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With youth participation in sports at an all-time high, youths have become more vulnerable to the silent epidemic of concussion. Psychologists should become aware of the alarming frequency of mild concussion and the subtle effects of concussion, which often go unnoticed or result in misdiagnosis. This article provides a basic survey of the research and literature on this topic, a simplified knowledge base for understanding updated assessment and management techniques, and a discussion of the important role psychologists can play in educating the public and their patients. Practitioners can become more aware of this developing practice opportunity.

Keywords: concussion, youth, sports, brain, testing

The phenomenon of sports concussion in athletes was first prominently studied in the mid-1980s at the University of Virginia by Barth et al. (1989). This groundbreaking research explored the neurocognitive sequelae of and recovery from mild head injury in college football athletes. Since then, the identification, assessment, treatment, and management of sports-related concussion has expanded, most conspicuously to professional sports, a multibillion-dollar business in which the performance and careers of highly paid athletes are carefully managed and protected (La Pointe, 1998). As early as 1998, USA Today (Pedulla, 1998) discussed how “concussions take [a] toll” in the NHL, and soon after, The New York Times (“Gauging how badly,” 1999) reported on the benefits of preseason testing for postconcussion comparison. Comprehensive concussion programs within the National Football League and National Hockey League (Lovell, 2006a) have been created and conducted by neuropsychologists, physicians, and athletic trainers working in collaboration. These programs are also functioning within sports such as international soccer, rugby, and auto racing (Lovell, 2006a). However, recognition of the need to systematically protect younger athletes has now become more commonplace in high schools (Collins et al., 2002) as well as in the colleges (Lovell & Collins, 1998) where these programs were first developed.

It has been estimated that, every year, 20% of all high school football players sustain concussions (Gerberich, Boen, Straub, & Maxwell, 1983). In a study of 235 high schools over a 3-year period, concussions accounted for 5.5% of all reported sports-related injuries (Powell & Barber-Foss, 1999). Recently, Moser, Schatz, and Jordan (2005) noted that in a sample of 223 high school students who participated in a variety of sports, the prevalence of a reported history of previous or recent concussion was as high as 63%.

The sports-loving American public has become more aware of concussion and what it means, especially as people view concussion on the television during broadcasted games and hear sports commentators routinely provide updates on the recovery of the affected high-profile athletes (Allen, 1998). Participation in youth sports continues to increase overall, with specific focus on women since Title IX was passed in 1972 and on athletes ages 5–13 years (Seefeldt & Ewing, 1996). In a culture that boasts of soccer moms taxing preschoolers and their older siblings to the community recreation leagues as well as to school-based competitive venues, we are placing at risk the brains of our youths. This occurs at earlier ages and for longer periods of time than experienced by previous generations. Furthermore, youths are now engaging in nontraditional athletic activity outside of school, often without training or guidance, such as mountain biking, roller blading, skateboarding, snowboarding, and other sports glorified in the media as “extreme,” which thus places the inexperienced youths at risk for injury. What is frightening is that there appear to be subtle yet enduring cognitive changes in “normal,” reportedly asymptomatic youth athletes who have suffered two or more concussions, regardless of severity (Moser & Schatz, 2002; Moser et al., 2005).

Psychologists are well positioned to address this significant public health issue that affects youths. Psychologists understand the importance of the brain and how it affects physical, intellectual, neuropsychological, and emotional functioning. They understand the assessment of cognitive abilities and the interpretation of test data. They understand how a compromised brain affects learning and the school experience. At a time when psychology has asserted itself as a health profession that strives to become a household word, psychologists have the opportunity to become educators, consultants, and treating health care professionals in this new frontier, this new market share that is in its developmental stages. With our knowledge and expertise, we can help our communities understand this phenomenon and learn how to develop...
programs to protect our children’s brain. To develop such outreach to our patients and the community, we need to understand concussion as a unique brain phenomenon.

Understanding Concussion

Concussion is the most common form of head injury for athletes. It can be associated with immediate symptoms of disorientation, amnesia, nausea, confusion, visual disturbance, blank stare, slurred speech, vertigo, headache, loss of consciousness, or any alteration in consciousness. Contrary to the belief of many, visual disturbance, pupil dilation, and/or loss of consciousness are not necessary for the diagnosis of concussion. Furthermore, any of these symptoms may last less than 15 minutes and still indicate a mild concussion (American Academy of Neurology, 1997). Thus, symptoms may linger or may disappear. The key to identification is that there has been a change in mental status. Often, athletes refer to this phenomenon as a “ding” or “bell ringer.” Also, it is a common fallacy that one must hit one’s head to sustain a concussion. Concussions can occur from whiplash (acceleration-deceleration) or rotational injuries. As the brain moves around within the skull and is shaken, tearing and shearing of axons occurs. Therefore, mouth guards and helmets, although very important, cannot be relied on to prevent concussions.

The pathophysiology of concussion continues to be explored through experimental animal studies. We know that trauma to the brain disrupts cerebral metabolism, with changes in “intracellular and extracellular environments” (Hovda et al., 1999, p. 13). The metabolism of glucose and oxygen and the flow of blood within the brain are compromised, and the brain engages in a struggle to restabilize. Also, changes in ion concentrations, such as those of potassium, calcium, and magnesium, significantly disrupt brain function as well as result in cell damage. Recovery and a state of equilibrium may take days or much longer, depending on the severity and nature of the concussion. During that period of time, the brain is much more vulnerable to catastrophic injury should a second, even mild, hit occur.

There are numerous formal definitions of concussion that have been scrutinized and refined over the years (Solomon, Johnston, & Lovell, 2006). Webbe (2006) has reviewed the historical development of these definitions and has offered the following as a working definition of concussion:

Cerebral concussion is a closed head injury that represents a usually transient alteration in normal consciousness and brain processes as a result of traumatic insult to the brain. The alterations may include loss of consciousness, amnesia, impairment of the reflex activity, and confusion regarding orientation. Although most symptoms resolve within a few days in the majority of cases, some physical symptoms such as headache, and cognitive symptoms such as memory dysfunction, may persist for an undetermined time. (p. 48)

Similarly, there are numerous grading systems for concussions, with somewhere over 20 or so documented, none of which is research based (Barth, Broshek, & Freeman, 2006). However, the latest research suggests that the severity of a concussion is not well understood for an individual until it has run its course. For example, there are some individuals who experience loss of consciousness but whose symptoms resolve more quickly than the symptoms of those individuals who never suffer loss of consciousness. Although headache and loss of consciousness typically have been viewed as indicators of severity of concussion, it has been thought that the symptom of amnesia either before (retrograde) or following (anterograde) the event is a far better predictor of severity and recovery (Cantu, 2001). In postconcussion syndrome, recovery is prolonged, and the afflicted individual continues to experience persistent symptoms, such as (a) difficulties in attention, concentration, and/or speed of mental processing; (b) emotional symptoms of irritability, depression, or moodiness; and (c) physical symptoms of headaches, fatigue, and/or sleep difficulties.

Individuals with persistent postconcussion syndrome experience problems at work or at school, with specific difficulties such as mental slowness in completing assignments, problems understanding verbal communication in group discussions, greater distractibility and poor concentration, ineffective multitasking, and severe fatigue. Brain injuries cannot be “seen,” and family, friends, teachers, and peers often expect concussed individuals to fully recover and “shake it off.” Yet, long after the injury, work or academic performance may greatly suffer and may be misinterpreted as laziness or attitudinal or behavioral procrastination. It is not uncommon for students with no history of academic or behavioral difficulties to present with a gradual decline in grades on tests, increasing episodes of incomplete homework assignments, low frustration tolerance, and weak self-confidence because of an undiagnosed postconcussion syndrome. Over time, if the condition is untreated and if the student, family, and school have not been educated about concussion, behavioral difficulties, family conflict, and depression may ensue.

Much of the research on concussion severity and recovery has been conducted on adults. Researchers are now discovering that youths’ brains (up to the age of 21 or so) seem to exhibit a different severity and recovery profile. Animal studies suggest that younger brains tend to be more vulnerable and exhibit a longer recovery period (Giza & Hovda, 2001). Concussed high school athletes may experience greater memory dysfunction compared to concussed college athletes (Field, Collins, Lovell, & Maroon, 2003).

In addition, the phenomenon of second impact syndrome, although rare, is often fatal and has been observed in youths (Solomon et al., 2006). In this syndrome, an athlete suffers a concussion, but before he or she is fully recovered, he or she sustains another hit, which actually may seem minor compared to the first. However, there is an immediate, devastating brain response, which then typically results in brainstem failure within minutes. In these cases, fatality or severe neurological impairment occurs before the young athlete reaches medical assistance.

Baseline and Concussion Assessment

In current practice, we believe that early identification and management of concussion helps to decrease the recovery period, prevent superimposed concussions, reduce enduring effects, lessen institutional liability, and promote a safe return to play. We know that once an athlete has sustained a concussion, she or he is four to six times more likely to sustain another concussion. Nonpsychologists are often the first-line health care professionals to identify and manage concussion in youths. Yet many of these professionals, including physicians, do not understand the phenomenon of concussion, are not up to date on the latest research and treatment recommendations, and may not provide proper guidance to con-
When one is choosing a baseline–postconcussion instru-
ture recovery. The tools are not considered diagnostic in themselves,
native forms, and it is expected that the concussed athlete should
large groups of students or athletes. Such tools should have alter-
and limitations of these computerized instruments.

general sports concussion literature to further research the benefits
ple, Spatial Processing, and Code Substitution. The reader of this

tinuous Performance, Mathematical Processing, Matching to Sam-
Simple Reaction Time, Code Substitution, Running Memory Con-

(Bleiberg, Cernich, & Reeves, 2006), which includes subtests of
Neuropsychological Assessment Metrics Sports Medicine Battery
memory, sustained attention, and learning; and (d) Automated
on tasks of simple reaction time, choice reaction time, working
memory, sustained attention, and learning; and (d) Automated
Neuropsychological Assessment Metrics Sports Medicine Battery
Hopkins Verbal Learning Test (Brandt, 1991); (f) the Wechsler Adult Intelligence Scale—III
Symbol Search, Digit Symbol, and Digit Span subtests (Wechsler,
and (g) the Post Concussion Symptom Scale (Lovell, 1999).

With the specter of litigation in youth sports injuries, many high
schools across the United States have developed or are in the
process of implementing concussion testing programs. These pro-
grams are often run by athletic trainers and athletic directors, who
then may consult with local physicians or who may telephone
other consultants to aid in decision making. It is interesting that the
professionals in charge of these school-based programs might have
attended a workshop on the tool they use but, for the most part,
unless they are psychologists or neuropsychologists, have not been
trained to understand cognitive processes and testing.

Concussion Management

On the whole, management of concussion is composed of (a)
ruling out of more serious neurological or physical injury through
medical exam and possible radiological or neurological studies, (b)
education of the student and family about the effects and risks of
concussion, (c) more than usual physical and mental rest, (d)
prevention of premature return to physical activity and contact
play, (e) repeated postconcussion neurocognitive assessment until
the student reaches or exceeds baseline and has stabilized, and (f)
physical exertional testing of the athlete, usually conducted by the
athletic trainer. Exertional testing occurs when the student is
asymptomatic and has demonstrated cognitive recovery. The ath-
etic trainer progressively guides the student through activities of
physical exercise, such as cycling or running, increasing the time
duration, to be sure that concussion symptoms do not return with
physical exertion. The most important piece in shortening recovery
time, however, appears to be the immediacy of physical and
mental rest and increased sleep to allow the brain to heal. If
needed, students should stay home from school, with no home-
work or tests, to accelerate symptom reduction. Students, espe-
cially high achievers, and school officials often balk at these
recommendations for rest and medical leave. However, many
experienced school nurses know that it is not uncommon for
students who have not followed this advice to return to the doctor’s
office weeks later with complaints of persistent headaches and
poor school performance.
Role of the Psychologist

The role of the psychologist in addressing this public health issue will be determined by her or his specialty and/or training and level of interest. A psychologist who specializes in neuropsychology will likely have the most comprehensive training with regard to brain pathology, brain function, neuropsychological assessment, and brain injury treatment and management. She or he will be able to provide direct evaluation and treatment of the student who has suffered a significant brain injury. The expertise of the neuropsychologist is particularly instrumental in cases that are complex and unresolved, with coexisting conditions (learning disorders, attention disorders, and/or emotional overlay). In contrast, the expertise of school psychologists is greatly valuable with regard to recommending and implementing academic accommodations and understanding the learning process. School psychologists are in a position to help concussed students transition back to their academic and sports activities. One might think that school psychologists are best positioned to create, implement, and supervise school-based preseason baseline and concussion testing programs. Ironically, it is more likely that a school’s athletic director or trainer, in partnership with a consulting physician, is implementing the school’s program. Child psychologists provide expertise in evaluating and treating the emotional symptoms that may become prominent in a postconcussion syndrome. In fact, their knowledge of differential diagnosis can aid in identification of undiagnosed concussions that have resulted in behavioral and emotional changes. Psychologists specializing in family therapy can assist families in coping with and adapting to the changes in their concussed family member. Clarifying and dispelling misconceptions that a child is lazy or malingering, educating the family about concussion and its risks, and helping develop effective parental responses to cognitive, behavioral, emotional, and physical changes related to concussion are essential. Nonetheless, all psychologists who have a basic understanding of brain–behavior relationships and are interested in reducing this public health risk can become involved in public education opportunities. They can achieve this by providing presentations to schools and parent groups; targeting preseason educational meetings of local community recreation leagues, such as soccer, football, and ice hockey; writing articles for local publications; and advocating for preseason testing programs. Furthermore, psychologists who advocate for preseason testing programs are also in a position to create and implement these programs, bringing together the team of health care professionals for optimum care of our youths.

Ultimately, when assessing and treating children and adolescents in psychotherapy, psychologists should keep in mind their patients’ participation in sports and the possibility of exposure to head trauma. Psychologists should not assume that youths or their parents will recognize or report the incidence of sports-related concussion and its effects on behavior and school performance. Any health care practitioner who suspects the possibility of concussion should arrange for the appropriate referrals. Although there are no hard and fast rules regarding referrals, most believe it is best to err on the side of caution, especially with youths. In acute cases, an emergency room visit or clearance by the pediatrician or physician is important. For follow-up, to assist in return to play (or return to exercise and physical activity) decisions, the services of a concussion specialist are recommended. That specialist may be a physician, psychologist, or neuropsychologist who is trained and possesses specific expertise in postconcussion assessment. Finally, in cases in which symptoms persist and there is concern regarding enduring cognitive–behavioral changes, a neuropsychologist should be consulted for a comprehensive evaluation. Similar referral pathways may be followed for active, athletic adults.

Some Ethical and Legal Considerations in a Sports Concussion Practice

The sports concussion psychology practice reveals challenges that are likely different from those of a typical psychology practice. It is notable that although many nonpsychologists engage in sports concussion practice, those professionals may not face the same challenges or requirements that psychologists face, because of diverse professional guidelines or state, provincial, and federal law. First and foremost, psychologists must be responsible for familiarizing themselves with their own ethical guidelines and state or provincial practice board regulations as well as any other legal requirements that are applicable to sports concussion practice.

For example, a school may provide routine baseline and postconcussion services to its students and follow specific organizational, legal requirements. However, if a psychologist is working as a consultant to that school’s staff, whether providing interpretation of testing, helping in return-to-play decisions, or recommending temporary academic accommodations, that psychologist needs to clarify who is the client (school vs. parent vs. student), the scope of practice, and the nature of the professional relationships involved. In addition, the open culture of sports is different from the discreet culture of mental health care; thus, issues of confidentiality may be casually overlooked in sports injuries, including concussion, and consent may be inadvertently implied rather than correctly formalized.

In the consultant role, psychologists must be vigilant. They should educate parents and students about the nature of baseline and concussion services, secure formal consent to provide such services, and obtain proper releases to communicate with school staff and medical personnel who are involved in the care of the student. In working with minors, psychologists should be aware of parental custody regulations in their local jurisdiction and the possible need for consent from both parents as well as whether minors of a certain age are also required to provide formal consent for services.

Informed consent may include statements about the scope of services and a description of baseline assessment and postconcussion intraindividual comparison. Parents and students need to know that the testing tools used are not for diagnosis of learning or attention deficit disorders, that they are not intelligence or achievement testing, and that they simply provide a snapshot profile of a sample of skills that vary across individuals. Parents and students also need to be assured that the results of baseline assessment are not used in any other manner and are simply stored to be used for intraindividual comparison should the student sustain a concussion.

Informed consent may also include a statement to protect the psychologist from liability regarding the possible outcome of return-to-play decision making. Generally, this may be more relevant an issue for professional athletes. However, it is important to
recognize that a recommendation to keep a student from play and athletic activity may have consequences regarding college recruitment and scholarships. This is all the more reason for a sports concussion team approach that includes medical and athletic personnel, as well as the family and the student, in the decision-making process.

Another sticky situation to avoid is that of providing interpretation of postconcussion testing data without ever examining the student in person. It has become a common practice for consultants to schools, such as psychologists, neuropsychologists, and physicians, to receive a request from a school to interpret data regarding a recently concussed student and to make return-to-play recommendations without conducting an exam. Sometimes these requests are made because of time, geographic, or financial constraints. The psychologist is well advised to seriously think through the necessity of such short-cut methods and the ethical and legal implications, no matter how routinely such blind interpretation may be performed in practice.

Finally, but never of least importance, psychologists may do well to specifically document their training and expertise in the area of sports concussion. Training can include attendance at sports concussion workshops that are offered by psychological associations, national and international neuropsychological associations, athletic trainer societies, and local brain injury associations. Membership groups such as the National Academy of Neuropsychology, International Neuropsychological Society, APA Division 40, and Brain Injury Association of America serve as just some of the resources in this area of expertise. Recently, the Brain Injury Association of New Jersey conducted a special grant program for schools that wish to start their own concussion program (Brain Injury Association of New Jersey, 2006). Through funding by the Traumatic Brain Injury Fund of the New Jersey Department of Human Services, free training has been offered to professionals who wish to serve as consultants to these school-based programs. In addition, vendors of the baseline–conclusion assessment tools may offer their own training workshops. For example, ImPACT Applications, Inc. (www.impacttest.com), the vendor of Immediate Post Concussion Assessment and Cognitive Testing, a computerized neurocognitive assessment tool, provides a Web site that offers a newsletter and research articles on concussion assessment and advertises training workshops and a business practice tool (Moser & Barbrack, 2005) to assist individuals in setting up a sports concussion practice. Also, there is a plethora of available research literature published in numerous neuropsychological, medical, and athletic and sports journals as well as two relatively new books that provide solid, readable summaries of this new field (Echemendia, 2006; Solomon et al., 2006).

In Summary

Sports and athletic involvement is an important part of growing up in the United States (Ferguson, 1999). We now know that sports concussion is a significant public health risk for our children. Each year we spend millions of dollars on protective sports equipment and yearly medical preseason physicals. Yet we are still behind in brain hygiene: namely, the care and protection of our most vital organ. Currently, there is a fast-growing trend for the development of high school and youth athletic preseason and postconcussion testing programs, often run and managed by school athletic personnel. There is a window of opportunity for psychologists to use our profession as a vehicle to educate, advocate, and practice in the field of sports concussion. We are naturally equipped with our relevant knowledge and our dedication to making psychology an everyday word, and it is up to us to determine whether we will forge this new frontier alongside other health care professionals.

References


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