REPORT TO CHAIRMAN CONYERS
RANKING MEMBER SMITH AND
MEMBERS OF THE CONGRESSIONAL JUDICIARY COMMITTEE

In 1992 Al Toon of the New York Jets was the first NFL player known to have retired because of post concussion syndrome. In 1993 Merrill Hoge of the Chicago Bears retired because of the same problem. In 1994 Commissioner Paul Tagliabue formed the Mild Traumatic Brain Injury (MTBI) Committee to gather data to answer the question if this was a new problem, a misdiagnosed or an unrecognized one.

The committee was composed of experts inside and outside the league. It was specifically charged to initiate and support independent scientific research to provide better understanding of the causes, diagnosis, treatment and prevention of concussion. The following is a brief summary of some of the scientific efforts of the committee.

Protection Against Concussion – Helmet Standards

The National Organizing Committee for Safety in Athletic Equipment (NOCSAE) in 1973 established standards for impact performance of football helmets. Certification for college players was in 1978 and high school players in 1980. By increasing the standards for head gear, marked reductions in injuries were observed after the voluntary adoption of these standards by helmet manufacturers. Little was known at the time about the manner in which helmets reduced or prevented concussions and the Committee initiated a series of research projects aimed at defining the biomechanics of concussive impacts in professional football.

The committee undertook a considerable amount of biomechanical research. This included video reconstruction and analysis of impacts, the development of new testing models and mathematical modeling—all of which led to a much greater understanding of the kinds of impacts that result in concussions. This data was published and shared with all helmet manufacturers and NOCSAE. It has resulted in improved helmets and better testing methodology.

II. Biomechanical testing

Using the cinematographic analysis of athletes who had experienced concussions and transposing this into hybrid 111 male dummies important observations were made. For one, those forces impacting the temporal and mandibular area and the side of the face mask resulted in the greatest risk of concussion.

This data was then compared with boxers striking head models. This resulted in determining that rotational acceleration of the brain in boxing and translational forces in football were most responsible for concussions. The translational forces in football were more prominent because the shell of the helmet allows the player's head to slide relative to another thus limiting head rotational acceleration. Finite element modeling showed that strains develop late, after the primary impact force, and focus their response at the midbrain. Thus, in concussive blows there is the complicated interaction of the head in the role of brain movement and deformation within the skull.

Also discovered was that NOCSAE standards used the head drop test to evaluate shock attenuating properties of the helmet. Serious head injury is

determined from the Severity Index (SI) but this standard does not fully address helmet performance in reducing the risk of concussion.

The impact data and the understanding of the biomechanics learned from analyzing concussive blows was shared with NOCSAE and helmet manufacturers and for the first time helmets were expressly designed to reduce the risk of concussion. This resulted in the Adams USA Pro Elite, the Riddell Revolution, the Xenith and the Schutt Sport Air Varsity Commander and DNA helmets as examples of head gear designed specifically using the new biomechanical information to reduce concussions.

The committee then had the older VSR-4 Riddell tested against the new helmets. This testing revealed that the newer helmets reduced concussion risks in collisions in the range of 10-20%. This is accomplished by using thicker and more energy absorbing padding on the side and the back of the helmets and around the ears.

Most importantly, studies are now underway comparing 13 helmets from 5 different manufacturers for their concussion prevention capacity. Each helmet is being evaluated by 23 different biomechanical tests derived from the data noted above. For the first time, in 2010, objective and comparative data will be presented to the teams, players, equipment managers and physicians so data-driven choices can be made in selecting appropriate head protection. It is expected that the effect of these improvements, as they spread to the 1.2 million high school and colleges athletes will be profound in concussion reduction. Also, it will stimulate manufacturers to do even better.

Injury Collection and Data Analysis

I. Prevalence of concussion

The Center for Disease Control and Prevention estimates that there are approximately 300,000 concussions per year in all sports. The National Athletic Trainer's Association estimates between 43,000-67,000 concussions among high school football players annually. Research suggests this may be higher because many symptoms go unreported. Quarterbacks, wide receivers, defensive backs and special team players on kicking units are most vulnerable. In the NFL approximately 49% of players with concussions return to play the same game and 97.1% return to play by day 9 post injury. 2.9% missed more than 9 days before returning to play. Only 9.3% experienced loss of consciousness as the result of a severe head impact. Thus, 9 out of 10 NFL athletes with concussive injuries do not lose consciousness. An extremely important observation since many outside the NFL still believe that the primary criterion for a concussion is loss of consciousness.

II. Repeat Concussions

The I Committee then looked at the incidence of repeated concussion from 1996 to 2001 prospectively collected and analyzed. Out of 887 athletes with concussions, 160 experienced repeat injuries with 51 experiencing 3 or more concussions during the same 6 year study period. Although 90% of NFL players return to play within one week, recurrent injury caused by increased vulnerability in the immediate post concussion period did not seem to be a factor in this study.

Specifically, there have been no reported cases of second impact syndrome in the history of the NFL. More recently, there have been reports of chronic traumatic encephalopathy in former NFL players. Although this is well recognized in boxers, the same clinical features including a combination of motor, speech and gait dysfunction along with cognitive and personality changes has not been reported in NFL players with repeated injury. The issue of CTE and other long term effects is one that deserves further study. The committee has met with leaders in this research and will continue to do so. We support this and other research designed to improve our knowledge and help doctors,, players, and others evaluate and reduce risk.

III. Post Concussion Syndrome

This refers to the post-traumatic symptom complex characterized by memory impairment, headache, difficulty with concentration, impaired reaction time and personality changes commonly seen after a concussion., Because of the concern for this entity the committee performed a critical analysis of the widely promoted guidelines for the evaluation and management of concussion in sports. This was a six year study. It was found that concussion severity was best determined retrospectively on the basis of how long it takes the player to become asymptomatic. The guidelines used in the past were not as reliable as thought.

IV. Neuropsychological Testing in Evaluating Concussion

With the recognition that attention, memory and cognitive processing speed abnormalities were prevalent in athletes with concussion, the NFL

Committee evaluated the ImPACT program—Immediate Post Concussion Assessment and Cognitive Testing. This consists of six neuropsychological tests designed to target different aspects of cognitive function, including attention, memory, processing speed and reaction time. When compared with high school athletes with concussions, it was seen that the NFL players returned to normal in a shorter time whereas high school athletes had residual difficulties in reaction time and memory longer than the professional athlete. In 2007 neuropsychological baseline testing was mandated for all NFL teams.

V. Return to Play

Data analysis was undertaken concerning concussed athletes from the period 1996 – 2001 and compared with more recent 2002-2006 documented injuries.

- This study revealed a decrease in injury rate in the more recent study by 7.6% per team game.
- A statistically significant reduction of athletes that return to play in the same game (8.4% v 16.1%).
- A statistically significant increase in the number of cases that are classified as removed from play in that game (50.7% v 44.0%).
- The more recent study from 2002-2006 had a larger proportion of cases out 7+ days (16.7 v 8.2%) even though the signs and symptoms of the concussions were identical between the two study periods.
- The incidence of concussions in the NFL was determined to be 2 in every 5 games.

NFL Retired Players Study

In 2007 the NFL funded a research study to investigate the potential long term cognitive affects of professional football participation. This study is underway and will include a cohort of NFL players who have played at least four years in the NFL matched against a group of football players who have played college and no more than one year of professional football. Extensive studies include a baseline neurological and complete medical examination, neurocognitive testing, neuroimaging to include brain MRIs and evaluation of various blood components. When completed we hope that this study will contribute to the ongoing efforts to understand the incidence and extent of cognitive deficits from prolonged football participation and how we can better prevent those effects in current and future players

Additional Action by the NFL

As a result of the intensive research efforts and by constructively utilizing these observations , the NFL has initiated 1) educational and preventive measures, 2) guidelines for management of concussions and 3) specific rule changes.

Educationally major steps have been taken to educate the players, trainers, coaches and team physicians about the definition and implications of cerebral concussion. Specific symptoms and risks have been outlined and distributed to all NFL players in pamphlet form and through direct education by athletic trainers and team physicians. It is recognized that returning to play before symptoms have completely subsided is a risk factor for future injury. This

has been conveyed to all in the league and specific management and preventive guidelines have been instituted.

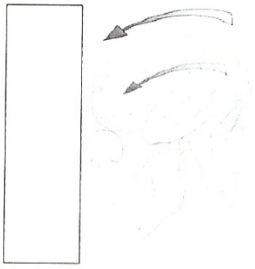
Specifically, neurocognitive testing is now mandatory as a preseason baseline and within 24-48 hours following a diagnosed cerebral concussion.

Further preventive measures include penalties and fines for helmet to helmet contact and blows to the head. Recently a whistle blower system with a toll free hotline was instituted to guard against players being pressured or forced into playing while hurt or returning too soon.

In summary, since the formation of the Committee by the NFL in 1994 the findings and analysis of research undertaken by the committee has led to major changes in the prevention and management of cerebral concussion. Ongoing studies hopefully will lead to even more effective preventive measures in the future.

APPENDIX A

Concussive Episode



Disruption of brain function

Results from sudden movement of the head

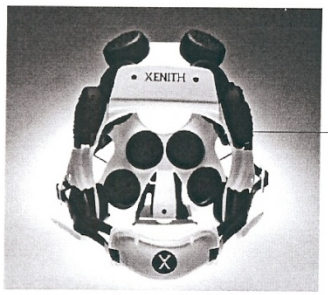
Force = Potential for Damage

Force = Mass * Acceleration

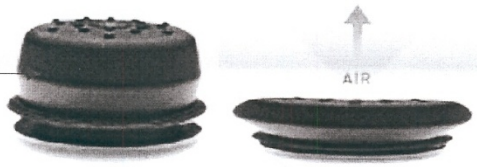
Force = Mass * (Change in Velocity)
TIME

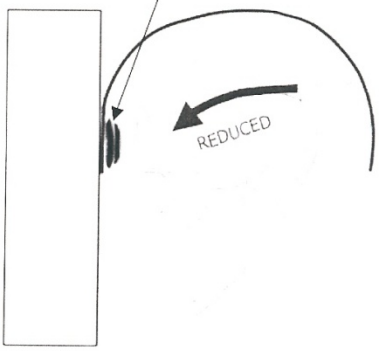
MORE TIME=LOWER RISK =LOWER magnitude of acceleration and force	**LESS TIME=HIGHER RISK** =HIGHER magnitude of acceleration and force

Xenith Shock Bonnet



Xenith Aware-Flow Shock Absorber





The Xenith Shock Bonnet is a suspension of Aware-Flow Shock Absorbers, which function like automotive air bags. Aware-Flow Shock Absorbers collapse over a prolonged period of time, which minimizes the sudden movement of the head during impact. Aware-Flow Shock Absorbers adapt to impact in order to function over a wide energy range; they refill instantaneously, function over a wide temperature range, and show outstanding multi-impact durability.

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