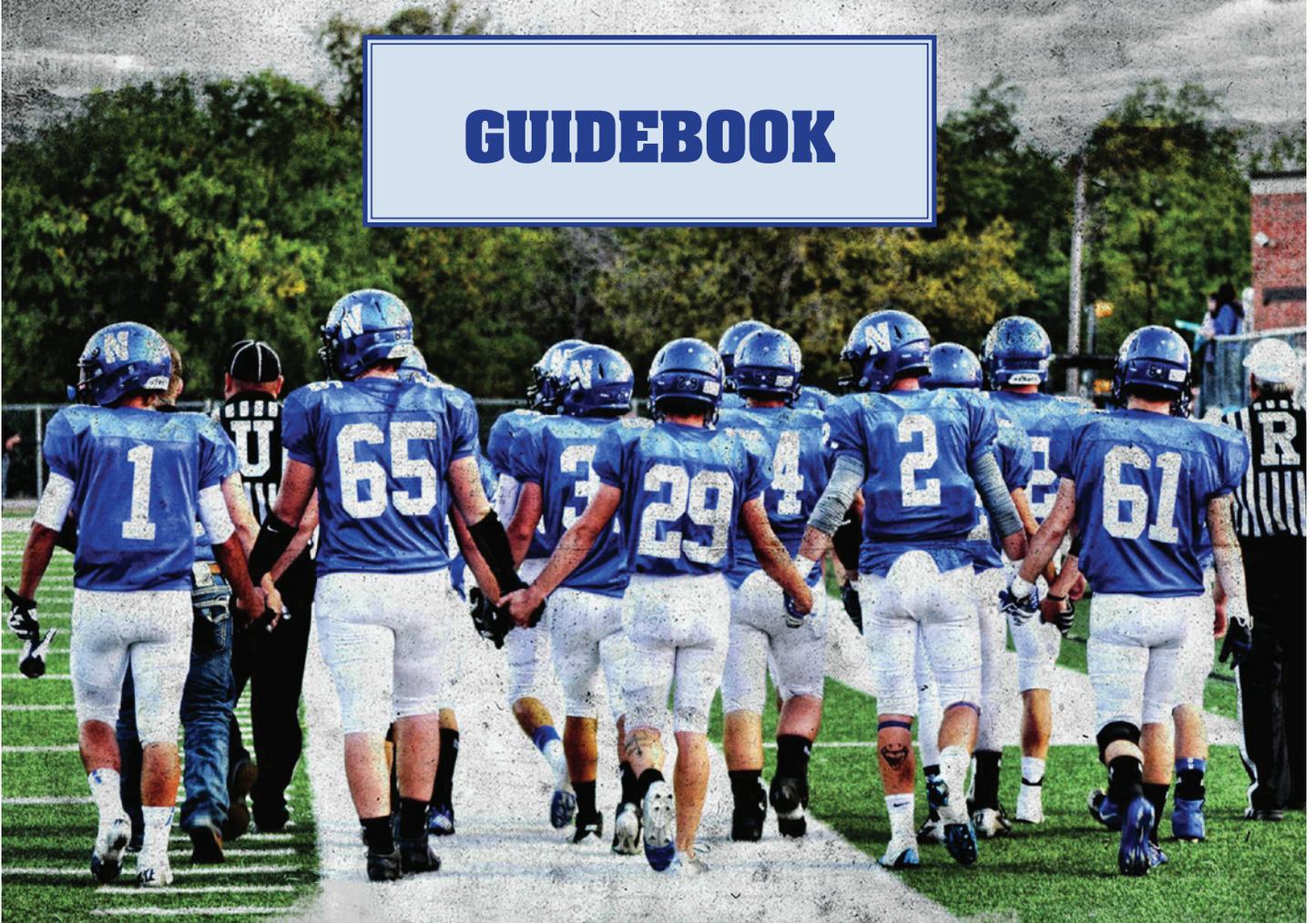


MOMSTEAM PRESENTS

# THE SMARTEST TEAM

MAKING HIGH SCHOOL FOOTBALL SAFER

**GUIDEBOOK**



# **THE SIX PILLARS OF CONCUSSION RISK MANAGEMENT**<sup>1</sup>

## **SUMMARY AND OVERVIEW**

Head injuries in football, as in other contact and collision sports, cannot be completely eliminated, but there ARE steps that can be taken to minimize risk.

“The Smartest Team” (“TST”) focuses on what MomsTEAM Founder and Publisher Brooke de Lench calls The Six Pillars™ of concussion risk management:

### **Pillar One: Comprehensive concussion education**

A comprehensive concussion risk management program begins with education.

Virtually every expert in the field puts concussion education at the top of the list of ways in which football - and all contact and collision sports - can be made safer.

All stakeholders in football - athletes, referees, administrators, parents, coaches, and health care providers - should be educated about:

1. ways to reduce the risk of concussion and brain/neck/spine injury (Pillar Two)
2. early identification of concussion, its clinical features (signs and symptoms), and assessment techniques (Pillar Three)
3. conservative treatment and management (physical and cognitive rest) and return to learn (Pillar Four)
4. principles of cautious return to play (Pillar Five); and
5. factors suggesting that retirement from football and other contact and collision sports is advisable (Pillar Six)

### **Pillar Two: Protection (Minimizing Risk)**

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Experts believe that, while there is no way to make football completely concussion-risk free, there are a number of ways the risk of brain injury from playing contact and collision sports can be minimized:

1. Requiring **pre-participation physical evaluations** of all players on a yearly basis;
2. Equipping players with **properly fitted** and maintained helmets;
3. Training players to **tackle and block without using their helmets**;
4. Enforcing **existing rules** against helmet-to-helmet contact;
5. Enacting **new rules** to further reduce helmet-to-helmet contact;
6. Encouraging players to maintain peak physical condition and **strengthen neck muscles**;  
and
7. Working to reduce total brain trauma through **sensible, evidence-based limits on full-contact practices**.

All seven present challenges, and none is sufficient by itself, so that adopting an "all-of-the-above" approach is likely the best way to reduce the risk to youth and high school athletes from brain injury.

### **Pillar Three: Early Identification/Immediate Removal from Play**

To minimize the risk of delayed recovery and long-term injury (or, in rare instances, catastrophic injury or death from diffuse cerebral swelling, a/k/a "second impact syndrome"), it is critical that football players suspected of having sustained a concussion be removed from play as soon as possible, a step now required by law, at least at the high school level, in nearly all states.

Because of the well-documented and persistent unwillingness of athletes to report concussion symptoms (especially those they consider minor, what many still call 'bell-ringers' or 'dings'), because the vast majority of sport-related concussions occur without loss of consciousness or other obvious neurological signs of injury and may not be the result of a specific concussive blow, identifying a concussion, especially early, continues to be a challenge.

### **Five "E's"**

To increase the chances of early identification, a multi-pronged approach utilizing every "tool" in the concussion toolbox is recommended, emphasizing the "Five E's":

1. Employing a **certified athletic trainer** to be on the sideline at every game and practice;
2. Encouraging **honest self-reporting** by athletes of concussion symptoms by creating an environment in which athletes feel safe in reporting, and through use of a "buddy

system" in which players look for - and are obligated to report - signs of concussion in designated teammates;

3. Equipping players with **impact sensors** to alert sideline personnel to blows which may cause concussion to trigger closer monitoring and/or a sideline assessment for concussion;
4. Evaluating players for suspected concussion on the sideline utilizing a **battery of assessment tools**; and
5. Ensuring that any player suspected of concussion **not be allowed to return to game or practice play** but referred for more formal evaluation and assessment by a qualified medical professional whenever concussion is suspected.

#### **Pillar Four: Conservative Treatment (Physical/Cognitive Rest)**

Along with teachers, coaches, school nurses, school psychologists, neuropsychologists, and administrators, parents play a crucial role in a child's treatment and recovery from diagnosed concussion. No matter how 'mild' a concussion may seem, concussion is a traumatic brain injury (TBI), and need to be treated seriously.

Immediately after a concussion, engaging in even the most basic physical or mental tasks can make symptoms worse and slow recovery. In the first few days after concussion parents therefore need to make sure their child get lots of rest and limits physical exertion and activities of daily living.

Because a concussion impacts the brain's cognitive functions (those that involve thinking, concentrating, learning, memory, and reasoning), limiting an athlete's scholastic and other cognitive activities, at least initially, is believed to give the brain time to heal and is thought to speed recovery.

The optimal amount and timing of physical and cognitive rest, however, is not yet known. Experts therefore recommend taking a common sense approach, keeping a concussed student-athlete home from school for a few days, and then easing back into school gradually before returning to a full school day (what is now increasingly dubbed "return to learn") and social activities. The key is to reintroduce physical and mental activities in a way which does not make symptoms worse, and to discontinue any activity if it provokes symptoms or makes them worse.

In the event concussion symptoms/cognitive impairment persist (post-concussion syndrome), management by a multi-disciplinary team of concussion specialists, more formal academic accommodations such as an IEP or 504 plan, and consideration of additional treatment modalities, including alternative therapies, may need to be considered.

### **Pillar Five: Cautious Return to Play**

The return to play (RTP) protocol after a child or teen suffers a sport concussion should only begin *after* a student-athlete (1) reports being symptom free; (2) has returned to a full academic workload without accommodations; (3) is performing at or near their pre-injury baseline on all post-concussion tests; and (4) has been cleared by their doctor, based on his or her clinical judgment and consideration of all relevant factors, to begin the following, exercise-limited, return-to-play protocol:

1. No activity (symptom-limited physical and cognitive rest) (Pillar Four).
2. Light aerobic exercise
3. Sport-specific exercise
4. Non-contact training drills
5. Full-contact practice
6. Return to play

Generally, each step takes 24 hours, so that concussed high school athletes whose symptoms clear within 24 hours (about 25% of the total) will take approximately 1 week to complete the full rehabilitation protocol, if they continue to be asymptomatic at rest and with exercise.

While an estimated 80 to 90% of concussions heal spontaneously in the first 7 to 10 days, a more conservative RTP approach (longer rest period and/or extended period of non-contact exercise) is recommended for younger athletes.

### **Pillar Six: Retirement**

Medicine has not yet figured out how many concussions is too many. Contrary to popular belief, there is no magic number, with the number that leads to permanent deficits in memory, concentration, and other cognitive processes, and/or that increases the risk of dementia and other problems later in life, likely to be different for each athlete.

Among the factors that may prompt a recommendation to an athlete to consider retiring from contact or collision sports (either not resume playing that season or not begin play the next season), are:

1. Number of concussions;
2. Concussions occurring with less force;
3. Slower recovery;
4. More pronounced cognitive losses; and

5. The role football plays in the athlete's life and his realistic prospects for college and pro career.

The decision to retire should be made jointly, after long discussion among and between the athlete, the athlete's family, other people important to the athlete (e.g. coach) and the health care team involved in the athlete's care, and should ideally take place over a series of visits lasting weeks to months.

## **PILLAR ONE: EDUCATION**

### **Parents and Players**

While nearly every state in the country now requires that parents and players receive some basic concussion safety information as a condition to participation, much more education than can fit on to an 8 1/2 by 11 sheet of paper is recommended.

“The Smartest Team” provides an overview to the subject of concussion risk management, but it is intended to be an introduction and a starting point.

Ideally, all parents and players should attend a comprehensive concussion safety meeting before every football season, where they can learn:

#### **1. The signs and symptoms of concussion:**

(a) **symptoms** (headache, nausea, vomiting, dizziness, visual problems, sensitivity to light/noise, balance problems);

(b) **physical signs** (loss of consciousness, unsteady gait/balance problems/dazed facial expression);

(c) **impaired brain function** (confusion, feeling mentally "foggy," feeling slowed down, difficulty concentrating and remembering a/k/a amnesia);

(d) **abnormal behavior** (change in personality, irritability, sadness, nervousness, more emotional, depression); and/or

(e) **sleep disturbances** (insomnia, drowsiness, sleeping less than usual, sleeping more than usual);

2. **The importance of watching for delayed symptoms.** It is not uncommon for concussion symptoms or signs, including behavioral changes, and concentration and memory problems, to first appear hours or even days after a strong blow to the body or head during practice or game action. Delayed onset of symptoms is especially common among younger athletes;

3. **The need to regularly and close monitor athletes during the first 24-48 hours after diagnosed concussion** for signs of deteriorating mental condition suggesting a more serious brain injury which requires immediate hospitalization;

4. **The benefits of cognitive and physical rest** in the first few days after concussion, including staying home from school (Pillar Four)

5. The **importance of a gradual return to school ("return to learn")** (Pillar Four) and **to sports ("return to sports")** (Pillar Five); and

6. The **dangers of continuing to play with concussion symptoms and/or returning to play too soon**, before a child or teen's still-developing brain has fully healed (**Pillars Four and Five**), including increased risk of **adverse short- and long-term, and even catastrophic health consequences**, which can include:

- (a) **longer recovery time**;
- (b) **increased likelihood of a second concussion** (3 to 6 times more likely, according to one study);
- (c) **persistent symptoms** which may linger for weeks or months (e.g., **post-concussion syndrome**);
- (d) **permanent cognitive difficulties** (problems with memory and concentration), and **emotional problems**; up to
- (e) **devastating degenerative neurological disease**, such as chronic traumatic encephalopathy (CTE).

The precise effects of traumatic brain injury such as resulting from concussion and repetitive sub-concussive hits, and the degree they increase the risk of long-term health problems is unknown and will vary tremendously among student-athletes.

## **Coaches**

While a certified athletic trainer (AT) is the key person in the concussion risk management program outlined in TST, coaches play an important role in concussion risk management as well, especially in *high* school and youth football programs without access to an AT:

1. Coaches should be trained to teach players **heads up tackling and blocking** (**Pillar Two**);
2. Coaches should be trained to **watch for and recognize the signs of concussion**.
3. When an athletic trainer, team doctor or other trained medical professional is not present on the sideline - which is **strongly recommended** - a coach should know to **immediately remove a player** from practice or play and the need to arrange for an immediate evaluation by medical professional, and **not allow the athlete to return to play that day**, if he or she observes any of the following signs observed after a direct or indirect blow to an athlete's head:
  - a. loss of consciousness (however brief);

- b. balance or coordination problems (unsteady gait, athlete stumbles, walks sideways or is labored in their movements);
  - c. disorientation or confusion (inability to respond appropriately to ‘Maddocks questions’ designed to test an athlete’s orientation to time and place);
  - d. blank or vacant look; or
  - e. visible facial injury in combination with any of the above.
4. Coaches, as primary influencers of an athlete’s attitude towards reporting suspected concussion, should be part of the concussion solution, not a continued part of the concussion problem by:
- a. actively, consistently, and repeatedly encouraging **honest self-reporting** of concussion symptoms by athletes;
  - b. creating a **safe reporting environment** for athletes, such as by being understanding and supportive, especially in front of other athletes, when an athlete reports concussive symptoms and is unable to continue playing; and
  - c. employing a "**buddy system**" in which athletes are assigned to watch for signs or symptoms of concussion in designated teammates.

### **Game officials**

Game officials are closest to the action, and thus are often in the best position to detect the often subtle signs of concussions in athletes. Unfortunately, sports officials don't usually have the power to order a sideline evaluation for concussion, if they reasonably suspect one has occurred, and may not have received any concussion education.

Game officials should be educated about concussion signs and symptoms (as required by law in some states), and, as is the case in some states, empowered to remove a player with a suspected concussion from the contest.

### **Health care professionals**

Studies show that many primary care physicians (PCPs), who, along with certified athletic trainers, treat the vast majority of concussions which do not require specialized care, admit to being unaware of current concussion management guidelines (**Pillars Three and Four**), or find the guidelines too confusing or cumbersome to put into practice.

Increased concussion education of PCPs is needed, especially now that nearly every state now requires that high school athletes suspected of having a concussion receive written approval from

a clinician with concussion expertise before returning to play (**Pillar Five**). One of the principal purposes of such laws – not to return athletes to play prematurely before their brains have healed - will be thwarted if clinicians do not know how to diagnose and manage concussion, or are unaware of current RTP guidelines, putting athletes at risk of premature return to play.

### **Mobile applications and video games**

One way for athletes, coaches, parents, officials, support staff and medical personnel to become educated about concussions is to download concussion "apps" on their mobile devices. Because of their widespread use, portability and wireless connectivity, smart phones can serve a unique and valuable function in bridging the significant gap in concussion education.

The key advantages of a mobile phone app as an educational tool are twofold: not only do they give the user the opportunity to download educational materials quickly, but they possess operating systems that support engaging and interactive solutions to learning.

While there is also a need for smart phone apps to organize information on injury demographics, symptom timing, recovery milestones, and medical appointments, and to provide licensed health care professionals diagnostic screening tools), easily accessible across computing platforms, only four of the eleven applications identified in a 2013 study as being assessment tools state that they are for use by health care professionals. Because use by parents and other non-medical personnel might carry significant legal liability, such applications should only be used as diagnostic screening tools by licensed health care professionals.

Video games has also been touted as a concussion education tool by some leading concussion experts, including Dr. Bob Cantu of Boston University's Center for the Study of Traumatic Encephalopathy and co-founder of the Sports Legacy Institute, who sees video gaming as "an effective method for educating kids about concussions and to impress on them the importance of coming forward with symptoms they are feeling and otherwise might ignore." Emerging research suggests that the games are effective tool in head trauma education.

### **Education is not a panacea**

While increased concussion education is critically important, it is not a panacea.

The effectiveness of concussion education in making contact and collision sports safer has not been well-studied, but the studies that do exist, while they suggest increased awareness, also show that athletes are still very resistant to self-reporting and that the culture of contact and

collision of sports and pressure from – and the attitudes of – coaches, parents, and teammates tends to make athletes reluctant to report possible concussion.

A survey of Washington State adults a year after passage of that state's groundbreaking concussion safety law, for instance, found that 85% of the study population was aware of the law and over 90% had a good understanding regarding the definition, diagnosis and potential severity of a concussion.

But, as a 2013 study in the prestigious *British Journal of Sports Medicine* noted, "Despite the interest generated through media exposure and public education programmes, there appears to be remain widespread misconceptions about the diagnosis and management of concussions, as well as knowledge gaps among athletes, parents, and coaches."

Moreover, a 2013 study suggests that, even when athletes have received concussion education and are aware of the dangers of continuing to play with concussion symptoms, most, unfortunately, remain willing to take that risk:

- An astounding 91 percent surveyed felt that it was okay for an athlete to play with a concussion;
- 75 percent said they would play through any injury to win a game;
- 53 percent said they would always or sometimes continue to play with a headache sustained from an injury;
- Only 54 percent would "always or sometimes report symptoms of a concussion to their coach," and;
- Only 4 in 10 would tell their coach immediately if they had concussion symptoms.

Thus, comprehensive concussion education should be seen as just one prong in a multi-pronged approach to concussion risk management.

## **PILLAR TWO: PROTECTION AND RISK MINIMIZATION**

As a collision sport, football involves inherent risk of brain injury. While the risk of concussion or brain trauma as a result of the cumulative effects of low-grade (e.g. sub-concussive) hits in football cannot be completely eliminated, **steps can be taken to minimize risk NOW** including:

1. **Requiring comprehensive sports physicals:** All athletes should undergo a pre-participation physical evaluation (PPE) before every season to identify those who, because of a history of concussion or other brain trauma (*all* brain injuries, not just those sustained during sports) or other pre-existing medical conditions – such as chronic migraines, ADHD, learning disabilities, or sleep disorders – should be advised to at least consider not beginning to play contact or collision sports or, if they have been playing such sports, to consider retirement (**Pillar Six**);
2. **Ensuring that players wear properly fitted helmets:** Football helmets need to fit properly **before the season**, and proper fit must be **maintained** over the course of the season (especially important for newer helmets with air-bladder systems, because helmet fit may be compromised, either because air leaks from the bladder or because players intentionally let the air out for comfort). After the season, helmets must be properly reconditioned, or replaced if they have reached the end of their 10-year useful life.

### **Three important notes about protective equipment:**

- a. Although biomechanical studies have shown that helmets, and other protective equipment, may reduce impact forces to the brain, there are no studies involving actual players showing that such equipment reduces, much less prevents concussion, nor is there data to say that one type of helmet is superior to another kind of helmet in preventing concussions (although in laboratory tests, some helmets appear to do better at attenuating certain kinds of impact forces than others);
  - b. While a properly fitted helmet does not reduce concussion risk, there is some preliminary data to suggest that an improperly fitted helmet can *increase* risk of concussion, especially if the helmet comes off during play (one of the two concussions suffered by Newcastle players during the 2012 season occurred after an opposing player intentionally shoved his helmet off); and
  - c. There continues to be no compelling evidence that mouth guards protect athletes from concussion, but they nevertheless are an important piece of safety equipment because of their role in preventing dental and orofacial injuries.
3. **Teaching players proper tackling and blocking technique, keep their head up, and look for and brace for contact.**

- a. All football players, regardless of position, need to learn how to tackle properly (eg. in a way that minimizes helmet-to-helmet contact):
  - b. Players on the offensive and defensive line should learn how to avoid using their helmets as the initial point of contact with opponents on the line of scrimmage. Despite being technically illegal and a point of emphasis in recent years in rules enforcement at the high school level, such helmet-to-helmet contact continues to be a widespread practice during line play, with players rarely penalized (one of those rare times when a flag was thrown for helmet-to-helmet contact was actually captured during a scrimmage filmed for The Smartest Team and appears in the documentary to emphasize the point that such contact is illegal); and
  - c. Players should keep their heads up, aware of their surroundings so that, when they see a hit coming, they can brace for the blow. Studies of hockey players show that bracing for a body blow reduces of the risk of concussion.
4. **Encouraging players to strengthen their neck muscles.** Emerging evidence suggests that stronger neck muscles may help players better withstand the linear and rotational forces that cause concussion. Players should also maintain peak overall physical condition all year round, which reduces the overall risk of injury, not just of concussion.
5. **Strictly enforcing existing rules** against helmet-to-helmet contact and against defenseless players. Rules designed to protect players against contact that increases risk of concussion, and serious, and potentially fatal, head/neck/spine injuries, need to be more strictly enforced. Such rules are only as protective as the officials charged with enforcing them. While recent years have seen greater emphasis on efforts to penalize illegal hits at all levels of football, some suggest that, if an official is unsure whether an illegal hit has occurred, they should err on the side of caution by calling a penalty.
6. **Adopting new rules** where there is strong evidence that a particular aspect of play increases injury risk. TST includes an interview with a Newcastle player who suffered multiple concussions as a result of what he admits was a "bad habit" as running back of lowering his head and exposing the crown of his helmet. A new rule, adopted by NFL owners in March 2013, penalizes with a 15-yard penalty a runner or a tackler who initiates forcible contact by delivering a blow with the top/crown of his helmet against an opponent in the open field (when both players clearly are outside the tackle box, an area extending from tackle to tackle and from three yards beyond the line of scrimmage to the offensive team's end line). New rules against intentional helmet-to-helmet contact – including penalizing infractions with automatic game disqualification – have also been

adopted by the NCAA for the 2013 season. These new rules warrant adoption by the National Federation of High School Associations (NFHS) and its member high school athletic associations as soon as possible.

7. **Working to reduce total brain trauma:** While medical science works to find the thus far elusive threshold above which repetitive brain trauma significantly increases risk of permanent brain damage - a concussion 'holy grail' which some experts question will ever be found - common sense steps can and should be taken NOW to reduce and/or limit the number of impacts players sustain over the course of a season or career, such as by reducing or eliminating off-season practices at the high school level, and by reducing the number of full-contact practices during the regular season, as has been done in the National Football League, many youth football programs, the Ivy League and Pac-12, and is just now beginning to be done at the high school level in some states.

### **PILLAR THREE: EARLY IDENTIFICATION/REMOVAL FROM PLAY**

To minimize the risk of delayed recovery and long-term injury (or, in rare instances, catastrophic injury or death), it is critical that football players suspected of having sustained a concussion are removed from play as soon as possible (or not permitted to return to play in the event of a delayed onset of symptoms, which is common at the youth and high school level). Removal from play in case of a suspected concussion is now required by law, at least at the high school level, in almost all states.

Identification of concussion is difficult for three main reasons: (1) athletes are often unwilling to report concussions or fail to recognize that they have suffered a head injury; (2) a significant percentage of diagnosed concussions are not the result of a specific blow observable on the sideline, and the force required to cause a concussion varies widely from athlete to athlete; and (3) even trained health care professionals have a hard time spotting the often subtle signs of concussion, which may not even be present at the time of injury (delayed onset is particularly common among younger athletes).

Experts believe that the chances that a concussion will be identified early can be maximized by following a multi-pronged approach (**the Five "E's"**):

1. **Employing** a certified athletic trainer with specialized expertise in screening for possible concussion on the sideline at every game and practice [Note: making the clinical *diagnosis* of concussion should always be left to a doctor, and occur after a full evaluation away from the sports sideline);
2. **Encouraging** honest self-reporting by athletes of concussion symptoms, not just during game or practice action but in the hours and days after play, by:
  - a. creating a safe environment for reporting, such as by having the athletic director at the school bring in medical providers from the community to talk about concussion, and the coach being understanding and supportive when an athlete reports concussive symptoms and is unable to continue playing, especially in front of the athlete's teammates; and
  - b. employing a "buddy system" in which players look for and report signs of concussion in designated teammates.

Despite ongoing concerns about chronic underreporting of concussion or the resulting symptoms by athletes, symptom assessment remains a critical component of concussion evaluation;

3. **Equipping** players with impact sensors (e.g. accelerometers) – whether in or on the outside of helmets, embedded in mouth guards, chin straps, skull caps, or head bands – to alert coaches, athletic trainers, team doctors, other sideline personnel and/or parents to impacts of sufficient force to possibly cause concussion so as to trigger either closer observation of the athlete for signs of concussion or a brief sideline assessment.

While there are currently no published studies to support the use of impact sensor systems in this manner, and a precise "concussion threshold" has not been established, a 2013 study points to the "potential clinical utility" of impact sensors and recommends that their use "be carefully considered";

4. **Evaluating** players on the sideline (or in the locker room) utilizing sideline assessment tools capable of detecting and quantifying the acute phase of concussion, including one or more of the following:
  - a. **Sports Concussion Assessment Test version 3 (SCAT3)**(for use by athletic trainers and other health care professionals);
  - b. **Standardized Assessment of Concussion (SAC)**(intended for use by athletic trainers and other health care professionals, but may be used by coaches with training);
  - c. **Balance Error Scoring System (BESS)** or Modified BESS (M-BESS)(for use by trained health care professionals, preferably on both a hard surface and foam pad and away from the sports sideline after a rest period);
  - d. **King-Devick Test** (best used by trained health care professionals, but designed to be a simple, quick and easy "remove from play" screening tool for use by volunteers with little or no training).
  - e. **Maddocks questions:** a series of five questions (four slightly different questions for athletes under the age of 13) designed to test an athlete's orientation to time and place which, while just one part of the SAC and SCAT3, has value as a stand-alone assessment tool and remove-from-play screen because the questions can be asked by anyone, including a coach, parent, or volunteer, when a trained health care professional is not on the sideline (as is often the case in youth football).

#### *Notes of caution about sideline assessments*

>>**Reliability:** A 2013 analysis of the peer-reviewed literature on date of injury assessments found the SAC reliable in detecting and quantifying acute cognitive impairment, and the BESS to be an "important component" of the sideline assessment, but said further research was required

to establish the reliability, sensitivity, and clinical utility of the SCAT3, and that it was too early to draw any conclusion regarding the eventual usefulness of the K-D Test or others still in the development pipeline.

>>**Require training:** With the exception of the K-D test and Maddocks questions, all the sideline assessment "remove from play" screening tools are designed for use on the sports sideline by trained health care professionals.

In the absence of such personnel, a coach/parent/volunteer should immediately remove a player from practice or play, arrange for a prompt evaluation by medical professional, and not allow the athlete to return to play that day, if he or she observes any of the following signs observed after a direct or indirect blow to an athlete's head:

- loss of consciousness (however brief)
- balance or coordination problems (unsteady gait, athlete stumbles, walks sideways, is labored in their movements)
- disorientation or confusion (inability to respond appropriately to questions such as the Maddocks questions)
- blank or vacant look
- visible facial injury in combination with any of the above.

>>**Do not diagnose concussions:** All five are quick screening tools intended only for use to guide an initial "remove from play" decision. **None are meant to *diagnose* concussion**, which should be left to a qualified health care professional based on a formal symptom assessment and standardized testing of cognitive ability and balance, and consideration of all clinical factors.

5. **Ensuring** that no player is allowed to return to game or practice play if there is *even a slight suspicion*, based on the sideline evaluation, self-reported symptoms, or observable signs, to suggest that the athlete *may* have suffered a concussion (the standard under the law in most states), but is referred for a more formal evaluation by a health care professional with appropriate training and expertise in the diagnosis and management of concussion.

**If there is any question about whether a player has suffered a concussion, follow the mantra, "When in doubt, sit them out."**

## PILLAR FOUR: CONSERVATIVE TREATMENT

Along with teachers, coaches, school nurses and administrators, parents play a crucial role in a child's treatment for and recovery from a suspected or diagnosed concussion.

Parents and athletes should remember that a concussion, no matter how "mild" it may seem, is a traumatic brain injury.

Immediately after a concussion, even the most basic physical or mental tasks can make symptoms worse.

In the first few days after concussion parents therefore should try to make sure their child get **lots of rest and limits physical exertion and activities of daily living**. Keeping them home from school is strongly recommended.

Because a concussion impacts the brain's cognitive functions (e.g. those that involve thinking, concentrating, learning, memory, and reasoning), limiting an athlete's scholastic and other cognitive activities, at least initially, is believed to give the brain time to heal and speed recovery.

Because of the lack of research establishing the optimal amount and timing of physical and cognitive rest, experts recommend taking a **common sense approach** involving a few days off from school, followed by a gradual return to a full school day ("return to learn") and social activities, done in a way that does not make symptoms worse, and discontinuing an activity if symptoms get worse or reappear.

### **Physical rest**

While strict bed rest is not necessary, most experts recommend broad restrictions on physical activity in the first few days after a concussion.

Physical rest means:

- no sports;
- no weight training;
- no cardiovascular training;
- no PE classes;
- no chores that result in perspiration/exertion;
- no sexual activity; and

- no leisure activities such as bike riding, street hockey, and skateboarding that risk additional head injury or make symptoms worse.

### **Cognitive rest**

Cognitive rest means:

- Time off from school or work;
- No homework;
- No reading;
- No visually stimulating activities, such as computers, video games, texting or use of cell phones,
- Limited or no television;
- No trips, social visits in or out of the home;
- No driving; and
- Increased rest and sleep.

### **“Return to Learn”**

While an athlete must be 100% symptom-free before a *return to sports (Pillar Five)*, he or she does not need to be 100% symptom-free to *return to school*.

Because concussion may still be affecting their thinking, ability to remember (especially new information), and organization, however, parents and school personnel (e.g. school nurse, school psychologist or a neuropsychologist and teachers) should work together to help student-athletes to "return to learn" by adjusting their academic workload (taking time off from school to attending partial days), and making other appropriate academic accommodations, for student-athletes who are still exhibiting cognitive problems.

### **Persistent symptoms**

In the 10-15% of cases in which concussion symptoms persist for 10 days or longer, management by a team of health care providers with experience in treating post-concussion syndrome is recommended.

For those concussed athletes who continue to experience cognitive difficulties outside the usual 1- to 3-week recovery window, academic accommodations will need to stay in place longer, and development of a 504 or IEP may be required.

## PILLAR FIVE: CAUTIOUS RETURN TO PLAY

### **Return to Play Protocol**

Return to play (RTP) after a child or teen suffers a sport concussion is a six step, exercise-limited process which should proceed slowly and err on the side of caution in order to allow the brain time to fully heal:

1. **No activity** (symptom-limited physical and cognitive rest) (**Pillar Four**). When a student-athlete is no longer reporting concussion symptoms or receiving academic accommodations, and performing at or near his pre-injury baseline on all post-concussion tests (e.g. neurocognitive, balance, vision), he may proceed to Step 2.
2. **Light aerobic exercise** such as 5 to 10 minutes on an exercise bike, walking, swimming or light jogging, at 70% or less of maximum permitted heart rate can begin, but not resistance training, while monitoring for a return of any symptoms. If no symptoms recur after 24 hours, the athlete can be allowed to progress Step 3. If symptoms recur, wait 24 hours, and, if symptoms clear, try Step 2 again.
3. **Sport-specific exercise**. Continue with moderate jogging, brief running, or moderate-intensity stationary biking. No head impact activities. If no symptoms recur, progress in 24 hours to Step 4. If symptoms recur, wait 24 hours, and, if symptoms clear, try again.
4. **Non-contact training drills**: more complex training drills, e.g. passing drills, running plays without pads or contact. The athlete may start progressive resistance/weight training. If no symptoms recur, progress in 24 hours to Step 5. If symptoms recur, wait 24 hours, and, if symptoms clear, try again.
5. **Full-contact practice**: Following medical clearance (now required in almost all U.S. states), an athlete may participate in normal training activities. Such participation helps to restore the athlete's confidence (remember: psychological readiness for a return to play is just as important as physical readiness), and allows the coaching staff to assess the extent to which the athlete is ready for game action. Again, if symptoms recur, wait 24 hours, and, if symptoms clear, try again.
6. **Return to play**. With medical authorization (required in most states, at least at the high school level).

### **Cautious approach urged**

Generally, each step takes at least 24 hours (concussion symptoms, of course, may take much longer in some cases to clear), so that an athlete who is asymptomatic within the first 24 hours after injury will take approximately 1 week to complete the full rehabilitation protocol once asymptomatic at rest and with exercise.

Experts nevertheless caution that, while an estimated 80 to 90% of concussions heal spontaneously in the first 7 to 10 days, a **more conservative RTP approach is recommended for children and adolescents**, as they may require a longer rest period and/or extended period of non-contact exercise than adults because their developing brains cause them to experience a different physiological response to concussion than adults and to take longer to recover.

In the absence of testing by a health care professional with concussion expertise (e.g., certified athletic trainer, school/team/primary care/sports medicine physician, neuropsychologist) to clear a student-athlete to begin the graduated return-to-play protocol, a student-athlete should observe a 7 day rest/recovery period *before* commencing the protocol. This means that, for such athletes, return to sports will take at least two weeks.

Some leading concussion experts, including Dr. Rosemarie Scolaro Moser, a sports concussion neuropsychologist featured in TST, recommend taking a minimum of *three weeks* off before returning to sports after a concussion.

**Younger students (K-8)** should observe the 7 day rest/recovery period after they are symptom-free at rest prior to initiating the graduated-return-to play protocol.

As youth and high school athletes tend to consider only a small subset of their potential symptoms when reporting their recovery or saying they are "back to normal" after concussion, caution is urged in considering athletes' self-reported symptoms in making return-to-play decisions, and the same caution is warranted in relying solely on neurocognitive test scores having returned to normal before the graduated exercise protocol is begun.

Indeed, a recent study of concussed student-athletes who reported no symptoms and had returned to baseline on computerized neurocognitive tests taken before beginning the graduated exercise protocol found that more than a quarter exhibited declines in verbal and visual memory on the tests *after* moderate exercise, prompting a recommendation that student-athletes not be cleared for full contact activity until they are able to demonstrate stability, particularly in memory functioning, on neurocognitive concussion testing performed *after* the exercise protocol is begun. While the study's results have yet to be replicated, additional *post-exercise* neurocognitive testing may eventually become an important part of the RTP protocol.

## **PILLAR SIX: RETIREMENT**

Medicine has not yet figured out how many concussions is too many. The number that leads to permanent deficits in memory, concentration, and other cognitive processes, and/or that increases the risk of dementia and other problems later in life, is likely different for each athlete.

### **Factors**

Several factors will help influence a recommendation to an athlete to consider retiring from contact or collision sports, including:

**Number of concussions:** Contrary to popular belief, there is no magic number of concussions that disqualifies an athlete from further participation in contact or collision sports. The number of concussions is a factor, but only one.

**Concussions occurring with less force:** For some athletes, as the number of concussions rises, the force required to produce a concussion seems to decrease. When an athlete reports developing concussion symptoms after a seemingly minor blow to the head (such as an accidental blow to the head by the arm of an opponent or friend), such a sign is concerning, and will prompt a sports concussion specialist to discuss retirement with the athlete.

**Slower recovery:** Most athletes recover from concussions quickly, in a matter of days to weeks. In high school-aged athletes, nearly 85 percent will be symptom-free within one week of their injury. Some athletes, however, take longer to recover, with symptoms persisting for weeks or even months. Some athletes recover from their first few concussions quickly, but, as they suffer more concussions, the recovery time increases, lasting weeks to months, or in some rare cases, longer than a year.

**More pronounced cognitive losses.** After a concussion, many athletes temporarily lose some cognitive function, experiencing difficulty in thinking, remembering, concentrating, and reasoning, which they regain as they recover, and which is prerequisite for return to play (**Pillar Five**). For some athletes, the cognitive losses they experience at the time of injury increase with the number of concussions, with their memory, reaction time, and the speed at which they process information (all of which can be measured through pencil and paper or computerized neurocognitive testing), becomes much worse.

Even without the presence of these concerning factors, there remains some risk, of course, from continued participation in contact or collision sports after concussion, with increased risk of a

second concussion.

### **Complicated family decision**

The decision to retire should be made jointly, after long and thoughtful discussion between the athlete, the athlete's family, other people important to the athlete (e.g. coach) and the team involved in the athlete's care, including the physician, neuropsychologist, nurse practitioner, and other members of the care team, and should take place over a series of visits lasting weeks to months.

For most athletes, retiring from contact or collision sports has a major impact on their lives. For elite high school and college athletes trying to make it to the pros, it means giving up their dream.

Even for athletes at the high school level and younger, much social activity, self-identity, and enjoyment comes from sports participation, which, studies show, have many benefits for both boys and girls. The importance of such participation is often underestimated by clinicians, parents, teachers and other adults.

Often, when an athlete stops playing contact and collision sports, they lose the friends they spend time with before practice, in the locker room before practice and games, stretching, warming up, before practice, on bus rides to and from away games, and showering and changing after practices and games. Not being around during these times means they miss out on conversations, jokes, the latest gossip, and the discussions that make people friends. This can be quite devastating to the athlete.

Some parents and athletes may try desperately to convince themselves and the doctors that another concussion won't happen, that they will defy the odds. And, believe it or not, in some extreme cases, some young athletes become so angry and emotional (partly due to the brain changes from their concussions which can result in irritability and depression) that they threaten to hurt themselves if their school won't allow them back on the field. It is hard to believe sometimes that sports can have such a strong hold on the lives of our children as well as on our own lives.

For some parents and athletes, a recommendation to retire from contact or collision sports comes as a relief, because the journey of multiple concussions, long-lasting symptoms, and the effect on overall quality of life has led them to appreciate that the brain is too precious to jeopardize any further.

For others, the decision to change sports is extremely agonizing. For them, their sport has defined who they are as athletes, as parents, and as a family. Leaving the sport means no longer being part of a social network and a group of their peers (for both parents and kids), and leaving behind the travel, the games, the tournaments, and joy of team success, and eliminating a way of expressing a specific athletic talent that has been groomed and nurtured for years, often since early childhood. Unfortunately, for a few, it may mean removing the only activity in which the child fields confident and self-assured.

For those young athletes who do not seek to play professional sports, or who do not have a realistic chance of doing so, most will assume less risk, and will retire from high-risk sports after fewer concussions than prompt an athlete who earns their living by playing professional sports to retire.

Ultimately, athletes make the decisions themselves, and only in very rare cases will a doctor refuse to allow an athlete to return against his or her wishes, and, even then, they are encouraged to seek a second opinion.

Athletes who fare best when forced to retire from a contact or collision sport are those who also enjoy other low-risk sports, are talented in other endeavors in their lives, have clear academic goals, fear the risk of further injuring their brains, have high self-esteem, and have parents who are easily able to make the responsible choice and support the retirement decision.

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