

Hard Hits: Sports-Related Concussions, the Role of Certified
Athletic Trainers, and Current Concussion Policy

An Honors Thesis (HONRS 499)

by

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A handwritten signature in black ink that reads "Casey Galloy". The signature is written in a cursive style with a large, stylized initial "C" and "G".

Ball State University
Muncie, Indiana

April 2010

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Abstract

Recently, there has been media attention on the occurrence and severity of concussions in sports and the long-term effects that they have. A concussion is a traumatic brain injury that can be suffered after sustaining a direct blow. This injury can lead to serious complications, including second impact syndrome. The presence of an athletic trainer to assess and manage these types of injuries is imperative at every level of competition. The National Athletic Trainers' Association has released a position statement on the management of sport-related concussions. It is of the utmost importance that athletic trainers and other health care professionals are able to recognize the signs and symptoms of this injury and be able to manage it. It is also important to have a concussion policy in place.

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Concussions have been a hot button topic in the news and media as of late. Concussions are most likely to occur in contact sports, such as football, hockey, and soccer, but there is a potential for sustaining a concussion in every sport. To the general public, concussions are referred to as “dings” or when someone has had their “bell rung”. These terms tend to diminish the seriousness of a concussion. To healthcare professionals, concussions are serious traumatic brain injuries that could possibly have serious consequences. A certified athletic trainer is often the first responder when an athlete suffers a concussion in an athletic event. Athletic trainers are certified healthcare professionals that specialize in the prevention, diagnosis, management, and rehabilitation of athletic injuries and are well qualified to manage a concussion.

A concussion is a traumatic brain injury that is a result of a direct blow. It could also be the result of a blow to the body that causes a whiplash effect, which means that the head snaps forwards and backwards.¹ There are two mechanisms of injury for a concussion, coup injury and contrecoup injury. A coup injury occurs when the head is immobile and sustains a forceful blow resulting in injury under the point of contact.² A contrecoup injury occurs when a moving head comes in contact with an unyielding object resulting in an injury opposite the site of impact as a result of the brain shifting in the cranium.² Most occurrences of concussions are a combination of a coup and contrecoup injury.²

When it is suspected that an athlete has sustained a concussion, a certified athletic trainer should complete a thorough evaluation of the athlete. In 2004, the National Athletic Trainers’ Association (NATA), the governing body of certified athletic trainers, issued a position statement on the management of sport-related concussion, outlining what should be done by an athletic trainer if an athlete should suffer a concussion. These aspects include a history, observation and inspection of the athlete, palpation, testing for anterograde and retrograde

amnesia, testing cognitive function, neurological testing, functional testing, and neuropsychological testing.² A history will give the athletic trainer an understanding of what the athlete remembers, let an athletic trainer know if the athlete has previously suffered a concussion, and determine the mechanism of injury. There is evidence that the effects of concussions are cumulative which means that repeated concussions can lead to irreversible damage.⁴ During observation and inspection, general demeanor of the athlete should be noted, among many other things like facial symmetry. The Glasgow Coma Scale, which is used to determine the level of consciousness, can be used during this part of the evaluation.¹ Palpation of the skull should be performed to ensure that there are no fractures or deformities. Retrograde and anterograde amnesia are tell-tale signs of a concussion, but do not necessarily have to be present for an athlete to be concussed. Retrograde amnesia is when the athlete cannot remember the events before suffering a concussion.¹ To test the athlete, the athletic trainer could ask questions to see if the athlete remembers his or her name, to see if the athlete remembers what play was being run, and who his or her opponent is. Anterograde amnesia is when the athlete cannot remember the events after suffering a concussion.¹ Some questions that can be asked to test the athlete are how they got to the athletic training room from the floor or field, who was the first person to help you, and three word recall.

Cognitive function testing is done to assess the performance of the brain, including the level of consciousness, intellectual performance, emotional status, and sensory interpretation.¹ Loss of consciousness can occur after an athlete has sustained a concussion, but loss of consciousness is not always present and indicative of a concussion.³ To test cognitive function, there are a couple of tests that can be done. The athletic trainer can have the athlete recite the months of the year backwards from December and counting backwards from 100 by 2. For

neurological testing, the seven cranial nerves should always be tested. Included in this is testing eye function and balance. When an athlete suffers a concussion, it is important to make sure that the athlete's pupils are equal and reactive to light. It is also important to note any nystagmus, which is the involuntary jerking of the eye, when testing eye movement. If nystagmus is present, it could indicate a lesion in the posterior aspect of the brain.¹ The athlete's sensation, motor function, and reflexes should all be tested during a neurological exam. Functional testing can include Romberg test, heel-toe walking, the finger-to-nose test, and the Balance Error Scoring System (BESS) test. Lastly, neuropsychological testing should be performed.

Neuropsychological testing assesses the athlete's orientation, immediate memory recall, delayed recall, and concentration.¹ These tests, such as the Standardized Assessment of Concussion (SAC), should be done to test any neuropsychological deficits that the athlete might have after the injury. There is even some computerized neuropsychological testing that is now being used on athletes. The most well known is called Immediate Postconcussion Assessment and Cognitive Testing (ImPACT). The advantage of having a computerized test is that it is less time consuming and more efficient.

After completing this evaluation, an athletic trainer should determine if the athlete can return to play. Return-to-play guidelines are extremely important. An athlete can return to play 7 to 10 days after the injury but only if they are completely symptom free.¹ If a player is returned to play too soon before full recovery from the initial injury it can result in serious complications, which is why it is better for the athletic trainer to err on the side of caution when deciding to return an athlete to play. Second impact syndrome is a very serious condition that can occur when an athlete is returned to play before full recovery and sustains another concussion. Second impact syndrome is most likely to occur in athletes 20-years-old or younger.² It is characterized

by rapid swelling of the brain and can result in permanent brain damage or even death.⁴ This makes it essential for an athletic trainer to recognize the signs and symptoms of a concussion.

After completing the evaluation and determining that the athlete is concussed, an athletic trainer should classify the severity of the injury and determine whether a referral to a physician is necessary. There are scales and checklists that an athletic trainer can refer to help in this determination. There are scales that athletic trainers and other healthcare professionals use to determine the severity of concussions. Most of them use a three level grading system. The problem with these scales is that none of them have been universally accepted, so there is no standardization in one particular scale being used by everyone. The Cantu Evidence-Based Grading System for Concussion and the American Academy of Neurology Concussion Grading Scale are two examples of such tests.² Another problem with these tests is that they are largely based on the loss of consciousness to determine the severity of a concussion. As previously stated, loss of consciousness is not always present in a concussed athlete. The grading of a concussion, mild, moderate, or severe, should be determined by the severity of the symptoms.² In terms of when to refer a concussed athlete to a physician, there several criteria that indicate whether an athlete should be referred the day of the injury or if there should be a delayed referral (Appendix A).

There will come a point where the athlete has to leave the care of the athletic trainer. At this point, it is essential for the athletic trainer to educate the concussed athlete and the individual who will be taking care of them. It is important for any institution to have a checklist in place on home care of a concussed athlete to share with the individual who is assuming care of the athlete (see attached checklist). Education is of the utmost importance, not only education regarding homecare, but education of coaches, parents, and athletes on the recognition of concussions. In a

bill that went into effect in 2007, Texas requires high school coaches to learn how to recognize and manage catastrophic injuries, including concussions, second impact syndrome, and returning a player to activity too soon.⁴ Education of athletes and parents can be achieved by the athletic trainer giving a presentation at the beginning of the season for each sport and sending them home with materials on the subject.

Weeks or even months after an athlete has suffered a concussion, an athletic trainer should be aware of any ongoing symptoms and a condition called postconcussion syndrome. This is a condition where concussion symptoms persist over an extended period of time. The World Health Organization (WHO) defines postconcussion syndrome as “a syndrome that occurs following head trauma and includes three or more of the following eight symptoms: headache, dizziness, fatigue, irritability, difficulty in concentrating and performing mental tasks, impairment of memory, insomnia, and reduced tolerance to stress, emotional excitement, or alcohol”.⁵ In 2007, the limit of the occurrence of three symptoms was changed to any number of symptoms.⁵ An athletic trainer should be aware of all the symptoms of postconcussion syndrome (Appendix B). Postconcussion syndrome should be closely monitored and can be managed by adjusting the athlete’s activity level. The athlete should not be returned to play until he or she is symptom free.

There are certain populations that are at-risk for concussions. Young athletes are perhaps the most at-risk population for concussions. Studies have shown that young athletes recover more slowly than older athletes who suffer a concussion.⁴ Although young athletes are at a greater risk for concussions and second impact syndrome, only 42% of high schools have an athletic trainer.⁴ The age of the athletes does not predispose them to sustaining concussions, but it does affect how a young athlete recovers from an injury. Studies have shown that young

athletes recover more slowly than older athletes who suffer a concussion.⁶ Every year an estimated 300,000 sport-related concussions occur in the United States, 64,000 of which were suffered by high school football players.⁴ Once an athlete has suffered a concussion, they are 4 to 6 times more likely to sustain another concussion.⁴ As previously stated, it is the young population that is most at risk for suffering from second impact syndrome. This could be due to the longer recovery period, lack of presence of a certified athletic trainer, and the lack of knowledge of the signs and symptoms by coaches.

The population getting the most media attention right now is football players. The National Football League (NFL) has made headline recently because of a change to their concussion policy. There have been several cases of NFL players who have had to cut their career short due to the occurrence of too many concussions. Merrill Hoge and Steve Young are just two of the many players who have had to do this. Just this past season, Jamal Lewis retired after suffering another concussion. The NATA has even outlined guidelines to disqualify an athlete for their career after suffering too many concussions in its 2004 publication of its position statement on sport-related concussions. Before undergoing recent changes, the NFL's concussion policy only outlined that a player could not return to a game only if he had lost consciousness.⁷ The policy change specifies that a player who sustains a concussion should not return to play on the same day and must be evaluated by an independent neurologist.⁷

The long term effects that concussions have on the brain are important to understand and recognize. Research has found that 20.2% of football players who have suffered three or more concussions were later diagnosed with depression.⁸ Some experts believe that the occurrence of depression after suffering a concussion is much higher because of failure to report the injuries.⁸ There is also a link between the occurrence of concussions and the occurrence of suicide. Two

notable cases of football players who suffered from depression that has been linked to their concussion history who eventually took their own lives are Terry Long, formerly of the Pittsburgh Steelers, and Andre Waters, formerly of the Philadelphia Eagles. Long term effects like this spur policy change, not only in the NFL but in other leagues.

In 2007, Major League Soccer (MLS) joined in a partnership with ImPACT for their Concussion Management Program to promote testing, education, and awareness.⁹ In December 2009, the National Collegiate Athletic Association (NCAA) proposed a change in the concussion policy. The new policy would require “any athlete exhibiting an injury that involves significant symptoms, long duration of symptoms or difficulty with memory functions should not be allowed to return to play during the same day of competition”.¹⁰ In January 2010, the rules panel supported the policy change.¹¹

Another population getting a lot of attention is high school students because of their increased risks. There have been laws put in place to regulate the management of concussions in football and other sports on the high school level. These are mostly on a state-to-state basis. As previously stated, “Will’s Bill” went into effect in Texas in 2007.⁴ Most recently, the New Jersey State Interscholastic Athletic Association will likely approve new regulations that have been proposed in April 2010. The proposed regulation is that an athlete must undergo “a battery of tests” and be cleared by a physician before returning to play.¹² The regulations also call for education of parents, student-athletes, and coaches on concussions.¹² Virginia has also recently changed their policy on handling concussions in high school athletes. Like in New Jersey, an athlete must be cleared by a physician to return to play and education is being made mandatory.¹³ Washington, Oregon, and Maine have recently implemented new policies regarding concussions as well.

Concussions are very serious injuries and should be treated as such. As the understanding of concussions and its effects evolves, so should current policy. The recent awareness on the issue, especially in the NFL, is a great catalyst for more rule changes at every level and in every sport. The severity of this injury and all the variables that go into diagnosis and managing the condition shows how important it is for a certified athletic trainer to be present at sporting events, whether practice or games, to manage these injuries.

Appendix A. Physician Referral Checklist¹

Day of Injury Referral

1. Loss of consciousness on the field
2. Amnesia lasting longer than 15 minutes
3. Deterioration of neurological function*
4. Decreasing level of consciousness*
5. Decrease or irregularity in respirations*
6. Decrease or irregularity in pulse*
7. Increase in blood pressure
8. Unequal, dilated, or unreactive pupils*
9. Cranial nerve deficits
10. Any signs or symptoms of associated injuries, spine or skull fracture, or bleeding*
11. Mental status changes: lethargy, difficulty maintaining arousal, confusion, or agitation*
12. Seizure activity*
13. Vomiting
14. Motor deficits subsequent to initial on-field assessment
15. Sensory deficits subsequent to initial on-field assessment
16. Balance deficits subsequent to initial on-field assessment
17. Cranial nerve deficits subsequent to initial on-field assessment
18. Postconcussion symptoms that worsen
19. Additional postconcussion symptoms as compared with those on the field
20. Athlete is still symptomatic at the end of the game (especially at high school level)

Delayed Referral

1. Any finding in the day-of-injury referral category
 2. Postconcussion symptoms worsen or do not improve over time
 3. Increase in the number of postconcussion symptoms reported
 4. Postconcussion symptoms begin to interfere with the athlete's daily activities (i.e., sleep disturbances or cognitive difficulties)
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*Requires that the athlete be transported immediately to the nearest emergency department.

Appendix B. Post-Concussive Symptoms¹⁴

Somatic	Cognitive	Affective
Headache	Impaired attention	Anxiety
Sleep disturbances	Difficulty concentrating	Depression
Dizziness/vertigo	Memory problems	Emotional disturbances
Nausea		
Fatigue		
Photophobia/phonophobia		



Ball State University

Athletic Training

BALL STATE UNIVERSITY INTERCOLLEGIATE ATHLETICS HEAD INJURY FORM

Head injuries are common in athletics with most individuals recovering fully in a brief amount of time. It is not uncommon to have a headache after a head injury. Also, it is not uncommon to not have any symptoms from a head injury immediately afterwards, but they can appear several hours later. If any of the following symptoms are experienced following a head injury, medical help should be sought:

1. Headache that persists or increases in intensity.
2. Nausea, vomiting, dizziness, unsteadiness.
3. Visual disturbances such as difficulty focusing or blurry vision.
4. Abnormal drowsiness or sleepiness-wake the athlete every one or two hours to check state of consciousness and sense of orientation.(ask name, address, etc.)
5. Convulsions
6. Bleeding or clear fluid from the ears or nose.
7. Weakness of facial muscles, arms, or legs.
8. Loss of appetite.
9. Loss of emotional control or irrational behavior.
10. Persistent ringing of the ears.
11. Amnesia/memory loss.
12. Pupil irregularity.
13. Loss of coordination/balance problems.
14. Slurred speech/unable to talk.

The appearance of any of the above symptoms indicates a significant head injury that requires medical attention. Do not give any medication to the individual.

BALL STATE MEDICAL STAFF

Neal Hazen: (H) 765- [REDACTED]

(C) 765- [REDACTED]

Shawn Comer: (H) 765- [REDACTED]

(C) 765- [REDACTED]

Casey Chambers: (C) 765- [REDACTED]

Ball State Health Center: 285- [REDACTED]

Ball Memorial Hospital: 747- [REDACTED]

Ball State Campus Police: 285- [REDACTED]

Football Athletic Training Room: 285- [REDACTED]

Worthen Arena Training Room: [REDACTED]

Ball Gym Training Room: 285- [REDACTED]

Irving Gym Training Room: 285- [REDACTED]

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