

# Get Current on Concussion

## Identification and Management Strategies

for Coaches, Parents, Athletes & Others



### “A Silent Epidemic...”

In sport, no injury is cloudier than concussion, and few are as catastrophic. Often though, the identification of concussion does not take place. While cases that involve a loss of consciousness are easily recognized to someone with an untrained eye, subtle concussion cases are not. For years, many people have used the labels *bell-ringer* or *ding* to describe the effects of a subtle blow to the head. This has led to the popular assumption that such momentary states of confusion or disorientation are not reasons to be concerned. This, however, is not the case.

No matter the severity, concussion is more than an injury; it is a silent killer. Every year, an estimated 300,000 sport-related concussions occur annually in the United States<sup>1</sup> with high school football players suffering nearly one quarter of those injuries.<sup>2</sup> Concussion is not isolated to football though, and it is also not isolated to boys. By the time their high school playing career is complete, more than 60 percent of all teenage athletes will have experienced some type of concussive injury. These are the known cases. Thousands more go unreported.<sup>4</sup> The prevalence of this injury is so high that for young people aged 15 to 24, concussion is second only to motor vehicle crashes when it comes to traumatic brain injury.<sup>1</sup> In 1990, Dr. M. Goldstein<sup>5</sup> referred to concussion as “a silent epidemic.” Unfortunately, nearly two decades later, Goldstein’s warning still goes unheeded as some young athletes die from their sport-induced concussions.

### Find Out More

To find out more about the management of concussion, please refer to the National Athletic Trainers’ Association Position Statement on the Management of Sports-Related Concussion.

The document can be downloaded from the NATA’s website at:

<http://www.nata.org/statements/position/concussion.pdf>

The Heads-Up Concussion ToolKit is also available free of charge from the U.S. Centers for Disease Control at <http://www.cdc.gov>



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# Concussion Management Strategies

## Understanding Concussion

A concussion is an injury that causes a disturbance in normal brain function.<sup>6,7</sup> Treatment generally consists of monitoring symptoms and rest. Concussion can be caused by either getting hit directly on the head or by a hit to another part of the body that causes the head to accelerate either forward or backward (like whiplash).

Most athletes who experience concussion will exhibit any one of more of a variety of symptoms.<sup>8,9</sup> **Loss of consciousness** is not always present. Headache is the most common symptom, however all athletes will experience concussion differently. So, while one athlete may have a **headache**, another may not. Other signs and symptoms can include being **nauseous**, having **poor balance** or **coordination**, being **dizzy**, **dazed** or **confused**, and suffering from **memory deficits**. Headaches may linger, but so can not-so-obvious symptoms. These can include **sensitivity to light or noise**, **emotional changes**, **sleep disturbances** and **personality changes**. Often, the signs and symptoms of a concussion are not evident until several minutes to hours later. The severity of the symptoms will vary as will their duration.



## Signs and Symptoms of Concussion

- Headache
- Nausea/Vomiting
- Blurry Vision
- Dizziness
- Drowsiness
- Sleeping More or Less Than Usual
- Fatigue
- Feeling “In a Fog”
- Feeling “Slowed Down”
- Unusually Emotional
- Irritable, Nervous or Sad
- Loss of Consciousness
- Loss of Orientation
- Memory Problems
- Nervousness
- Personality Changes
- Poor Balance/Coordination
- Ringing in the Ears
- Sensitivity to Light/Noise
- Glassy Eyes/Vacant Stares

*Concussed athletes may experience one or more of any of these symptoms.*

## Why Concussed Kids Must Be Treated With Extra Caution

The recognition of concussion is especially critical for those working with younger athletes. Leading experts agree that high school athletes have a significantly greater risk of sustaining a concussion, and those concussions are taking significantly longer to heal when compared to older athletes.<sup>11,12</sup> There are many potential reasons for this, but most researchers agree that the younger brain is more vulnerable

because it is not

fully developed.<sup>13</sup> There is also a strong suggestion that many concussions sustained by younger athletes go unreported because of a lack of awareness of what constitutes a concussion. Because of this, young athletes are often not referred for medical care and are allowed to continue to play. This can be catastrophic.

Youth sport coaches and parents of young athletes should be vigilant in their watch for the onset of concussive signs and symptoms. If concussion is suspected,

- Always seek advice from a physician and/or athletic trainer, and**



# Concussion Management Strategies

## The Importance of Stepwise Return to Play

Returning to play too soon following a concussive injury, even a *bell ringer* or a *ding*, can turn catastrophic.<sup>1,11,14-15</sup> Therefore, once it is decided that an athlete is ready to return to play, coaches, parents, and athletes should follow a stepwise sequence to ensure the healing process is complete. Stepwise Return to Play<sup>15</sup> calls for a **gradual and systematic return to physical activity**. If the athlete is able to complete the activity without the resurrection of symptoms or deterioration of brain function, he/she can graduate to the next step. If symptoms reappear at any step in the sequence, athletes are instructed to *step back*. Each successful step forward should be separated by **at least 24 hours**.<sup>8,13</sup>

### Stepwise Return to Play

Each step should be separated by 24 hours

- 1 NO ACTIVITY. Rest until asymptomatic.**
- 2 Light aerobic exercise.**  
Examples: Light jogging; Stationary bike.
- 3 Sport-specific exercise. No contact.**  
Examples: Running; Shooting on a side basket.
- 4 Non-contact sport drills.**  
Examples: Full-speed agility drills; Passing drills.
- 5 Full-contact sport drills.**  
Examples: Tackling drills; Scrimmaging.
- 6 Full activity.**  
Practice/Game with no restrictions.

**Do not advance to the next step if symptoms reappear**

## At Home Care: The Dos and Don'ts

### It is OK to...

- Take acetaminophen
- Ice the head and neck
- Eat a light diet
- Return to school
- Sleep
- Rest

### There is NO NEED to...

- Check eyes with a flashlight
- Wake up every hour
- Test reflexes
- Stay in bed

### Do NOT...

- Drink alcohol
- Eat spicy foods
- Check eyes with a flashlight
- Wake up every hour
- Test reflexes



## Second Impact Syndrome

The immediate recognition of the concussion is critical because repeated concussions pose a very real threat of death.

There is evidence that athletes who suffer a second concussion before the symptoms of the first have healed are susceptible to a phenomenon called Second Impact Syndrome, or SIS<sup>15-16</sup>.

Though rare, SIS is characterized by rapid swelling of the brain. Surgery does not help and there is little hope for recovery. Most die, but those who live through SIS are often severely disabled. SIS is most often associated with athletes under the age of 19, perhaps because of the sensitivity of their developing brain and perhaps because the seriousness of the first concussion is often overlooked.<sup>4,15-18</sup>

The first concussion does not need to be severe in order for SIS to occur. And, in many instances, it does not take a crushing second blow either to spark the onset of SIS. In fact, typically it is a subtle blow and it can occur days or even weeks after the initial concussion is sustained.<sup>16,17,18</sup>

# Concussion Management Strategies

## Making Concussion Assessment More Objective

It's important to understand that a concussion is a **functional** injury, not a **structural** one.<sup>17</sup> While neuroimages like CT-Scans and MRIs may come back normal, damage to the cells of the brain can change how the brain functions.<sup>19,20</sup>

For years, most concussion assessments involved coaches or parents asking athletes if they had any symptoms, such as headache. While **symptom scale checklists** are always warranted, they should not be used as the sole indicator of whether or not an athlete's brain has healed.<sup>13</sup> It is widely known that some athletes will hide their symptoms for fear of not being allowed to continue to play. Athletes are often unaware of potential long-term effects and their will to *play through the pain* is often a more convincing argument anyway.

Because of this and because of the nature of the injury, it is recommended that coaches, parents, and athletic trainers integrate objective measurements of brain function.<sup>13</sup> Such tests include the **Sideline Assessment of Concussion**, the **Balance Error Scoring System**, and neurocognitive, software-based assessments such as **ImPACT™**. Each of these instruments is detailed in this newsletter and each can be used as a supplement to the Symptom Scale Checklist for more reliable return to play decision-making.<sup>13</sup>



## Neurocognitive Assessment

Computerized neurocognitive testing programs can be a valuable tool for concussion assessment. They can also help coaches, parents, and athletes determine when it is safe to return to play by assessing brain function after a head injury is sustained.<sup>13</sup> Many neurocognitive assessments, including **ImPACT™**, are software-based and administered on a computer. These tests make possible a quantitative measurement of a brain's function through measurements of multiple aspects of cognitive activity. These include memory, reaction time, and attention span.<sup>21,22,23</sup> When used in conjunction with **standardized symptom scale checklists**, neurocognitive assessments give physicians, athletic trainers, coaches, and parents a greater guarantee of the appropriate time for an athlete's safe return to activity.<sup>8,13,22</sup> Ideally, the tests are given to athletes before the season begins so a "baseline" score is obtained. Then, after a suspected concussion is sustained, a follow-up test is given and scores are compared to the initial assessment.

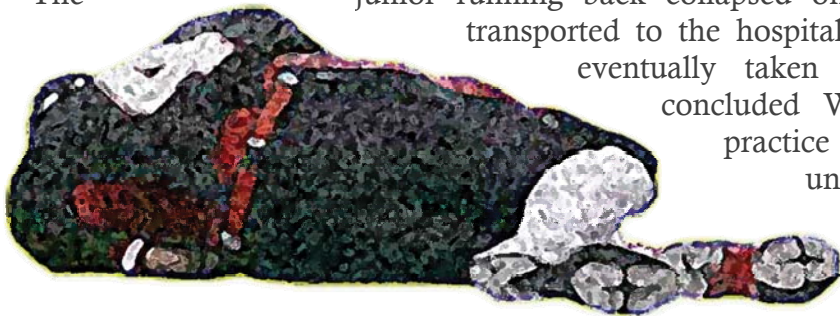


# Concussion Management Strategies

## Concussion Turns Catastrophic: Young Athletes Die from Sport-Related Trauma

In the fall of 2008 alone, at least five young athletes died from their sport-induced head injuries.<sup>24</sup> Sixteen-year-old **Ryne Dougherty** of Montclair, New Jersey died in October from a brain hemorrhage. Dougherty had sustained a concussion in practice three weeks previous and had been medically cleared to play despite complaining to friends of blurred vision and headaches. Seventeen-year-old running back **Douglas Morales**, also of New Jersey, collided helmet first with a defender's shoulder pads during practice and collapsed on his way to the sideline. He spent four days in a coma before succumbing to his traumatic brain injury. **Vinny Rodriguez**, a sophomore running back and safety from Boron, California suffered the same fate after sustaining a head injury while making a routine tackle during a game. He underwent surgery to relieve swelling but died four days later. **Atlas Fraley** of Chapel Hill, North Carolina, was pulled from the football practice field after complaining of a severe headache. After being sent home, Fraley, an offensive lineman, called 9-1-1 and complained to the dispatcher that his body was "hurting all over." Paramedics went to his home, determined Fraley was just dehydrated. He received fluids but was not transported to a hospital. Several hours later, Fraley was found dead in his family's living room. **Matt Gfeller**, a high school sophomore from Winston-Salem, North Carolina, died August 24 after a hit he sustained led to a cranial bleed. And sixteen-year-old **Jaquan Waller** from Greenville, North Carolina.

The junior running back collapsed on the sideline after being tackled. He was transported to the hospital, was brain dead by the next morning and eventually taken off life support. The medical examiner concluded Waller had suffered a mild concussion in practice two days previous. That injury went undetected and undiagnosed. The hit he sustained during the Friday night game triggered massive swelling of the brain and he died from **Second Impact Syndrome**.



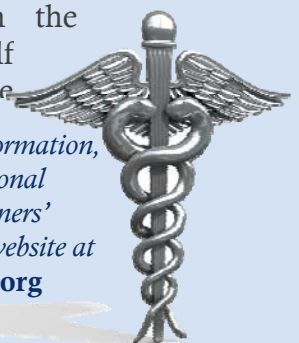
## Certified Athletic Trainers: The Front Line for Athletic Health Care

The best-case scenario for youth sport coaches, administrators and parents is to have a **Certified Athletic Trainer** at all sport practices and games.<sup>13,25</sup> Athletic Trainers are highly educated health care professionals who specialize in preventing, diagnosing, managing and rehabilitating injuries that result from physical activity. Their

medical education is unique to the sport setting and they also possess skills that allow them to promptly and properly diagnose and manage acute and chronic injuries, including concussion. They also are qualified to make those critical decisions regarding return to play. As of 2008, only 42% of high schools in the United States had access to athletic trainers and the

majority of those work in schools in the eastern half of the

*For more information, visit the National Athletic Trainers' Association website at [www.nata.org](http://www.nata.org)*



# 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.

	<b>None</b>	<b>Moderate</b>			<b>Severe</b>		
<b>Score According to Severity</b>	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						
Dizziness						
Drowsiness						
Sleeping More than Usual						
Easily Distracted						
Fatigue						
Feeling "In a Fog"						
Feeling "Slowed Down"						
Headache						
Unusually Emotional						
Irritability						
Loss of Consciousness						
Loss of Orientation						
Memory Problems						
Nausea						
Nervousness						
Personality Changes						
Poor Balance/Coordination						
Ringling in the Ears						
Sadness						
Seeing Stars						
Sensitivity to Light						
Sensitivity to Noise						
Sleep Disturbances						
Vacant Stares/Glassy Eyes						
Vomiting						
<b>TOTAL SYMPTOM SCORE:</b>						

# The Sideline Assessment for Concussion

Obtain Pre-Season Baseline Score; Compare with Post-Concussion Score<sup>31-32</sup>

<b>NAME OF ATHLETE:</b>		
Age:	Sex:	Examiner:
Nature of Injury:		
Date of Exam:	Time:	

I. ORIENTATION			
Month	0	1	
Date	0	1	
Day of Week	0	1	
Year	0	1	
Time	0	1	
<b>Orientation Total Score:</b>			<b>/5</b>

III. NEUROLOGICAL SCREENING			
Recollection of injury (pre- or post-traumatic amnesia):			
Strength:			
Sensation:			
Coordination:			

IV. CONCENTRATION			
<b>Digits Backwards:</b> If correct, go to the next string length. If incorrect, read second trail. Stop after incorrect on both trails.			
4-9-3	6-2-9	0	1
3-8-1-4	3-2-7-9	0	1
6-2-9-7-1	1-5-2-8-6	0	1
7-1-8-4-6-2	5-3-9-1-4-8	0	1
<b>Months of the Year in Reverse Order:</b> Athlete must recite entire reverse sequence correct.			
Dec-Nov-Oct-Sep-Aug-Jul-Jun-May-Apr-Mar-Feb-Jan	0	1	
<b>Total Concentration Score:</b>			<b>/5</b>

V. EXERTIONAL MANEUVERS			
5	5	5	5
Jumping Jacks	Sit-ups	Push-ups	Knee- bends

II. IMMEDIATE MEMORY						
All 3 trials are completed regardless of score on trial 1 & 2; score equals sum across all 3 trials.						
List	Trial 1		Trial 2		Trial 3	
Elbow	0	1	0	1	0	1
Apple	0	1	0	1	0	1
Carpet	0	1	0	1	0	1
Saddle	0	1	0	1	0	1
Bubble	0	1	0	1	0	1
<b>Total Immediate Memory Recall:</b>					<b>/15</b>	
<i>Note: Do not inform the subject that delayed recall will be tested.</i>						

VI. DELAYED MEMORY RECALL						
List	Trial 1		Trial 2		Trial 3	
Elbow	0	1	0	1	0	1
Apple	0	1	0	1	0	1
Carpet	0	1	0	1	0	1
Saddle	0	1	0	1	0	1
Bubble	0	1	0	1	0	1
<b>Total Delayed Memory Recall:</b>					<b>/15</b>	

SUMMARY OF TOTAL SCORES	
<b>Orientation</b>	<b>/5</b>
<b>Immediate Memory</b>	<b>/15</b>
<b>Concentration</b>	<b>/5</b>
<b>Delayed Memory Recall</b>	<b>/15</b>
<b>Overall Total Score</b>	<b>/40</b>
<i>If score is below baseline, DO NOT return to play.</i>	

# The Balance Error Scoring System (BESS)

Obtain Preseason Baseline Score; Compare with Post-Concussion Score<sup>33-34</sup>

The Balance Error Scoring System<sup>33-34</sup> provides a portable, cost-effective and objective method of assessing static **postural stability**. The BESS can be used to assess the effects of mild head injury on static postural stability. Information obtained from this clinical balance tool can be used to assist clinicians in making return to play decisions following mild head injury. The BESS can be performed in nearly any environment and takes approximately 10 minutes to conduct.

The balance-testing regime consists three stances on two different surfaces. The three stances are **double leg stance**, **single leg stance** and **tandem stance**. The two different surfaces include both a **firm** (ground) and **foam** surface. **Athletes' stance should consist of the hands on the iliac crests, eyes closed and a consistent foot position depending on the stance.** Shoes should not be worn.

In the **double leg stance**, the feet are flat on the testing surface approximately pelvic width apart.

In the **single leg stance** position, the athlete is to stand on the non-dominant leg with the contralateral limb held in approximately 20° of hip flexion, 45° of knee flexion and neutral position in the frontal plane.

In the **tandem stance** testing position, one foot is placed in front of the other with heel of the anterior foot touching the toe of the posterior foot. The athlete's non-dominant leg is in the posterior position. Leg dominance should be determined by the athlete's kicking preference.

**Administering the BESS:** Establish baseline score prior to the start of the athletic season. After a concussive injury, re-assess the athlete and compare to baseline score. Only consider return to activity if scores are comparable to baseline score. Use with Standardized Symptom Scale Checklist.

**Scoring the BESS:** Each of the trials is **20 seconds**. Count the number of errors (deviations) from the proper stance. The examiner should begin counting errors only after the individual has assumed the proper testing position.



Double Leg Stance  
Firm Surface



Single Leg Stance  
Firm Surface



Tandem Stance  
Firm Surface



Double Leg Stance  
Foam Surface



Single Leg Stance  
Foam Surface



Tandem Stance  
Foam Surface

## Errors:

- Moving the hands off the hips
- Opening the eyes
- Step, stumble or fall
- Abduction or flexion of the hip beyond 30°
- Lifting the forefoot or heel off of the

testing surface

- Remaining out of the proper testing position for greater than 5 seconds

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

*If a subject commits multiple errors*

## B.E.S.S. SCORECARD

Count Number of Errors max of 10 each stance/surface	FIRM Surface	FOAM Surface
<b>Double Leg Stance</b> (feet together)		
<b>Single Leg Stance</b> (non-dominant foot)		
<b>Tandem Stance</b> (non-dominant foot in back)		
<b>TOTAL SCORES:</b> total each column		
<b>B.E.S.S. TOTAL:</b> (Firm+Foam total)		

# Concussion Management Strategies

## Understanding the Effects of Post-Concussion Syndrome

**Post-Concussion Syndrome (PCS)** is a term used to describe a set of symptoms that a person may experience for weeks, months, or even years after a concussion is sustained.<sup>35</sup> The condition can cause lasting physical effects such as frequent or long-lasting **headaches**. It can lead to psychological, behavioral, and/or cognitive effects. Psychological effects include **irritability, anxiety, changes in personality** and **depression**. Other emotional and behavioral symptoms can include **restlessness, aggression, mood swings, impulsiveness** and difficulty controlling one's own **anger**.<sup>35-36</sup>

Cognitive deficits can also linger and can affect a child in the classroom. Because of the disruption in brain function, athletes may experience **academic difficulties** due to deficits with simple processes including concentration, working memory, immediate memory, recall, and rapid visual processing. Processing speed can be impaired as can the speed of fine motor skills. An athlete's attention span might also be altered.<sup>37</sup>

## Girls Often More Susceptible to Concussion

A recent study<sup>38-40</sup> showed concussion rates to girls are higher than those to boys in some sports. The study, conducted at Ohio State University, showed girls sustain more concussions in soccer, hockey and basketball. In soccer, girls sustained concussion 68 percent more often than boys. In basketball, girls' concussion rates were

almost three times higher than boys. Girls also took consistently longer for their symptoms to resolve. Girls' soccer ranked second only to football in the number of concussive injuries in high school sports, followed by boys' soccer and girls' basketball. While fatal instances of concussion were exceedingly rare among female athletes, instances of post-concussion



*"When in Doubt,*

## Concussed Athletes Need Help in the Classroom

Even though they may be academically-strong normally, what concussed kids may hear in the classroom is comparable to what Charlie Brown heard when his teacher spoke... *"Wa wa wa wa..."*

Here's some advice for parents:

1. **Talk to your child's school counselor and teachers. Inform them that your child has sustained a concussion and that he/she may need extra time to complete assignments.**
2. **Realize that your child may be struggling to concentrate. Encourage them to do their homework but allow them to take frequent breaks.**
3. **Be supportive of your child if their grades suffer. Remind yourself and your child that things will get easier and make more sense as their brain heals. That just takes time.**
4. **Be patient with the athlete. Often they are just as frustrated as you are.**

# Concussion Management Strategies

## Mouth Guards: The First Line of Protection

While there is no scientific proof that mouth guards can prevent concussion,<sup>42</sup> there is still agreement among many experts in the field that properly fitted mouth guards are an essential piece of equipment for kids participating in contact sports.<sup>13</sup> Not only do mouth guards protect the teeth, there are still some people convinced that mouth guards can help to absorb some of the force the head and brain receive upon contact. Most mouth guards worn by young athletes are “boil and bite” guards. They are purchased at sporting good stores, heated up and provide some dentition to an athlete’s mouth. For better results, consult your dentist or orthodontist. They can custom build a mouth guard that provides even more protection while creating minimal interference with normal breathing and talking.



*The two mouth guards shown here were discovered after two athletes sustained season-ending concussions. The first (left) was from a high school football player; the second (right) from a 7th grade football player. The coaches and parents of these athletes were unaware of the condition of the athletes’ mouth guards.*

## When it Comes to Concussion, How Many is Too Many?

It’s difficult to say

how many concussions are too many. There is no general rule. The American Academy of Neurology<sup>43</sup> recommends termination of the season after the third concussion within that same season. Important for coaches and parents of young athletes to understand is that an athlete disqualified for a “season” may need to continue to be held out through successive sports. Each young athlete must be considered on an individual basis. Factors to consider will be the number of concussions sustained and the severity of each concussion.

The risk level for concussion in a particular sport must also be considered as must the athlete’s age and level of participation.<sup>13</sup> Some other research suggests that an athlete who has sustained three previous concussions in a career should no longer be allowed to participate in contact sport.<sup>2,19</sup> What is known is that once an athlete sustains one concussion, he or she is at increased risk for sustaining subsequent concussions.<sup>28,36</sup>

Furthermore, with the evidence surrounding the need for additional recovery time, coaches and parents should be extremely conservative when managing younger athletes concussion. Regardless of the number of concussive injuries, should only be considered after all symptoms have resolved returned to normal on post-concussion neurological or postural the **SAC, BESS or software-based test.**

with return to play and when the athlete has stability examinations such as



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## Why Bell-Ringers and Dings Should Be Taken Seriously

We often hear the term *bell-ringer* or *ding* used to describe a momentary state of confusion or disorientation that results from head-on contact during sport. The casual terms tend to infer the injury is not reason to be concerned, but this is not the case. **Bell-ringers or dings are the most common type of concussion**, yet in youth and high school sport they are often not taken seriously enough. In fact, many go unreported. In addition to the very real threat of **Second Impact Syndrome**, which can result in death, several studies have clearly shown these mild instances of concussion can have significant and long-lasting neurocognitive effects.<sup>2,4,8,15,19,22</sup> While many in the athletic community tend to believe **bell-ringers** or **dings** heal rapidly and warrant continuation of physical activity, the cellular and functional damage to the brain can take much longer than minutes to resolve. Continuing to ignore the very real threat bell-ringers and dings present puts the health and safety of the young athlete at definite risk – especially considering that once an athlete sustains one concussion (even a mild one), he/she is four to six times more likely to sustain another.<sup>10</sup>



*When in Doubt, Sit 'em Out!*

### Concussion Awareness Campaign

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