

ANNUAL SURVEY OF CATASTROPHIC FOOTBALL INJURIES

1977 - 2009

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CATASTROPHIC FOOTBALL INJURIES

INTRODUCTION

In 1977 the National Collegiate Athletic Association initiated funding for the First Annual Survey of Catastrophic Football Injuries. Frederick O. Mueller, Ph.D., and Carl S. Blyth, Ph.D., both professors in the Department of Exercise and Sport Science at the University of North Carolina at Chapel Hill were selected to conduct the research. The research is now being conducted as part of the National Center for Catastrophic Sports Injury Research, University of North Carolina at Chapel Hill, Frederick O. Mueller, Director and Robert C. Cantu, Medical Director.

The Annual Survey of Catastrophic Football Injuries was part of a concerted effort put forth by many individuals and research organizations to reduce the steady increase of football head and neck injuries taking place during the 1960's and 1970's. The primary purpose of the research was and is to make the game of football a safer sport.

DATA COLLECTION

Since 1977 and the initiation of this research, catastrophic injuries were defined as football injuries which resulted in brain or spinal cord injury or skull or spine fracture. It should be noted that all cases involved some disability at the time of the injury. Neurological recovery is either complete or incomplete (quadriplegia or paraplegia). Yearly follow-up is not done, thus neurological status (complete or incomplete recovery) refers to when the athlete is entered into the registry which is usually two to three months after injury. Injuries, which result in death, are not included in this report.

Data were compiled with the assistance of high school and college coaches, athletic directors, school administrators, physicians, athletic trainers, executive officers of state and national athletic organizations, sporting goods dealers and manufacturers' representatives, on-line search engines, and professional associates of the researchers. Data collection would have been impossible without the help of the National Federation of State High School Associations, the National Collegiate Athletic Association, and the American Football Coaches Association. The research was funded by a grant provided by the National Collegiate Athletic Association.

Upon receiving information concerning a possible catastrophic football injury, contact by telephone, personal letter, and questionnaire is made with the injured player's coach, physician and athletic director. The questionnaire provides background data on the athlete (age, height, weight, experience, previous injury, etc.), accident information, immediate and post-accident treatment, and equipment data.

In 1987, a joint endeavor was initiated with the Sports Medicine section of the American Association of Neurological Surgeons. The purpose of this collaboration was to enhance the collection of medical data. Dr. Robert C. Cantu, Chairman, Department of Surgery and Chief, Neurosurgery Service, Emerson Hospital, in Concord, MA, and the Medical Director of the National Center for Catastrophic Sports Injury Research has been responsible for collecting the medical data.

BACKGROUND

An early investigation into serious head and neck football injuries was conducted by Schneider.(1) He reported 30 permanent cervical spinal cord injuries in high school and college football during the period from 1959 - 1963. A later study by Torg indicated a total of 99 permanent cervical spinal cord injuries in high school and college football from 1971 - 1975. (3) Torg has discontinued his research, but his data show a decline in permanent cervical cord injuries in high school and college from 34 cases in 1976 to 5 cases in 1984. A study published in 1976 reported the incidence of neck injuries based on roentgenographic evidence was as high as 32% in a sample of 104 high school students and 75 college freshmen in Iowa. (2)

In order to help alleviate this problem the National Collegiate Athletic Association and the National Federation of State High School Associations implemented rule changes in 1976 to prohibit using the head as the initial contact point when blocking and tackling. Furthermore, the American Football Coaches Association Ethics Committee went on record opposing this type of blocking and tackling. The National Federation of State High School Associations 2006 Football Rule Book states that butt blocking, face tackling and spearing are illegal. Butt blocking is defined as a technique involving a blow driven directly into an opponent with the face mask, frontal area or top of the helmet as the primary point of contact either in close line play or in the open field. Face tackling is defined as driving the face mask, frontal area or top of the helmet directly into the runner. Spearing, as

opposed to butt blocking and face tackling, is defined as the use of the helmet in an attempt to punish an opponent. All three of these illegal techniques can cause catastrophic head and neck injuries to the athlete. Coaches should not teach these techniques and referees should do a better job of calling these penalties in a game. The rules have also eliminated the word intentional from the spearing rule.

Emphasis on complete physical examinations and improved physical conditioning programs has also been recommended to mitigate the injury issue.

SUMMARY

1. During the 2009 football season there were a total of nine cervical cord injuries with incomplete neurological recovery. Seven of the injuries occurred at the high school level, one at the college level, none at the sandlot level, and one at the professional level. The 2009 number is five fewer than the 14 in 2008 and equal to the nine in 2007. (Table I)

2. The incidence of catastrophic injuries is very low on a 100,000-player exposure basis. For the approximately 1,800,000 participants in 2009 the rate of injuries with incomplete neurological recovery was 0.50 per 100,000 participants.

3. The rate of injuries with incomplete neurological recovery in high school and junior high school football was 0.46 per 100,000 players and the rate at the college level was 1.33. (Table II)

4. A majority of catastrophic spinal cord injuries usually occur in games. During the 2009 season five injuries took place in games, two in practice, and two in a scrimmage games.

5. Tackling and blocking have been associated with the majority of catastrophic football injuries. In 2009, six injuries were caused by tackling, two tackling on a kick-off, and one head-to-head collision. As shown in Table IV tackling has been associated with 67.8% of the catastrophic injuries since 1977.

6. As indicated in Table III a majority of the catastrophic injuries occur while playing defensive football. In 2009 eight players were on defense, none on offense, and one was unknown.

7. During the 2009 football season there were also nine brain injuries which resulted in incomplete recovery. All nine were at the high school level. (Table VI).

8. In 2009 there were also 24 injuries that involved either a head or neck injury, but the athlete had full neurological recovery. High school athletes were associated with nine cervical vertebrae fractures, two brain injuries, and two spinal cord transient injuries. College athletes were associated with two cervical vertebrae fractures, one spinal concussion, one thoracic spine fracture, one lumbar spine fracture, one spinal stenosis injury, and one sickle cell trait. Professional players were involved with one cervical vertebra fracture. It should be emphasized that the researchers are not confident concerning the number of injuries with full recovery, but data collection in 2007, 2008, and 2009 produced the highest number of catastrophic recovery injuries since the study was initiated in 1977. (Table VII).

DISCUSSION

For the past 33 years there have been a total of 307 football players with incomplete neurological recovery from cervical cord injuries. Two hundred and fifty-three of these injuries have been to high school players, thirty-four to college players, six to sandlot players and fourteen to professionals. This data indicate a reduction in the number of cervical cord injuries with incomplete neurological recovery when compared to data published in the early 1970's. The 2005 data showed a major reduction to five from the 13 injuries in 2004, but the 2008 data show a major increase to 14. If future reports continue to show these high numbers steps will have to be taken for reducing these injuries. Any injury that causes permanent disability is a major concern and future reports must be monitored closely.

The thirteen cervical cord injuries with incomplete recovery in 2004 was a dramatic increase from the years of single digits - 1991-1998. An update in 1999 increased that number to 10. The 2005 data showed a return to single digits, but the 2006 and 2008 put the **numbers back to double digits. Four of the last seven** years show double digits. Since 1984 there have also been 133 brain injuries with incomplete recovery. These numbers also are a concern, and if the cervical cord injuries and the cerebral injuries with incomplete recovery are combined, the number of incomplete recovery injuries is 440. That is an average of approximately 13.3 injuries with incomplete recovery for the past

33 years. Coaches, players, athletic trainers, physicians and administrators must continue the emphasis on eliminating permanent spinal cord and brain disability injuries to football players at all levels of play.

The latest participation figures show 1,500,000 players participating in junior and senior high school football and 75,000 in college football. Table II illustrates the incidence of spinal cord injuries for both high school and college participants. The incidence rate per 100,000 participants in 2009 is less than one per 100,000 at the high school level (0.46) and 1.33 at the college level. In looking at the incidence rates for the past 33 years, the high school incidence is 0.53 per 100,000 participants and the college incidence is 1.37 per 100,000 participants.

As indicated in past reports a majority of the permanent cervical cord injuries are taking place in games. In 2009 five of the nine injuries took place in games, two in practice, and two in scrimmage games.

Table III indicates that when comparing cervical cord injuries to offensive and defensive players, it is safer playing offensive football. During the 33 year period from 1977-2009, 216 (70.4%) of the 307 players with cervical cord injuries were playing defense. A majority of the defensive players were tackling when injured. In 2009, eight of the nine injured players were tackling. Coaches have indicated that their players have been taught to tackle with the head up, but for some reason many of the players are lowering their heads before making contact. Sixty-two or 20.0% of the injured players were tackling with the head in a down position (chin to chest and contact with the top or crown of the helmet). These are the only players we are sure had their heads down, but it is possible that there were others tackling with the head down. In addition to tackling with the head down, ball carriers are being injured with their heads in a down position while being tackled. It is important for coaches to emphasize head up tackling, but it is also important to emphasize head up blocking and head up ball carrying when being tackled. Many coaches teach their ball carriers to lower the head before being tackled and to run over the tackler, but this activity can be dangerous and can cause cervical spine and brain injuries with incomplete recovery. Nine-point-eight percent of the cervical cord catastrophic injuries happened when being tackled.

Past reports (Table V) have revealed that defensive backs were injured at a higher rate than other positions. In 2009 five of the

injured players were defensive backs, two were on kick-off coverage, one was a running back, and one was a linebacker.

In 2009 there were nine brain injuries with incomplete neurological recovery. All nine of the injuries were at the high school level. In addition to the injuries with incomplete recovery, there were 24 injuries with complete recovery. As shown in Table VII, high school football accounted for 16, college football seven, and professional football one. As stated earlier the researchers do not have full confidence in the full recovery data, but the data in 2007, 2008, and 2009 are the highest number of catastrophic injuries with recovery since the study was initiated in 1977. It has always been our belief that there are a higher number of recovery injuries that we are not receiving information on, but the data from the last three years show that we are making progress.

RECOMMENDATIONS

As stated in earlier reports, there has been a reduction of permanent cervical cord injuries when compared to data from the early 1970's. The 1991 and 1994 data show a dramatic reduction to one permanent cervical cord injury in high school football (two total each year for all levels). That was a great accomplishment and every effort should be made to continue that trend. The problem is the double digit numbers in four of the last seven years with 13 in 2004 and 14 in 2008. These numbers are not acceptable and an all out effort must be made to reduce them. For the past ten years, 2000-2009, there has been an average of 9.5 cervical cord injuries with incomplete neurological recovery, and 6.2 cerebral injuries with incomplete recovery in football. The prior ten years averaged 7.4 cervical cord injuries with incomplete recovery and 4.5 cerebral injuries with incomplete recovery. This is a disturbing increase of 2.1 cervical injuries, and 1.4 cerebral injuries. The ten cerebral injuries in 2008 and nine in 2006 and 2009 were the highest numbers since we started to collect that data in 1984.

The initial reduction of permanent disability injuries was the result of efforts put forth by the total athletic community concerned with safety to football participants. **Major areas of emphasis that once again should receive attention are the 1976 rule change that eliminated the head as the initial point of contact during blocking and tackling, improved medical care both at the game site and in medical facilities, improved coaching**

techniques in teaching the fundamentals of tackling and blocking, and the increased concern and awareness of football coaches. The original 1976 rule defined spearing as "the intentional use of the helmet (including the face mask) in an attempt to punish an opponent". In the new 2005 definition of spearing the word "intentional" was removed from the rule in order to make it easier for the referees to call. There continues to be a number of disability injuries caused by helmet-to-helmet contact. During the 2009 football season there continued to be a number of helmet-to-helmet contacts that were related to disability injuries.

A concerted effort must be made to continue the reduction of cervical spine and cerebral injuries and to aim for the elimination of these injuries. Following are several suggestions for reducing these catastrophic injuries:

1. Brain and spinal injuries in football have been dramatically reduced since the rules were changed in 1976 to prohibit butt blocking and face tackling, and other techniques in which the helmet and facemask purposely received the brunt of the initial impact. There are still a number of football players that become paralyzed due to cervical cord injury. Because head contact largely caused these injuries it is important to remember the lesson to keep the head and face out of blocking and tackling. Coaches should drill the players in the proper execution of the fundamentals of football - particularly blocking and tackling. **SHOULDER BLOCK AND TACKLE WITH THE HEAD UP - KEEP THE HEAD OUT OF FOOTBALL.**

2. **Preseason physical exams for all participants. Identify during the physical exam those athletes with a history of previous brain or spinal injuries - including concussions. If the physician has any questions about the athlete's readiness to participate, the athlete should not be allowed to play.**

3. Athletes must be given proper conditioning exercises that will strengthen their necks in order to be able to hold their heads firmly erect while making contact during a tackle or block. Strengthening of the neck muscles may also protect the neck from injury.

4. Coaches and officials should discourage the players from using their heads as battering rams when blocking, tackling, and ball carrying. The rules prohibiting spearing should be enforced in practice and games. The players should be taught to respect the

helmet as a protective device and that the helmet should not be used as a weapon. **Ball carriers should also be taught not to lower their heads when making contact with the tackler.**

5. **Football officials can play a major role in reducing catastrophic football injuries.** The use of the helmet-face mask in making initial contact while blocking and tackling is illegal and should be called for a penalty. **Officials should concentrate on helmet-face mask contact (helmet-to-helmet contact) and call the penalty. If more of these penalties are called there is no doubt that both players and coaches will get the message and discontinue this type of play.** A reduction in helmet-face mask contact will result in a reduction of catastrophic football injuries.

6. All coaches, physicians and athletic trainers should take special care to see that the players' equipment is properly fitted, particularly the helmet.

7. It is important, whenever possible, for a physician to be on the field of play during game and practice. When this is not possible, arrangements must be made in advance to obtain a physician's immediate services when emergencies arise. Each institution should have a team certified athletic trainer who is a regular member of the institution's staff and who is qualified in the emergency care of both treating and preventing injuries.

8. Coaches must be prepared for a possible catastrophic head or neck injury. The entire staff must know what to do. Being prepared and knowing what to do may be the difference that prevents permanent disability. Have a written emergency plan and give copies to all personnel. Areas that should be covered are, 1) an evacuation plan, 2) available transportation, 3) portable and open communication, and 4) game/practice schedule awareness in local hospital emergency department.

9. When a player has experienced or shown signs of head trauma (loss of consciousness, visual disturbances, headache, inability to walk correctly, obvious disorientation, memory loss), he should receive immediate medical attention and should not be allowed to return to practice or game without permission from a medical physician or other qualified health professional. During the 2009 football season there was the possibility of second impact syndrome injuries.

10. Coaches should encourage players to let them know if they have any of the above mentioned symptoms (that can't be seen by others, such as headaches) and why it is important.

11. Both past and present data show that the football helmet does not cause cervical spine injuries, but that poorly executed tackling and blocking technique is the major problem.

Following is a list of post concussion signs/symptoms:

Depression	Numbness/Tingling	Dizziness	Poor Balance
Drowsiness	Poor Concentration	Excess Sleep	Fatigue
Sadness	Sensitive to Light	Headache	Irritability
Memory Problems		Vomiting	Nausea
Nervousness	Ringling in Ears		
Feel "in fog"	Trouble Falling to sleep		

12. The National Federation of State High Schools released the following statement on February 23, 2010: effective with the 2010 high school football season, any player who shows signs, symptoms or behaviors associated with a concussion must be removed from the game and shall not return to play until cleared by an appropriate health-care professional. The new concussion language is being placed in all NFHS rules books for the 2010-2011 season as well as the "NFHS Suggested Guidelines for Management of Concussion".

13 The National Collegiate Athletic Association revised its 16 year-old guideline on treatment of concussion in the NCAA Sports Medicine Handbook to better advise member institutions on responses to concussion injuries and procedures for returning athletes to competition or practice - "it is essential that no athlete be allowed to return to participation when any symptoms persist, either at rest or exertion". It details circumstances in which an athlete should be withheld from competition pending clearance by a physician.

Football catastrophic injuries may never be totally eliminated, but continued research has resulted in rule changes, equipment standards, improved medical care both on and off the playing field, and changes in teaching the fundamental techniques of the game. These changes were the result of a united effort by coaches, administrators, researchers, equipment manufacturers, physicians, athletic trainers and players. The new concussion

recommendations by the NFHS and the NCAA should play a major role in reducing brain injuries that often result in death or disability. They will also play a role in the reduction of second impact syndrome.

Research based on reliable data is essential if progress is to be made. Research provides data that indicate the problems and reveal the adequacy of preventive measures. It is important to point out that the information in this report is only as good as the data collected. The report only includes data on cases that are reported to us by the NFHS, the NCAA, coaches, athletic directors, and national newspaper and television news. . It is our feeling that we receive information on a majority of the cases, but that it is not possible to state we have information on 100% of the cases.

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CATASTROPHIC INJURY CASE STUDIES

HIGH SCHOOL

A high school junior football player was injured on October 23, 2009, while making a tackle. He was a defensive back and injured his cervical vertebra. The player had surgery and the outcome was incomplete recovery.

A 16 year-old high school football player was injured in a JV scrimmage on May 6, 2009. He was a defensive back making a tackle with his head in the up position. He had a seven hour surgery fusing CV 5-6. The outcome was incomplete recovery.

A high school football player was injured in a game on September 4, 2009, while tackling from his cornerback position. He fractured CV-5, had surgery and recovery was incomplete.

An 18 year-old high school football player fractured CV-4 during a scrimmage game on September 30, 2009. His head hit into the runner while he was being blocked. He had surgery and recovery was incomplete due to fine motor skill problems.

A high school football player was injured in a head-on collision during practice on August 31, 2009. He was an offensive lineman. Recovery was incomplete.

A high school football player fractured cervical vertebra 3 while making a tackle on kick-off coverage during a game on October 30, 2009. He had two surgeries and was in critical condition for a period of time. Recovery was incomplete.

A 14 year-old high school football player was injured after being hit by the blocker in the neck while attempting to make a tackle during a game on October 1, 2009. He was a safety and was five feet tall and weighed 135 pounds. Recovery is incomplete.

A senior high school football player was injured in a game on October 16, 2009. He was a defensive lineman and had brain surgery. Recovery was incomplete.

A sophomore football player suffered a subdural hematoma during a game on October 31, 2009. He was a running back and linebacker and complained of a headache during the 4th quarter. He had brain surgery and recovery was incomplete.

A 17 year-old high school football player was injured during a JV game on August 24, 2009. He was a linebacker who came off of the field in a daze. He had brain surgery to relieve the pressure on the brain and was in a coma for several days. Recovery was incomplete.

A 16 year-old high school football player received a brain injury during a practice session. He had a subdural hematoma (no surgery) and for seven days was in and out of consciousness. He was blocking at the time and was hit in the head by the knee of the opponent. Recovery was incomplete.

A high school football player passed out after a game on August 22, 2009. He suffered a stroke and paralysis due to a blood clot on the brain caused by trauma. Recovery was incomplete.

A high school quarterback was injured in a game while being tackled on the first play of overtime. He was knocked unconscious and was in the hospital for three months. He had surgery to relieve the pressure on the brain. Recovery was incomplete.

A high school football player suffered a brain injury during a game on October 16, 2009. He was a defensive back and wide receiver. He had surgery for a brain bleed and recovery was incomplete.

A high school senior suffered a brain injury during a game on October 9, 2009. He complained of a headache after making a tackle. He had surgery and was in a drug induced coma. Recovery was incomplete.

A 16 year-old high school football player received a brain injury during a game on November 26, 2009. He was a running back being tackled and hit the back of his head on the turf (field turf). He had a skull fracture and brain injury. Due to an earlier concussion the physician diagnosed the injury as second impact syndrome. Recovery is incomplete.

A high school football player received a brain injury during a practice scrimmage on August 13, 2009. He was a running back and was tackled with a helmet to helmet hit. He stayed out of the scrimmage for two plays, but put himself back into the scrimmage. The headache increased and he also vomited. He had emergency surgery to relieve pressure on the brain. He was recovering from the injury.

A 14 year-old middle school football player was injured during a game on September 12, 2009. He was being blocked during a kick-off return, walked off the field complaining of a headache, and later had surgery for a brain bleed. He has recovered after six weeks of recovery time.

A high school senior was injured in a game while making a tackle with his head down from his defensive back position. He was injured in the second quarter, but played the remainder of the game. He fractured CV 5 and was in a neck brace for eight weeks. He had a full recovery.

A high school football player was injured in a game on October 9, 2009. He was a running back and suffered a fractured cervical vertebra. He had surgery and was in a neck brace for a short period of time. Recovery was complete.

A high school football player suffered a fractured cervical vertebra and a concussion in a game on September 4, 2009. He was placed in a neck brace and missed the remainder of the season. Recovery was complete.

A high school football player fractured his second cervical vertebra in a game on September 25, 2009. He was a kick-off returner and was struck in the neck and head by an opponent. He missed the remainder of the season and was in a halo brace for three months. Recovery was complete.

A senior high school football player was injured while being tackled on a kick-off return. He had his head in a down position when tackled and fractured CV 1-2. He was in a halo brace for three months. Recovery was complete.

A high school football player was injured on the first play of a game scrimmage (played eight more plays) on August 21, 2009, and suffered a Jefferson fracture of CV-1. He was a running back and collided with the tackler head-to-head. He is wearing a halo brace, had a full recovery, but was advised to not play anymore football.

A high school football player was injured in a game on September 30, 2009. He was a linebacker and after a collision he suffered transient paralysis. He was taken to the hospital, was released, and recover was complete.

A high school football player had transient paralysis after being hit by a teammate helping to block a linebacker. The injured

player was a fullback in a scrimmage game on August 27, 2009. He was taken to the hospital and released 24 hours later. He had a complete recovery but was advised to not play anymore football.

A high school quarterback was injured in a game on October 16, 2009. He was hit by a second tackler and suffered a fractured cervical vertebra. He had surgery and wore a neck brace for a period of time. Recovery was complete.

A 15 year old high school football player was injured in a game on October 3, 2009. The injury happened on a kick-off with helmet-to-helmet contact. He fractured two cervical vertebrae, had a five hour surgery, and recovery was complete.

A 17 year-old high school football player fractured CV 3-4 in a game on September 19, 2009. He was a linebacker tackling at the time of the injury and walked off the field. He wore a neck brace for 12 weeks and recovery was complete.

A 15 year-old high school football player collapsed on the field during a football jamboree on August 14, 2009. His heart stopped, but he was revived with the use of an AED and was recovering in the hospital. Recovery was complete.

A 16 year-old high school football player collapsed during a summer condition session in June 2009. His heart stopped, but he was revived with the use of an AED. Recovery was complete.

A 14 year-old football player was struck by lightning on August 12, 2009 during a practice session. Apparently the sky was clear when the lightning struck. He was given CPR and the use of an AED. He was also placed in an induced coma at the hospital where he was in critical condition. After eight days in the hospital he was released and recovery was complete.

1979 UPDATE

A high school football player was injured in a game November 4, 1979 while making a head-on tackle. The player has been quadriplegic since the injury.

2001 UPDATE

A 14 year old high school football player was injured in a game on September 11, 2001 while making a tackle with his head in a down position. The player is quadriplegic.

2005 UPDATE

A 14 year old high school football player was injured in a practice on October 10, 2010. He suffered a serious brain injury and recovery was incomplete. The player received a hard hit to the head in the previous game and was told by a physician to not play for two weeks. The athlete went to practice and continued to play, but did not tell his parents. There was a three million dollar settlement with the school. The injury was diagnosed as second impact syndrome.

2006 UPDATE

A 17 year-old high school football player suffered a severe concussion after attempting a tackle in a practice session on October 5, 2006. This injury was his seventh concussion while playing football. He suffers from post traumatic concussion syndrome. After the first six concussions he was back on the field within a week. Recovery is incomplete.

2007 UPDATE

A high school football player was diagnosed with a spinal concussion after another player accidentally pulled on his face mask during practice in 2007. He could not walk for three months and wore a neck brace for five months. Recovery was complete and he played the next season.

2008 UPDATES

A 17 year-old high school football player was playing in a JV game on September 4, 2008. He was a defensive back tackling a receiver when another player collided with him from behind. He had a fractured 5th cervical vertebra. Recover is incomplete.

A high school football player had a serious brain injury in a game on 12/6/08 followed by three strokes. He also had a concussion earlier in the season. He was taken to the hospital unconscious, but breathing on his own. Recovery is incomplete.

SANDLOT

None

COLLEGE

A college football player was injured after a helmet to helmet tackle in a game on September 5, 2009. He was a defensive back tackling a running back. The injury was a spinal fracture and recovery was incomplete.

A college football player suffered a fractured thoracic vertebra in a game on September 5, 2009. He was running the ball on a kick-off return when he had helmet to helmet contact with the tackler. He did not need surgery, but would have to wear a full-torso back brace for three months. Recovery was complete.

A college football player suffered a couple of stingers during preseason camp and one was a helmet to helmet collision. After examination he was found to have congenital spinal stenosis. He recovered but was advised to not play anymore football.

In a game on October 3, 2009 a college football player fractured his 5th cervical vertebra after a head first hit with a teammate. He was a safety making a tackle when hit by his teammate. He had to wear a neck brace for three months and recovery was complete.

A college football player fractured lumbar cervical vertebra #5 in a practice in August 2009. Recovery was complete.

A college football player was injured on August 10, 2009. He was a sophomore linebacker and he had a spinal cord concussion that took place during warm-ups. Recovery was complete.

A college football player collapsed at practice in April 2009 and was in the hospital for a week. He had exertional sickling related to sickle cell trait. He has recovered.

A college football player suffered a crushed neck and larynx during a weight lifting session. It was not really a football related injury, but it was a football workout. He had emergency tracheotomy followed by constructive surgery. He was expected to have a full recovery. It was considered a non-football injury.

2008 UPDATE

A college football player was injured in a game on October 25, 2009. He fractured cervical vertebrae 4, 5, and 6. He was in a neck brace for three months and had a full recovery.

PROFESSIONAL

A semi-pro World Football League player was paralyzed in a game on June 6, 2009. At the time of the injury he was making a tackle on kick-off coverage. The injury was a fractured 6th cervical vertebra. He had surgery and recovery was incomplete.

An NFL football player was injured in a game on December 20, 2009. He fractured a cervical vertebra, had surgery and recovery was complete. He was a tight end and no other details were available.

1996 UPDATE

In a game an NFL football player suffered a spinal concussion. He had transient paralysis and recovery was complete.

TABLE I
CERVICAL CORD INJURIES 1977 - 2009*

YEAR	SANDLOT	PRO AND SEMI-PRO	HIGH SCHOOL	COLLEGE	TOTAL
1977	0	0	10	2	12
1978	0	1	13	0	14
1979	0	0	9	3	12
1980	0	0	11	2	13
1981	1	0	6	2	9
1982	1	1	7	2	11
1983	0	0	11	1	12
1984	1	0	6	0	7
1985	0	0	6	3	9
1986	0	0	4	0	4
1987	0	0	9	0	9
1988	0	0	10	1	11
1989	0	1	12	2	15
1990	0	0	11	2	13
1991	0	1	1	0	2
1992	0	1	6	0	7
1993	0	1	8	0	9
1994	0	0	1	1	2
1995	0	0	8	1	9
1996	0	0	6	3	9
1997	0	1	7	1	9
1998	0	0	4	0	4
1999	1	0	8	1	10
2000	0	0	6	2	8
2001	0	0	9	0	9
2002	0	0	6	1	7
2003	0	1	9	1	11
2004	1	1	11	0	13
2005	0	0	5	0	5
2006	0	0	8	2	10
2007	1	1	7	0	9
2008	0	3	11	0	14
2009	0	1	7	1	9
TOTAL	6	14	253	34	307

*Figures are updated annually due to new cases investigated after publication.

TABLE II
INCIDENCE PER 100,000 PARTICIPANTS 1977-2009*

YEAR	HIGH SCHOOL	COLLEGE
1977	0.77	2.67
1978	1.00	0.00
1979	0.69	4.00
1980	0.85	2.67
1981	0.46	2.67
1982	0.54	2.67
1983	0.85	1.33
1984	0.46	0.00
1985	0.46	4.00
1986	0.31	0.00
1987	0.69	0.00
1988	0.77	1.33
1989	0.80	2.66
1990	0.73	2.66
1991	0.07	0.00
1992	0.40	0.00
1993	0.53	0.00
1994	0.07	1.33
1995	0.53	1.33
1996	0.40	4.00
1997	0.47	1.33

TABLE II CONTINUED

1998	0.27	0.00
1999	0.53	1.33
2000	0.40	2.66
2001	0.60	0.00
2002	0.33	1.33
2003	0.60	1.33
2004	0.73	0.00
2005	0.33	0.00
2006	0.53	2.66
2007	0.40	0.00
2008	0.67	0.00
2009	0.46	1.33

*From 1977-1988 Based on 1,300,000 High School - Junior High School Players and 75,000 College Players. In 1989 High School and Junior High School Figure Increased to 1,500,000.

TABLE III

OFFENSIVE VS. DEFENSIVE FOOTBALL 1977 - 2009*

YEAR	OFFENSE	DEFENSE	UNKNOWN	TOTAL
1977	0	7	5	12
1978	2	11	1	14
1979	1	6	5	12
1980	3	8	2	13
1981	3	5	1	9
1982	3	8	0	11
1983	2	10	0	12
1984	1	5	1	7
1985	1	8	0	9
1986	0	3	1	4
1987	1	6	2	9
1988	2	9	0	11
1989	0	14	1	15
1990	2	11	0	13
1991	1	1	0	2
1992	2	3	2	7
1993	0	7	2	9
1994	0	2	0	2
1995	0	6	3	9
1996	1	6	2	9
1997	4	5	0	9

TABLE III CONTINUED

1998	1	3	0	4
1999	3	7	0	10
2000	3	5	0	8
2001	0	5	4	9
2002	0	5	2	7
2003	1	9	1	11
2004	1	11	1	13
2005	3	2	0	5
2006	3	5	2	10
2007	3	5	1	9
2008	3	10	1	14
2009	0	8	1	9
TOTAL	50	216	41	307

*Figures updated with availability of new information.

TABLE IV
CATASTROPHIC INJURIES 1977 - 2009

ACTIVITY	NUMBER	PERCENT
Tackling	126	41.0
Tackling Head Down	62	20.0
Tackling on Punt	4	1.3
Tackling on Kick-Off	17	5.5
Tackled	27	8.8
Tackled on Kick-Off	3	1.0
Collision	9	2.9
Blocking on Kick	4	1.3
Blocking on Kick-Off	4	1.3
Blocking	6	2.0
Contact After Interception	2	0.7
Blocked	4	1.3
Hitting Tacklematic Machine	1	0.3
Drill Hit Indoor Wall	1	0.3
DRILL	2	0.7
Unknown	35	11.4
TOTAL	307	100.0

TABLE V
CATASTROPHIC INJURIES 1977 - 2009
POSITION PLAYED

POSITION	NUMBER	PERCENT
Defensive Back	109	35.5
Kick-Off Team	27	8.8
Defensive Line	11	3.6
Linebacker	29	9.5
Kick-Off Return	12	3.9
Defensive End	7	2.3
Offensive Back	16	5.2
Quarterback	9	2.9
Flanker	2	0.7
Wide Receiver	6	2.0
Punt Coverage	3	1.0
Punt Return	1	0.3
Drill	5	1.6
Offensive Lineman	6	2.0
Unknown	64	20.9
TOTAL	307	100.0

TABLE VI
CEREBRAL INJURIES 1984 - 2009*

INCOMPLETE RECOVERY

YEAR	SANDLOT	PRO AND SEMI-PRO	HIGH SCHOOL	COLLEGE	TOTAL
1984	0	0	5	2	7
1985	0	0	4	1	5
1986	0	0	2	0	2
1987	0	0	2	0	2
1988	0	0	4	0	4
1989	0	0	6	0	6
1990	0	0	2	0	2
1991	0	0	3	1	4
1992	0	0	4	0	4
1993	0	0	5	0	5
1994	0	0	4	1	5
1995	0	0	4	0	4
1996	0	0	5	0	5
1997	0	0	7	1	8
1998	0	0	4	0	4
1999	0	0	4	0	4

TABLE VI CONTINUED

2000	0	0	6	1	7
2001	0	0	2	0	2
2002	0	0	1	1	2
2003	0	0	8	1	9
2004	0	0	2	1	3
2005	1	0	5	1	7
2006	0	0	9	0	9
2007	0	0	4	0	4
2008	1	0	9	0	10
2009	0	0	9	0	9
TOTAL	2	0	120	11	133

*Figures are updated annually due to new cases investigated after publication.

TABLE VII
CATASTROPHIC INJURIES 2009*
COMPLETE RECOVERY

INJURY	SANDLOT	PRO	HIGH SCHOOL	COLLEGE	TOTAL
Brain (subdural)	0	0	2	0	2
CV FX	0	1	9	2	12
Transient	0	0	2	0	2
Spinal Concussion	0	0	0	1	1
Thoracic Fx	0	0	0	1	1
Lumbar 5 Fx	0	0	0	1	1
Sickle Cell	0	0	0	1	1
Spine Stenosis	0	0	0	1	1
Heart - AED	0	0	2	0	2
Lightning	0	0	1	0	1
TOTAL	0	1	16	7	24

*Researchers realize that this data may not be complete due to the difficulty of receiving non-disability injury information.

