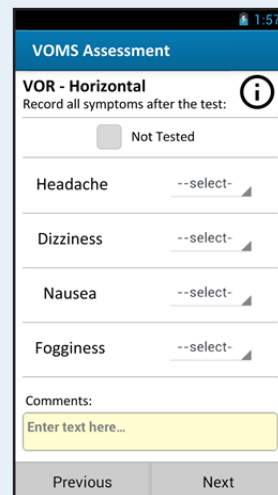
**Figure A19-7:**  
Convergence (Near Point)

**Vestibular-Ocular Reflex (VOR) Test** – Assess the ability to stabilize vision as the head moves. The patient and the examiner are seated. The examiner holds a target of approximately 14 point font size in front of the patient in midline at a distance of 3 ft.

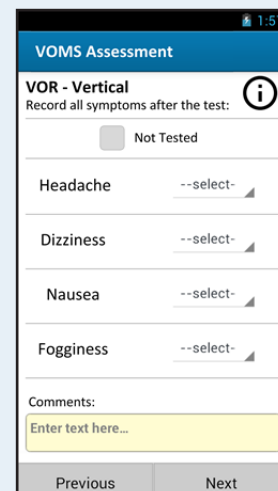
**Horizontal VOR Test:** The patient is asked to rotate their head horizontally while maintaining focus on the target. The head is moved at an amplitude of 20 degrees to each side and a metronome is used to ensure the speed of rotation is maintained at 180 beats/minute (one beat in each direction). One repetition is complete when the head moves back and forth to the starting position, and 10 repetitions are performed. Record: Headache, Dizziness, Nausea and Foggiess ratings 10 sec after the test is completed (Figure A19-8).

**Vertical VOR Test:** The test is repeated with the patient moving their head vertically. The head is moved in an amplitude of 20 degrees up and 20 degrees down and a metronome is used to ensure the speed of movement is maintained at 180 beats/minute (one beat in each direction). One repetition is complete when the head moves up and down to the starting position, and 10 repetitions are performed. Record: Headache, Dizziness, Nausea and Foggiess ratings after the test (Figure A19-9).

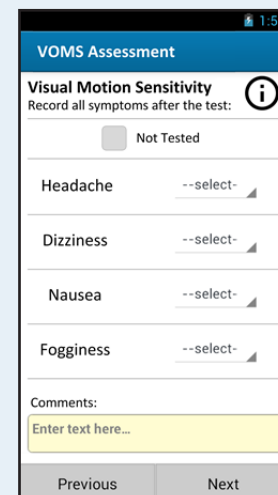
**Visual Motion Sensitivity (VMS) Test** – Test visual motion sensitivity and the ability to inhibit vestibular-induced eye movements using vision. The patient stands with feet shoulder width apart, facing a busy area of the clinic. The examiner stands next to and slightly behind the patient, so that the patient is guarded but the movement can be performed freely. The patient holds arm outstretched and focuses on their thumb. Maintaining focus on their thumb, the patient rotates, together as a unit, their head, eyes and trunk at an amplitude of 80 degrees to the right and 80 degrees to the left. A metronome is used to ensure the speed of rotation is maintained at 50 beats/min (one beat in each direction). One repetition is complete when the trunk rotates back and forth to the starting position, and 5 repetitions are performed. Record: Headache, Dizziness, Nausea & Foggiess ratings after the test (Figure A19-10).



**Figure A19-8:**  
Horizontal VOR Test



**Figure A19-9:**  
Vertical VOR Test



**Figure A19-10:**  
Visual Motion Sensitivity (VMS) Test

After all symptoms have been recorded press **NEXT** on the last symptom screen to navigate to the **VOMS Summary** (Figure A19-11).

	Headache	Dizziness	Nausea	Fogginess	Comments
Baseline	3	0	1	0	
Smooth Pursuits	5	0	2	0	
Saccades - Horizontal	4	2	1	1	
Saccades - Vertical	4	1	1	1	
Convergence (Near Point)	6	4	2	0	1: 5cm 2: 6cm 3: 4cm (Near Point in cm)
VOR - Horizontal	3	2	4	2	
VOR - Vertical	3	1	3	3	
Visual Motion Sensitivity Test	4	4	2	3	

Figure A19-11:  
VOMS Summary

## VOMS Detailed Results

Detailed results on current and previous VOMS tests are stored in the database and can be accessed from the **Information Hub** screen.

To access the **VOMS Detailed Results**, press the Vestibular/Ocular Motor Screening (VOMS) **VIEW** (Figure A19-12) button from the **Information Hub**.



**NOTE:** The **VOMS Detailed Results** will default to view the **CURRENT TEST** tab.

### Current Test Tab

The **VOMS Current Test Detailed Results** (Figure A19-13) contains two options to select from:

- Review – access all entered symptom scores
- New Test – start a new test



**NOTE:** While reviewing patient information the screen header will contain “Review” to inform the operator that they are currently in review mode.

The **VOMS Review** screens will appear in exact order of the testing sequence.

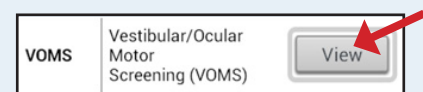


Figure A19-12  
VOMS results area from the  
**Information Hub**

	Headache	Dizziness
Baseline	3	0
Smooth Pursuits	5	0
Saccades - Horizontal	4	2
Saccades - Vertical	4	1
Convergence (Near Point)	6	4
VOR - Horizontal	3	2
VOR - Vertical	3	1
Visual Motion Sensitivity Test	4	4

Figure A19-13  
Current Test Detailed Results



Press the **REVIEW** button on the **VOMS Current Test Detailed Results** (Figure A19-13) to enter **VOMS Review**. An example of a **VOMS Assessment Review** screen is shown in Figure A19-14.

From the **VOMS Summary Review** (Figure A19-15) press **CONFIRM** to return to the **VOMS Current Test Detailed Results** (Figure A19-13).

From **VOMS Current Test Detailed Results** (Figure A19-13) a new test can be started.

Press **NEW TEST** to begin the VOMS test.

For instructions on completing a new VOMS test refer to the sections above.

## Previous Test Tab

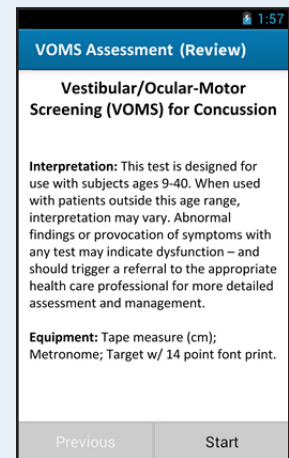
Results from previous VOMS tests can be reviewed from the **VOMS previous Tests Detailed Results** (Figure A19-16) by pressing the **PREVIOUS TESTS** Tab.

The **VOMS Previous Tests Detailed Results** lists all tests recorded by test date and time.

To view the VOMS Assessment Summaries, press the desired test from the "VOMS Tests List".

Once the test has been selected, the **VOMS Previous Test Review** (Figure A19-16) will appear displaying the test results.

For instructions on reviewing and starting a new test refer to the sections above.



**VOMS Assessment (Review)**

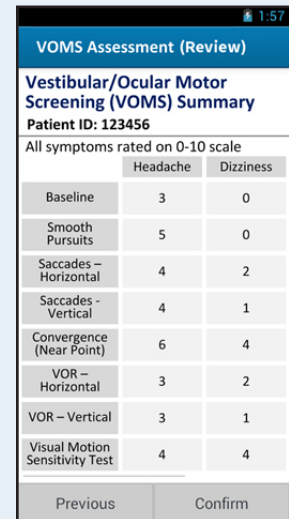
**Vestibular/Ocular-Motor Screening (VOMS) for Concussion**

**Interpretation:** This test is designed for use with subjects ages 9-40. When used with patients outside this age range, interpretation may vary. Abnormal findings or provocation of symptoms with any test may indicate dysfunction – and should trigger a referral to the appropriate health care professional for more detailed assessment and management.

**Equipment:** Tape measure (cm); Metronome; Target w/ 14 point font print.

Previous Start

**Figure A19-14:**  
Example of a VOMS Review



**VOMS Assessment (Review)**

**Vestibular/Ocular Motor Screening (VOMS) Summary**

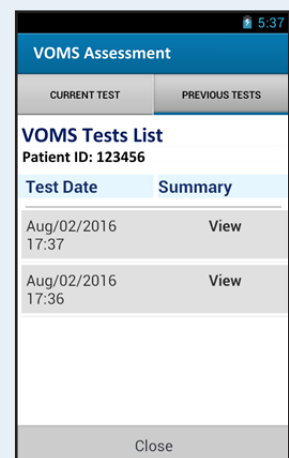
**Patient ID: 123456**

All symptoms rated on 0-10 scale

	Headache	Dizziness
Baseline	3	0
Smooth Pursuits	5	0
Saccades – Horizontal	4	2
Saccades – Vertical	4	1
Convergence (Near Point)	6	4
VOR – Horizontal	3	2
VOR – Vertical	3	1
Visual Motion Sensitivity Test	4	4

Previous Confirm

**Figure A19-15:**  
Example of a VOMS Summary



**VOMS Assessment**

CURRENT TEST PREVIOUS TESTS

**VOMS Tests List**

**Patient ID: 123456**

Test Date	Summary
Aug/02/2016 17:37	View
Aug/02/2016 17:36	View

Close

**Figure A19-16:**  
VOMS Previous Tests



## Near Point Convergence

**Equipment:** Tape measure (cm); Target with 14 point font print.

To begin the Near Point Convergence assessment from the **Information Hub**, press **START** (Figure A19-17) and the handheld will navigate to the **Near Point Convergence Start** screen (Figure A19-18).

**Near Point Convergence Instructions** – Measure the ability to view a near target without double vision. The patient is seated and wearing corrective lenses (if needed). The examiner is seated front of the patient and observes their eye movement during this test. The patient focuses on a small target (approximately 14 point font size) at arm's length and slowly brings it toward the tip of their nose. The patient is instructed to stop moving the target when they see two distinct images or when the examiner observes an outward deviation of one eye. Blurring of the image is ignored. The distance in centimeters (cm), between target and the tip of nose is measured and recorded. This is repeated a total of 3 times with measures recorded each time. Abnormal: Near Point of convergence  $\geq 6$  centimeters (cm) from the tip of the nose (Figure A19-18).

After all measures have been recorded press **START** to navigate to the **Near Point Convergence Summary** (Figure A19-19).

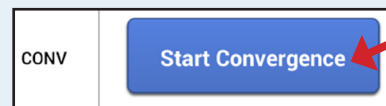
## Near Point Convergence Detailed Results

Detailed results on current and previous Near Point Convergence tests are stored in the database and can be accessed from the **Information Hub** screen.

To access the **Near Point Convergence Detailed Results**, press the Near Point Convergence **VIEW** (Figure A19-20) button from the **Information Hub**.



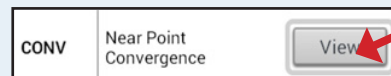
**NOTE:** The **Near Point Convergence Detailed Results** will default to view the **CURRENT TEST** tab.



**Figure A19-17:**  
Start Near Point Convergence Test

**Figure A19-18:**  
Near Point Convergence Test

**Figure A19-19:**  
Example of a Near Point Convergence Summary



**Figure A19-20:**  
Near Point Convergence results area from the **Information Hub**

## Current Test Tab

The **Near Point Convergence Current Test Detailed Results** (Figure A19-21) contains two options to select from:

- Review – access all entered symptom scores
- New Test – start a new test



**NOTE:** While reviewing patient information the screen header will contain “Review” to inform the operator that they are currently in review mode.

The **Near Point Convergence Review** screens will appear in exact order of the testing sequence.

Press the **REVIEW** button on the **Near Point Convergence Detailed Results** (Figure A19-21) to enter **Near Point Convergence Review**. An example of a **Near Point Convergence Assessment Review** screen is shown in Figure A19-22.

From the **Near Point Convergence Summary Review** (Figure A19-22) press **CONFIRM** to return to the **Near Point Convergence Current Test Detailed Results** (Figure A19-21).

From **Near Point Convergence Current Test Detailed Results** (Figure A19-21) a new test can be started.

Press **NEW TEST** to begin the Near Point Convergence test.

For instructions on completing a new Near Point Convergence test refer to the sections above.

## Previous Test Tab

Results from previous Near Point Convergence tests can be reviewed from the **Near Point Convergence Previous Tests Detailed Results** (Figure A19-23) by pressing the **PREVIOUS TESTS** Tab.

The **Near Point Convergence Previous Tests Detailed Results** lists all tests recorded by test date and time.

To view the Near Point Convergence Assessment Summaries, press the desired test from the “Near Point Convergence Tests List”.

Once the test has been selected, the **Near Point Convergence Previous Test Review** (Figure A19-23) will appear displaying the test results.

For instructions on reviewing and starting a new test refer to the sections above.

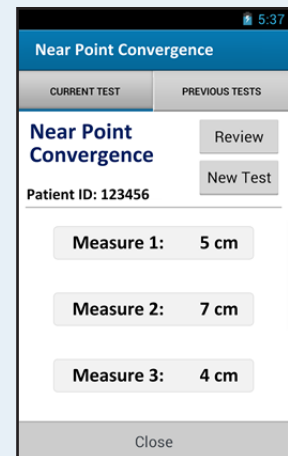


Figure A19-21:  
Current Near Point Convergence  
Detailed Results

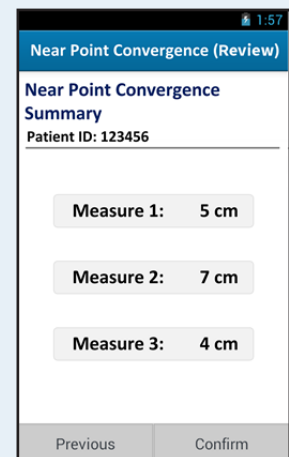


Figure A19-22:  
Example of a Near Point Convergence  
Review

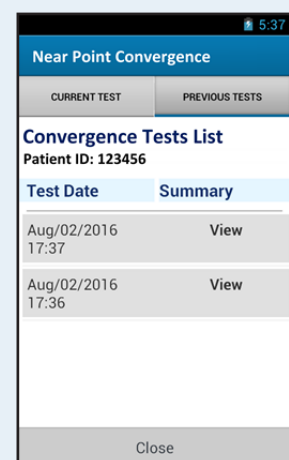


Figure A19-23:  
Near Point Convergence Previous  
Tests

## Accommodation

**Equipment:** Tape measure (cm); Target with 0.4M or 0.5M letters.

To begin the Accommodation assessment from the **Information Hub**, press **START** (Figure A19-24) and the handheld will navigate to the **Accommodation Start** screen (Figure A19-25).

**Accommodation Instructions** – For this test, use relatively small letters (0.4M or 0.5M) to help better control accommodation. Instruct the patient to close one eye. Slowly move the target toward the patient. Stop moving the target when the patient indicates that the target is blurry. Record the distance between the target and the tip of the patient's nose. Repeat the above procedure with the patient's other eye closed (Figure A19-25).

After all symptoms have been recorded press **START** to navigate to the **Accommodation Summary** (Figure A19-26).

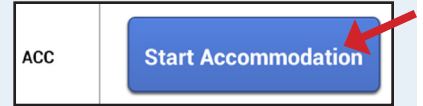
## Accommodation Detailed Results

Detailed results on current and previous Accommodation tests are stored in the database and can be accessed from the **Information Hub** screen.

To access the **Accommodation Detailed Results**, press the Accommodation score (Figure A19-27) on the **Information Hub**.



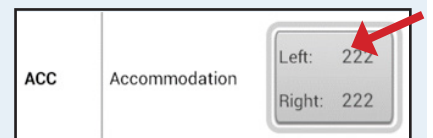
**NOTE:** The **Accommodation Detailed Results** will default to view the **CURRENT TEST** tab.



**Figure A19-24:**  
Start Accommodation Test

**Figure A19-25:**  
Accommodation Test

**Figure A19-26:**  
Example of a Accommodation Summary



**Figure A19-27:**  
Accommodation results area from the **Information Hub**

## Current Test Tab

The **Accommodation Current Test Detailed Results** (Figure A19-28) contains two options to select from:

- Review – access all entered symptom scores
- New Test – start a new test



**NOTE:** While reviewing patient information the screen header will contain “Review” to inform the operator that they are currently in review mode.

The **Accommodation Review** screens will appear in exact order of the testing sequence.

Press the **REVIEW** button on the **Accommodation Detailed Results** (Figure A19-28) to enter **Accommodation Review**. An example of an **Accommodation Assessment Review** screen is shown in Figure A19-29.

From the **Accommodation Summary Review** (Figure A19-29) press **CONFIRM** to return to the **Accommodation Current Test Detailed Results** (Figure A19-28).

From **Accommodation Current Test Detailed Results** (Figure A19-28) a new test can be started.

Press **NEW TEST** to begin the Accommodation test.

For instructions on completing a new Accommodation test refer to the sections above.

## Previous Test Tab

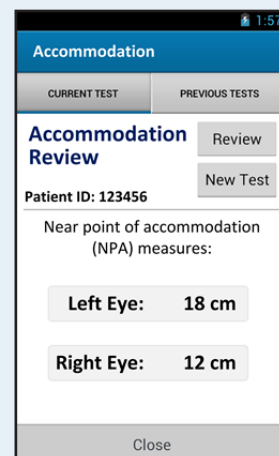
Results from previous Accommodation tests can be reviewed from the **Accommodation Previous Tests Detailed Results** (Figure A19-30) by pressing the **PREVIOUS TESTS** Tab.

The **Accommodation Previous Tests Detailed Results** lists all tests recorded by test date and time.

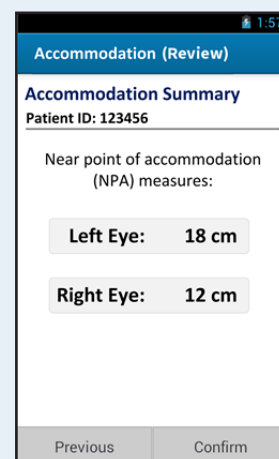
To view the Accommodation Assessment Summaries, press the desired test from the “Accommodation Tests List”.

Once the test has been selected, the **Accommodation Previous Test Review** (Figure A19-30) will appear displaying the test results.

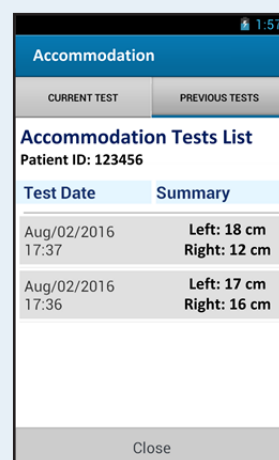
For instructions on reviewing and starting a new test refer to the sections above.



**Figure A19-28:**  
Current Accommodation Detailed Results



**Figure A19-29:**  
Example of an Accommodation Review



**Figure A19-30:**  
Accommodation Previous Tests

## Appendix 20: Sports Concussion Assessment Tool – 5th Edition (SCAT5)

The SCAT5 is a standardized tool for evaluating concussions designed for use by physicians and licensed healthcare professionals. The SCAT5 cannot be performed correctly in less than 10 minutes.

If you are not a physician or licensed healthcare professional, please use the Concussion Recognition Tool 5 (CRT5). The SCAT5 is to be used for evaluating athletes aged 13 years and older. For children aged 12 years or younger, please use the Child SCAT5.

Preseason SCAT5 baseline testing can be useful for interpreting post-injury test scores, but is not required for that purpose. Detailed instructions for use of the SCAT5 are provided on the following pages. Please read through these instructions carefully before testing the athlete. Brief verbal instructions for each test are given in *italics*. The only equipment required for the tester is a watch or timer.

### Recognize and Remove

A head impact by either a direct blow or indirect transmission of force can be associated with a serious and potentially fatal brain injury. If there are significant concerns, including any of the red flags listed, then activation of emergency procedures and urgent transport to the nearest hospital should be arranged.

### Key points

- Any athlete with suspected concussion should be REMOVED FROM PLAY, medically assessed and monitored for deterioration. No athlete diagnosed with concussion should be returned to play on the day of injury.
- If an athlete is suspected of having a concussion and medical personnel are not immediately available, the athlete should be referred to a medical facility for urgent assessment.
- Athletes with suspected concussion should not drink alcohol, use recreational drugs and should not drive a motor vehicle until cleared to do so by a medical professional.
- Concussion signs and symptoms evolve over time and it is important to consider repeat evaluation in the assessment of concussion.
- The diagnosis of a concussion is a clinical judgment, made by a medical professional. The SCAT5 should NOT be used by itself to make, or exclude, the diagnosis of concussion. An athlete may have a concussion even if their SCAT5 is "normal".

### Remember

- The basic principles of first aid (danger, response, airway, breathing, circulation) should be followed.
- Do not attempt to move the athlete (other than that required for airway management) unless trained to do so.
- Assessment for a spinal cord injury is a critical part of the initial on field assessment.
- Do not remove a helmet or any other equipment unless trained to do so safely.

## INSTRUCTIONS

Words in *italics* throughout the SCAT5 are the instructions given to the athlete by the clinician

### Symptom Scale

The time frame for symptoms should be based on the type of test being administered. At baseline it is advantageous to assess how an athlete "typically" feels whereas during the acute/post-acute stage it is best to ask how the athlete feels at the time of testing.

The symptom scale should be completed by the athlete, not by the examiner. In situations where the symptom scale is being completed after exercise, it should be done in a resting state, generally by approximating his/her resting heart rate.

For total number of symptoms, maximum possible is 22 except immediately post injury, if sleep item is omitted, which then creates a maximum of 21.

For Symptom severity score, add all scores in table, maximum possible is 22 x 6 = 132, except immediately post injury if sleep item is omitted, which then creates a maximum of 21x6=126.

### Immediate Memory

The Immediate Memory component can be completed using the traditional 5-word per trial list or, optionally, using 10-words per trial. The literature suggests that the Immediate Memory has a notable ceiling effect when a 5-word list is used. In settings where this ceiling is prominent, the examiner may wish to make the task more difficult by incorporating two 5-word groups for a total of 10 words per trial. In this case, the maximum score per trial is 10 with a total trial maximum of 30.

Choose one of the word lists (either 5 or 10). Then perform 3 trials of immediate memory using this list.

Complete all 3 trials regardless of score on previous trials.

*"I am going to test your memory. I will read you a list of words and when I am done, repeat back as many words as you can remember, in any order."* The words must be read at a rate of one word per second.

Trials 2 & 3 MUST be completed regardless of score on trial 1 & 2.

Trials 2 & 3:

*"I am going to repeat the same list again. Repeat back as many words as you can remember in any order, even if you said the word before."*

Score 1 pt. for each correct response. Total score equals sum across all 3 trials. Do NOT inform the athlete that delayed recall will be tested.

### Concentration

#### Digits backward

Choose one column of digits from lists A, B, C, D, E or F and administer those digits as follows:

Say: *"I am going to read a string of numbers and when I am done, you repeat them back to me in reverse order of how I read them to you. For example, if I say 7-1-9, you would say 9-1-7."*

Begin with first 3 digit string.

If correct, circle "Y" for correct and go to next string length. If incorrect, circle "N" for the first string length and read trial 2 in the same string length. One point possible for each string length. Stop after incorrect on both trials (2 N's) in a string length. The digits should be read at the rate of one per second.

#### Months in reverse order

*"Now tell me the months of the year in reverse order. Start with the last month and go backward. So you'll say December, November ... Go ahead"*

1 pt. for entire sequence correct

#### Delayed Recall

The delayed recall should be performed after 5 minutes have elapsed since the end of the Immediate Recall section.

*"Do you remember that list of words I read a few times earlier? Tell me as many words from the list as you can remember in any order."*

Score 1 pt. for each correct response

### Modified Balance Error Scoring System (mBESS)<sup>5</sup> testing

This balance testing is based on a modified version of the Balance Error Scoring System (BESS)<sup>6</sup>. A timing device is required for this testing.

Each of 20-second trial/stance is scored by counting the number of errors. The examiner will begin counting errors only after the athlete has assumed the proper start position. The modified BESS is calculated by adding one error point for each error during the three 20-second tests. The maximum number of errors for any single condition is 10. If the athlete commits multiple errors simultaneously, only

one error is recorded but the athlete should quickly return to the testing position, and counting should resume once the athlete is set. Athletes that are unable to maintain the testing procedure for a minimum of five seconds at the start are assigned the highest possible score, ten, for that testing condition.

OPTION: For further assessment, the same 3 stances can be performed on a surface of medium density foam (e.g., approximately 50cm x 40cm x 6cm).

#### Balance testing – types of errors

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

*"I am now going to test your balance. Please take your shoes off (if applicable), roll up your pant legs above ankle (if applicable), and remove any ankle taping (if applicable). This test will consist of three twenty second tests with different stances."*

(a) Double leg stance:

*"The first stance is standing with your feet together with your hands on your hips and with your eyes closed. You should try to maintain stability in that position for 20 seconds. I will be counting the number of times you move out of this position. I will start timing when you are set and have closed your eyes."*

(b) Single leg stance:

*"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. 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 hands on your hips and your eyes closed. I will be counting the number of times you move out of this position. If you stumble out of this position, open your eyes and return to the start position and continue balancing. I will start timing when you are set and have closed your eyes."*

(c) Tandem stance:

*"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 hands on your hips and your eyes closed. I will be counting the number of times you move out of this position. If you stumble out of this position, open your eyes and return to the start position and continue balancing. I will start timing when you are set and have closed your eyes."*

### Tandem Gait

Participants are instructed to stand with their feet together behind a starting line (the test is best done with footwear removed). Then, they walk in a forward direction as quickly and as accurately as possible along a 38mm wide (sports tape), 3 metre line with an alternate foot heel-to-toe gait ensuring that they approximate their heel and toe on each step. Once they cross the end of the 3m line, they turn 180 degrees and return to the starting point using the same gait. Athletes fail the test if they step off the line, have a separation between their heel and toe, or if they touch or grab the examiner or an object.

### Finger to Nose

*"I am going to test your coordination now. Please sit comfortably on the chair with your eyes open and your arm (either right or left) outstretched (shoulder flexed to 90 degrees and elbow and fingers extended), pointing in front of you. When I give a start signal, I would like you to perform five successive finger to nose repetitions using your index finger to touch the tip of the nose, and then return to the starting position, as quickly and as accurately as possible."*

### References

- McCrory et al. Consensus Statement On Concussion In Sport – The 5th International Conference On Concussion In Sport Held In Berlin, October 2016. British Journal of Sports Medicine 2017 (available at [www.bjsm.bmj.com](http://www.bjsm.bmj.com))
- Maddocks, DL; Dicker, GD; Saling, MM. The assessment of orientation following concussion in athletes. Clinical Journal of Sport Medicine 1995; 5: 32-33
- Jennett, B, Bond, M. Assessment of outcome after severe brain damage: a practical scale. Lancet 1975; i: 480-484
- McCrea M. Standardized mental status testing of acute concussion. Clinical Journal of Sport Medicine. 2001; 11: 176-181
- Guskiewicz KM. Assessment of postural stability following sport-related concussion. Current Sports Medicine Reports. 2003; 2: 24-30



## CONCUSSION INFORMATION

**Any athlete suspected of having a concussion should be removed from play and seek medical evaluation.**

### Signs to watch for

Problems could arise over the first 24-48 hours. The athlete should not be left alone and must go to a hospital at once if they experience:

- Worsening headache
- Repeated vomiting
- Weakness or numbness in arms or legs
- Drowsiness or inability to be awakened
- Unusual behaviour or confusion or irritable
- Unsteadiness on their feet.
- Inability to recognize people or places
- Seizures (arms and legs jerk uncontrollably)
- Slurred speech

**Consult your physician or licensed healthcare professional after a suspected concussion. Remember, it is better to be safe.**

### Rest & Rehabilitation

After a concussion, the athlete should have physical rest and relative cognitive rest for a few days to allow their symptoms to improve. In most cases, after no more than a few days of rest, the athlete should gradually increase their daily activity level as long as their symptoms do not worsen. Once the athlete is able to complete their usual daily activities without concussion-related symptoms, the second step of the return to play/sport progression can be started. The athlete should not return to play/sport until their concussion-related symptoms have resolved and the athlete has successfully returned to full school/learning activities.

When returning to play/sport, the athlete should follow a stepwise, **medically managed exercise progression, with increasing amounts of exercise.** For example:

### Graduated Return to Sport Strategy

Exercise step	Functional exercise at each step	Goal of each step
1. Symptom-limited activity	Daily activities that do not provoke symptoms.	Gradual reintroduction of work/school activities.
2. Light aerobic exercise	Walking or stationary cycling at slow to medium pace. No resistance training.	Increase heart rate.
3. Sport-specific exercise	Running or skating drills. No head impact activities.	Add movement.
4. Non-contact training drills	Harder training drills, e.g., passing drills. May start progressive resistance training.	Exercise, coordination, and increased thinking.
5. Full contact practice	Following medical clearance, participate in normal training activities.	Restore confidence and assess functional skills by coaching staff.
6. Return to play/sport	Normal game play.	

In this example, it would be typical to have 24 hours (or longer) for each step of the progression. If any symptoms worsen while exercising, the athlete should go back to the previous step. Resistance training should be added only in the later stages (Stage 3 or 4 at the earliest).

**Written clearance should be provided by a healthcare professional before return to play/sport as directed by local laws and regulations.**

### Graduated Return to School Strategy

Concussion may affect the ability to learn at school. The athlete may need to miss a few days of school after a concussion. When going back to school, some athletes may need to go back gradually and may need to have some changes made to their schedule so that concussion symptoms do not get worse. If a particular activity makes symptoms worse, then the athlete should stop that activity and rest until symptoms get better. To make sure that the athlete can get back to school without problems, it is important that the healthcare provider, parents, caregivers and teachers talk to each other so that everyone knows what the plan is for the athlete to go back to school.

**Note: If mental activity does not cause any symptoms, the athlete may be able to skip step 2 and return to school part-time before doing school activities at home first.**

Mental Activity	Activity at each step	Goal of each step
1. Daily activities that do not give the athlete symptoms	Typical activities that the athlete does during the day as long as they do not increase symptoms (e.g. reading, texting, screen time). Start with 5-15 minutes at a time and gradually build up.	Gradual return to typical activities.
2. School activities	Homework, reading or other cognitive activities outside of the classroom.	Increase tolerance to cognitive work.
3. Return to school part-time	Gradual introduction of school-work. May need to start with a partial school day or with increased breaks during the day.	Increase academic activities.
4. Return to school full-time	Gradually progress school activities until a full day can be tolerated.	Return to full academic activities and catch up on missed work.

If the athlete continues to have symptoms with mental activity, some other accommodations that can help with return to school may include:

- Starting school later, only going for half days, or going only to certain classes
- Taking lots of breaks during class, homework, tests
- More time to finish assignments/tests
- No more than one exam/day
- Quiet room to finish assignments/tests
- Shorter assignments
- Not going to noisy areas like the cafeteria, assembly halls, sporting events, music class, shop class, etc.
- Repetition/memory cues
- Use of a student helper/tutor
- Reassurance from teachers that the child will be supported while getting better

**The athlete should not go back to sports until they are back to school/learning, without symptoms getting significantly worse and no longer needing any changes to their schedule.**



There are two versions of the SCAT5 available with BrainScope One:

- Immediate or On-Field Assessment
- Office or Off-Field Assessment

The SCAT5 Office or Off-Field Assessment test sequence, will be available after the SCAT5 Immediate or On-Field Assessment test sequence.

For Immediate or On-Field Assessment see Figure A20-1; for Sideline and Office or Off-Field Assessment see Figure A20-2.

Figure A20-1 appears when the operator has not completed the Immediate or On-Field Assessment and the version in Figure A20-2 appears when the operator has completed the Immediate or On-Field Assessment.

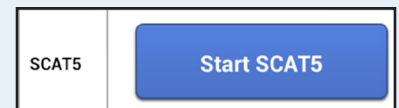
To begin the SCAT5 from the **Information Hub**, press **START** (Figure A20-1 or A20-2) next to the appropriate assessment and the handheld will navigate to **SCAT5 Start** (Figure A20-3 or A20-4).



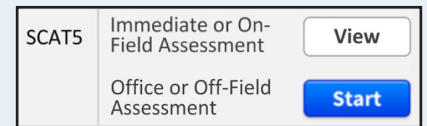
**NOTE:** Scoring on the SCAT5 should not be used as a stand-alone method to diagnose concussion, measure recovery or make decisions about an athlete's readiness to return to competition after concussion. Since signs and symptoms may evolve over time, it is important to consider repeat evaluation in the acute assessment of concussion.

The "Date of Injury" field on the **SCAT5 Immediate Assessment Start** screen (Figure A20-3) will be populated with the date of injury entered in Patient Information. The "Date" field on the **SCAT5 Office Assessment Start** screen (Figure A20-4) will be populated with the current date.

The "Name", "DOB", and "ID Number" fields on both start screens will be pre-populated for the current session. The "Examiner" field is pre-populated, but editable.



**Figure A20-1:**  
**Start SCAT5**



**Figure A20-2:**  
**Start SCAT5 After Immediate Assessment**

**Figure A20-3:**  
**Start SCAT5- Immediate Assessment**

**Figure A20-4:**  
**Start SCAT5 - Office Assessment**

## SCAT5 - Immediate or On-Field Assessment

Press **START** from the **SCAT5 Immediate Assessment Start** screen to navigate to a screen with the following instructions:

"The following elements should be assessed for all athletes who are suspected of having a concussion prior to proceeding to the neurocognitive assessment and ideally should be done on field after the first first aid / emergency care priorities are completed.

If any of the "Red Flags" or observable signs are noted after a direct or indirect blow to the head, the athlete should be immediately and safely removed from participation and evaluated by a physician or licensed healthcare professional.

Consideration of transportation to a medical facility should be at the discretion of the physician or licensed healthcare professional.

The GCS is important as a standard measure for all patients and can be done serially if necessary in the event of deterioration in conscious state. The Maddocks questions and cervical spine exam are critical steps of the immediate assessment; however, these do not need to be done serially."

Press **NEXT** to navigate to the **SCAT5 Immediate Assessment Red Flags** (Figure A20-5)

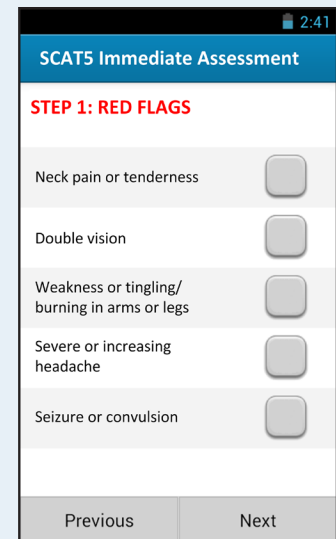
### Red Flags:

- Neck pain or tenderness
- Double vision
- Weakness or tingling/burning in arms or legs
- Severe or increasing headache
- Seizure or convulsion
- Loss of consciousness
- Deteriorating conscious state
- Vomiting
- Increasingly restless, agitated or combative

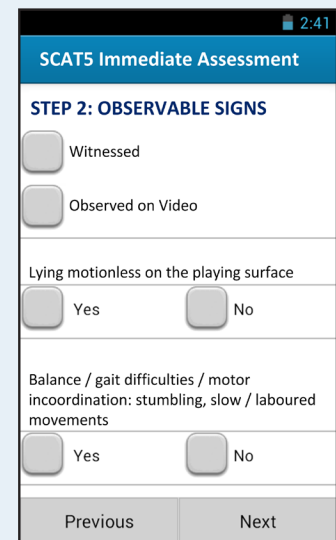
Press **NEXT** to navigate to **SCAT5 Observable Signs 1 and 2** (Figure A20-6).

The **SCAT5 Observable Signs 1 and 2** screens contain a series of questions to identify the potential signs of a concussion. The questions will cover the following signs:

- Lying motionless on the playing surface
- Balance / gait difficulties / motor incoordination: stumbling, slow / laboured movements



**Figure A20-5:**  
Immediate Assessment Red Flags



**Figure A20-6:**  
Immediate Assessment  
Observable Signs

- Disorientation or confusion, or an inability to respond appropriately to questions
- Blank or vacant look
- Facial injury after head trauma

Press **NEXT** to navigate to **SCAT5 Immediate Assessment Maddocks**.

The **SCAT5 Immediate Assessment Maddocks - Memory Assessment (1)** (Figure A20-7) will provide a text box to record the patient's memory of the event. The following instructions will be provided to read to the patient:

*"I am going to ask you a few questions, please listen carefully and give your best effort. First, tell me what happened?"*

Record the response in the text box using the onscreen keyboard.

Press **NEXT** to navigate to **SCAT5 Immediate Assessment Maddocks - Memory Assessment (2)** (Figure A20-8).

To record the subject's response press either **INCORRECT** or **CORRECT** to the answer they provided and move on to the next question. Repeat these steps for all questions on the **SCAT5 Immediate Assessment Maddocks - Memory Assessment (2)**. Press **NEXT** to navigate to **SCAT5 Immediate Assessment GCS** screen.

**SCAT5 Immediate Assessment GCS** (Figure A20-9) contains three drop-down menus to record responses for the following:

- Best eye response (E)
- Best verbal response (V)
- Best motor response (M)

For Best eye response (E) the following options are available to select from in the drop-down menu:

- 1 – No eye opening
- 2 – Eye opening in response to pain
- 3 – Eye opening to speech
- 4 – Eye opening spontaneously

For Best verbal response (V) the following options are available to select from in the drop-down menu:

- 1 – No verbal response
- 2 – Incomprehensible sounds
- 3 – Inappropriate words
- 4 – Confused
- 5 – Oriented

**Figure A20-7:**  
**Immediate Assessment Maddocks - Memory Assessment (1)**

**Figure A20-8:**  
**Immediate Assessment Maddocks - Memory Assessment (2)**

**Figure A20-9:**  
**Immediate Assessment GCS**

For Best motor response (M) the following options are available to select from in the drop-down menu:

- 1 – No motor response
- 2 – Extension to pain
- 3 – Abnormal flexion to pain
- 4 – Flexion/Withdrawal to pain
- 5 – Localizes to pain
- 6 – Obeys commands

Once the options for each response have been recorded the **SCAT5 Immediate Assessment GCS** will display the Glasgow Coma Scale score (E+V+M) at the bottom of the screen (Figure A20-9).

Press **NEXT** to navigate to the **SCAT5 Immediate Assessment Cervical Spine** (Figure A20-10).

To record the response press either **YES** or **NO** and move on to the next question. Repeat these steps for all questions on the **SCAT5 Immediate Assessment Cervical Spine**. Press **NEXT** to navigate to **SCAT5 Immediate Assessment Summary** (Figure A20-11).

On the **SCAT5 Immediate Assessment Summary** review the results and press **CONFIRM** to return to the **Information Hub** screen. To view the SCAT5 Immediate Assessment results press **VIEW** from the **Information Hub** (Figure A20-12).

## SCAT5 - Office or Off-Field Assessment

To begin the SCAT5 Office or Off Field Assessment from the **Information Hub**, press **START** (Figure A20-2) and the handheld will navigate to **SCAT5 Office Assessment Start** (Figure A20-4).



**NOTE:** The neurocognitive assessment should be done in a distraction-free environment with the athlete in a resting state.

Press **START** from the **SCAT5 Office Assessment Start** screen to navigate to the **SCAT5 Office Assessment Athlete Background 1 through 3** screens (Figure A20-12).

The **SCAT5 Office Assessment Athlete Background 1 through 3** provide a series of questions on the subjects background. Enter information using either the onscreen keyboard or by pressing the appropriate checkbox. At the end of the **SCAT5 Office Assessment Athlete Background** press **NEXT** to navigate to the **SCAT5 Office Assessment Symptoms 1 through 9** screens.

**Figure A20-10:**  
Immediate Assessment Cervical Spine

**Figure A20-11:**  
Immediate Assessment Summary

**Figure A20-12:**  
Assessment Athlete Background 1

The **SCAT5 Office Assessment Symptoms 1** screen (Figure A20-13) provides instructions for the symptoms evaluation. Check either **Baseline** or **Post-injury**, press **NEXT** and then hand the device to the subject.

The **SCAT5 Office Assessment Symptoms 2 through 9** screens (Figure A20-14) shows an example of one of the screens) will run through a series of symptoms comparing the symptoms to before the accident and rating each symptom by severity on a scale of 0-6 with the following labels:

- 0 – Absent
- 1, 2 – Mild
- 3, 4 – Moderate
- 5, 6 – Severe

Once the last response has been recorded press **NEXT** to advance to the **SCAT5 Office Assessment Symptoms Summary** (Figure A20-15).

The **SCAT5 Office Assessment Symptoms Summary** will display the total number of symptoms recorded and the symptom severity score.

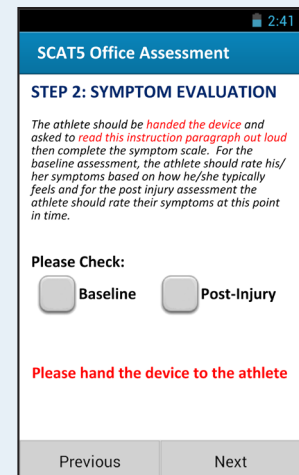
The **SCAT5 Office Assessment Symptoms Summary** allows for the operator to answer two questions to record whether the symptoms get worse with physical or mental activity.

The **SCAT5 Office Assessment Symptoms Summary** allows for the operator to ask the subject the following:

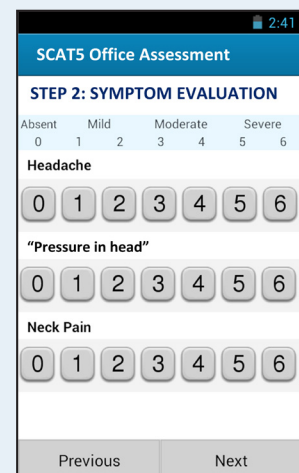
***"If 100% is feeling perfectly normal, what percent of normal do you feel?"***

If the subject replied, not 100%, ask the subject why and record it using the onscreen keyboard.

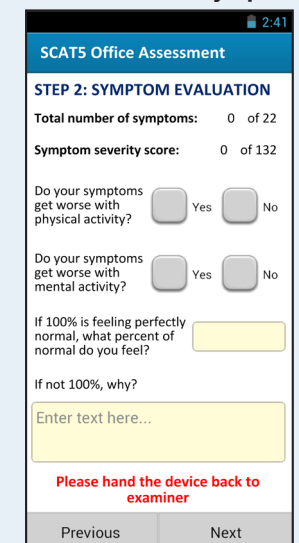
Press **NEXT** to navigate to **SCAT5 Office Assessment Cognitive Screening**.



**Figure A20-13:**  
**Office Assessment Symptoms 1**



**Figure A20-14:**  
**Office Assessment Symptoms 2**



**Figure A20-15:**  
**SCAT3 Office Assessment Symptoms Summary**



The SCAT5 Cognitive Evaluation includes a cognitive assessment of the following areas:

- Orientation
- Immediate Memory
- Concentration

The **SCAT5 Office Assessment Orientation** (Figure A20-16) consists of a series of questions to determine the subject's ability to identify time accurately.

Press **NEXT** to navigate to the **SCAT5 Office Assessment Immediate Memory** screens.



**NOTE:** The Immediate Memory component can be completed using the traditional 5-word per trial list or optionally using 10-words per trial to minimize any ceiling effect. All 3 trials must be administered irrespective of the number correct on the first trial. Administer at the rate of one word per second.

Please choose either the **5** or **10** word list groups.

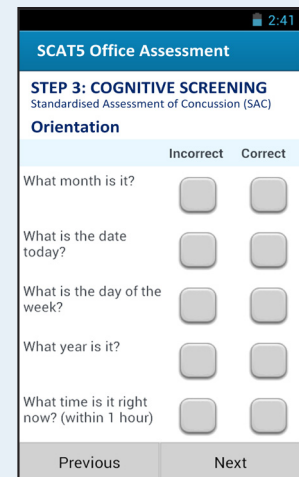
The **SCAT5 Office Assessment Immediate Memory 1** (Figure A20-17) will contain the following instructions for the operator to read to the subject:

**"I am going to test your memory. I will read you a list of words and when I am done, repeat back as many words as you can remember, in any order. For Trials 2 & 3: I am going to repeat the same list again. Repeat back as many words as you can remember in any order, even if you said the word before."**

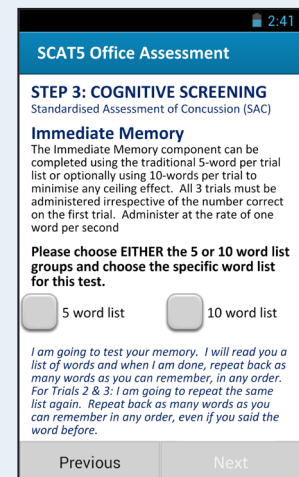
Press **NEXT** to navigate to the **SCAT5 Office Assessment Immediate Memory 2** screen (Figure A20-18 and A20-19).

The **SCAT5 Office Assessment Immediate Memory 2** contains either a 5 word list, five pairs (ten total) of checkboxes, or a 10 word list, 10 pairs (20 total) of checkboxes, with each pair displayed next to a test word defined by the selected list.

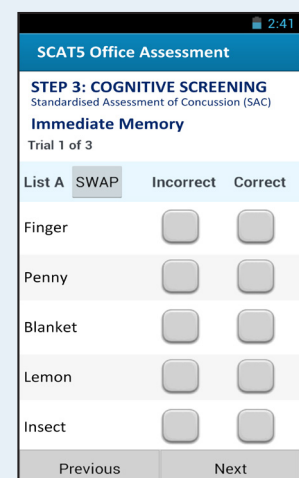
On the **SCAT5 Office Assessment Immediate Memory 2**, press **SWAP** to switch to a different list. The current list will be displayed next to the **SWAP** button; e.g. "List A", "List B" or "List C". Each time **SWAP** is selected, the display for the List column title shall cycle from "List A" through "List F" (5 word list) or "List H" through "List J" (10 word list), and then back to either "List A" or "List H".



**Figure A20-16:**  
**Orientation**



**Figure A20-17:**  
**Office Assessment Immediate Memory 1**



**Figure A20-18:**  
**Office Assessment Immediate Memory 2 (5 word list)**

The **SCAT5 Office Assessment Immediate Memory 2** uses the test words for each list as defined in the table below:

List Name	Ordered Test Words
List A	Finger, Penny, Blanket, Lemon, Insect
List B	Candle, Paper, Sugar, Sandwich, Wagon
List C	Baby, Monkey, Perfume, Sunset, Iron
List D	Elbow, Apple, Carpet, Saddle, Bubble
List E	Jacket, Arrow, Pepper, Cotton, Movie
List F	Dollar, Honey, Mirror, Saddle, Anchor
List H (10 word list)	Finger, Penny, Blank, Lemon, Insect, Candle, Paper, Sugar, Sandwich, Wagon
List I (10 word list)	Baby, Monkey, Perfume, Sunset, Iron, Elbow, Apple, Carpet, Saddle, Bubble
List J (10 word list)	Jacket, Arrow, Pepper, Cotton, Movie, Dollar, Honey, Mirror, Saddle, Anchor

The **SCAT5 Office Assessment Immediate Memory 3** navigates to Trial 2 of 3 and **SCAT5 Office Assessment Immediate Memory 4** navigates to Trial 3 of 3.

At the end of Trial 3, on both the 5 and 10 word list, a text box is available to enter **Time the last trial was completed**. Enter the time and press **NEXT** to navigate to the SCAT5 Concentration section.

The **SCAT5 Office Assessment Digits Backwards 1** (Figure A20-20) will contain the following instructions for the operator to read to the subject.

**"I am going to read a string of numbers and when I am done, you repeat them back to me in reverse order of how I read them to you. For example, if I say 7-1-9, you would say 9-1-7."**



**NOTE:** If subject answers correctly, go to next string length. If incorrect, read trial 2. 1 pt. possible for each string length. Stop after incorrect on both trials. The digits should be read at the rate of one per second.

**Figure A20-19:**  
**Office Assessment Immediate Memory 2 (10 word list)**

**Figure A20-20:**  
**Office Assessment Digits Backwards 1**



The **SCAT5 Office Assessment Digits Backwards 2** (Figure A20-21) will contain columns for "Trial 1", "Trial 2" and the answer ("Y" or "N").

The **SCAT5 Office Assessment Digits Backwards 2** uses the test numbers for each list as defined in the table below:

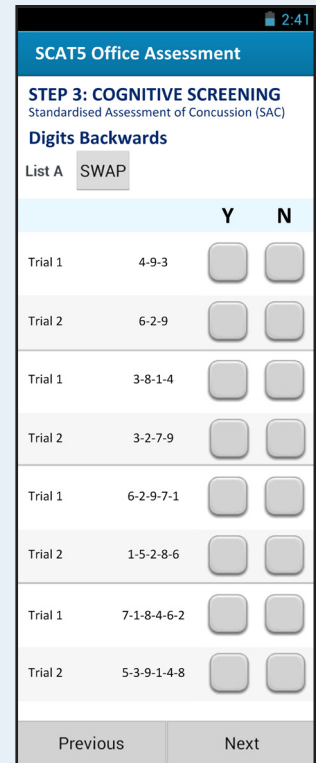
List	Trial 1	Trial 2
List A	4-9-3, 3-8-1-4, 6-2-9-7-1, 7-1-8-4-6-2	6-2-9, 3-2-7-9, 1-5-2-8-6, 5-3-9-1-4-8
List B	5-2-6, 1-7-9-5, 3-8-5-2-7, 8-3-1-9-6-4	4-1-5, 4-9-6-8, 6-1-8-4-3, 7-2-7-8-5-6
List C	1-4-2 6-8-3-1 4-9-1-5-3 3-7-6-5-1-9	6-5-8 3-4-8-1 6-8-2-5-1 9-2-6-5-1-4
List D	7-8-2 4-1-8-3 1-7-9-2-6 2-6-4-8-1-7	9-2-6 9-7-2-3 4-1-7-5-2 8-4-1-9-3-5
List E	3-8-2 2-7-9-3 4-1-8-6-9 6-9-7-3-8-2	5-1-8 2-1-6-9 9-4-1-7-5 4-2-7-9-3-8
List F	2-7-1 1-6-8-3 2-4-7-5-8 5-8-6-2-4-9	4-7-9 3-9-2-4 8-3-9-6-4 3-1-7-8-2-6

Press **NEXT** to navigate to **SCAT5 Office Assessment Months in Reverse**.

**SCAT5 Office Assessment Months in Reverse** (Figure A20-22) contains the following information to be read by the operator to the subject:

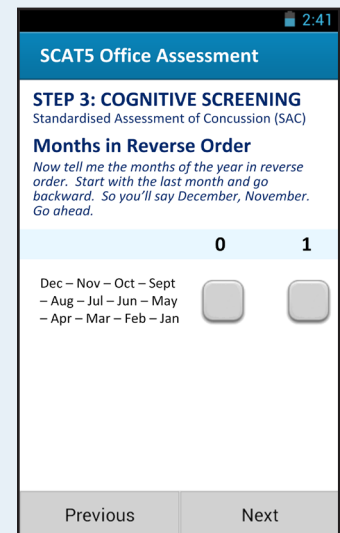
**"Now tell me the months of the year in reverse order. Start with the last month and go backward. So you'll say December, November. Go ahead."**

Press the checkbox with **0** for incorrect answer and **1** for correct answer. Press **NEXT** to navigate to the SCAT5 Neurological Screen sections.



The screenshot shows the 'SCAT5 Office Assessment' interface. It is on 'STEP 3: COGNITIVE SCREENING' under 'Standardised Assessment of Concussion (SAC)'. The section is 'Digits Backwards'. A dropdown menu shows 'List A' and a 'SWAP' button. Below are two columns, 'Y' and 'N', each with a checkbox. The trials are listed on the left, and the corresponding digit sequences are on the right. The trials are: Trial 1 (4-9-3), Trial 2 (6-2-9), Trial 1 (3-8-1-4), Trial 2 (3-2-7-9), Trial 1 (6-2-9-7-1), Trial 2 (1-5-2-8-6), Trial 1 (7-1-8-4-6-2), and Trial 2 (5-3-9-1-4-8). At the bottom are 'Previous' and 'Next' buttons.

**Figure A20-21:**  
**Office Assessment Digits Backwards 2**



The screenshot shows the 'SCAT5 Office Assessment' interface. It is on 'STEP 3: COGNITIVE SCREENING' under 'Standardised Assessment of Concussion (SAC)'. The section is 'Months in Reverse Order'. Below the title is a text prompt: 'Now tell me the months of the year in reverse order. Start with the last month and go backward. So you'll say December, November. Go ahead.' Below this are two columns, '0' and '1', each with a checkbox. The months are listed on the left: Dec - Nov - Oct - Sept, Aug - Jul - Jun - May, Apr - Mar - Feb - Jan. At the bottom are 'Previous' and 'Next' buttons.

**Figure A20-22:**  
**Office Assessment Months in Reverse**

## Neurological Screen

The **SCAT5 Office Assessment Neurological Screen Questionnaire** (Figure A20-23) presents a series of questions to ask the patient - reading skills, range of motion, eye movement, finger nose coordination and tandem gait performance ability. Record the results in the "Y" or "N" column. Press **NEXT** to navigate to **SCAT5 Office Assessment mBESS 1**.

The **SCAT5 Office Assessment mBESS 1** (Figure A20-24) allows for entry of the following conditions:

1. Testing foot (left or right)
2. Testing surface (hard floor, field, etc.)
3. Type of footwear

Press **NEXT** to navigate to **SCAT5 Office Assessment mBESS 2**.

**SCAT5 Office Assessment mBESS 2 displays types of errors and a statement to be read to the patient.**

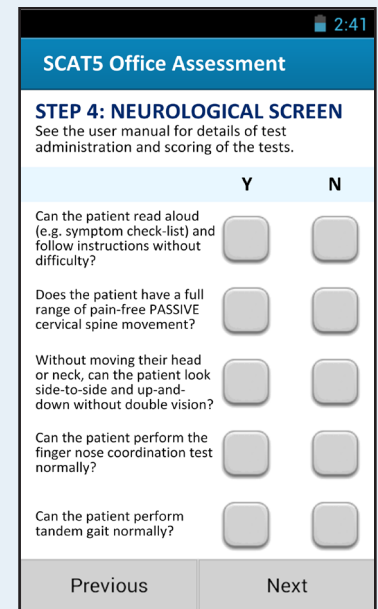
### Balance testing - types of errors

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

### Instructions to be read to the patient:

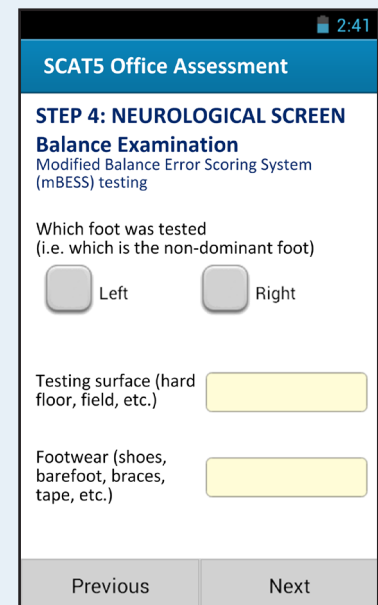
**"I am now going to test your balance. Please take your shoes off (if applicable), roll up your pant legs above ankle (if applicable), and remove any ankle taping (if applicable). This test will consist of three twenty second tests with different stances."**

Press **NEXT** to navigate to **SCAT5 Office Assessment mBESS 3**.



	Y	N
Can the patient read aloud (e.g. symptom check-list) and follow instructions without difficulty?	<input type="checkbox"/>	<input type="checkbox"/>
Does the patient have a full range of pain-free PASSIVE cervical spine movement?	<input type="checkbox"/>	<input type="checkbox"/>
Without moving their head or neck, can the patient look side-to-side and up-and-down without double vision?	<input type="checkbox"/>	<input type="checkbox"/>
Can the patient perform the finger nose coordination test normally?	<input type="checkbox"/>	<input type="checkbox"/>
Can the patient perform tandem gait normally?	<input type="checkbox"/>	<input type="checkbox"/>
<div>Previous</div> <div>Next</div>		

**Figure A20-23:**  
**Office Assessment Neurological Screen Questionnaire**



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.)

Previous

Next

**Figure A20-24:**  
**Office Assessment mBESS 1**



**NOTE:** Each of the 20-second trials is scored by counting the errors, or deviations from the proper stance, accumulated by the athlete. The examiner will begin counting errors only after the individual has assumed the proper start position. **The mBESS is calculated by adding one error point for each error during the three 20-second tests. The maximum total number of errors for any single condition is 10.** If an athlete commits multiple errors simultaneously, only one error is recorded but the athlete should quickly return to the testing position, and counting should resume once subject is set. Subjects that are unable to maintain the testing procedure for a minimum of **five seconds** at the start are assigned the highest possible score, ten, for that testing condition.



**NOTE:** For all SCAT5 Balance Tests the following apply:

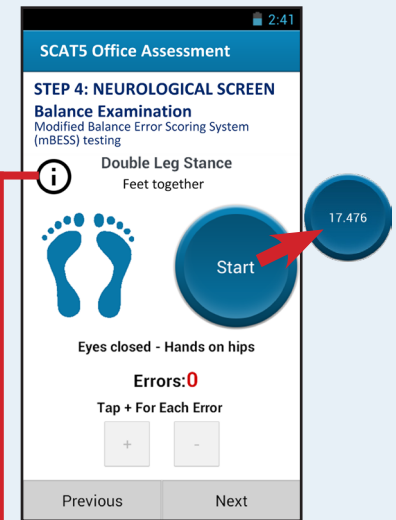
- Once **START** has been selected a timer will replace "Start" and count down from 20 seconds to 0 seconds (Figure A20-25)
- Once the timer has reached 0 seconds **START** will reappear and the test is complete.
- During the test press the **PLUS** and **MINUS** to increase or decrease the number of errors that occur during the 20 second testing period. Errors recorded will appear in red above the **PLUS** and **MINUS**.
- Once a test is complete press **NEXT** to proceed to the next stance test.
- At any time, press **PREVIOUS** to navigate to the previous screen.

## Double Leg Stance

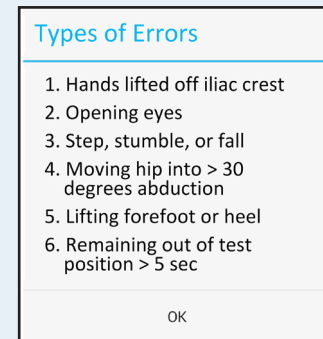
**SCAT5 Office Assessment mBESS 3** provides the following instructions on the screen that must be read to the subject prior to starting:

**"The first stance is standing with your feet together with your hands on your hips and with your eyes closed. You should try to maintain stability in that position for 20 seconds. I will be counting the number of times you move out of this position. I will start timing when you are set and have closed your eyes."**

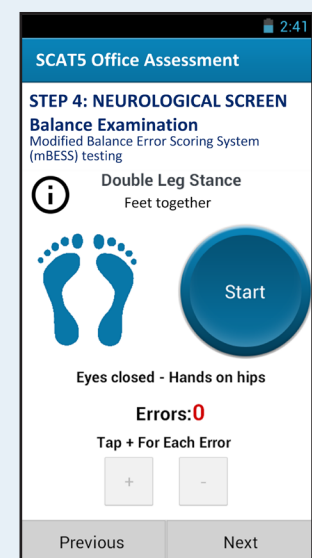
Confirm with the subject that they understand the instructions and press **NEXT** to navigate to **SCAT5 Office Assessment mBESS 4** (Figure A20-27).



**Figure A20-25:**  
**Start Button**



**Figure A20-26:**  
**Information - Type of Errors**



**Figure A20-27:**  
**Office Assessment mBESS 4**  
**Double Leg Stance**

Once the subject is in place, press **START** on **SCAT5 Office Assessment mBESS 4** to begin testing. When completed, press **NEXT** to navigate to the single leg stance assessment, **SCAT5 Office Assessment mBESS 5**.

### Single Leg Stance

The following instructions will appear on the **SCAT5 Office Assessment mBESS 5** screen and must be read to the subject prior to starting:

**“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. 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 hands on your hips and your eyes closed. I will be counting the number of times you move out of this position. If you stumble out of this position, open your eyes and return to the start position and continue balancing. I will start timing when you are set and have closed your eyes.”**

Confirm with the subject that they understand the instructions and press **NEXT** to navigate to **SCAT5 Office Assessment mBESS 6** (Figure A20-28).

Once the subject is in place, press **START**. When completed, press **NEXT** to navigate to the single leg stance assessment, **SCAT5 Office Assessment mBESS 7**.

### Tandem Leg Stance

The following instructions will appear on the **SCAT5 Office Assessment mBESS 7** screen and must be read to the subject prior to starting:

**“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 hands on your hips and your eyes closed. I will be counting the number of times you move out of this position. If you stumble out of this position, open your eyes and return to the start position and continue balancing. I will start timing when you are set and have closed your eyes.”**

Confirm with the subject that they understand the instructions and press **NEXT** to navigate to **SCAT5 Office Assessment mBESS 8**.

Once the subject is in place, press **START**. When completed, press **NEXT** to navigate to the delayed recall assessment, **SCAT5 Office Assessment Delayed Recall** (Figure A20-29).

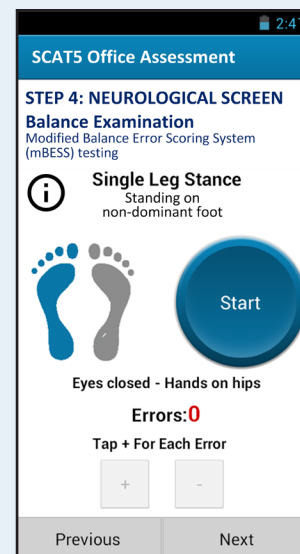


Figure A20-28:  
Office Assessment mBESS 6  
Single Leg Stance

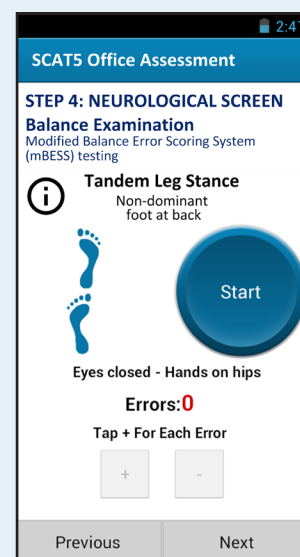


Figure A20-29:  
Office Assessment mBESS 8  
Tandem Leg Stance

## Delayed Recall

The delayed recall should be performed after completion of the Balance Examination.

**SCAT5 Office Assessment Delayed Recall** (examples of 5 and 10 word lists, Figure A20-30 or A20-31) will navigate to the list that was completed in **SCAT5 Office Assessment Immediate Memory 2** (5 or 10 word list).

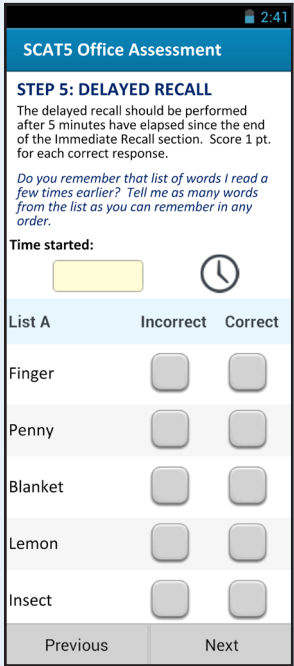
**SCAT5 Office Assessment Delayed Recall** provides the following instructions that must be read to the subject prior to starting the delayed recall test:

**Do you remember that list of words I read a few times earlier? Tell me as many words from the list as you can remember in any order.**

**Score 1 pt. for each correct response**

Record the time the test was started and check either the **INCORRECT** or **CORRECT** checkbox for the response.

Once the test is complete press **NEXT** to proceed to the **SCAT5 Office Assessment Decision 1** screen (Figure A20-32).




**SCAT5 Office Assessment**

**STEP 5: DELAYED RECALL**

The delayed recall should be performed after 5 minutes have elapsed since the end of the Immediate Recall section. Score 1 pt. for each correct response.

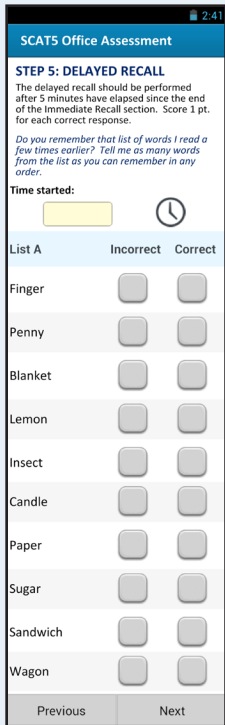
*Do you remember that list of words I read a few times earlier? Tell me as many words from the list as you can remember in any order.*

Time started:  

List A	Incorrect	Correct
Finger	<input type="checkbox"/>	<input type="checkbox"/>
Penny	<input type="checkbox"/>	<input type="checkbox"/>
Blanket	<input type="checkbox"/>	<input type="checkbox"/>
Lemon	<input type="checkbox"/>	<input type="checkbox"/>
Insect	<input type="checkbox"/>	<input type="checkbox"/>

Previous Next

**Figure A20-30:**  
**Office Assessment Delayed Recall**  
**(5 word list)**




**SCAT5 Office Assessment**

**STEP 5: DELAYED RECALL**

The delayed recall should be performed after 5 minutes have elapsed since the end of the Immediate Recall section. Score 1 pt. for each correct response.

*Do you remember that list of words I read a few times earlier? Tell me as many words from the list as you can remember in any order.*

Time started:  

List A	Incorrect	Correct
Finger	<input type="checkbox"/>	<input type="checkbox"/>
Penny	<input type="checkbox"/>	<input type="checkbox"/>
Blanket	<input type="checkbox"/>	<input type="checkbox"/>
Lemon	<input type="checkbox"/>	<input type="checkbox"/>
Insect	<input type="checkbox"/>	<input type="checkbox"/>
Candle	<input type="checkbox"/>	<input type="checkbox"/>
Paper	<input type="checkbox"/>	<input type="checkbox"/>
Sugar	<input type="checkbox"/>	<input type="checkbox"/>
Sandwich	<input type="checkbox"/>	<input type="checkbox"/>
Wagon	<input type="checkbox"/>	<input type="checkbox"/>

Previous Next

**Figure A20-31:**  
**Office Assessment Delayed Recall**  
**(10 word list)**

The **SCAT5 Office Assessment Decision 1** screen (Figure A20-32) will display results from each of the testing sections from the SCAT5.

Press **NEXT** to navigate to the **SCAT5 Office Assessment Decision 2** screen (Figure A20-33).

The **SCAT5 Office Assessment Decision 2** screen provides a series of questions to be answered based on the operator's clinical decision.

Check the checkbox that best corresponds with the answer to the question and then press **NEXT** to navigate to the **SCAT5 Office Assessment Decision 3** screen (Figure A20-34).

On the **SCAT5 Office Assessment Decision 3** screen use the onscreen keyboard to enter operator signature, name, title and registration number (if applicable).



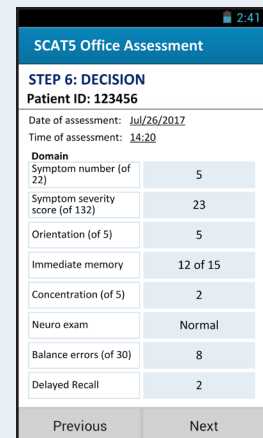
**NOTE:** Scoring on the SCAT5 should not be used as a stand-alone method to diagnose concussion, measure recovery or make decisions about an athlete's readiness to return to competition after concussion.

Press **NEXT** to navigate to the **SCAT5 Office Assessment Clinical Notes** screen.

Using the onscreen keyboard, enter clinical notes about the assessment to be included with the results and available on the printed report.

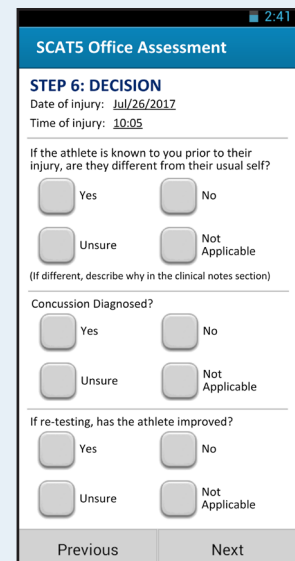
Press **CONFIRM** to navigate to the **Information Hub** screen.

At any time, press **PREVIOUS** to navigate to the previous screen.



SCAT5 Office Assessment	
<b>STEP 6: DECISION</b>	
Patient ID: 123456	
Date of assessment: Jul/26/2017	
Time of assessment: 14:20	
<b>Domain</b>	
Symptom number (of 23)	5
Symptom severity score (of 132)	23
Orientation (of 5)	5
Immediate memory	12 of 15
Concentration (of 5)	2
Neuro exam	Normal
Balance errors (of 30)	8
Delayed Recall	2
Previous Next	

**Figure A20-32:**  
**Office Assessment Decision 1**



**SCAT5 Office Assessment**

**STEP 6: DECISION**

Date of injury: Jul/26/2017  
Time of injury: 10:05

If the athlete is known to you prior to their injury, are they different from their usual self?

☐ Yes ☐ No  
☐ Unsure ☐ Not Applicable

(If different, describe why in the clinical notes section)

Concussion Diagnosed?

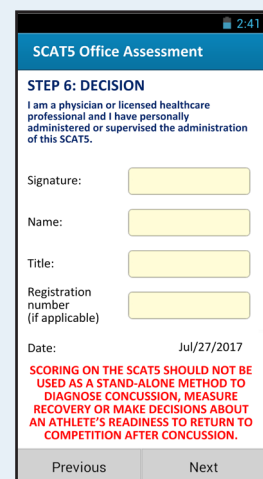
☐ Yes ☐ No  
☐ Unsure ☐ Not Applicable

If re-testing, has the athlete improved?

☐ Yes ☐ No  
☐ Unsure ☐ Not Applicable

Previous Next

**Figure A20-33:**  
**Office Assessment Decision 2**



**SCAT5 Office Assessment**

**STEP 6: DECISION**

I am a physician or licensed healthcare professional and I have personally administered or supervised the administration of this SCAT5.

Signature:

Name:

Title:

Registration number (if applicable):

Date: Jul/27/2017

**SCORING ON THE SCAT5 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.**

Previous Next

**Figure A20-34:**  
**Office Assessment Decision 3**



## SCAT5 Detailed Results

Detailed results on current and previous SCAT5 tests are stored in the database and can be accessed from the **Information Hub** screen.

Once a SCAT5 test session has been completed the SCAT5 scores will replace the **START** button next to the SCAT5 test on the **Information Hub**.

To access the **SCAT5 Detailed Results** screen do either of the following depending on what options are available:

- 1) Press **VIEW** next to Immediate Assessment (Figure A20-35) from the **Information Hub** screen to view the detailed results of the Immediate Assessment testing.
- 2) Press the score (Figure A20-36) from the **Information Hub** screen to view the detailed results of the Office Assessment testing.



**NOTE:** The **SCAT5 Office Assessment Detailed Results** will default to view the **CURRENT TEST** tab. The **SCAT5 Immediate Assessment Detailed Results** only display the current test. The SCAT5 Immediate Assessment can only be executed once whereas the SCAT5 Office Assessment can be executed several times.

### Current Test Tab

The **SCAT5 Office Assessment Current Test Detailed Results** (Figure A20-37) displays a summary of the assessment results. The **SCAT5 Office Assessment Current Test Detailed Results** contains two options to select from:

- Review – access responses and results from the SCAT5 Office Assessment
- New Test – start a new test

Press **REVIEW** to navigate to the review screens. An example of a **SCAT5 Office Assessment Review** screen is shown in Figure A20-38.

Press **CLOSE** to return to the **Information Hub**.



**NOTE:** While reviewing patient information the screen header will contain "Review" to inform the operator that they are currently in review mode.

SCAT5	Immediate or On-Field Assessment	<b>View</b>
	Office or Off-Field Assessment	<b>Start</b>

**Figure A20-35:**  
**SCAT5 After Immediate Assessment**

SCAT5	Immediate or On-Field Assessment	<b>View</b>
	Symptom Number	13/22
	Symptom Severity Score	45/132
	Orientation	3/5
	Immediate Memory	12/30
	Concentration	1/5
	Neuro Exam	Abnormal
	Balance Errors	0/30
	Delayed Recall	0/10

**Figure A20-36:**  
**SCAT5 After Both Immediate and Office Assessment**

3:14

SCAT5 Office Assessment

CURRENT TESTS	PREVIOUS TESTS																
<b>SCAT5 Office Assessment</b> <div>Review</div> <div>New Test</div>																	
<b>Patient ID: 123456</b> Date of assessment: Jul/26/2017 Time of assessment: 14:20 <b>Domain</b> <table border="1"> <tr> <td>Symptom number (of 22)</td> <td>5</td> </tr> <tr> <td>Symptom severity score (of 132)</td> <td>23</td> </tr> <tr> <td>Orientation (of 5)</td> <td>5</td> </tr> <tr> <td>Immediate memory</td> <td>12 of 15</td> </tr> <tr> <td>Concentration (of 5)</td> <td>2</td> </tr> <tr> <td>Neuro exam</td> <td>Normal</td> </tr> <tr> <td>Balance errors (of 30)</td> <td>8</td> </tr> <tr> <td>Delayed Recall</td> <td>2</td> </tr> </table>		Symptom number (of 22)	5	Symptom severity score (of 132)	23	Orientation (of 5)	5	Immediate memory	12 of 15	Concentration (of 5)	2	Neuro exam	Normal	Balance errors (of 30)	8	Delayed Recall	2
Symptom number (of 22)	5																
Symptom severity score (of 132)	23																
Orientation (of 5)	5																
Immediate memory	12 of 15																
Concentration (of 5)	2																
Neuro exam	Normal																
Balance errors (of 30)	8																
Delayed Recall	2																
<div>Close</div>																	

**Figure A20-37:**  
**Current Test Detailed Results for SCAT5 Office Assessment**



The **SCAT5 Office Assessment Review** screens will appear in the exact order of the testing sequence.

At the end of the **SCAT5 Office Assessment Review** sequence (Figure A20-38) press **CONFIRM** to return to the **SCAT5 Office Assessment Current Test Detailed Results** (Figure A20-37).

From **SCAT5 Office Assessment Current Test Detailed Results** (Figure A20-37) a new test can be started.

Press **NEW TEST** to begin the SCAT5 test.

For instructions on completing a new SCAT5 test refer to the sections above.

## Previous Test Tab

Results from previous SCAT5 tests can be reviewed from the **SCAT5 Office Assessment Previous Tests Detailed Results** (Figure A20-39) by pressing **PREVIOUS TESTS** tab.

The **SCAT5 Office Assessment Previous Tests Detailed Results** lists all tests recorded by test date, time and summary of symptoms.

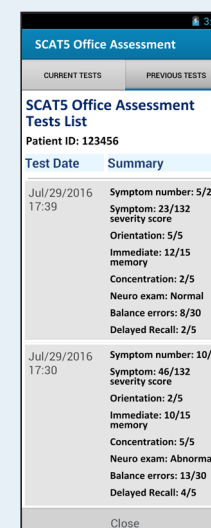
To view the SCAT5 Assessment Summaries, press the desired test from the "SCAT5 Tests List".

Once the test has been selected the **SCAT5 Office Assessment Previous Summary** (Figure A20-40) will appear displaying the test results for that selected test. To review the results press **REVIEW** to navigate to the review screens. Review of the test results follow the same navigation sequence as the current test review screens.

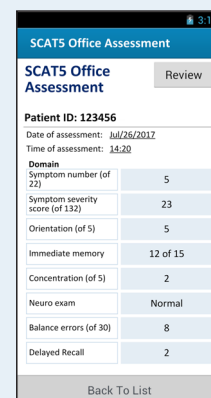
For instructions on reviewing and starting a new test refer to the sections above.



**Figure A20-38:**  
Example of a SCAT5 Office  
Assessment Review Screen



**Figure A20-39:**  
SCAT5 Office Assessment Tests  
List



Domain	Score
Symptom number (of 23)	5
Symptom severity score (of 132)	23
Orientation (of 5)	5
Immediate memory	12 of 15
Concentration (of 5)	2
Neuro exam	Normal
Balance errors (of 30)	8
Delayed Recall	2

Back To List

**Figure A20-40:**  
Example of a SCAT5 Summary