FROM THE EDITOR

The FARA Communications Committee welcomes you back to campus with a special concussion issue of the FARA Voice. As guest Editor, I invited Connie Dillon (Oklahoma; NCAA Committee on Competitive Safeguards and Medical Aspects of Sports), Tom Stephens (Rutgers), and David Clough (Colorado) to guide FARs in all three Divisions through the most current research, and to inform us about how each FAR can play an active and positive role on her or his campus in concussion management and prevention.

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Note: The NCAA office of Health and Safety will present a session on concussion issues at the 2011 NCAA Annual Convention in San Antonio.

Bigger, Faster, Stronger: Concussions as a Consequence of the Athletic Arms Race

Introduction

The 1980 Pittsburgh Steelers won the Super Bowl with an offensive line whose average weight was 254 lbs. In 2010, the New Orleans Saints won the Super Bowl with an offensive line that had an average weight of 319 lbs. This change represents a 25 percent increase in the mass of the offensive line over the 30-year period. However, given the modest increases in the speeds achievable by these athletes over short distances, the kinetic energies associated with collisions have seen an even greater magnification.

Bigger, faster, stronger. A neglected consideration in our conversation about the athletic arms race, head contact in sport carries potentially catastrophic consequences to student-athlete health and safety, which is one of our vital concerns as Faculty Athletics Representatives. This special edition of the _FARA Voice_ focuses upon concussions by exploring related research (Some Good News and Insights), the science of concussions (Physics 101 for FARs), student-athlete responsibility (What We Have Here is a Failure to Communicate), information about diagnosis and treatment (Problems and Challenges), playing rules and legislative initiatives (Membership Response), and the future (Zero Tolerance: What FARs Can Do). We hope through this special issue, that we can provide all FARs with the most current information about concussion in sport: the causes, consequences, care and most important, prevention.
Heads Up on Concussions: Some Good News and Insights from the Research

Over the past year concerns about concussions have been reported widely in the media and throughout the halls of Congress. However, some of the news is good. In fact, the most recent analyses suggest that concussive incidents have leveled off since 2003. Following an alarming seven percent increase each year between 1988-89 and 2003-04 (Hootman, et al., 2007), the number of concussions reported has remained relatively flat, even showing a slight decline (Datalys Center, 2009). Current research provides insights into possible reasons for this trend as well as factors that may help us further reduce the number and severity of athletically related concussions.

Hootman, et. al (2007) suggest that the nearly three-fold increase in reported concussions over the 16-year period beginning from 1988-89 to 2003-04, may be the result of an increase in the actual number of concussions. However, the increase may also reflect more accurate reporting of concussive events. Additionally, the authors suggest that improvements in diagnosis along with greater knowledge about the consequences of concussive events has contributed to reversing the trend in concussion rates. Published in 2001, the Vienna Concussion Consensus statement (Aubry, 2002) influenced early NCAA concussion management plans and sports medicine practice. Most recently the Zurich Concussion Consensus Statement (McCrory, et al., 2009) serves as the blueprint for the current NCAA concussion-management-plan policy and all future legislation to be considered by the membership.

While concussions in high-profile football programs have received the most attention, it is important to realize that concussive incidents are not limited to football, nor are they limited only to men’s sports or even to the highly charged environment of Division I competition. In fact, women’s soccer has one of the highest rates of concussions per competition exposure among all sports, along with men’s and women’s ice hockey (Hootman, et al., 2007; Datalys Center, 2009). Basketball, both men’s and women’s, is showing an increase in head and face injuries, a trend also noted at the high school level (Dick, et al., 2007; Borowski, et al., 2008). Surprisingly, the injury rate per exposure for football is higher in Division III than Division I, the ostensibly more competitive environment (Guskiewicz, 2003).

In the past, loss of consciousness (LOC) and amnesia were considered the primary symptoms associated with a concussive incident. However, we now know that the LOC is present in less than ten percent of concussive episodes while most symptoms vary widely with the most common symptom presenting as a simple headache or ringing of the ears. Other symptoms include cognitive dysfunction and balance problems. McCrea, et al. (2003) found that concussees with such symptoms can take up to seven days for full recovery and that a second concussive incident before full recovery can significantly exacerbate the severity of the injury. Guskiewicz, et al. (2003) found that the first concussive incident increases the risk of subsequent concussions by threefold and that subsequent concussions will likely be increasingly severe. We also know that concussions have much more deleterious effects on children and teenagers than on adults. Additionally, research has debunked the “myth” that once a concussee is over the event, there will be no subsequent effects. Rather, concussees frequently suffer lingering and continual effects.
Armed with research such as this, in 2004 the National Athletic Trainers Association (NATA) was the first sports-medicine association to publish a consensus statement on concussion which is still considered to be one of most comprehensive documents published to date on sports related concussions (Cantu, 2007).

References
Physics 101 for FARs

Reviewing some elementary physics can help us grasp the consequences of collisions in football and why as size, speed, and strength increase along with improvements in agility, we can expect a concomitant rise in the number and severity of concussive incidences. These statistics point to a considerable increase in the kinetic energies, forces and accelerations/decelerations associated with collisions involving athletes. Through basic physics and its field of kinematics, we can better understand the “impact” of the collision between two human beings or a human being and an object, such as a soccer ball.

Extreme accelerations and decelerations cause concussions. As an offensive lineman “fires out” and blocks a defensive lineman or linebacker, his motion may be described by his speed, acceleration, momentum and kinetic energy. If this “O” lineman can run the 40-yard dash in 5 seconds, his average speed is about 7 meters/second (m/s), but, generally, that speed may be somewhat greater if the lineman is given enough distance to “fire off” and collide with a linebacker who is a small distance back from the line of scrimmage. We might estimate a speed of about 10 m/s. The momentum carried by that lineman is given by mass times velocity. Ignoring direction for the moment (velocity is speed in a given direction), the momentum of our lineman would be 1450 kg\(\cdot\)m/s and his kinetic energy would be given by \(\frac{1}{2} \cdot m \cdot v^2\) where \(m\) is the mass and \(v\) the velocity. In this instance, his kinetic energy would be about 7.25 kilojoules (kJ).

Imagine, being a bit unrealistic, that our “O” lineman collides with a linebacker who is stationary. The linebacker has a mass of 120 kg (265 lb). An important consideration is the fact that increases in the mass of our defensive players have been less when compared to those of offensive linemen. If this collision were head on, helmet-to-helmet and relatively elastic, both momentum and kinetic energy would be conserved into the motion of both players after the collision. Working the math out, after the collision, the “O” lineman would be slowed to about 0.9 m/s and the linebacker would be projected backward at a speed of about 10.9 m/s. The momentum and kinetic energy of the “O” lineman would be 140 kg\(\cdot\)m/s and 0.07 kJ, while those of the linebacker would be 1310 kg\(\cdot\)m/s and 7.18 kJ, respectively. If you add up appropriate momentum and kinetic energy quantities, you will see that these are conserved in the collision. A real collision will be somewhat inelastic and the transfer of momentum and kinetic energy will not be as complete.

Given our example, the remaining quantities to estimate are the acceleration experienced by the linebacker and the deceleration experienced by the “O” lineman. To know that, we have to estimate either the time over which or the distance through which the collision and transfer of energy takes place. Let’s say that the time was 1/10\(^{th}\) of a second. If the “O” lineman has experienced a change in speed of -9.1 m/s over that period of time, the average deceleration would be 91 m/s\(^2\). And the linebacker went from stationary to 10.9 m/s and experienced an average acceleration of 109 m/s\(^2\). How do we interpret these acceleration/deceleration values? We often do this by comparing them to the acceleration due to gravity (giving rise to the downward “g” force), which is about 9.8 m/s\(^2\).
So, in our simple example, fraught with many approximations, we see that the “O” lineman and linebacker experience about 10 g’s. There are data that support a claim that single accelerations of 30 g’s (for example, in high speed automobile collisions) cause concussive brain damage. There is concern that collisions involving lower “g” forces can cause concussion and that repeated collisions will cause eventual brain damage.

How has the situation changed from the 1980 Steelers to the 2010 Saints? A similar analysis using players of mass typical to the 1980 teams and somewhat slower speeds shows accelerations/decelerations about 20% lower in magnitude.

Of course, the physics of collisions in sport is not that simple. Collisions are inelastic and angled. There is rotation of the body, head and brain involved (e.g., a “clothesline” collision), all of which can and do impact the severity of the concussion.

**What We Have Here is a Failure to Communicate**

FARs should never forget the fact that many student-athletes will go to extraordinary lengths to hide an injury for fear of being removed from play. A Rutgers University’s student newspaper, *The Daily Targum*, recently ran a feature story on student-athletes and their return to the playing field well before medically recommended guidelines. (See Playing through pain: The risk behind American football culture, by Sam Hellman. Online [http://www.dailytargum.com/sports/playing-through-pain-the-risk-behind-american-football-culture-1.2243158](http://www.dailytargum.com/sports/playing-through-pain-the-risk-behind-american-football-culture-1.2243158). Published 27 April 2010; accessed 24 June 2010). Yet we know from evidence that coaching staffs and the concussed student-athletes alike will seek a “return to duty” as quickly as a release can be secured from their doctors. This quick return is not recommended, according to those who study concussions and related injuries. Let’s take a hypothetical but realistic episode.

A “mythical” newspaper article regarding a concussive situation: Point guard Casey Dutra-Balompié of Prado & Atlantic State College was knocked to the court and remained there unmoving for five minutes during the game against Bastille Tech last night. When Casey came to, he walked to the locker room, only to return in 15 minutes to watch the last minutes of the Prado win. After the game, his head coach, Jimbo Jumpball, spoke to the press. "Casey got a little dinged up," Jumpball said, "but he's tough and he'll be back at practice tomorrow, working hard like he always does."

Yet, here is what happened when we get “just the facts” without “coach-speak”; and what should have happened during this concussive event. Casey experienced a severe concussion when his head slammed to the floor. He should have been properly and closely monitored by the team’s medical staff until all the signs of concussion dissipated. Casey should get plenty of rest – preferably in bed, avoid bright lights, cease reading activities until released by the doctors, and follow all the doctors’ orders. The coaching staff should not be involved in the medical evaluation process and should have little say in how quickly Casey returns to practice or play.
In another recent mythical soccer match between the Whodoneit Hornets and the Playitagain Sams, during the second period, opponents Suzy Detrocroix and Jennifer Millicent collided while simultaneously trying to head the ball. A bit dazed, Suzy fell to the ground but appeared to recover quickly and continued to play, knowing that if she left the game she may not be able to return. Under the re-entry rules in effect prior to this year, a player could return only if an opposing player was cautioned or ejected. The re-entry rules now in place prevent a student-athlete from being penalized for reporting an injury. Rules of play should not unnecessarily penalize an injured player or their team by preventing a medical assessment as disruptive to the flow of the game.

We must give student-athletes a clear message that they must take responsibility for reporting injuries. However, both playing rules and standard procedures should be consistent with this message.

**Concussions in Sport: Membership Response**

In June 2009, the NCAA Competitive Safeguards and Medical Aspects of Sports (CSMAS) Committee initiated a review of sports rules as these relate to the treatment and prevention of head injuries. The CSMAS committee recognized the need for rules changes that would provide consistency across sports when addressing head injuries, in order to construct rules in such a way that neither student-athletes nor their teams would be penalized for reporting a head injury. Following this review, last December the CSMAS Committee crafted concepts for consideration by the playing rules committees.

The central principle guiding these recommendations is that the medical team, not others, should be authorized to make decisions about removal from and return to play. Additionally, the rules will require that any student-athletes experiencing signs and symptoms of concussions be immediately removed from play and not allowed to return the same day. These concepts were endorsed by the NCAA Playing Rules Oversight Panel, which has instructed each rules committee to review rules for stoppage of play and to consider rules that would reduce head injuries. These considerations have subsequently prompted rules changes in several sports including football, men’s and women’s soccer, men’s and women’s basketball, men’s and women’s ice hockey, water polo, and wrestling.

The CSMAS Committee also modified concussion guidelines and concussion-management recommendations and sponsored “A Concussion in Collegiate Sport Summit” held in April 2010. The summit brought together leading experts in the field to explore emerging trends in the medical management of concussions, prevention strategies, research and educational initiatives. Key recommendations emerging from the summit include new legislation for the 2010 cycle that will require all member institutions to have on file a Concussion Management Plan consistent with the guidelines recommended by the 2009 Zurich Consensus Statement on Concussion in Sport. The committee also produced fact sheets about concussion in sport for coaches and student-athletes. All related informational and educational materials can be found on the NCAA Health and Safety Website at: [http://www.ncaa.org/health-safety](http://www.ncaa.org/health-safety).
Problems and Challenges of Concussion Diagnosis and Treatment

Even when coaches and student-athletes appropriately report concussive incidents, medical science currently lacks an absolute standard for validation that a concussive event has occurred. Baseline testing coupled with application of a Standardized Assessment of Concussion Test (SAC) which includes neurological examination, has improved the effectiveness of diagnosis and treatment. These parameters serve as integral components of the concussion-management plan recommended for years by the NCAA Competitive Safeguards and Medical Aspects of Sports Committee (CSMAS).

A critical factor mitigating concussion risk is the ability to determine the severity of the concussion. Although the number of concussive incidents appears to have remained constant or declined in recent years, these data give us little information about changes in severity. As our physics lesson demonstrates, we should expect an increase in kinetic energy released upon impact, which will ultimately increase the severity of the injury. Unfortunately, current medical science offers little guidance for diagnosing concussion severity. However, critical factors include the acceleration/deceleration incurred by the collision, the number of successive concussions, and age. Advances in neuropsychological testing and brain chemistry analysis will continue to improve our diagnostic capabilities helping our medical professionals identify concussive occurrences and diagnose the severity of concussive incidents to mitigate future negative consequences, through treatment and monitoring.

Key elements of current concussion-management practice include following a graduated return-to-play protocol: 1) no same day return to play for collegiate or younger athletes; 2) psychological management and mental-health monitoring; and 3) no return-to-play until symptom free.

Zero Tolerance: What FARs Can Do

Among our many responsibilities as Faculty Athletics Representatives (FARs), none is more important than our work on behalf of student-athlete health and safety. We should recognize the impact we can have promoting educational efforts and policy changes at our institutions and throughout our governance system.

Who’s In Charge? FARs should be confident that medical staff have the appropriate authority with regard to playing and practice decisions for student-athletes who are ill or injured. Athletic trainers should not report to coaches, and FARs should ensure that the institution’s President or Chancellor clearly communicates the appropriate responsibility accordingly. FARs should be confident that athletic trainers and medical staff are able to discuss concerns freely and unimpeded by fear of reprisal. FARs should be confident that their athletics departments err on the side of student-athlete well-being.
Prevention: The Best Cure. In 2005, new rules were implemented in the sport of football, eliminating spearing and head-down contact. That same year the concussion injury rate in football dropped from 3.8 per thousand exposures in the previous year to 2.4. The best way to reduce injuries from concussion is to eliminate head contact. FAR groups can promote this concept by adopting a “zero tolerance” stance for all playing rules that unnecessarily encourage head contact.

Prevention Through Education. FARs should ensure that institutions and conference officials are properly educated about concussion prevention as well as concussion diagnosis and treatment. At the Conference level, FARs should be confident that head contact prevention rules are being enforced and that our officials are appropriately educated and monitored relative to making calls that are consistent with student-athlete safety. Second, we should remember that concussions happen in practice as well as in competition. In the sport of football, concussive incidents could be reduced by half by implementing small changes in drills in practices, changes that would have no impact upon competition. At the institutional level, FARs should ensure that our coaches, strength and conditioning staff, and student-athletes are educated about the dangers of head contact and methods and practices designed to eliminate head contact in practice as well as in competition. While improvements in equipment and protective gear hold promise, such improvements are not a panacea and to date these modifications have only had minimal effect in mitigating concussive severity.

Classroom accommodations. FARs should ensure that institutions take into account physical, neurocognitive and academic considerations for the student-athlete with a concussion. Each institution should outline the measures to be taken in the event a concussed student-athlete requires academic accommodations during their recovery. Management of non-sport-related concussions should be treated the same as a sport-related concussion and return-to-play decisions should follow an institution’s concussion-management plan.

2010 Policy Initiatives. FARs should become familiar with the 2010 NCAA Executive Committee’s policy on concussions and address future legislative initiatives through the various governance opportunities. This policy requires institutions to have a written concussion-management plan which describes the role of the athletics healthcare staff, ensures that institutional procedures are consistent with established medical practice, requires student-athletes acknowledge their role in reporting inquiries, and requires return-to-play decisions be made by a physician or the physician’s designee. This policy addresses removal and return to practice and competition in a way that would ensure consistency among all NCAA sports. In addition, a set of best practices accompany these policies.

Injury Monitoring. Preventing injury requires collecting and analyzing data about the number and nature of sports-related injuries. In 1982 the NCAA created the Injury Surveillance system designed to collect data from member institutions about injury trends. However, member participation is voluntary. FARs should become familiar with the NCAA injury-prevention monitoring program and its research staff, and work with their institutions to encourage broad participation in the Injury Surveillance System so we can continue to collect valid and reliable data on which to base future policies and practices. More information about this program can be found at www.DatalysCenter.org.
Governance. A FAR-designated spot on NCAA Competitive Safeguard and Medical Aspects of Sport Committee (CSMAS) would ensure ongoing communication between the medical community and the FAR groups. Awareness and prevention of all injuries require shared information among major health organizations, the medical profession, the athletics medical and training staff, and other interested parties, including athletics directors, coaching staffs, and FARs. The FARs’ role in oversight of injury recovery and prevention must maintain a primacy within this decision-taking hierarchy. FAR representation is needed on this important committee and we should work through our governance groups to promote FAR service on the CSMAS Committee.

FAR participation in governance, if that is not already clear, is the preeminent component of these well-being initiatives. In September 2010, IA FARs will again meet with the IA Directors of Athletics in Dallas. At that meeting the Board of Directors of the 1A FARs has programmed an extended session on concussions and their impact on student-athlete well-being and playing time. There, the Board expects the participation of Dr. Kevin Guskiewicz (University of North Carolina), a renowned expert on concussion in sports. All FARs from all Divisions are welcome to attend.

For more information about this meeting and registration information, go to the IA FAR website at http://www.d-1a.com, and click on “Annual Meeting” in the left column, or you may contact Diann Schiessler at dschiessler2@unl.edu for further information.

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*While their experience informs the views expressed in this newsletter, the authors are not health-care professionals and do not speak for the NCAA or the NCAA Competitive Safeguards and Medical Aspects of Sports Committee.
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