

ANNUAL SURVEY OF CATASTROPHIC FOOTBALL INJURIES

1977 - 2011

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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. 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 (NFHS), the National Collegiate Athletic Association (NCAA), and the American Football Coaches Association (AFCA). 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 2011 Football Rule Book states the following: Illegal helmet contact is an act of initiating contact with the helmet against an opponent. There are several types of illegal helmet contact:

- a. Butt blocking is an act by an offensive or defensive player who initiates contact against an opponent who is not a runner with the front of his helmet.

- b. Face tackling is an act by a defensive player who initiates contact with a runner with the front of his helmet.
- c. Spearing is an act by an offensive or defensive player who initiates contact against any opponent with the top of his helmet.

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.

In the 2010 high school football rule book the concussion rule (3-5-10b) was revised as follows; Any player who exhibits signs, symptoms, or behavior consistent with a concussion (such as loss of consciousness, headache, dizziness, confusion or balance problems) shall be immediately removed from the game and shall not return to play until cleared by an appropriate health-care professional. This time-out, if not charged, is an official's time-out. In Appendix B, page 100, they also have suggested guidelines for management of concussion injuries.

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

Participation numbers changed in 2010 to 4,200,000 from 1,800,000 in previous reports. The change includes 1,135,000 high school players grades 9-12, 100,000 post high school players, and 3,000,000 youth players (estimate by USA Football).

## **SUMMARY**

1. During the 2011 football season there were a total of eight cervical cord injuries with incomplete neurological recovery. Six of the injuries occurred at the high school level, one at the semi-pro level, and one in youth football. The 2011 number is six fewer than the 14 in 2008, one fewer than the nine in 2009, and one more than the seven in 2010. (Table I)

2. The incidence of catastrophic injuries is very low on a 100,000-player exposure basis. For the approximately 4,200,000 participants in 2011 the rate of injuries with incomplete neurological recovery was 0.19 per 100,000 participants.

3. The rate of injuries with incomplete neurological recovery in high school and junior high school football was 0.40 per 100,000 players (1,500,000 high school and junior high school players). The rate at the college level was 0.00. The rate for youth players was 0.03 per 100,000 participants. (Table II)

4. A majority of catastrophic spinal cord injuries usually occur in games. During the 2011 season seven injuries took place in games and one in practice.

5. Tackling and blocking have been associated with the majority of catastrophic cervical cord injuries. In 2011, two injuries were caused by tackling, one being tackled, one by a collision, one in a drill, one crashing into the stands at the end of a run, one while blocking on a kick-off return, and the activity of one was unknown. As shown in Table IV tackling has been associated with 66.9% of the catastrophic injuries since 1977. (Table IV)

6. As indicated in Table III a majority of the catastrophic injuries occur while playing defensive football. In 2011 five players were on defense one on offense, and two were unknown. Since 1977, 226 players with permanent cervical cord injuries were on the defensive side of the ball and 55 were on the offensive side with 43 being unknown. Defensive backs were involved with 112 (34.6%) of the permanent cervical cord injuries followed by members of the kick-off team (9.3%) and linebackers (9.3). (Tables IV & V)

7. During the 2011 football season there were also fourteen brain injuries which resulted in incomplete recovery. Thirteen were at the high school level and one at the youth level. That is an increase of nine when compared to the 2010 data. (Table VI)

8. In 2011 there were also 22 injuries that involved either a head or neck injury, but the athlete had full neurological recovery. High school athletes were associated with 13, college football was associated with seven, youth football none, and professional football two. It should be emphasized that the researchers are confident concerning the number of catastrophic injuries with permanent disability, but also realize that there are cases that we do not have. The researchers are not confident concerning the number of injuries with full recovery and realize those numbers could be double or more. It is impossible to accurately record every catastrophic football injury that takes place in the United States. (Table VII).

## **DISCUSSION**

For the past 35 years there have been a total of 324 football players with incomplete neurological recovery from cervical cord injuries. Two hundred and sixty-five of these injuries have been to high school players, thirty-six to college players, eight to sandlot players and 15 to pro and semi-pro players. 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 numbers for 2010 show seven and for 2011 eight cervical cord injuries with disability.

The fourteen cervical cord injuries with incomplete recovery in 2008 was a dramatic increase from previous years. There were also updated increases in 1997, 1999, and 2006. The 2009 data showed a return to single digits, but the fourteen in 2008 was a major concern. Four of the last ten years show double digits.

Since 1984 there have also been 164 brain injuries with incomplete recovery. These numbers are a major concern, and if the cervical cord injuries and the cerebral injuries with incomplete recovery are combined, the number of incomplete recovery injuries is 488. That is an average of approximately 14 injuries with incomplete recovery for the past 35 years. The incidence rate in 2011 for high school players with permanent brain damage is 0.86 per 100,000 participants. 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 2011 is less than one per 100,000 at the high school level (0.40) and 0.00 at the college level. In looking at the incidence rates for the past 35 years, the high school incidence is 0.53 per 100,000 participants and the college incidence is 1.37 per 100,000 participants. The 28 year incidence rate for brain injuries with disability is 0.36 for the high schools and 0.52 for the colleges.

As indicated in past reports a majority of the permanent cervical cord injuries are taking place in games. In 2011 seven of the eight injuries took place in games and one in practice.

Table III indicates that when comparing cervical cord injuries to offensive and defensive players, it is safer playing offensive football. During the 35 year period from 1977-2011, 226 (69.7%) of the 324 players with cervical cord disability injuries were playing defense. A majority of the defensive players were tackling when injured. In 2011, two of the eight 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 19.1% 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. Ten-point-two 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 2011 two players were defensive backs and for the past 35 years defensive backs accounted for 34.6% of the cervical cord injuries.

In 2011 there were fourteen brain injuries with incomplete neurological recovery. Thirteen of the injuries were at the high school level and one at the youth level. This is the highest number since we began collecting catastrophic brain injuries. This is a major problem. The football rules state that initial contact with the helmet or face mask is illegal, but many of the injuries are being caused by helmet-to-helmet hits, and many of them are not being called by the referees. It is interesting that brain deaths have been decreasing over the years, but brain injuries with disability have been increasing. (See graphs at end of report - brain data collection not started until 1984)

In addition to the injuries with incomplete recovery, there were 22 injuries with recovery. As shown in Table VII, high school football accounted for 13, college football seven, and professional football two. As stated earlier the researchers do not have full confidence in the full recovery data. It has always been our belief that there are a higher number of catastrophic injuries, both permanent disability and recovery injuries, that we do not receive data on. **What is important is that the National Center for Catastrophic Sports Injury Research has been collecting catastrophic football injury data (fatalities, disability, serious injuries) at the University of North Carolina at Chapel Hill for the past 48 years and has been directly responsible for the reduction of football fatalities from 36 in 1968 to zero in 1990, and the reduction of cervical cord injuries from 30 a year in the late 1960s to single digits in most years since 1991. We will continue to collect this data and to make safety recommendations to the NFHS, the NCAA, and youth football programs.**

## **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 ten years with 11 in 2003, 13 in 2004, 11 in 2006, 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, 2002-2011, there has been an average of 9.4 cervical cord injuries with incomplete neurological recovery, and 8.2 brain injuries with incomplete recovery in football. The prior ten years averaged 7.7 cervical cord injuries with incomplete recovery and 5.0 cerebral injuries with incomplete recovery. The 14 cerebral injuries in 2011 was the highest number 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 and during the 2011 football season there were a number of helmet-to-helmet contacts that were related to disability injuries.

A concerted effort must be made to reduce both cervical spine and brain injuries and to aim for the elimination of these injuries. The increase in brain injuries with disability needs immediate attention. 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 has in recent years been an increase the number of football players that have permanent disability due to cervical cord and brain injuries. Because head contact largely causes 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-to-helmet 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 NATA 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) immediate first aid 3) available transportation, 4) portable and open communication, and 5) 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.

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. As stated earlier in this report we know that it is not possible to collect all catastrophic injury data in American football, but these reports have been responsible for the reduction of football fatalities and catastrophic injuries.

## REFERENCES

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## CATASTROPHIC INJURY CASE STUDIES

### HIGH SCHOOL

A 13 year old junior high school football player was injured in October 2011 after a helmet to helmet collision in a game. He suffered a fractured cervical vertebra, had surgery, and recovery was incomplete.

A high school football player suffered a fractured cervical vertebra during a game on 10/14/2011. He was placed in a neck brace and recovery was incomplete.

A high school football player was tackling in a game on 10/7/2011 and his head struck the shoulder of his opponent. He had a fracture/dislocation of a cervical vertebra and is quadriplegic.

A high school football player (running back) was injured in a game on 9/29/2011 when he crashed into the spectator stands at the end of a run. He fractured his 6<sup>th</sup> cervical vertebra and is quadriplegic.

On 9/9, 2011 a high school football player was injured during practice drills. He was struck under the chin with the result being a fractured cervical vertebra and a spine bruise. He spent 10 days in the hospital and was placed in a halo cast. Recovery was incomplete.

A high school football player was injured in a game on 11/5/2011 while blocking on a kick-off return. He lowered his head during the block and there was helmet to helmet contact. He had a fracture-dislocation of a cervical vertebra followed by surgery and rehabilitation. Recovery is incomplete.

A 16 year old high school football player collapsed before half-time of a game on 10/7/2011. He had a brain bleed and was placed in an induced coma. The injury may have been related to a hit earlier in the week during practice. He was in critical condition for a few days and recovery is incomplete.

A high school football player was injured on 9/30/11 during a game. He collapsed while walking off the field. He had a brain bleed, but it was not known when it actually happened. He had surgery and recovery was incomplete.

A high school football player was injured during a game on 9/30/2011. He suffered a brain injury and was in intensive care.

It was not known when the actual hit took place, and the athlete collapsed on the field. Recovery was incomplete.

On 9/12/2011 a freshman football player was injured during tackling drills in practice. The player slipped in the mud and was struck in the back of the neck by the other player. He suffered a brain and spinal injury, had vertigo and muscle and nerve damage. Recovery was incomplete.

A high school football player had a subdural hematoma after a helmet to helmet hit during a game on 9/16/2011. He was injured in a practice session earlier in the week. Recovery was incomplete and he will not be able to play football again.

A high school football player was a linebacker tackling in a game on 9/30/2011. He had a brain injury - subdural hematoma - and recovery was incomplete.

A high school quarterback was injured in a game on 8/21/2011. He was hit while throwing a pass and collapsed on the sideline. The injury was diagnosed as a brain bleed, there was no surgery, and recovery was incomplete. He had a concussion in 2010 and was cleared to play in 2011.

A high school receiver was injured in a game on 9/2/2011 while being tackled after catching a pass. The injury was a brain bleed with surgery. The tackle was helmet to helmet and recovery was incomplete.

A high school football player was tackling in a September 2011 game. The hit was helmet to helmet. Later in the game he was hit again after catching a ball and ruptured a blood vessel in the brain. He had surgery and recovery was incomplete.

A 17 year old high school football player was tackled in a game on 9/23/2011 and collapsed after the hit. He was diagnosed with a subdural hematoma, had surgery, and recovery was incomplete.

A high school football player received a concussion in the first game of the 2011 season, missed two weeks of play and was cleared to play in the next game by a physician. He was involved in a helmet to helmet collision in a game, suffered a brain bleed and a stroke. He did not have surgery and recovery was incomplete.

On 9/16/2011 a high school football player suffered a brain injury in a game. He walked off the field and collapsed on the

sideline. He was in critical condition, had surgery, and recovery was incomplete.

A 17 year old high school football player suffered a brain injury in a game on 9/16/2011. He was in a coma and had multiple surgeries. Recovery is incomplete.

A 17 year old high school football player was involved in a helmet to helmet hit during a scrimmage in the fall of 2011. He had a subdural hematoma and had surgery. Recovery was complete, but he will not be allowed to play football again.

A 15 year old high school football player suffered transient paralysis during a game on 9/2/2011. At the time of the injury he was returning a punt and was tackled. He had a similar injury in 2010 while tackling. Recovery was complete.

A high school football player was injured in a game on 9/23/2011. He was tackled by two defensive players and fractured a cervical vertebra. Recovery was complete.

A high school football player fractured a cervical vertebra during a game in November 2011. He was injured during a helmet to helmet collision and was placed in a halo cast for three months. Recovery was complete.

A high school football player was injured during a spring practice. He received a subdural hematoma while tackling. He had surgery in May 2011 and had a full recovery, but will not play anymore football.

A 16 year old high school football player had a burst blood vessel in his neck during a game on 9/23/2011 which led to two strokes over the next two days. After being hit he fell to the ground and had his head bent backwards. Recovery is expected.

A high school senior football player was injured in a game on 10/1/2011 during a head to head block. The injury was a subdural hematoma. The player had surgery and recovery was complete.

A high school football linebacker was injured in a game while tackling on 9/30/2011. He fractured cervical vertebra 1 in three places and was in a halo cast for 12 weeks. He had a full recovery, but will not play anymore football.

A high school football player was injured in a JV game on 10/14/2011. He collapsed on the sideline and was rushed to the

hospital for surgery. The injury was a brain bleed and recovery was expected.

On 9/16/2011 a high school football player was injured in a pile-up in a game and experienced transient paralysis. He spent the night in the hospital and was released with a neck brace. Recovery was complete.

A junior varsity football player was injured in a game on 9/9/2011 after being tackled. He complained of a headache and had a minor brain bleed. A complete recovery was expected.

A high school football player was injured during two-a-day practice sessions. He was tackling at the time of the injury. He slipped prior to the tackle and with his head in a down position made contact with the ball carrier's leg. He fractured cervical vertebra 5. He wore a halo cast for 10 weeks and recovery was complete, but no more football.

In August 2011 a high school football player was covering a kick-off during a game when he placed his head into the shoulder pads of the blocker. He fractured two vertebrae and continued to play thinking it was a stinger. He was placed in a neck brace and recovery was complete.

## **2010 UPDATES**

On October 14, 2010 a 15 year old high school football player suffered second impact syndrome. On September 23, 2010 he had a concussion in a JV game with a severe headache and vomiting. The next week he practiced three days and still had a headache and vomiting. On October 14, 2010, he made a head to head tackle from his linebacker position. He had severe pain and vomiting, was taken to the hospital where he had six hours of surgery and diagnosed with a subdural. Neurosurgeon stated the injury was second impact syndrome. The athletic trainer approved his playing in the October 14 game. Recovery was incomplete.

A 15 year old middle school football player was injured in a game on October 25, 2010 while making an improper tackle. He fractured a cervical vertebra, had surgery and went through rehabilitation. Recovery was complete.

A high school football player fractured a cervical vertebra during a JV game in 2010. He was in a neck brace for three months and recovered to play football in 2011.

An 18 year old high school football player was injured in a game in 2010 while tackling on a kick off. He fractured cervical vertebra 6, had surgery, and had a full recovery. He will not be able to play anymore football.

A high school football player was injured in October 2010 as an offensive lineman. He fractured a cervical vertebra and was out of school for four months. He did not have surgery. He had a full recovery and played in 2011.

In a September 2010 football game a senior linebacker fractured a cervical vertebra. He played for six weeks with the fracture before it was diagnosed. He had surgery in December of 2010. The injury happened when he was blocking on a kick-off return and the crown of his helmet hit the opposing player's helmet. He recovered from the injury.

#### **2009 UPDATE**

A 15 year old sophomore high school football player was injured in a game in October 2009. He suffered a concussion and was sent back into the game. He was hit in the first and second quarters and told his coach. Coach told him to try and stick it out. Hit for third time, had seizures, vomited, and passed out. Recovery was incomplete. Lawsuit in 2011.

#### **2008 UPDATE**

A high school football player was injured in a practice on May 16, 2008. He fractured a cervical vertebra and had a full recovery.

#### **2007 UPDATE**

In 2007 during a game a high school football player suffered a severe brain injury. On October 12<sup>th</sup> he had a hard hit to the head, another on November 2nd, and on November 9 a helmet to helmet hit. Coach put him back in the game. He had brain damage and recovery was incomplete.

#### **2006 UPDATE**

On August 14, 2006, a high school football player was injured while tackling in practice. He fractured cervical vertebra 5 and had surgery. Recovery was incomplete.

## **2005 UPDATE**

A high school football player had a concussion on September 2, 2005, and had severe headaches the next week. He missed the game on September 9<sup>th</sup>, and tried to practice the next week. He collapsed at practice on that Wednesday and was taken to the hospital where his injury was diagnosed as a subdural hematoma. He was placed in an induced coma and recovery was incomplete.

## **2003 UPDATE**

In August of 2003 a high school football player made a tackle in a scrimmage game and fractured a cervical vertebra. His face mask made contact with the ground. He did not have surgery, but was placed in a halo cast. He recovered from the injury.

## **SANDLOT (RECREATIONAL)**

A 13 year old Pop Warner football player was injured in a game on 11/6/2011 while making a tackle on the goal line. He fractured his fifth cervical vertebra and had surgery. Recovery was incomplete.

A five year old youth football player was injured during warm-up drills on 10/1/11. He had a brain bleed and was in a coma for 20 days and had three surgeries with another planned. He was in the hospital for three months and recovery was incomplete.

## **1997 UPDATE**

Youth football player was playing with friends in September 1997 and made a head to head tackle. He was wearing a helmet and shoulder pads. He fractured a cervical vertebra and is quadriplegic.

## **COLLEGE**

On 10/11/2011 a division I college football player was injured in a game. He was a corner back making a tackle and hit his head to the knee of the pass receiver. He fractured a cervical vertebra and had surgery. Recovery was complete.

An NCAA Division II football player was injured in a game on 10/29/2011. He was tackling and had a dislocation/fracture of a cervical vertebra. He continued to play after the injury. He had surgery and was in a neck brace for six weeks. Recover was complete.

A Division I NCAA football player made a helmet to helmet tackle in a game in September 2011. He did not have surgery, but was placed in a halo cast. He will not play anymore football but recovery was complete.

In a game on 9/24/2011 a Division I college football player was making a helmet to helmet tackle and had a spinal concussion. He was released from the hospital the same day and recovery was complete.

A division II college football player was injured in a game on 9/10/11 after receiving a blow to the head from the tackler's face mask. He was diagnosed with a brain bleed, had surgery and recovery was complete.

In a game on 10/8/2011 a Division I college football running back was tackled and had a compression fracture of T 5-6. He also had a back injury last year and spent the off-season trying to recover. The athlete had complete recovery.

A division I college football player was injured in a game on 10/1/2011. He was a running back and had a fractured cervical vertebra. He had surgery, was placed in a neck collar, and recovery was complete.

In addition to the above there was a college player in Canada who suffered a subdural hematoma and a number of cases not related to football.

## **2010 UPDATE**

A Division III college football player suffered a brain contusion while blocking a linebacker during a game on 10/9/2010. While trying to block the linebacker from his tight end position his head hit the knee of his opponent. He recovered from the injury, but will not play anymore football.

## **PROFESSIONAL**

A professional football player had a serious injury to his lower back that needed surgery. He was injured in a game on 12/18, 2011. Recovery is expected.

In a pre-season game in August 2011 a professional football player fractured a cervical vertebra while blocking from an offensive line position. He had surgery and recovery is complete, but his playing days are in doubt.

In May of 2011 a semi-professional football player received a serious neck injury. He was a wide receiver and the activity at the time of the injury was not clear. The injury was diagnosed as a cervical vertebra injury and the athlete was quadriplegic.

**TABLE I**  
**CERVICAL CORD INJURIES 1977 - 2011\***

<b>YEAR</b>	<b>SANDLOT</b>	<b>PRO AND SEMI-PRO</b>	<b>HIGH SCHOOL</b>	<b>COLLEGE</b>	<b>TOTAL</b>
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	1	1	7	1	10
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	9	2	11
2007	1	1	7	0	9
2008	0	3	11	0	14
2009	0	1	7	1	9
2010	0	0	5	2	7
<b>2011</b>	<b>1</b>	<b>1</b>	<b>6</b>	<b>0</b>	<b>8</b>
<b>TOTAL</b>	<b>8</b>	<b>15</b>	<b>265</b>	<b>36</b>	<b>324</b>

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

**TABLE II**  
**INCIDENCE PER 100,000 PARTICIPANTS 1977-2011\***

<b>YEAR</b>	<b>HIGH SCHOOL</b>	<b>COLLEGE</b>
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	0.60	2.66
2007	0.40	0.00
2008	0.67	0.00
2009	0.46	1.33
2010	0.33	2.66
<b>2011</b>	<b>0.40</b>	<b>0.00</b>

\*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 - 2011\***

<b>YEAR</b>	<b>OFFENSE</b>	<b>DEFENSE</b>	<b>UNKNOWN</b>	<b>TOTAL</b>
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

**TABLE III CONTINUED**

1997	5	5	0	10
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	4	5	2	11
2007	3	5	1	9
2008	3	10	1	14
2009	0	8	1	9
2010	2	5	0	7
2011	1	5	2	8
<b>TOTAL</b>	<b>55</b>	<b>226</b>	<b>43</b>	<b>324</b>

\*Figures updated with availability of new information.

**TABLE IV**  
**CATASTROPHIC INJURIES 1977 - 2011**

ACTIVITY	NUMBER	PERCENT
Tackling	132	40.7
Tackling Head Down	62	19.1
Tackling on Punt	4	1.2
Tackling on Kick-Off	19	5.9
Tackled	30	9.3
Tackled on Kick-Off	3	0.9
Collision	11	3.4
Blocking on Kick	4	1.2
Blocking on Kick-Off	5	1.5
Blocking	6	1.9
Contact After Interception	2	0.6
Blocked	4	1.2
Hitting Tacklematic Machine	1	0.3
Drill Hit Indoor Wall	1	0.3
DRILL	3	0.9
Unknown	37	11.5
<b>TOTAL</b>	<b>324</b>	<b>100.0</b>

**TABLE V**  
**CATASTROPHIC INJURIES 1977 - 2011**  
**POSITION PLAYED**

<b>POSITION</b>	<b>NUMBER</b>	<b>PERCENT</b>
Defensive Back	112	34.6
Kick-Off Team	30	9.3
Defensive Line	11	3.4
Linebacker	30	9.3
Kick-Off Return	13	4.0
Defensive End	7	2.2
Offensive Back	19	5.9
Quarterback	10	3.1
Flanker	2	0.6
Wide Receiver	6	1.8
Punt Coverage	3	0.9
Punt Return	1	0.3
Drill	6	1.8
Offensive Lineman	6	1.8
Unknown	68	21.0
<b>TOTAL</b>	<b>324</b>	<b>100.0</b>

**TABLE VI**  
**BRAIN INJURIES 1984 - 2011\***  
**INCOMPLETE RECOVERY**

<b>YEAR</b>	<b>SANDLOT</b>	<b>PRO AND SEMI-PRO</b>	<b>HIGH SCHOOL</b>	<b>COLLEGE</b>	<b>TOTAL</b>
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	8	1	9
1998	0	0	4	0	4
1999	0	0	5	0	5

**TABLE VI CONTINUED**

2000	0	0	6	1	7
2001	0	0	2	0	2
2002	0	0	2	1	3
2003	0	0	8	1	9
2004	0	0	3	1	4
2005	1	0	7	1	9
2006	0	0	9	0	9
2007	0	0	6	0	6
2008	1	1	10	0	12
2009	1	0	10	0	11
2010	0	0	5	0	5
<b>2011</b>	<b>1</b>	<b>0</b>	<b>13</b>	<b>0</b>	<b>14</b>
<b>TOTAL</b>	<b>4</b>	<b>1</b>	<b>148</b>	<b>11</b>	<b>164</b>

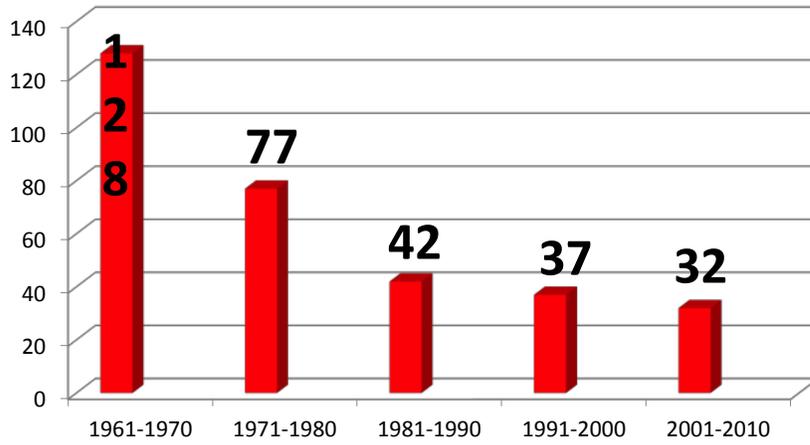
\*Figures are updated annually due to new cases investigated after publication.

**TABLE VII**  
**CATASTROPHIC INJURIES 2011\***  
**COMPLETE RECOVERY**

<b>INJURY</b>	<b>SANDLOT</b>	<b>PRO</b>	<b>HIGH SCHOOL</b>	<b>COLLEGE</b>	<b>TOTAL</b>
Brain (subdural)	0	0	5	1	6
CV FX	0	1	5	4	10
Transient	0	0	2	1	3
Thoracic FX	0	1	0	1	2
Blood Vessel Neck	0	0	1	0	1
<b>TOTAL</b>	<b>0</b>	<b>2</b>	<b>13</b>	<b>7</b>	<b>22</b>

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

## FOOTBALL BRAIN FATALITIES 1961-2010



## FB BRAIN DISABILITY INJURIES 1961-2010

