Computerized Cognitive Baseline Testing - a Best Practice for Concussion Management

Introducing and Implementing a Baseline Testing Program

February 17, 2012
PRESENTERS AND DISCLOSURES

Dr. Jim Moriarity, Head Team Physician
University of Notre Dame
Paid consultant of Axon Sports
James.M.Moriarity.1@nd.edu

Polly James, CEO and President
Axon Sports
pjames@axonsports.com
One in 10 young Athletes will suffer a concussion this year *

Rates of concussion for high school sports: highest in football and

girl’s soccer *

Activities associated with the greatest number of TBI-related ER visits: bicycling, football, playground activities, basketball and soccer *

*Centers for Disease Control & Prevention
CONCUSSION IS NOT NEW, BUT....

- Most states have enacted legislation governing concussion management in youth sports

- The NCAA now requires member schools to formulate a concussion management plan that includes neuropsychological testing and/or balance testing

- Heightened media attention: a Google search for “concussion 2011” produced 168 million hits
US YOUTH SOCCER UNIQUELY POSITIONED TO MAKE A DIFFERENCE

- 3.1 million players
- 1.9 million American households
- 55 State Associations
- 330,000 possible concussions
- Parents looking for direction
WHY ARE WE HERE?

- Discuss cognitive Baseline testing as a “best practice” in a contemporary concussion management plan

- Address these questions
  - What is cognition?
  - Why is cognitive testing needed?
  - How does cognitive testing work?
  - Is cognitive testing reliable?
CONCUSSION MANAGEMENT PLAN

Baseline Cognitive screening

Pre-Season Physical Evaluation

Education of Athletes and Coaches

Sideline Assessment Plan for suspected concussion

Physician Evaluation protocol

Needs assessment: academics and sport

Exercise Trial

Return to Play

Baseline Cognitive screening

After Injury Cognitive Test

Pre-Season Physical Evaluation

Education of Athletes and Coaches

Sideline Assessment Plan for suspected concussion

Physician Evaluation protocol

Needs assessment: academics and sport

Exercise Trial

Return to Play
HOW IS COGNITION DEFINED?

- “Cognition” = “Thinking”
- “Thinking” = Ability to:
  - Reason
  - Store and retrieve memory
  - Recognize verbal and visual symbols
  - Learning
  - Task discrimination
COGNITION AND CONCUSSION

- Concussive injury to the brain impairs the ability to “think” (cognition) by interfering with cellular metabolism at the microscopic level.

- In addition to cognitive impairment, changes are also seen at an emotional and physical level.
SYMPTOMS OF COGNITIVE IMPAIRMENT

Cognitive Dysfunction

- Amnesia
- Delayed verbal and other responses
- Difficulty concentrating
- Difficulty remembering
- Dis-orientation
- Feeling slowed down
- Feeling foggy
- Feeling stunned
- Feeling foggy
- Inability to focus
- Loss of consciousness
- Vacant stare
- Slurred speech

USYOUTHSOCCER.ORG
WHY IS COGNITIVE TESTING NEEDED?

“Assessment of symptoms has traditionally been used to monitor recovery; however, the role of cognitive dysfunction has received significant attention.

“Although described inconsistently in the literature, cognitive function likely recovers independently of symptoms. This raises concern for increased risk of additional injury even after symptoms have resolved.”

Current Concepts in Concussion: Evaluation and Management
Scorza, et al
American Family Physician, Jan. 15, 2012
"Most concussions lead to subtle changes; therefore, evaluation can be challenging. Numerous assessment tools exist to aid diagnosis and management. Although none are exclusively effective, combining tools increases sensitivity and specificity... Assessment tools are most beneficial when Baseline measurements are available for comparison."

Current Concepts in Concussion: Evaluation and Management
Scorza, et al
American Family Physician, Jan. 15, 2012
HOW IS COGNITION MEASURED?

- Medical examination
  - Highly subjective
  - Very inaccurate in subtle impairment

- Pencil and Paper tests
  - Time consuming
  - Large learning effect

- Physical symptom assessment
  - Requires patient honesty
  - Not always suitable for younger children

- Computerized cognitive assessment
  - Objective assessment
  - Easy to administer
Approximately 1000 Australian Rules Football Athletes: 88 with concussion

Axon Sports deficits

Makdissi, AJSM, March 2010
WHY COMPUTERIZED TESTING?

Computerized testing is more sensitive at detecting cognitive impairment than judgment by a qualified Medical Provider, Pencil and Paper tests, and Athlete-reported symptoms.
HOW DOES COMPUTERIZED COGNITIVE TESTING WORK?

- Taking a “snapshot” of the Athlete’s cognitive function when they are *healthy* and *uninjured* = Baseline test

And

- Comparing it to a “snapshot” of the Athlete’s brain, taken after the Athlete is injured = After Injury test


RATIONALE FOR BASELINE TESTING EVERY YEAR

- Age-related brain maturation
- Identifies off season or lingering injuries
- Identifies and reinforces concept of “best effort”
- May identify early decreases in cognitive function due to repetitive injury
USE OF TASKS ON CHILDREN: MATURATIONAL EFFECTS ON COGNITIVE FUNCTION

Figure 1  Mean (and standard error) response speed on four cognitive tasks in nine different age bands, from 8 to 25 years of age.

“Stable” at 14-15
Norms down to age 7. Longitudinal norms also being collected

McCrory et al Br J Sports Med 2004
IS COGNITIVE BASELINE TESTING RELIABLE?

<table>
<thead>
<tr>
<th>YES: When best effort is given</th>
<th>NO: When best effort is lacking</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Quiet setting</td>
<td>1. Fatigue</td>
</tr>
<tr>
<td>2. Practice test first</td>
<td>2. Distraction</td>
</tr>
<tr>
<td>3. Free from distractions</td>
<td>3. “Sandbagging”</td>
</tr>
<tr>
<td>4. Athlete is rested</td>
<td>4. No built-in integrity checks</td>
</tr>
<tr>
<td>5. “Skin” in the game</td>
<td>5. No age-matched controls</td>
</tr>
<tr>
<td>6. Integrity checks present in the test</td>
<td>6. Low passing criteria</td>
</tr>
<tr>
<td>7. Age-matched normative controls in place with high passing requirement</td>
<td>7. Lack of team leadership and parental support</td>
</tr>
</tbody>
</table>
BASELINE TESTING: THE KEY TO MEASURING COGNITIVE CHANGE

- Establishes a benchmark for later comparison
- “Which side of average do you fall on?”
- 10 - 15% of first-time testers get an unacceptable result primarily due to distractions or test-taking errors
- Experience shows taking a Practice test first improves the passing rate significantly

Is cognition impaired?

Has there been change in cognition?

After-Injury Baseline

Decline Improve

Repeated Assessment
## BASELINE TESTING: WHAT IT IS AND WHAT IT IS NOT

<table>
<thead>
<tr>
<th>WHAT IT IS</th>
<th>WHAT IT IS NOT</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Can help in identifying previous head injuries before an Athlete competes</td>
<td>1. Is not specific for concussion</td>
</tr>
<tr>
<td>2. With an After Injury test, can reliably identify changes in cognition</td>
<td>2. Cannot tell if an Athlete is ready to return to competition</td>
</tr>
<tr>
<td>3. Can detect changes in cognitive ability when symptoms of concussion have disappeared</td>
<td>3. Is not a substitute for a reasoned and thorough examination</td>
</tr>
<tr>
<td></td>
<td>4. Is not the same as a comprehensive neuropsychological test administered by a clinical neuropsychologist</td>
</tr>
</tbody>
</table>

A computerized cognitive assessment is one of several tools a qualified Medical Provider will use in assessing a head injury and in caring for an injured Athlete.
COGNITIVE BASELINE TESTING: A BEST PRACTICE FOR CONCUSSION MANAGEMENT

- One tool in an effective concussion management plan
- Measures what you can’t see – cognitive function
- A best practice
  - NCAA Guidelines
  - American Academy of Pediatrics (AAP)
COMPUTERIZED COGNITIVE TESTING OPTIONS

Automated Neuropsychological Assessment Metrics (ANAM)

HEADMINDER™

axonSPORTS

IMPACT™

CNS Vital Signs™
WHY AXON SPORTS IS HERE

- A social, medical and personal “need”
  - Baseline testing is an important safety basic; a necessity like wearing your seat belt, not texting while driving, etc.

- A need under-served, lacking in options that are convenient, accessible and affordable

- Integrating education for the Athlete and the Parent with the needs of the medical community and sports organization
  - Common language that all can understand and utilize
IT TAKES A TEAM

Parents, Schools, Leagues and Clubs

Specialty Care Doctors

Athletic Trainers

Frontline Medical Doctors

Athlete

USYOUTHSOCCER.ORG
ATHLETE-CENTRIC MODEL

- All testing data stored in a central Athlete account, with a user ID and password unique to each Athlete. Test results can be accessed from any location, providing you have a computer connected to the Internet.

- Test results stay with the Athlete, in one account, whether they change teams, doctors, insurance plans, or move...all likely possibilities for Athletes who begin to play sports at age 4 or 5 and play into their adult lives.

- Athletes and their Parents manage who they share their test results with. Sharing can be done simply and easily. Access can be removed as quickly as it is given.
EVERY ATHLETE EVERY YEAR

- Regardless of gender or sport
  - Soccer may not be your Athletes only exposure for concussion.
    - Multiple sports and active lifestyles (skiing, skateboarding, bicycling, snowboarding, etc).
  - An annual Baseline can support them no matter when, where, or how they might be injured.

- The Axon Sports CCAT can safely and reliably test down to age 10.

- Annual Baselines can detect injuries that were perhaps unrecognized or unreported
  - Annual Baselines may now show cumulative trauma over time
IMPLEMENTING A PROGRAM

Common Questions:

- Is the test hard to take and interpret?
- How can we fit this into our budget?
  - Who pays for it?
- Where should our Athletes test?
- Who should administer this program?
- How much time is it going to take to implement a Baseline testing program?
SIMPLE

- Immediate and clear feedback…no waiting for results
- Built-in integrity checks prohibit “sandbagging”
- Clear Best Practices Action Plan
ACCESIBLE

- Anytime, Anywhere
  - The Axon Sports resources and test can be accessed on-line using any computer (PC or MAC) with a browser

- Baseline tests should be supervised by a responsible adult to ensure the Athletes are giving their best effort

- Customer Service
  - Axon Sports: 12 hours a day, available via phone, email or live chat
CONVENIENT

- **Time**
  - It takes about 15 minutes to register and finish a Baseline test
  - Subsequent tests take 8-10 minutes

- **Three-minute sample test**
  - Available free at [axonsports.com/demotest](http://axonsports.com/demotest)
  - Allows anyone to familiarize themselves with the test at their convenience…takes the mystery out of testing

- **Share Results**
  - Sharing test results is quick, simple, and can be done in a number of ways based on team requirements and family preferences
FLEXIBLE IMPLEMENTATION

- Pay as you go -- you can easily adapt to changes in financial accountability without affecting the underlying Athlete accounts.

- No minimum purchase requirements. Test credits do not expire.

- Volume discounts encourage aggregate purchase solutions.

- Integration with two on-line registration tools
  - Integrate the purchase of Baseline test credits into your club’s registration process

- Both provide options with respect to who pays for the Baseline tests, whether or not a Baseline is required of the registrant, and how/if it’s integrated into the management by your team or club administrator.

- Both tools are integrated with the Axon Sports platform to minimize and eliminate redundant efforts in registration/account set-up information.
FLEXIBLE IMPLEMENTATION

- **Testing Environment** – you choose the environment appropriate for your organization and the situation at hand
  - Clinics, school labs, dormitories, or home

- **Implementation** – whether you require, recommend or suggest Baseline testing the same system can be adapted to your needs and objectives

- **Results Sharing** – view as little or as much as you’d like of the Athletes’ test results
  - Require access be shared with an administrator, or designated Medical Provider
  - Accept printed or emailed copies of test results (PDFs)
  - Accept certificates of completion that verify an acceptable outcome, but do not share specific results
American Eagles - Concussion Baseline Testing

The American Eagles aim to remain ahead of the curve when it comes to our players’ safety which is why we’ve partnered with Axon Sports to provide the latest technology in Baseline Testing and Concussion Management. Axon’s latest concussion management programs feature several tools to ensure Athlete health and safety. One of those tools is cognitive testing—long considered a best practice at all levels of play. Axon Sports meets this best practice by providing Athletes a quick online test and then stores the results for easy access. Athletes establish Baseline or “snapshots” of their brains’ speed and accuracy using the Axon Sports Computerized Cognitive Assessment Tool. Repeating the same tasks “After Injury” identifies any cognitive changes from the Baseline performance. This helps indicate whether the brain has fully recovered from the head injury. Doctors use the test results in making decisions about when it is safe for Athletes to return to the classroom, practice, or competitive play.

American Eagles Soccer Club is making available to every player in the Club, cognitive Baseline testing for best-practice concussion management.

If you lost your unique voucher code, contact Axon Sports.

Contact Methods:
Live Chat: www.axonsports.com
Phone: 877-399-2966 (US & Canada)
Phone: 01-800-681-9273 (Mexico)
Vcard: Click here
Email: customerservice@axonsports.com
SYSA Concussion Information Page

Concussions can be difficult to diagnose, in part because symptoms can be subtle. Sometimes you'll notice that your child may be unusually tired, they "just don't seem like themselves" or they're bothered by loud noises or bright lights. Other symptoms are more obvious, such as vomiting or the inability to answer questions. It's important to remember that your child may not be able to recognize and/or verbalize their own symptoms, especially if they are young. And to make it even more complicated, symptoms may not show up for hours or even days. For older children, they may intentionally hide their symptoms because they want to get back in the game or to appear "tough". The best preparation is to be informed. Please take the time to review the following.

For the complete SYSA Concussion Policy click here

Additional Resources - These groups provided invaluable knowledge and expertise to SYSA in the development of our concussion policy

SportsConussions.org - They work to raise awareness that concussions are brain injuries and need to be taken seriously. Their mission is to support and advocate for individuals affected by brain injury and raise public awareness through education and prevention. Their vision is a world where all individuals with brain injury and their caregivers maximize their quality of life, the consequences of all unavoidable brain injuries are minimized and all preventable brain injuries are prevented.

Axon Sports - Axon Sports offers online cognitive assessment tools that aid in the evaluation and management of sports related concussions. Their software tests records a baseline of your player's healthy cognitive abilities that can be used for comparison should a concussion occur. There is an attachment for more information at the bottom of this web page.

Additional Information

If a concussion is suspected - make sure your child is immediately removed from activity. When in doubt, sit them out. Don't allow anyone, young or old, to return to play without written medical authorization from a medical professional trained in the diagnosis and management of concussion.

Determine if emergency help is needed

Most concussions resolve within a few days or weeks, and emergency help is required in very few instances. However, if your child has suffered a concussion, it is important to observe them carefully until they have been cleared to return to unrestricted physical and cognitive activity by a medical professional. If any of the following signs/symptoms appear at any time, call for emergency help...
Volume pricing is available at a considerable savings.

All US Youth Soccer members receive a 15% discount off of their purchases.

There are no minimum purchases. Test credits do not expire.

There are no hidden fees to Medical Providers. It’s as cost friendly to a Doctor servicing one Athlete from a team, as it is for a Doctor servicing the entire team.

A Baseline and an After Injury test credit can be reused until an acceptable outcome is achieved.
What We Are and What We Are Not

- **Not a diagnostic tool**
  - The Axon Sports CCAT is one of several tools that any Medical Provider can use to manage care and to assist in making difficult decisions about returning Athletes to the classroom, practice, and competitive play.

- **Not a preventative tool**

- **Not a sideline tool**
  - Independent research has yet to support or validate any “sideline” applications or tools that diagnosis a concussion
  - Cognitive impairment may not be apparent for minutes, or even several hours post injury
  - Rely on the recommended list of physical signs and symptoms to identify cases of suspected concussion
Providing the framework to build simple or elaborate concussion management programs using today’s Best Practices

- Customizable forms, return-to-play permission slips, locker room posters, and other items
- Educational materials geared for Athletes, Parents, Coaches and Medical Providers in variety of formats and across an ever growing range of topics
TOOLS FOR LEAGUES

NEW COACH? PLANNING A PARENT MEETING? NO WORRIES. WE'LL GET YOU STARTED WITH ANNOUNCEMENTS, FLYERS, VIDEOS, AND MUCH MORE.

**School QSG**
- League/Club QSG
- User Manual
- Grouping Athletes & Baseline Rosters

**Concussion Management Program**
- (new) School/Team flyer
- (new) Concussion Mgmt Best Practices, an Open Letter from Dr. James Morarity
- (new) Sample Concussion Mgmt Framework
- (new) Sample Return to Play form

**Communicating With Parents**
- Parental Consent Overview
- Informed Consent (CDC)

**Communicating With Parents**
- Parental Consent Overview
- Informed Consent (CDC)

**Preseason Parent Meeting**
- (new) Meeting Announcement
- Letter for Parents

**Communicating With Parents**
- Parental Consent Overview
- Informed Consent (CDC)

**Communicating With Parents**
- Parental Consent Overview
- Informed Consent (CDC)
OTHER RESOURCES AVAILABLE

**School, Coach, Team, or Athletic Trainer Information**

- You have the flexibility to have Athletes take the test in the school computer lab, in your office, or at their home.
- You can monitor your Athletes' results and see for yourself which Athletes have acceptable Baseline tests.
- You do not need to purchase test credits and send vouchers.
- You can group Athletes by Team or Sport.
- You can share results with others vested in an Athlete's care.

**Quick**
- The Athlete account is easily created and secured. A Baseline test will take about eight to 10 minutes.

**Easy to Understand**
- Playing cards are used in each task, providing a universally understood medium for every age and educational level.

**Can be Used Frequent with Confidence**
- Whether it's used daily or hourly, repeated testing will not generate a practice effect.

**Convenient**
- No software to download. The test and resulting data is available online and protected using an encrypted password system.

**Scientifically Valid**
- The Axon Sports SCAT is powered by Cogstate technology, which has been validated in peer-reviewed articles.

**Welcoming**
- We invite you to explore our website for additional information. You can also watch videos or download helpful documents from either our Resource Center or our School of the Game books.

**Customer Service**
- Live support is available via phone or live chat. You can also email us at customerservice@axonports.com.

---

**Why Axon Sports?**

- Axon Sports is proud to lead the way as an innovator in online concussion management tools.
- They have developed Baseline and After Injury tests.
- Our mission is to protect and then the athletic brain. We believe every Athlete should have access to a Baseline Test Every Year.

**Cognitive Testing in Concussion Management Programs**

- The latest concussion management programs feature several tools to ensure Athlete readiness for play with the most accurate and effective testing in a brief practice at all levels of sport. Axon Sports meets this standard by providing Athletes a quick and cost-effective online test.
- When an Athlete takes a cognitive Baseline test, he or she is scored on their brain's speed and accuracy.
- Repeating this test after an injury helps identify any cognitive changes from the Athlete's Baseline performance, which is used by an Athlete's Medical Provider in determining if the brain has fully recovered.
- Qualified Medical Providers use the Axon Sports online After Injury test results when making decisions about when it is safe for your Athlete to return to play or to the classroom.

---

**Know the Score**

**Why do you baseline?**

- Baseline tests help establish a reference point for your athlete's cognitive abilities, which can be valuable when diagnosing a possible concussion.

**Baseline Testing**

- Baseline testing is an important step in injury prevention. It helps identify potential changes in an athlete's cognitive function, which can be critical for early detection of a concussion.

---

**Learn More**

We invite you to explore axonsports.com to learn more.

On the website, you can buy test credits, as well as take and view Baseline tests. You can sign up for the quarterly newsletter and explore our educational materials.

---

**League/Club**

A QUICK AND EASY GUIDE TO THE AXON SPORTS CCAT

- **Step 1: Register for a League/Club Account at axonsports.com**
  - Registered account holders may share test credits, view test results of their Athletes and gain access to the Axon Sports Ahead of the Game tool kit.
  - Please note: All Athletes under the age of 18 will need the consent of their Parent or Guardian. For options, see the Parental Consent Overview available in the Resource Center at axonsports.com.

**Learn how to use the After Injury test.**

**Vouchers for your Athletes**

We encourage you to think about the use of vouchers for your Athletes. Share My Results. This allows for the testing process your injury test. The three-minute test.

**Learn more about the After Injury test.**

The Axon Sports cognitive baseline test captures a snapshot of your brain's speed and accuracy and can be used by a licensed Medical Provider to help determine if it safe to return to play. We encourage you to use it for every Athlete you have.

For more information on Baseline testing visit axonsports.com.
EDUCATIONAL RESOURCES

Aggregating access to complimentary educational courses for Coaches & Parents:

- **Michigan Neurosport**
- **National Federation of State High School Associations (NFHS)**
- **The Centers for Disease Control (CDC)**
LET'S TAKE A LOOK

AXON SPORTS FOR COACHES
What's your game plan for handling concussions? Axon Sports can get you started.

DOCTORS / ATHLETIC TRAINERS
New pre-recorded webinars! Plus answers to your FAQs about cognitive Baseline tests and concussion management.

SCHOOLS / COACHES
Register to access our online toolkit. Create your own concussion management plan with our new downloads!

PARENTS / ATHLETES
Learn more! We've posted six videos on sports-related Concussions and Baseline tests.
Thank you!